

Network Rail and the Office of Rail  
Regulation

**Network Rail carbon review**

AO/042 Review of Network Rail's  
carbon reduction calculations and  
CP5 trajectory

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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**ARUP**

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## Glossary of terms

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|                  |  |
|------------------|--|
| EA               | Environment Agency   |
| CEN              | European Committee for Standardisation   |
| CP               | Control Period   |
| CO <sub>2</sub>  | Carbon dioxide   |
| DECC             | Department of Energy & Climate Change  |
| Defra            | Department for Environment, Food and Rural Affairs                                 |
| RED              | Railway Energy Database hosted by Optima   |
| HA               | Highways Agency  |
| HLOS             | High Level Output Specification  |
| ISO              | International Organisation for Standardisation                                     |
| kWh              | Kilowatt hours   |
| NR               | Network Rail   |
| ORR              | Office of Rail Regulation  |
| SBP              | Strategic Business Plan  |
| SNCF             | Societe National des Chemins de fer Francais (French National Railway Corporation) |
| SoS              | Secretary of State   |
| tCO <sub>2</sub> | Tonnes of carbon dioxide   |
| MDU              | Maintenance delivery unit  |

# 1 Introduction

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This report is in response to mandate AO/042 for an Independent Reporter (Arup) to review Network Rail's (NR) carbon<sup>1</sup> reduction calculations and Control Period (CP) 5 trajectory.

The mandate for this work is provided in Appendix C.

## 1.1 Review background

The Secretary of State's (SoS) High Level Output Specification (HLOS) requires that the rail industry measures, monitors and reports carbon emissions on a regular basis. In response NR has included 'carbon emission baseline forecasts' and 'expected carbon intensity of electricity supply' as indicators within its Strategic Business Plans (SBP) for England and Wales, and Scotland.

The Office of Rail Regulation (ORR) has appointed an independent party to review NR's reported carbon emissions and projected reductions for assurance purposes, a role which is being fulfilled by Arup.

## 1.2 Structure of this report

This report is structured as follows to address the objectives presented in Section 2.1:

- Section 2 describes the review process and methodology;
- Section 3 presents and discusses the results;
- Section 4 summarises the findings in relation to the objectives;
- Section 5 makes recommendations;
- Appendix A presents the detailed review analysis in table format;
- Appendix B presents the inception and data handover meeting minutes; and
- Appendix C is the original Mandate AO/042.

# 2 Description of the review process

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The review of NR's carbon reduction calculations and CP5 trajectory has been based on a 4-step approach consistent with BS EN ISO14064-3<sup>2</sup> on the validation and verification of greenhouse gas assertions. Figure 1 presents the stepped approach taken to the review. Each step is further described in the sections below.

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<sup>1</sup> Carbon is used throughout this report generically to represent greenhouse gas emissions.

<sup>2</sup> BS EN ISO 14064-3:2012 Greenhouse gases – Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions.



Figure 1 The four step approach taken to the NR carbon review

## 2.1 Objectives

The objectives of this carbon review were agreed with the ORR and NR at the beginning of the process, with the ORR setting out five headline questions:

1. How accurate and reliable was the calculation process used to determine the forecasts?
2. Did NR use appropriate assumptions and input data in calculating the forecasts?
3. Is the level of NR's carbon reduction forecasts in line with those of other similar organisations?
4. Do NR's carbon reduction forecasts accurately reflect the key drivers of reduction cited in their SBP; 'planned and on-going rationalisation of offices, signalling locations and maintenance depots'?
5. Has NR omitted other drivers of carbon reduction that would otherwise impact the trajectory of their forecasts?

It is important to recognise that implicit in objective two is the review of applied boundary conditions and by implication what has been included and excluded from the carbon assessment.

Reported baseline and projected emissions would be reviewed using NR's and ORR's own reliability grading system (see Appendix C). It was also agreed that organisations similar to NR would be reviewed as a basis for comparison.

It is important to note that this review is not intended to fulfil NR's internal audit requirements of the Carbon Reduction Commitment (CRC) reporting scheme. We understand that these are dealt with under separate arrangements that NR has in place. This project will complement these arrangements and work to similar audit principles, but will focus on the NR carbon reduction calculations reported in the England & Wales, and Scotland SBPs.

## 2.2 Scope

The scope of this review covers:

- NR's 2011/12 baseline and forecast CP5 emissions for both England and Wales and Scotland, as reported in the SBPs;
- Scope 1 and 2 emissions including road fleet, managed buildings and infrastructure assets;
- Carbon intensity of electricity supply projections, as reported in the SBPs;

- Benchmarking NR’s carbon reduction forecasts with similar organisations.

Construction related embedded emissions (scope 3) along with as traction emissions from rail operating companies along the network were out of scope of this review.

It is important to understand that the NR emissions published in the SBPs are baseline forecasts and not reduction targets. Arup has been advised that they have been developed to allow NR to develop more detailed reduction targets.

Figure 2 illustrates the carbon reporting model used by NR to develop the baseline and forecast emissions. Greater detail on each of these elements is provided in section 2.3.

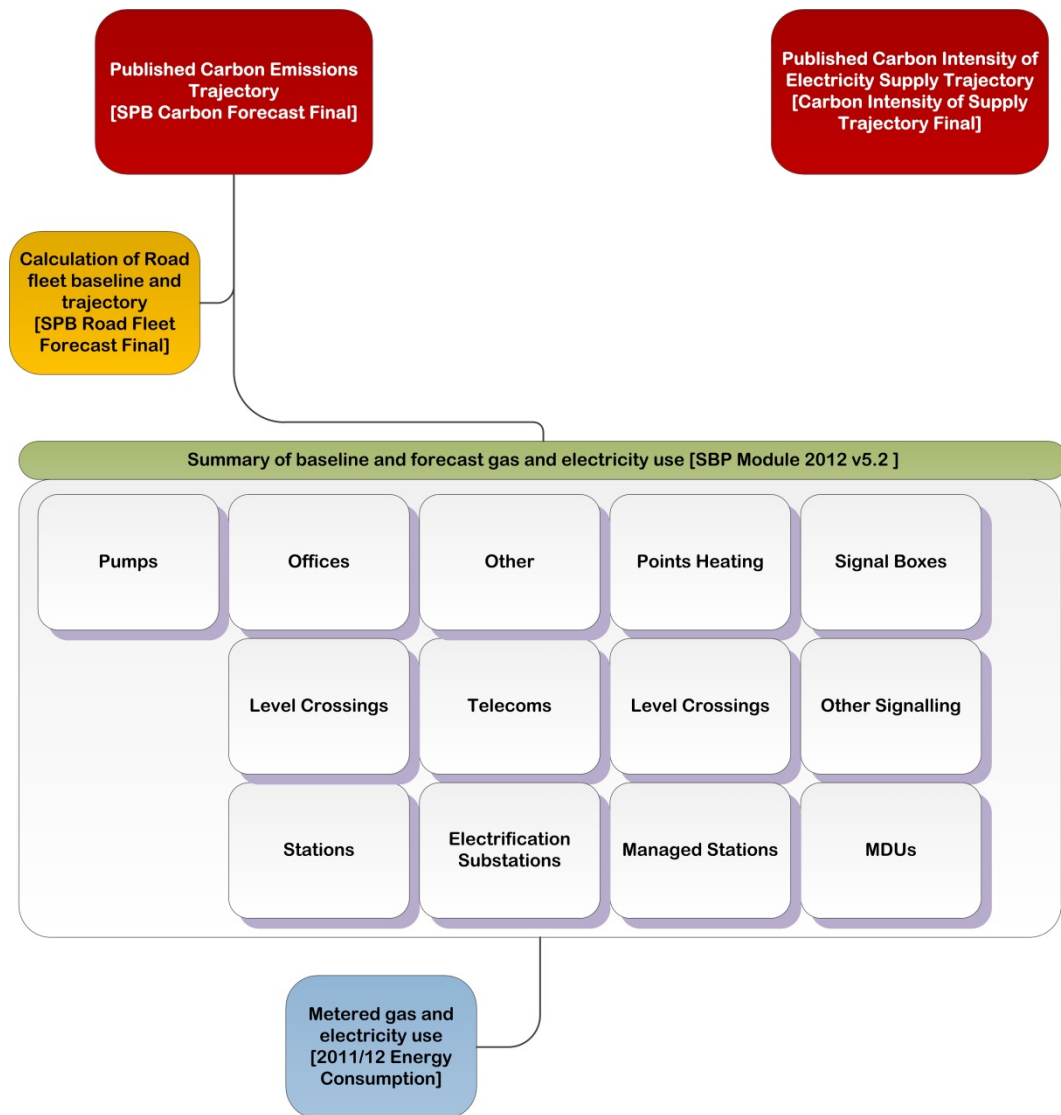


Figure 2 Network Rail’s carbon reporting model

### 2.3 Review of inventory data

NR provided a range of datasheets and notes as supporting evidence to the forecasts published in the SBPs. The key sources of information for the project are

listed below. How these link together to form the carbon model is illustrated in Figure 2.

- 2011/12 Energy Consumption – excel sheets summarising automated electricity and gas meter readings. These sheets will be referred to as RED (Railway Energy Database hosted by Optima) hereinafter.
- SBP Module 2012 v5.2 – this excel sheet summarises data from the RED spreadsheets, adds manual meter readings, deals with data gaps and makes energy consumption projections for CP5. These sheets are referred to as Dashboard hereinafter.
- Utilities Business Plan Compilation – this report summarises the calculations, assumptions and sources of information behind the RED and Dashboard spreadsheets.
- SBP Carbon Forecast Final – this excel sheet brings together the baseline and forecast fuel use data from 'RED' and 'SBP Road Fleet Forecast Final' spreadsheets. The energy use data is split between England and Wales and Scotland and combined with carbon factors to produce the overall forecasts reported in the SBPs.
- SBP Road Fleet Forecast Final – this excel sheet summarises the number of road fleet vehicles and fuel use data from fuel cards for the baseline and forecasts future fuel use based on assumed improvements in efficiency over time.
- Baseline Carbon Forecasting for SBP - this report summarises the data sources, assumptions and calculations in the 'SBP Carbon Forecast Final' spreadsheet.
- Carbon Intensity Trajectory for SBP - this report summarises the assumptions and data sources in the 'Carbon Intensity of Supply Trajectory Final' spreadsheet.
- Carbon Intensity of Supply Trajectory Final - this excel sheet contains the calculations for the expected changes in carbon intensity of electricity supply reported in the SBPs.
- 121025 New Vehicle Efficiency - this excel sheet contains the reference information on future vehicle efficiency used in 'SBP Road Fleet Forecast Final'

## 2.4 The review process

The review process involved six key steps as described below:

1. Arup, ORR and NR met to agree project objectives and scope and to complete a first exchange of information. Minutes from the inception meeting are provided in Appendix B.
2. Arup reviewed the supplied information in a systematic approach. This was based on a series of defined criteria that were developed by interpreting the ORR reliability grading system and the project objectives set out earlier. A summary of each of the criteria is shown in Table 1.

Table 1 Criteria used in review process

| Criteria                                     | Interpretation   |
|--|--|
| <b>Appropriate assumption/algorithm/data</b> | Is the data set used and/or assumption made appropriate for the objective of the study?  |
| <b>Auditable/ Properly documented</b>        | Was all the required information available or adequately referenced?   |
| <b>Well-defined</b>                          | Was the scope of the data and/or assumption clearly described?   |
| <b>Consistent with SBP</b>                   | Were the results consistent with what was reported in the SBPs?<br>OR<br>Were the assumptions consistent with those used/reported in the SBPs? |
| <b>Evidence of automated collection</b>      | Was there evidence or reference that the data had been generated by automatic collection?  |
| <b>Evidence of internal review</b>           | Was there evidence or reference that the data and/or assumptions had been checked or reviewed with another internal party?                     |
| <b>Best Practice</b>                         | Is the level of information used or the assumptions made in line with what could be considered best practice in the industry?                  |
| <b>Variance adequately explained</b>         | If there is a discrepancy in the data, is the variance adequately explained?   |
| <b>Correctly applied/ calculated</b>         | Of the calculations checked, are they linking to the correct cells and performing the calculations expected?                                   |

Each of these criteria was assessed as yes (Y), no (N), not applicable (N/A) or 'to be determined' (TBD) for each aspect of the model reviewed.

Based on this a reliability grading was applied to each element assessed. The typical strategy for this is summarised in Table 2.



Table 2 Typical grading criteria

| Grading | Criteria                                    |
|---------|---|
| A       | No criteria were assessed as 'no'           |
| B       | 1-2 criteria were assessed as 'no'          |
| C       | 3 criteria were assessed as 'no'            |
| D       | All relevant criteria were assessed as 'no' |

There were a few exceptions to this system as some criteria were weighted more highly than others, for example, 'Evidence of internal review' was considered a relatively minor aspect and therefore if the only 'no' was for this criterion, the resulting grading was an A. Conversely the 'appropriateness' of the assumptions and data was considered to be highly important and therefore where this criterion was assessed as 'no' this typically lowered the grade rating.

In addition, the accuracy in terms of the calculations that have been made was also assessed through a series of spot checks throughout the review.

3. Following the initial review a teleconference was held (26.4.13) between Arup and NR to clarify questions arising regarding data and approach to the NR carbon assessment. Further clarifications were received following this meeting.
4. The review exercise was repeated focusing on questions outstanding and gaps.
5. Organisations similar to NR were identified and information on their carbon assessment work was collated to compare against NR reported carbon emission forecasts.
6. The project documentation including the collected evidence base and review materials was brought together into a formal report which sets out the findings in relation to the project objectives together with recommendations.

## 2.5 Verification report

This report sets out the method, results and recommendations from the review process.

The draft report was issued to ORR and NR on 1 May 2013, and a feedback session was held on 8 May 2013 to discuss comments received. This final publishable report was issued on the 10 May 2013.

## 3 Results

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Results from the review process are presented here in the form of answers to the original project objectives. This summary of results provides a record of the most significant findings. Not all details have been brought out and the reader is directed to Appendix A for the full results.

Throughout this section references are made to 'forecasts' and 'SBPs'. Unless otherwise stated all results are equally applicable to the England and Wales and Scotland elements of the review.

### 3.1 How accurate and reliable was the calculation process used to determine the forecasts?

NR has reported two forecasts in the SBPs:

1. Baseline forecasts for NR's scope 1 and 2 carbon emissions; and
2. Expected carbon intensities of the electricity supply.

The accuracy and reliability for each of these forecasts are discussed separately below.

#### 3.1.1 Carbon emission baseline forecasts

Overall, NR's calculations have been reviewed as *moderately reliable (B)* with some minor shortcomings, which are discussed in more detail in section 3.2.

The most significant of these minor shortcomings is the use of constant carbon intensity factors for energy sources, as opposed to incorporating anticipated future changes in the carbon intensity of electricity and other fuels. As the purpose of this assessment is to allow more detailed reduction targets to be developed, the baseline forecast should reflect as accurately as possible the anticipated future carbon intensity of electricity and other fuels.

Based on the approach taken by NR, the reductions forecast in the SBPs represent an understatement of their anticipated baseline future emissions. This topic is discussed in more detail in section 3.2.3.

All calculations checked were implemented correctly; therefore the calculation can be considered 100% accurate.

#### 3.1.2 Carbon intensity of electricity supply forecasts

In order to influence the carbon intensity of the electricity supply, NR has forecast an expected electricity decarbonisation trajectory. The method used to calculate the reductions reported in the SBP is *not accurate/reliable (D)* for this application.

A simplified approach has been used which assumed a linear decarbonisation of the electricity supply between 2010 and 2050. This is not a realistic assumption and there are more realistic models available upon which the trajectory could have been forecast.

Indeed, we acknowledge that NR has used one of these references to inform calculations in their analysis spread sheets. However, this data was not chosen for incorporation into the SBPs forecasts. Therefore, the expected reductions of the carbon intensity of electricity supply published in the SBPs are underestimated compared to DECC's current projections.

All calculations checked were implemented correctly, therefore the calculation can be considered 100% accurate.

This carbon intensity of electricity supply forecast has not been included in the calculation on the baseline emission forecasts discussion in section 3.1.1 and therefore does not impact on the accuracy or reliability of these results.

The appropriateness of publishing an expected carbon intensity of electricity supply is discussed in section 3.2.2.

### 3.1.3 Findings

Table 3 summarises the reliability of the various parts of NR's carbon model and supporting documents in relation to the grading system. Full and detailed results from the reliability assessment are contained in Appendix A.

Table 3 Summary results from the reliability grading assessment

| Ref. | Document reference  | Overall Rating |
|------|---|----------------|
| 1.0  | Carbon Intensity Trajectory for SBP [note]  | D              |
| 2.0  | Carbon Intensity of Supply Trajectory Final [spreadsheet]   | D              |
| 3.0  | Baseline Carbon Forecasting for SBP [note]  | B              |
| 4.0  | SBP Carbon Forecast Final [spreadsheet]   | B              |
| 5.0  | SBP Module 2012 v5.3 (calculation of baseline and forecast gas and electricity use) [spreadsheet] | B              |
| 6.0  | SBP Road Fleet Forecast Final [spreadsheet]   | B              |
| 7.0  | 2011/12 Energy Consumption (metered gas and electricity use) [spreadsheet]                        | A              |

## 3.2 Did Network Rail use appropriate assumptions and input data to determine the forecasts?

This question has been tested across a series of carbon model parameters including:

- Scope;
- Functional unit;
- Carbon intensity factors; and
- Input data.

### 3.2.1 Scope

The scope of the NR footprint (scopes 1 and 2) is *appropriate* for understanding and managing the carbon emissions most directly under their control and influence.

The SBP also mentions that NR are starting to consider wider scopes such as the carbon embedded in the materials they procure. This is a positive step and we would encourage NR to start monitoring these and other scope 3 emissions alongside their current activities. This will assist with establishing reduction targets for future reporting cycles.

NR could also quantify the considerable influence they have on the overall carbon emissions of the UK and the movement of goods and people. As highlighted in the SBPs, traction emissions account for 63% of the railway industry's impact. NR influences UK emissions per passenger and freight km through investing in track improvements, network expansion, capacity building, electrification etc. Quantifying these emissions and the net reduction benefits they have presents an opportunity for NR to highlight how they are contributing to the reduction of the UK's national carbon footprint.

NR is looking to influence the carbon intensity of electricity as they are a large consumer across their asset base. They have published expected reductions in the carbon intensity of electricity. While it is vital that large purchasers of energy, such as NR, put pressure on electricity providers to reduce their emissions; ultimately this aspect is out of NR control and therefore should not prevent NR from working on carbon reduction initiatives, such as those discussed in section 3.5.

### 3.2.2 Functional Unit

NR has reported emissions and trajectories using two metrics:

1. Whole company (ktonnes of CO<sub>2</sub>e); and
2. Carbon intensity of electricity supply (kg of CO<sub>2</sub>e/kWh).

These units are discussed separately below.

#### Whole company emissions

It is important for NR to understand the impact of their whole organisation, and therefore reporting at this level is *appropriate*.

However, reporting at this level can make it difficult to understand whether the resulting emissions are due to improvement/reduction in efficiency, changes in company practice, or increased/decreased activity. Therefore it is recommended that NR also reports carbon emissions and forecasts in relative terms (often referred to as normalised units).

A number of different units may be appropriate to support understanding of carbon emissions in a more contextual way. Some normalised units which may be appropriate for NR to consider are:

- tCO<sub>2</sub>e/employee;

- tCO<sub>2</sub>e/travelled km (passenger + freight);
- tCO<sub>2</sub>e/m<sup>2</sup> offices (for office emissions only);
- tCO<sub>2</sub>e/m<sup>2</sup> managed stations (for station emissions only); and
- tCO<sub>2</sub>e/m track maintained (for non-office/station emissions).

These would provide contextual reporting and reflect future changes NR might see in passenger numbers, track ownership, office portfolio, employee numbers etc.

### Carbon intensity of electricity supply

In order to influence the carbon intensity of the electricity supply, NR has forecast an expected electricity decarbonisation trajectory. The aim is to use their purchaser power to encourage electricity companies to supply less carbon intensive electricity. The intent of this functional unit is *appropriate* for a large organisation such as NR.

NR has no direct control over grid carbon intensity and should continue with efforts to reduce emissions directly within its scope, control and influence as discussed in section 3.5.

### 3.2.3 Carbon Intensity Factors

NR used carbon emission factors published by DEFRA<sup>3</sup> for the reporting of company GHG emissions. This is the most *appropriate* data source to use for this type of study.

However, NR has reported their baseline emission forecasts using constant emissions factors, as opposed to incorporating anticipated future changes in the carbon intensity of electricity and other fuels.

While this gives a clear picture of how the energy use of the company is expected to change relative to today as a reference point, this is not a reflection of what future GHG emission levels are expected to be. As the purpose of this assessment is to allow more detailed reduction targets to be developed, the baseline SBP forecast should reflect as accurately as possible the anticipated future carbon intensity of electricity and other fuels.

Therefore for this study it would be more appropriate, and best practice, to use carbon intensity factors which account for changes in the carbon intensity of the energy in emission forecasts. This calculation has been carried out by NR in the calculation spread sheets but has not been reported in the SBPs.

### 3.2.4 Input Data

NR's carbon footprint is based on recorded (automated and manual readings) energy consumption figures for all 13 assets illustrated in Figure 2. These are referred to as input data from hereafter. Input data is then converted into carbon emissions using published factors. This process has been well documented for all assets with only some minor shortcomings:

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<sup>3</sup> Defra, DECC (2012) 2012 Guidelines to Defra/ DECC's GHG Conversion Factors for Company Reporting.

- Automated meter readings across assets record energy consumption (kWh) as well as the associated time (start and end date). Occasionally the recorded period is less than a full year without any prorated calculations to scale numbers up to a full year. It was assumed that this was a correct reflection of energy consumption but better clarity associated with input data would improve the auditability of the CP5 forecasts.
- Projected station energy consumption is fixed over time unless there is a physical change in the asset itself, such as new lifts and escalators for example. The evidence on what impact such changes would have on station's energy consumption was described qualitatively at a high level. More quantitative evidence (such as changes in efficiency measures or examples where similar work has been carried out) would have added more confidence to NR's figures.
- Office energy is slightly underestimated due to data gaps with sites where service charges are paid directly to the landlord and meter readings are not available. Data gaps like this should be dealt with by estimating office energy on a per floor space (kWh/m<sup>2</sup>) basis.
- With regards to points heating, following discussions with NR (26.4.13) it was confirmed that remote controls are being installed which reduce energy consumption, as reflected in the calculation sheets. These calculations could be further refined by considering how heating times may change over time with climate change, as well as incorporating 20-year average degree days.

The input data associated with the remaining assets (level crossings, substations, pumps, telecoms etc.) is relatively simple with few assumptions underpinning the energy calculations.

### 3.2.5 Findings

In testing the question '*did NR use appropriate assumptions and input data in its calculation*' the review findings suggest that the scope adopted is correct and the input data used is of appropriate detail. Improvements need to be made regarding the carbon intensity factors applied to future forecasts and in the documentation provided with future models.

## 3.3 Is the level of Network Rail's carbon reduction forecasts in line with those of other similar organisations?

The carbon emission reduction forecasts of a number of organisations similar to NR are summarised here.

### 3.3.1 Deutsche Bahn

Deutsche Bahn is the most similar company to NR for which information was found as it owns and operates rail track, signals and stations. However it also operates rail services, land, sea and air freight. As a company, Deutsche Bahn has set a target to reduce its carbon emissions by 20% by 2020 compared to 2006.

This includes all aspects of the company. They have set a goal of CO<sub>2</sub>-free rail transport, powered entirely by renewable energy sources by 2050.

### 3.3.2 Réseau Ferré de France

Réseau Ferré de France is the owner and manager of the French railway network<sup>4</sup>. While it has not set specific targets for carbon reductions, it has assessed its annual greenhouse gas emissions to be 6.5 tCO<sub>2</sub>e/employee or 5,830 tCO<sub>2</sub>e in total. They have committed to assess the greenhouse gas emission over the life cycle of all their projects and have established a method to reduce the carbon emissions linked to the construction of infrastructure assets (embedded emissions).

### 3.3.3 Environment Agency

The Environment Agency is considered an appropriate benchmarking company as they also manage and maintain infrastructure assets. They have published a target to reduce their carbon emission by 33% and to reduce their energy usage by 33% compared to a baseline year of 2006/7 by 2015. The scope of their carbon footprinting includes their buildings, their travel and their operational activities such as pumping flood water and maintaining river levels.

### 3.3.4 Highways Agency

The Highways Agency reports on scope 1, 2 and 3 emissions and has made a commitment to reduce its emissions by 25% by 2014/15 compared to a 2009/10 baseline year. It has also set itself an annual reduction target of 13%. These reductions include changes in the carbon intensity of energy sources over time.

### 3.3.5 Findings

NR reported carbon emission baseline SBP forecasts are for a 'business as usual' scenario. They do not reflect the potential reductions that could be achieved through implementing a reduction strategy. As the examples show, none of the comparable organisations are reporting their emissions in the way that is consistent to the NR approach. Therefore it was not felt appropriate to compare the reductions reported in the SBPs to those of other organisations which are based on active reduction strategies.

The example organisations and the emission reduction information they have reported should provide good indication of what NR might be able to achieve when it develops and applies its emission reduction strategy.

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<sup>4</sup> Note that unlike NR, the Réseau Ferré de France do not own the stations (owned by SNCF) nor do they provide maintenance or route traffic control operations.

### 3.4 Do Network Rail's carbon reduction forecasts accurately reflect the key drivers of reduction cited in their SBP?

The key drivers cited in mandate AO/042 were planned and on-going rationalisation of offices, signalling locations and maintenance depots. It can be confirmed that the carbon model does accurately reflect these drivers.

Other drivers have also been identified within NR's carbon reduction forecasts, such as the installation of automated meter system for heating points or the scaling back of personnel associated with MDUs. These strategies appear to be in line with the SBPs and sustainability strategy which states that one of its aims is to be energy efficient across its entire operations, however there were a number of exceptions.

The detailed review of which elements of the model do/do not accurately reflect the SBP is included in Appendix A.

### 3.5 Has Network Rail omitted other drivers of carbon reduction that would otherwise impact the trajectory of their forecasts?

NR has stated that the published carbon emission baseline forecasts are for a 'business as usual' approach and has not actively sought to identify additional areas of reduction potential. Therefore there are many opportunities for NR to influence the trajectory of their forecast. These include for example:

#### Managed Stations & Offices

- NR could recognise a refurbishment strategy to improve the operational efficiency of these.
- NR could recognise a behaviour change strategy (e.g. training employees to operate new and more efficient systems) to improve the operational efficiency of these.

#### Fleet

- NR could consider using bio-derived fuels, hybrid or electric vehicles in their fleet.

#### Electricity supply

- NR could investigate the feasibility of using renewable energy sources.

In addition, on a wider scope, as discussed in section 3.2 above, NR has an opportunity to significantly affect the carbon footprint of the UK though assisting in providing low carbon rail travel.

#### 3.5.1 Findings

It could be argued that there are drivers of carbon reduction excluded that are relevant to NR and their forecasts, but which sit outside the chosen scope as the NR published SBP baseline forecasts are for 'business as usual' scenarios.



## 4 Summary

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### 4.1 Summary

Based on the review process described in section 2 of this report, the following conclusions can be drawn:

- The CP5 carbon emission baseline forecasts in the England and Wales and Scotland SBPs are moderately reliable, with one significant minor shortcoming in the use of constant emissions factors for energy sources, as opposed to incorporating anticipated future changes in the carbon intensity of electricity and other fuels.
- The calculation process used to calculate the carbon emission baseline forecasts was found to be accurate.
- NR has mostly used appropriate assumptions and input data in calculating the forecasts.
- The reported carbon emission baseline forecasts are for a 'business as usual' scenario which does not reflect the potential reductions that could be achieved through implementing a reduction strategy. Therefore it was not felt appropriate to compare the reductions reported in the SBPs to those of other organisations which are based on active reduction strategies.
- The carbon emission baseline forecasts accurately reflect the key drivers cited in their SBPs.
- There are many potential drivers of reduction that have not been captured in the CP5 baseline forecasts as they are for a 'business as usual' scenario.
- The expected reductions in carbon intensity of the electricity grid are not accurate or reliable.

## 5 Recommendations

Table 4 presents recommendations for NR to consider based on the review of the carbon model and data reported in the SBPs.

Table 4 Table of Recommendations

| No        | Recommendations  | Benefits  | Evidence of implementation  | Section         | NR Champion  | Date |
|-----------|--|---|---|-----------------|--|------|
| 2013CRC01 | Modify NR's baseline forecast to include decarbonisation of grid-supplied electricity.   | NR will benefit from the UK's drive to increase the renewables proportion in electricity generation, which in turn will reduce NR's CO <sub>2</sub> emissions. Including this aspect will provide a more accurate baseline in line with industry best practice.   | Subsequent carbon calculation sheets to link annual energy consumption to current UK grid intensity figures and forecasts to use carbon intensity factors which incorporate anticipated future changes in the carbon intensity of electricity and other fuels . | 3.1.2,<br>3.2.3 | Head of Sustainable Business Strategy (SBS)                            | TBC  |
| 2013CRC02 | Monitor selected scope 3 emissions such as business travel and emissions embedded in materials over CP5.   | Although not mandatory many organisations are already reporting on scope 3 emissions, which in some instances, can be as large as scope 1 & 2 emissions if the supply chain is large and complex. This is considered good practice, being transparent with stakeholders and helps identify new CO <sub>2</sub> saving opportunities. Monitoring during CP5 will allow reduction targets to be established in future reporting cycles. | Annual estimated volumes of construction material or purchased equipment (tonnes, volume or £ spend) associated with new assets such as stations or electrical masts converted into CO <sub>2</sub> emissions.  | 3.2.1           | Head of Sustainable Business Strategy (SBS)                            | TBC  |
| 2013CRC03 | Establish what relative carbon intensities (normalisation metrics) are most appropriate and report these alongside the company's total carbon impact, as discussed in section 3.2. | NR is a complex organisation whose carbon footprint is likely to increase as passenger numbers increase and new assets are added. By reporting emissions in relative terms, improvements in efficiency are captured and presented. The reporting unit will depend on the asset at hand e.g. offices (tCO <sub>2</sub> /m <sup>2</sup> or tCO <sub>2</sub> /employee).   | Report relative carbon intensities alongside the company's total carbon impact.   | 3.2.2           | Director Energy Services / Head of Sustainable Business Strategy (SBS) | TBC  |

|           |   |   |  |          |  |     |
|-----------|---|---|--|----------|--|-----|
| 2013CRC04 | Develop a carbon reduction strategy, identifying actions they can undertake to actively reduce their carbon footprint as discussed in section 3.5.                  | Setting carbon reduction targets will support NR's SBP claim that they wish to contribute to the UK's drive towards a low carbon economy. | An explanation in the carbon calculation sheets as to how the carbon reduction targets were developed, and what changes need to happen within the assets to achieve this so that two scenarios can be compared: (1) baseline versus (2) low carbon scenario. | 3.3, 3.5 | Director Energy Services / Head of Sustainable Business Services (SBS) | TBC |
| 2013CRC05 | Provide more robust and quantitative evidence associated with changes in most assets, such as new platforms and escalators or the installation of automated meters. | This will aid future reviews and improve NR's reliability grading score.  | More detailed documented evidence within the CO <sub>2</sub> calculation sheets and supporting documents.  | 3.2      | Director Energy Services   | TBC |

## Appendix A

Table of findings of the review  
process

| Ref.       | Document reference & Section                                     | Statement/Topic   | Comments   | Appropriate assumption/al gorithm/data | Auditable/ Properly documented | Well-defined | Consistent with SBP | Evidence of automated collection | Evidence of internal review | Best Practice | Variance adequately explained | Correctly applied/ calculated | Overall Rating |
|------------|--|---|--|--|--------------------------------|--------------|---------------------|----------------------------------|-----------------------------|---------------|-------------------------------|-------------------------------|----------------|
| <b>1.0</b> | <b>Carbon Intensity Trajectory for SBP [note]</b>                |   |  |  |                                |              |                     |                                  |                             |               |                               |                               | <b>D</b>       |
| 1.1        | Introduction   | NR state their priority for carbon reductions is through influencing improvements in the carbon intensity of electricity by making carbon intensity a key consideration | This is not an appropriate priority for NR as it is beyond their scope of direct influence and target reductions set now would not be able to be fulfilled by the energy companies in the time frame stated.   | N                                      | N/A                            | Y            | Y                   | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | C              |
| 1.2        | Calculating the trajectory                                       | We expect equal year-on-year improvements between 2010 and 80% reduction in 2050 of carbon intensity of electricity   | This is not appropriate or realistic. There are more detailed estimates available.   | N                                      | Y                              | Y            | Y                   | N/A                              | N/A                         | N             | N/A                           | Y                             | D              |
| <b>2.0</b> | <b>Carbon Intensity of Supply Trajectory Final [spreadsheet]</b> |   |  |  |                                |              |                     |                                  |                             |               |                               |                               | <b>D</b>       |
| 2.1        | Analysis   | We expect equal year-on-year improvements between 2010 and 80% reduction in 2050 of carbon intensity of electricity   | There are published forecasts of how the carbon intensity of grid delivered electricity are expected to change between now and 2050. There will not be a linear decrease as proposed and it is not appropriate to assume so.   | N                                      | Y                              | Y            | Y                   | N/A                              | N                           | N             | N/A                           | Y                             | D              |
| <b>3.0</b> | <b>Baseline Carbon Forecasting for SBP [note]</b>                |   |  |  |                                |              |                     |                                  |                             |               |                               |                               | <b>B</b>       |
| 3.1        | Introduction   |   | No comments  |  |                                |              |                     |                                  |                             |               |                               |                               |                |
| 3.2.1      | Footprint scope and emissions factors                            | Scope is scope 1 & 2  | This is appropriate for understanding and managing the carbon emissions most directly under their control and influence. Other scopes could be considered to understand the wider impact NR have. Scope 3 and 'use of infrastructure' are commonly incorporated by other similar organisations.  | Y                                      | N/A                            | Y            | Y                   | N/A                              | N/A                         | Y             | N/A                           | N/A                           | A              |
| 3.2.2      |  | 2 areas of utilities are excluded (Tenants use of energy at NR location and NR use of energy in landlord managed offices.   | It is appropriate to exclude energy use off-charged to tenants however energy use in landlord managed offices should have been included and could have been estimated based on energy use in NR owned offices.   | N                                      | Y                              | Y            | N/A                 | N/A                              | N/A                         | N             | N/A                           | N/A                           | B              |
| 3.2.3      |  | Total Direct GHG factors (DEFRA) have been used   | This is the most appropriate data for company level monitoring and reporting.  | Y                                      | Y                              | Y            | Y                   | N/A                              | N/A                         | Y             | N/A                           | Y                             | A              |
| 3.3.1      | Source data  | Historic consumption of fuels, person referenced  | This data is referenced and appears to be from an automated collection, however the source data is not provided, therefore it is not fully auditable.  | Y                                      | N                              | Y            | N/A                 | Y                                | Y                           | TBD           | N/A                           | N/A                           | B              |
| 3.3.2      |  | Historic and forecast consumption of utilities are from 'Utilities Business Plan Compilation'   | This data is explored in more depth in section 6.  | N/A                                    | Y                              | N/A          | N/A                 | Y                                | N/A                         | N/A           | N/A                           | TBD                           | TBD            |
| 3.3.3      |  | Footnote states 'Small discrepancy between annual reporting and forecast – due to bottom up modelling.' No further clarification of this is given.                      | There is no quantification or explanation of this discrepancy.   | N/A                                    | N                              | N            | N/A                 | Y                                | N                           | N/A           | N                             | N/A                           | C              |
| 3.4.1      | Allocating Consumption by funding region                         | 9.45% split for Scotland liquid fuels   | This is referenced to the finance department and is reported to be a standard figure used to forecast cost splits between the two regions. It would be beneficial to have more documentation on the justification of the split, however in this case it seems appropriate.   | Y                                      | N                              | N            | N/A                 | N                                | Y                           | N             | N/A                           | Y                             | C              |
| 3.5.1      | Data accuracy  | Personal car use excluded...'could' be considered scope 3   | This is scope 3 and therefore not covered by the scope of this calculation, however it would be appropriate to include this as a scope 3 emission in future calculations.  | Y                                      | N/A                            | N            | Y                   | N/A                              | N/A                         | N             | N/A                           | N/A                           | B              |
| 3.5.2      |  | Fuel card consumption considered accurate   | Employees could potentially use fuel card vehicles for their own personal use. This could impact the accuracy of the data. The magnitude of this could be investigated to establish if this is having a significant impact on the fuel use or not.   | Y                                      | N/A                            | N/A          | N/A                 | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | A              |
| 3.5.3      |  | Locally procured fuels are 'likely' to have a small contribution to the footprint.  | It would be beneficial to know what the locally procured fuels are and what they are used for. Is appropriate to exclude them if they are likely to represent less than 1% of the total overall emissions, however without quantification or consideration it is difficult to know if this is appropriate or not. There is a risk that if many items that are considered small are excluded that a more significant proportion of the emissions could be missed. | N                                      | N                              | N            | N/A                 | N                                | N                           | N             | N/A                           | N/A                           | D              |
| 3.6.1      | Forward modelling  | 2010/11 fleet not specified   | This data is missing. It will be important to complete this data to monitor fuel use related to number of vehicles.  | N/A                                    | N                              | N/A          | N/A                 | N                                | Y                           | N/A           | N/A                           | N/A                           | N/A            |
| 3.6.2      |  | Consistent vehicle fleet of 7,500 vehicles  | According to the fleet policy document the number of road vehicles will remain constant at 6,535 vehicles during CPS.  | N                                      | Y                              | Y            | Y                   | N/A                              | Y                           | N/A           | N/A                           | Y                             | B              |
| 3.6.3      |  | Roll out of telematics  | The use of telematics is not included in the SBP. Some detail was provided on the estimate of a 3% efficiency improvement due to their use.  | Y                                      | N                              | N            | N/A                 | N/A                              | Y                           | N/A           | N/A                           | Y                             | B              |

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|-------|---|---|--|--|--------------------------------|--------------|---------------------|----------------------------------|-----------------------------|---------------|-------------------------------|-------------------------------|----------------|
| 3.6.4 |   | 2016/17 refresh of road fleet   | The SBP reports that the fleet ownership structure will change during CP5, currently road fleet is leased and during CP5 it will be owned. Therefore this assumption can be considered appropriate. More details was provided on the assumed efficiency improvements when requested. the source of the data was the Department for Transport.                        | N/A                                    | Y                              | N/A          | Y                   | N/A                              | Y                           | N/A           | N/A                           | Y                             | A              |
| 3.6.5 |   | 2011/12 year only is used as baseline.  | It would have been more appropriate to estimate the ratio of fuel use compared to no. of vehicles used based on the recorded data.   | N                                      | Y                              | Y            | N/A                 | N/A                              | Y                           | N             | N/A                           | Y                             | B              |
| 4.0   | SBP Carbon Forecast Final [spreadsheet]   |   |  |  |                                |              |                     |                                  |                             |               |                               |                               | B              |
| 4.1.1 | Input data  | NR Totals not linked  | Diesel and Petrol values match 'SBP Road Fleet Forecast_Final' Gas and electricity values are consistent with 'Utilities SBP Module 2012v5-2a Final' Calor Gas, gas oil and LPG not referenced. Confirmed on 08.05.13 data taken from historical carbon reporting data. This data not verified, but relatively small percentage of overall reductions, therefore ok. | N/A                                    | Y                              | Y            | N/A                 | N/A                              | N                           | N/A           | N/A                           | Y                             | B              |
| 4.1.2 |   | Conversion factor for Scotland - percentage used to split totals<br>Utilities imported separately                 | See 2.4.1  | N/A                                    | N/A                            | N/A          | N/A                 | N/A                              | N/A                         | N/A           | N/A                           | Y                             | A              |
| 4.1.3 |   | Assumed no change in amount of gas oil or LPG or Calor gas used after 2011/12                                     | Confirmed on 08.05.13 with NR this data came from previous carbon reporting. As small percentage of overall footprint assumption ok.   | Y                                      | N                              | N            | N/A                 | N                                | N/A                         | N/A           | N/A                           | N/A                           | C              |
| 4.2.1 | Conversion factors  | DEFRA factors for fuel types extracted for 2011/12. Used for all years  | Diesel and petrol values used are for average Biofuel blend. This is in line with the guidance provided by DEFRA.  | Y                                      | Y                              | Y            | N/A                 | N/A                              | N/A                         | Y             | N/A                           | Y                             | A              |
| 4.2.2 |   | For calor gas, compressed natural gas (usually stored at 200 bar for use as alternative transport fuel.) is used. | Calor gas is butane or propane. These is no data provided by DEFRA for these fuels and therefore compressed natural gas seems most appropriate.  | Y                                      | N                              | N/A          | N/A                 | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | B              |
| 4.2.3 |   | DECC Forecast projections   | The latest tables from DECC (Oct 2012) differ from values in spreadsheet, dated Oct 2011, however this is acceptable. This data is not used in the SBP, however it would have been more appropriate to report the reduction trajectory using this data than using consistent factors.  | Y                                      | Y                              | Y            | N                   | N/A                              | N                           | Y             | N/A                           | Y                             | B              |
| 4.2.4 |   | 2011/12 DEFRA carbon emissions factors are used for all years.  | This does not take into account anticipated future changes in the carbon intensity of energy. This is not best practice in the industry and it would have been more appropriate to include this decarbonisation in the baseline forecasts.   | N                                      | Y                              | Y            | Y                   | N/A                              | N                           | N             | N/A                           | N/A                           | C              |
| 5.0   | SBP Module 2012 v5.3 (calculation of baseline and forecast gas and electricity use) [spreadsheet] |   |  |  |                                |              |                     |                                  |                             |               |                               |                               | B              |
| 5.1   | Dashboard   |   |  |  |                                |              |                     |                                  |                             |               |                               |                               | B              |
| 5.1.1 | Dashboard   | Electricity, gas & water consumption summary  | CP5 & CP5 projected consumption figures presented here   | N/A                                    | Y                              | Y            | N/A                 | N/A                              | N                           | N/A           | N/A                           | Y                             | A              |
| 5.1.2 |   | Carbon conversion factors (CO2/kWh) for electricity   | The projected factors in the sheet are different to what is stated in the SBP for England and Wales (2013) pg. 13 (no future changes considered in the grid).<br>Not relevant to overall calculation as re-calculated in another sheet.  | N/A                                    | N/A                            | N/A          | N                   | N/A                              | N                           | Y             | N/A                           | Y                             | N/A            |
| 5.1.3 |   | Carbon conversion factors (CO2/kWh) for gas   | Figure of 0.184 kgCO2/kWh used - not properly sourced but assumed to be 'natural gas' from Defra 2012<br>Not relevant to overall calculation as re-calculated in another sheet.  | Y                                      | N                              | Y            | N/A                 | N/A                              | N                           | Y             | N/A                           | Y                             | N/A            |
| 5.1.4 |   | Water (cu.m) consumption  | Water consumption information is gathered for 'managed stations' + 'other' yet the water carbon footprint is not calculated and included in the total. This is not within the current scope of the calculation.  | N/A                                    | Y                              | Y            | N/A                 | N/A                              | N                           | N             | N/A                           | N                             | N/A            |
| 5.1.5 |   | Data consistency between sheets   | Q. The electricity and gas consumption figures here do not all match what is reported in the RED/ Optima summary sheet. A. Figures actually do match where assets are correctly matched with consumption figures. Otherwise a bottom up approach is used to fill in any gaps, so the methodology is correct.   | N/A                                    | Y                              | N/A          | N/A                 | N/A                              | N                           | N/A           | N/A                           | Y                             | B              |
| 5.2   | Stations  |   |  |  |                                |              |                     |                                  |                             |               |                               |                               | B              |
| 5.2.1 | Managed Stations  | Baseline (2011/12) electricity and gas consumption  | Half hourly meters electricity data is automatically collected while the remaining data is gathered through bills. Gas and water consumption is gathered manually. There is no official internal review process (interview with A.Bullock and D. Davis 26.4.13). The process is overall sound.   | Y                                      | Y                              | Y            | N/A                 | Y                                | N                           | N/A           | N/A                           | Y                             | A              |

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|------------|------------------------------|--|--|--|--------------------------------|--------------|---------------------|----------------------------------|-----------------------------|---------------|-------------------------------|-------------------------------|----------------|
| 5.2.2      |                              | Gas consumption  | Q. Out of the 14 sites - 4 have zero gas, is this n/a (i.e. data gap) or indeed zero? A. Interview on 26.4.13 confirmed that zero/ no data means no gas is used.   | N/A                                    | Y                              | N/A          | N/A                 | N/A                              | N                           | N/A           | N/A                           | Y                             | A              |
| 5.2.3      |                              | Gas consumption / RED Optima   | Q. Total gas figure does not quite match automatic recorded figures in the RED Optima sheet. A. Figures do match unless metre readings do not match asset list where pro-rate (average) figure was applied (bottom up approach).   | N/A                                    | Y                              | N/A          | N/A                 | N/A                              | N                           | N/A           | N/A                           | Y                             | A              |
| 5.2.4      |                              | Gas & Electricity consumption  | Q. Are the 2010/11 and 2011/12 values for NR controlled consumption? NR control % factor not applied it seems. A. Yes, it was confirmed that just NR controlled energy is reported, this was simply not clear in the data provided.  | N/A                                    | N                              | N/A          | N/A                 | N/A                              | N                           | N/A           | N/A                           | Y                             | B              |
| 5.2.5      | Managed Stations             | Electricity & Gas projections for CP4 & CP5  | Q. Energy projections are fixed unless there is a change in assets (new building, CHP specification) - explanations are provided at a high level with overarching assumptions but is this enough? A. Interview on 26.4.13 confirmed that energy projections were overestimated to ensure no energy shortages. Apart from the calculation sheets there was little detail explaining assumptions on future energy use changes. Estimates of new stations could be based on existing info per m3 of ft3 of space. | N/A                                    | Y                              | N            | Y                   | N/A                              | N                           | N/A           | N/A                           | Y                             | B              |
| 5.2.6      |                              | Electricity & Gas projections for CP4 & CP5  | Behavioural influence on station energy consumption was not included (see pg. 70 SBP England & Wales 2013), just changes in station numbers. There was also no evidence of new stations coming in operation.   | N/A                                    | N/A                            | N/A          | N                   | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | N/A            |
| 5.2.7      |                              | Electricity & Gas projections for CP4 & CP5  | Station energy appears to increase instead of being reduced (see SBP England & Wales 2013 pg. 70). Perhaps it may be worth considering reporting emissions and setting CO2 targets in relative terms i.e. kgCO2 per m2 or per passengers. As NR's assets grow, you would expect emissions to do like wise - thus relative emissions would capture efficiency measures.   | N/A                                    | N/A                            | N/A          | N/A                 | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | N/A            |
| <b>5.3</b> | <b>Points Heating</b>        |  |  |  |                                |              |                     |                                  |                             |               |                               |                               | <b>B</b>       |
| 5.3.1      |                              | Traction heating energy consumptions   | Calculation/ estimates based on meter readings - data is well documented and clear   | Y                                      | Y                              | Y            | N/A                 | Y                                | N                           | N/A           | N/A                           | Y                             | A              |
| 5.3.2      |                              | Non-traction energy consumption  | Values not linked. Source of data confirmed on 26.04.13 as '2011 12 energy consumption data v2' spread sheet.  | N/A                                    | N                              | Y            | N/A                 | N                                | N                           | N/A           | N/A                           | Y                             | B              |
| 5.3.3      |                              | Projections  | Q. Energy consumption is dependent on estimated hrs. of heating time - reduced from 1,600 down to 800 hrs./yr. because of remote controls fitted. Is this a fair assumption? A. Interview on 26.4.13 confirmed that heating periods were based on discussions with asset managers and experience over time. By placing automated systems this would reduce energy consumption (this is evidence of influencing behaviour change).  | Y                                      | Y                              | N/A          | N/A                 | Y                                | N                           | N/A           | N/A                           | Y                             | A              |
| 5.3.4      |                              |  | Could climate change influence estimated heating times in the future? This was not considered by NR, and neither was the 20 degree day average.  | N                                      | N/A                            | N/A          | N/A                 | N/A                              | N/A                         | N/A           | N/A                           | N                             | C              |
| <b>5.4</b> | <b>Signal Boxes</b>          |  |  |  |                                |              |                     |                                  |                             |               |                               |                               | <b>A</b>       |
| 5.4.1      | Signal Box Calcs             | Calculations of average energy use by signal box size  | General sheet calculations - overall well documented and sourced   | Y                                      | Y                              | Y            | N/A                 | Y                                | N                           | N/A           | Y                             | Y                             | A              |
| 5.4.2      |                              | Calculations of average energy use by signal box size  | The correlation between SEU and energy use (kWh) was not very high, particularly for small size signal boxes   | Y                                      | Y                              | N/A          | N/A                 | Y                                | N/A                         | N/A           | Y                             | Y                             | B              |
| 5.4.3      | ROC Assumptions              | New Route Operating Centres will be open in place of the closing Signal Boxes                  | General - overall Signal Boxes strategy was well documented as were the calculation assumptions  | Y                                      | Y                              | Y            | N/A                 | Y                                | N                           | N/A           | N/A                           | Y                             | A              |
| 5.4.4      | ROC-SigBox kWh               | CP4 & CP5 Projections  | The projections are based on signal boxes closing over different years and energy transferring to ROCs - this appears to be correctly reflected in the calc sheets   | Y                                      | Y                              | Y            | Y                   | Y                                | N                           | N/A           | N/A                           | Y                             | A              |
| 5.4.5      |                              | CP4 & CP5 Projections  | The closing of signalling boxes reflect and is in line with the SBP driver of rationalising signalling boxes (see SBP for England & Wales 2013 pg. 70)   | N/A                                    | N/A                            | N/A          | Y                   | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | A              |
| <b>5.5</b> | <b>Level Crossings</b>       |  |  |  |                                |              |                     |                                  |                             |               |                               |                               | <b>B</b>       |
| 5.5.1      | Level Crossings              | Energy consumed at level crossings is mostly to operation CCTV and manually operated crossings | Baseline calculations are hard to follow - they are not linked or referenced. Source of data confirmed on 26.04.13 as '2011 12 energy consumption data v2' spread sheet.   | N/A                                    | N                              | N            | N/A                 | Y                                | N                           | Y             | N/A                           | Y                             | B              |
| 5.5.2      |                              | Projections  | New technology is being trialled but it is not yet known if this will change consumption figures, and neither will the number of level crossings change significantly throughout CP5 - assume no change in energy during CP5   | Y                                      | N                              | N/A          | Y                   | Y                                | N                           | N/A           | N/A                           | Y                             | B              |

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|-------|------------------------------|--|---|--|--------------------------------|--------------|---------------------|----------------------------------|-----------------------------|---------------|-------------------------------|-------------------------------|----------------|
| 5.5.3 |                              |  | This, to some extent, is inline with the SBP driver of looking to improve technology - although in this case whether it reduces energy and emissions remains to be seen. 26.4.13 interview confirmed the moved towards automated level crossings which is believed to reduce energy and carbon.   | N/A                                    | N/A                            | N/A          | Y                   | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | A              |
| 5.6   | <b>Other signalling</b>      |  |   |  |                                |              |                     |                                  |                             |               |                               |                               |                |
| 5.6.1 | Other signalling             | Covers all signalling consumption other than Signal Boxes  | Q. Baseline figure for 2011/12 - hard to review as the information is pasted values. A. Interview 26.4.13 confirmed audit back to the Optima sheets.  | Y                                      | Y                              | N/A          | N/A                 | Y                                | N                           | Y             | N/A                           | Y                             | A              |
| 5.6.2 |                              |  | Although the Pivot table in the Optima SR sheet has the same kWhs figure for Other Signalling - following this back to the actual metre readings proves difficult as you get a different total  | Y                                      | N                              | N/A          | N/A                 | Y                                | N/A                         | N/A           | N/A                           | Y                             | B              |
| 5.6.3 |                              | Projections  | No evidence for projections apart from supporting document stating that the asset manager confirmed that the management policy states that there will be no change in energy consumption regarding 'Other Signalling'. Indirectly emissions remain the same. Overall the SBP talks about increasing efficiency and reduction emissions. It seems that this is not happening with Other Signalling, at least not in CP5. | N/A                                    | N/A                            | N/A          | N                   | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | N/A            |
| 5.7   | <b>MDU</b>                   |  |   |  |                                |              |                     |                                  |                             |               |                               |                               |                |
| 5.7.1 | MDU                          | MDU energy consumption data was estimated on a (1) per person unit and (2) on a per site for both electricity and gas                                      | Per Person Calculation has a high correlation   | Y                                      | Y                              | Y            | N/A                 | Y                                | N                           | N/A           | N/A                           | Y                             | A              |
| 5.7.2 |                              |  | Per Site Calculation had a high correlation as well - note that only 40% of sites use gas   | Y                                      | Y                              | Y            | N/A                 | Y                                | N/A                         | N/A           | N/A                           | Y                             | B              |
| 5.7.3 |                              | Auditing between RED sheets (pivot table) and Dashboard averages   | Q. MDU energy figures to not appear to match between sheets for the baseline year (2011/12). A. Meeting on 26.4.13 confirmed that meter readings did not match assets - this MDU energy was estimated based on per person and per site average consumption figures - this calculation was well documented and sourced.  | N/A                                    | Y                              | N/A          | N/A                 | N/A                              | N                           | N/A           | N/A                           | Y                             | A              |
| 5.7.4 |                              | CP4 & CP5 Projections  | There is documented information stating that there is no intention to scale back the number of MDU buildings - but will cut personnel numbers - this is in line with the SBP for England & Wales to some extent, but believe that more can be done to improve efficiency of MDUs and look at behaviour change as well.  | N/A                                    | Y                              | N/A          | Y                   | N/A                              | N                           | N/A           | N/A                           | Y                             | A              |
| 5.7.5 |                              |  | MDU energy and carbon was calculated on a per site, and on a per personnel basis. Because NR's strategy is to rationalise employee numbers in CP5, as a result emissions are reduced as well. This is in line with the SBPs, but NR could also consider efficiency measures associated with the MDU sites themselves.   | N/A                                    | N/A                            | N/A          | N                   | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | N/A            |
| 5.8   | <b>Offices</b>               |  |   |  |                                |              |                     |                                  |                             |               |                               |                               |                |
| 5.8.1 | Offices                      | Electricity, gas and water was measured for NR offices where NR pays bills directly only (does not include locations where utilities are part of the rent) | There is evidence NR's energy sheets of office floor space (sq.f) information - this could be used to estimate energy and water use per floorspace, or even per employee - but also project energy use (gas & electricity ) in the future.  | N                                      | Y                              | Y            | N/A                 | Y                                | N                           | N             | N/A                           | N                             | D              |
| 5.8.2 |                              |  | Q. There are many sites where there is either '0' consumptions of cells are left blank despite the office being in operation - are these data gaps? A. Meeting 26.4.13 confirmed that '0' are sites were no energy is consumed.   | N/A                                    | Y                              | N            | N/A                 | Y                                | N                           | N/A           | N/A                           | Y                             | B              |
| 5.8.3 |                              |  | Q. Office energy data reported in the RED Optima sheets and the Dashboard summary do not match. A. Many office sites pay a standard landlord service charge where exact energy consumption figures are not reported - thus explaining the discrepancies.  | Y                                      | Y                              | N/A          | N/A                 | N/A                              | N/A                         | N/A           | N/A                           | N/A                           | A              |
| 5.8.4 |                              | CP4 & CP5 Projections  | There seems to be rationalisation of offices over time, with many closures and the opening of the Milton Keynes National Centre - this seems in line with the SBP for England and Wales 2013 (key driver). Meeting on 26.4.13 confirmed that NR is now beginning to look at performance of station operations.  | N/A                                    | N/A                            | N/A          | Y                   | N/A                              | N/A                         | N/A           | N/A                           | Y                             | A              |
| 5.9   | <b>Pumps</b>                 |  |   |  |                                |              |                     |                                  |                             |               |                               |                               |                |
| 5.9.1 | Pumps                        | General calculations audits  | Data is fairly simple, with what appears to be metered readings by site, per year, and audit back to Optima readings (non traction)   | N/A                                    | Y                              | Y            | N/A                 | Y                                | N                           | N/A           | N/A                           | Y                             | A              |







## **Appendix B**

Inception meeting minutes

|                         |   |   |
|-------------------------|---|---|
| Project title           | AO042 Review of Network Rail's carbon reduction calculations and CP5 trajectory | Job number<br>600878-04                           |
| Meeting name and number | Inception & data handover meeting 1   | File reference                                    |
| Location                | OKS - Room 10   | Time and date<br>10:00 - 12 April 2013<br>11:30am |
| Purpose of meeting      | Review proposal, clarify deliverables and handover data                         |   |
| Attendance              |   |   |
| Apologies               |   |   |
| Circulation             | Those attending   |   |

Action

## Summary

Network Rail has a set of measures and environmental indicators, including carbon reduction targets and intensities which they would like reviewing. Arup has been asked to:

- verify the carbon target calculations;
- ensure the numbers are correct; and
- benchmark/ compare NR's reduction targets with other similar organisations – comment on the level of ambition from NR's part and propose recommendations.
- Produce a draft and final report

The current carbon reduction targets in the SBP are not aspirational, but represent a business as usual (BAU) case.

**Arup** will review the BAU projections

In order to project NR's carbon emission reduction trajectory, a 'baseline' figure (2011/12) was also modelled.

**Arup** to review the baseline figures

It was noted that the carbon footprint review will focus only on NR's Scope 1 and 2 emissions.

Agree that the Carbon Review Report will not include an 'accuracy' assessment. Just a 'reliability' assessment.

Note that NR's approach to carbon calculations may not be regarded 'best practice', but is more of a bespoke approach tailored to NR's reporting needs.

Prepared by



Date of circulation

11 April 2013

# Agenda

| Project title   | Job number | Date of Meeting |
|---|------------|-----------------|
| AO042 Review of Network Rail's carbon reduction calculations and CP5 trajectory | 600878-04  | 12 April 2013   |

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## Action

Some of the possible benchmarking examples include: European Rail, UIC, SYSTRA, EuroStat, and London Underground (LU).

**Arup** to carry out a desk-top review

NR's rail carbon footprint is approximately 1/3 road fleet, 1/3 buildings and 1/3 infrastructure assets.

The key deadline for ORR is the draft report of the carbon assessment due on the 1<sup>st</sup> May 2013.

**Arup** to issue draft report on 1/5/13

It was noted that NR buys and sells electricity to Rail Operators but believed that this transaction evens itself out over the period of a year.

Data was handed over by NR to Arup on (1) Utilities and (2) Forecasting calculations. Supporting word documents explaining the methodology were also shared.

**Arup** to review this data on week beginning 15/4/13 and arrange follow-up meeting with NR

During the data handover it was noted that serviced offices are not metered and thus the footprint does not include their emissions because NR pays a general tenant service charge.

With regards to supporting evidence of NR's projected carbon reductions, discussions were held with asset owners in 2010 and 2012 on current and future strategic plans.

Network Rail to confirm the project go-ahead.

**Network Rail** to confirm (via email or letter) that they've accepted Arup's Proposal on Mandate AO042

## Appendix C

Mandate AO/042 - Review of  
Network Rail's carbon reduction  
calculations and CP5 trajectory

## Mandate for Independent Reporter Part A – Review of Network Rail’s carbon reduction calculations and CP5 trajectory

|                        |   |
|------------------------|---|
| Audit Title:           | Review of Network Rail’s carbon reduction calculations and CP5 trajectory |
| Mandate Ref:           | AO/042  |
| Document version:      | Final   |
| Date:                  | 2 April 2013  |
| Draft prepared by:     | Chris Fieldsend   |
| Remit prepared by:     | Chris Fieldsend   |
| Network Rail reviewer: | Jon Haskins   |

### Authorisation to proceed

|              |                |  |
|--------------|----------------|--|
| ORR          | John Larkinson |  |
| Network Rail | Jon Haskins    |  |

## 1 Purpose

This mandate sets out the scope of work for the Part A Independent Reporter (Arup) to review Network Rail’s carbon reduction calculations and CP5 trajectory. As a key component of Network Rail’s proposed CP5 output framework, it is critical that ORR has assurance of the quality of Network Rail’s sustainable development indicators and ambition of Network Rail’s targets.

## 2 Background

The Secretary of State’s (SoS) High Level Output Specification (HLOS) states the ‘rail industry should set itself carbon and energy efficiency objectives, develop indicators to measure its performance against these, and publish this information regularly’. Network Rail included ‘Carbon trajectory’ as an indicator in the Outputs Framework of its Strategic Business Plan (SBP), Network Rail also included annual ‘carbon dioxide emission’ forecasts for 2013-2014 and each year of CP5.

ORR is pleased that Network Rail has responded to the HLOS with a proposal to monitor carbon reduction and a proposed trajectory. We now require assurance that the calculations are sound and reduction levels in line with other similar large infrastructure companies.

## 3 Scope

The review should initially provide accuracy and reliability ratings for the following measures (as reported in Network Rail’s CP5 SBP):

1. Carbon dioxide emissions by year for England & Wales and Scotland
2. Carbon intensity for CP5 and CP6 for England & Wales and Scotland

Network Rail will publish further sustainable development indicators in its Delivery Plan. At this stage, a new mandate will be issued to cover these additional measures

This initial review should cover:

- How accurate and reliable was the calculation process used to determine the forecasts?
- Did Network Rail use appropriate assumptions and input data in calculating the forecasts?
- Is the level of Network Rail’s carbon reduction forecasts in line with those of other similar organisations?

- Do Network Rail's carbon reduction forecasts accurately reflect the key drivers of reduction cited in their SBP; 'planned and ongoing rationalisation of offices, signalling locations and maintenance depots'?
- Has Network Rail omitted other drivers of carbon reduction that would otherwise impact the trajectory of their forecasts?

## 4 Methodology

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The Reporter should meet with relevant Network Rail employees to understand the calculations and business assumptions used in developing the forecasts. The Reporter should also review all relevant documentation and systems, and comment on their quality and fitness for purpose. The Reporter should draw on (and not duplicate) work previously undertaken in their review of Network Rail's SBP and environmental measures. The Reporter's proposal should articulate clearly how they will address each element of the above scope, including which organisations they will consider when comparing Network Rail's carbon reduction forecasts.

## 5 Deliverables

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The Reporter should provide a publishable report, including findings, conclusions and recommendations (explaining the reasons for them and the benefits if implemented along with timescales for completion). The report should be prepared in draft form and sent electronically to Network Rail and ORR, at the same time. The Reporter should facilitate feedback (via a tripartite feedback session if appropriate) and provide a revised report with track changes. This should be followed by a final report for publication on ORR's website.

## 6 Timescales

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A fully costed proposal for this work is required by 09:00 on 8 April. Work is expected to commence immediately after following approval by Network Rail and ORR. A draft report is required by 1 May and a final report is required by 8 May 2013.

## 7 Independent Reporter remit proposal

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The Independent Reporter shall prepare a fully costed proposal for review and approval by Network Rail and ORR on the basis of this mandate. The approved remit will form part of the mandate and shall be attached to this document.

The proposal will detail methodology, tasks, programme, deliverables, resources (including consideration of the mix of seniority and skills required) and costs.

## 8 Confidence grades

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The Independent Reporter shall provide a confidence grade for the annual forecasts for carbon dioxide emissions for England & Wales and Scotland, and carbon intensity forecasts for CP5 and CP6 for England & Wales and Scotland. The confidence grading system in Annex A should be used.

## 9 Conflict of interest

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The Reporter should explicitly highlight any conflicts of interest.

## 10 ARUP quality assurance

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The Reporter should describe the internal processes in place to quality assure the work delivered under this mandate.



## 11 Annex A: Confidence grading system

### System reliability grading system

| System Reliability Band | Description  |
|-------------------------|--|
| A                       | <p>Appropriate, auditable, properly documented, well-defined and written records, reporting arrangements, procedures, investigations and analysis shall be maintained, and consistently applied across Network Rail. Where appropriate the systems used to collect and analyse the data will be automated. The system is regularly reviewed and updated by Network Rail's senior management so that it remains fit for purpose. This includes identifying potential risks that could materially affect the reliability of the system or the accuracy of the data and identifying ways that these risks can be mitigated.</p> <p>The system that is used is recognised as representing best practice and is an effective method of data collation and analysis. If necessary, it also uses appropriate algorithms.</p> <p>The system is resourced by appropriate numbers of effective people who have been appropriately trained. Appropriate contingency plans will also be in place to ensure that if the system fails there is an alternative way of sourcing and processing data to produce appropriate outputs.</p> <p>Appropriate internal verification of the data and the data processing system is carried out and appropriate control systems and governance arrangements are in place.</p> <p>The outputs and any analysis produced by the system are subject to management analysis and challenge. This includes being able to adequately explain variances between expected and actual results, time-series data, targets etc.</p> <p>There may be some negligible shortcomings in the system that would only have a negligible affect on the reliability of the system.</p> |
| B                       | <p>As A, but with minor shortcomings in the system.</p> <p>The minor shortcomings would only have a minor effect on the reliability of the system.</p>   |
| C                       | <p>As A, but with some significant shortcomings in the system.</p> <p>The significant shortcomings would have a significant effect on the reliability of the system.</p>   |
| D                       | <p>As A, but with some highly significant shortcomings in the system.</p> <p>The highly significant shortcomings would have a highly significant effect on the reliability of the system.</p>  |

#### Notes:

1. System reliability is a measure of the overall reliability, quality, robustness and integrity of the system that produces the data.
2. Some examples of the potential shortcomings include old assessment, missing documentation, insufficient internal verification and undocumented reliance on third-party data.

### Accuracy grading system

| Accuracy Band | Description   |
|---------------|---|
| 1*            | Data used to calculate the measure is accurate to within 0.1%     |
| 1             | Data used to calculate the measure is accurate to within 1%       |
| 2             | Data used to calculate the measure is accurate to within 5%       |
| 3             | Data used to calculate the measure is accurate to within 10%      |
| 4             | Data used to calculate the measure is accurate to within 25%      |
| 5             | Data used to calculate the measure is accurate to within 50%      |
| 6             | Data used to calculate the measure is inaccurate by more than 50% |
| X             | Data accuracy cannot be measured                                  |

Notes:

1. Accuracy is a measure of the closeness of the data used in the system to the true values.
2. Accuracy is defined at the 95% confidence level - i.e. the true value of 95% of the data points will be in the accuracy bands defined above.