

Network Rail and Office of Rail  
Regulation

**AO/041: Review of Network Rail's  
Access Charge Supplement  
Calculation**

Report

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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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### Appendix A

Mandate



# 1 Introduction

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In its Part A Independent Reporter role, Arup was commissioned by Network Rail and ORR to review Network Rail's calculation of its Access Charge Supplement (ACS).

This report presents the findings of the review. Following this introduction, the aims of and calculation process for the Access Charge Supplement are briefly described. The overall approach taken to the review is then summarised, and is followed by a detailed description of the review and a presentation of its findings. These are then followed by our conclusions and recommendations. The mandate text is included as Appendix A.

## 2 Background: Access Charge Supplement

### 2.1 Purpose and Aims of the ACS

Franchised passenger Train Operating Companies (TOCs) pay Network Rail an Access Charge Supplement (ACS), and, in return, receive Schedule 4 payments to compensate them for disruption they experience as a result of planned possession activities for Maintenance and Renewals (M&R) activities (disruptions due to Enhancement works are handled separately).

The levels of the ACSs are set so as to cover the estimated Schedule 4 payments incurred by Network Rail as a result of an appropriate number of effectively planned possessions. If possession numbers or durations exceed those anticipated, TOCs may receive Schedule 4 payments in excess of their ACS payments, and Network Rail is thus incentivised to plan and conduct possessions efficiently.

Freight operators (FOCs) are not required to pay ACSs (their compensation payments are funded from Network Rail's general settlement), but may do so in return for full Schedule 4 compensation payments and/or having a cap placed on their Schedule 8 payments arising from a single FOC-attributable incident.

### 2.2 ACS Calculation Methodology

Network Rail uses a spreadsheet-based model to calculate the ACS, and to estimate the expected Schedule 4 costs due to payments to FOCs. Since detailed possession plans are not available for Control Period 5 (CP5), 'bottom up' calculation of CP5 Schedule 4 costs is not possible, and estimated costs based upon historic data are instead used.

In order to determine the value of the ACS, Network Rail calculates a Schedule 4 unit cost per activity, based upon historic (2011/12) aggregate national Schedule 4 payments per unit or volume of maintenance and renewals activity type. As noted in our conclusions, the use of a single base year for this purpose introduces some risk of bias, in the event that it is unrepresentative of the Control Period. However, we understand from Network Rail that changes in access strategies in CP4 have meant that it is difficult to produce consistent unit cost values for different years, and that unit costs for one year would have to be adjusted to make them consistent with those for another, essentially 'cancelling out' some of the potential benefits. If access strategies stabilise in CP5, it should be more feasible to consider multiple years, and, if it is decided to consider costs at a more disaggregate Route or Route Criticality level, it would be particularly beneficial to do so, to provide suitably large and representative disaggregate datasets.

These unit costs are then applied to forecast route-level activity volumes to obtain total forecast Schedule 4 costs for CP5. The total cost is divided among different TOCs in proportion to their historic Schedule 4 payments to determine individual ACSs.

The Schedule 4 cost estimates are then adjusted relative to the 2011/12 data to:

- reflect the improvements required to meet the CP4 target for Possession Disruption Index – Passenger (PDI-P), resulting in an annual reduction of 5% per annum in 2012/13 and 2013/14; and

- reflect the anticipated increase in Schedule 4 track renewal costs, reflecting a greater concentration of CP5 renewals work in more critical sections (i.e. main lines) of the network, resulting in an increase of approximately 25%.

Having thus obtained estimated M&R-related passenger Schedule 4 costs for CP5, the following costs are added:

- an allowance for Schedule 4 compensation associated with Emergency Timetables (due mainly to extreme weather conditions); and
- an estimate of freight Schedule 4 costs, based on ORR's view of the appropriate basis for freight Schedule 4 compensation rates.

## 3 Review Process and Findings

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### 3.1 Overall Approach

This review has two overall points of focus: (i) data quality and (ii) process accuracy and reliability.

There are two main sources of data: historic records of Maintenance and Renewals (M&R) costs and volumes, and forecast volumes for CP5. The historic data are processed extensively in various preliminary spreadsheets and databases to obtain the required cost/volume relationships prior to their input to the main model, while the forecast volumes are calculated outside the main ACS process, and input directly to the main ACS model. These processes were reviewed both qualitatively, in terms of their general suitability, clarity and robustness, and quantitatively, by means of a sample-based audit of the calculations used and the transfer of data between different elements of the overall process.

The preparation of the forecast M&R data for CP5 was reviewed in detail under Independent Reporter Mandates AO/030 and BA/025, and this element of the current review therefore draws upon and summarises the findings of these previous pieces of work.

### 3.2 Data Quality

Data quality is essentially a measure of the robustness of the data used in the activity under review, in this case the data feeding the ACS calculation process. Data quality depends upon various factors, particularly the extent to which the data are recorded objectively and automatically, or are measured and/or recorded subjectively, and are thus prone to errors of measurement or judgement, and therefore potentially inaccurate and/or inconsistent.

As noted above, the two main sources of data feeding the ACS calculation process are (i) the historic possessions volumes and costs data, and (ii) the forecast volumes data. The quality of both sources is reviewed and assessed in the following sub-sections.

#### 3.2.1 Historic Volumes and Costs Data

These data are drawn from the records contained within the Possession Planning System (PPS) and Schedule 4 Compensation System (S4CS). Schedule 4 costs data are obtained from S4CS, while possession activities are obtained from the corresponding PPS records, and the corresponding volumes are obtained from Network Rail's Annual Return.

##### 3.2.1.1 Review Process

A review of the PPS and S4CS systems, and the preparation of the ACS input data, is beyond the scope of the current mandate, and the current review is therefore focussed upon the needs for data cleansing within the ACS calculation process. However, PPS and S4CS have come under review in previous Part A Independent Reporter activities, and some findings from that previous work are referred to in this report.



### 3.2.1.2 Review Findings

The major element of the data cleansing work required in the ACS calculation process is due to mismatches between possession record IDs in PPS and S4CS, which require a significant element of manual intervention. Further problems arise from non-standard data entries, which require additional checking and intervention.

Similar problems with PPS and S4CS records were observed and noted in the Part A Independent Reporter's 2010/11 Quarter 2 report, issued in November 2012, and it is therefore recommended that steps should be taken to improve the consistency within and between PPS and S4CS data records, which will benefit future ACS calculation activities (and also the wider Schedule 4 and Network Availability calculation processes). It is acknowledged that the responsibility for implementing this recommendation lies outside the ACS calculation team within Network Rail.

### 3.2.2 Forecast Volumes Data

As noted above, the forecast M&R data for CP5 were reviewed in detail under the separate Independent Reporter Mandates AO/030 and BA/025, and the findings of these mandates, and their implications for the overall ACS calculation process, are summarised below.

Mandate AO/030 reviewed Network Rail's Strategic Business Plan (SBP) submission for M&R, and thus forecast volumes, in the following categories:

- Track;
- Civils (Structures and Earthworks);
- Buildings;
- Drainage;
- Off-track; and
- Fleet.

Mandate BA/025 reviewed the remaining categories:

- Signalling;
- Level Crossings;
- Electrical Power & Fixed Plant; and
- Telecoms.

#### 3.2.2.1 Review Process

As specified in the brief for this mandate, this element of the current review draws upon the work carried out in Mandates AO/030 and BA/025, but does not duplicate it: this element of the current review is based solely upon a review of the findings reported under the two Mandates above.

### 3.2.2.2 Review Findings

In general terms, the Draft Executive Summary of the Summary Report on Mandate AO/030 notes elements of best practice in Network Rail's SBP submission, including the "application of Asset Policies to derive volumes and costs through strategic models (Tier 1 modelling)" and the use of both 'top down' and 'bottom up' approaches to the determination of forecast volumes and costs, thus "creating a 'comparator' and generating 'competitive tension'". However, the report also noted that it had been "very challenging to clearly identify a 'final' set of volumes and costs that 'represent' the SBP funding request", and it notes that "the exact source of volumes [data] varied from asset to asset, and sub-asset line to sub-asset line for a number of assets." These observations indicate some doubt about the sources and overall quality of the volumes data.

Similarly, the Draft Main Report on Mandate BA/025 (p94) notes "discrepancies between the tables incorporated in the SBP narrative documents and the more detailed costs and volumes models and tables", "errors in the detailed cost and volume datasets", and "discrepancies between the forecast costs and volumes in the latest CP4 Delivery Plan and those captured in [the] SBP."

In the individual M&R categories, the following observations were made in respect of volumes data:

- Track: "there is ... some uncertainty regarding the volume of maintenance activity that Network Rail are proposing for CP5. No maintenance volumes have been provided."
- Civils (Structures and Earthworks): for Bridges, it was noted that there was "significant ... volume uncertainty", while for Major Structures, Tunnels and Other Assets, it was observed consistently that Network Rail had "submitted little information"; for Earthworks, the report noted "moderately high uncertainty associated with the calculated volumes and costs for CP5 and CP6-CP11."
- Buildings: the volumes were described as "generous".
- Drainage: lack of clarity was noted in regard to targets and activities.
- Off-track: no specific comment was made as to the quality of volumes data.
- Fleet: again, no specific comment was made as to the quality of volumes data.

(Note: the following M&R categories were covered by Mandate BA/025, and the findings were presented somewhat differently, but they are again summarised.)

- Signalling: Maintenance and Renewals volumes were found to be aligned consistently between the Tier 1 and Tier 0 models.
- Level Crossings: no comment was made.
- Electrical Power & Fixed Plant: Renewals volumes were found to be aligned consistently between the Tier 1 and Tier 0 models, but no Maintenance values were included in the Tier 0 model.

- Telecoms: Again, renewals volumes were found to be aligned consistently between the Tier 1 and Tier 0 models, but no Maintenance values were included in the Tier 0 model.

There thus appears to be doubt as to the sources and consistency of some of the forecast Volumes data feeding the ACS calculation process. Addressing these, however, would be a major undertaking, and it is again acknowledged that the responsibility for its implementation lies beyond the ACS calculation team. There are nonetheless some lessons that could be learned for repeating the process for CP6 deliverables. For the purposes of the CP5, it is noted that there is scope to adjust the forecast volumes used to reflect ORR's final determination for the Control Period.

### 3.3 Process Accuracy and Reliability

While the Data Quality element of the review focuses upon the robustness of the data feeding the ACS calculation process, this section considers the accuracy and reliability of the processes through which the data pass, and thus the quality of the final outputs.

Factors for consideration include process errors, the extent of process automation (manual intervention, copying and pasting, etc. introduce scope for human error and reduce the quality of the audit trail through the process), process repeatability, the use of spreadsheet best practice (elements of which are listed below in sub-section 3.3.1.1), and the extent and quality of process documentation.

#### 3.3.1 Historic Volumes and Costs

This element of the review covers the spreadsheets and databases used to cleanse and manipulate the historic volumes and costs data prior to their entry to the main ACS calculation spreadsheet, as well as the main spreadsheet itself.

##### 3.3.1.1 Review Process

At the outset of the review process, Network Rail provided the Reporter team with an overview of the Schedule 4 process and a 'walk-through' of the overall model, describing the constituent spreadsheet and database components and the calculation processes used.

The subsequent, detailed review process focussed primarily on the main forecast model spreadsheet itself ([5\\_SBP Schedule 4 forecast route model Oct12 v13](#)). Input spreadsheets linking into, or 'feeding', the forecast model were also assessed. The possession matching spreadsheet ([1\\_Sch4 cost – activity analysis 2011-12 v02](#)) was reviewed first, as it forms the initial input to the model.

The general approach taken was to conduct a sample audit of the consistency and continuity of data running through the model itself, and also through and from the input spreadsheets that provide source data and are linked directly into the model. While carrying out the review, the following key components of spreadsheet best practice were assessed:

- Consistency in the data;

- Sensible use of copying and pasting of 'hard-coded' data where absolutely necessary;
- Good use of 'named ranges' to eliminate inaccuracies;
- Consistent use of formulas, particularly where the 'fill across or down' functionality has been used in tables and lists; and
- Where MS Access has been used, whether the interface with MS Excel is transparent and functioning correctly.

In the following section of this report, any specific recommendations, queries or comments based on errors, observations or non-conformance with spreadsheet best practice are highlighted in *italic text* and are then consolidated in Section 5. In the following section (and as seen above), references to spreadsheets are shown in red text for clarity, and references to other worksheets within the same spreadsheet are presented in *italics*.

### 3.3.1.2 Review Findings

Following the initial process walk-through, Network Rail provided the Reporter team with some documentation describing the overall calculation process. However, no documentation was available listing the specific data sources or individual model components, or describing the flow of data through the model and the modelling process and steps. It is recommended that such documentation be produced, to record the process and to guide and inform new and future users of the process.

#### Possessions Matching

As noted above, the spreadsheet entitled **1\_Sch4 cost – activity analysis 2011-12 v02** was examined first, since it is a key input to the final model. This is where the possessions data from S4CS and PPS are collated and matched, making use of an Access database. Of the 32,190 S4CS records contained in the spreadsheet, 29,150 were matched to the PPS database, using a combination of automated possession ID matching and a subsequent, semi-manual matching process. This represents a correspondence of 91%, and, based upon an examination of the remaining non-matches, is the best result that can reasonably be expected without resorting to a laborious and very time-consuming manual search for additional individual matches (this tallies with experience gained from work undertaken in the preparation of the Part A Independent Reporter 2010/11 Quarter 2 report, referred to above, and emphasises the need for improved correspondence between the underlying PPS and S4CS data).

An error in this spreadsheet was identified in the process of importing the data back from 'Table 130' in the Access database. In the Access database, the first 225 rows in 'Table 130' were not calculated and presented in 'Line Ref' order (the ID key brought through from Excel). This meant that when the table was copied back to Excel, without the 'Line Ref' ID, the first 225 rows were being pasted in the incorrect order. This meant that all calculations following on from this point were incorrect, introducing errors which affected the outputs to the final model (although the number of affected records was a small proportion of the total). Network Rail reviewed and repeated the process, which worked correctly, so the error appears to have been an unexplained 'one-off'. However, its occurrence emphasises the benefits of using standardised, automated processes

where possible, including in-built checks, and having documentation describing and explaining the processes used, and highlighting potential pitfalls and the corresponding checks to be made.

*Recommendation – The ‘Line Ref’ data field should be included in the data export from Access to Excel, so that it can be verified that the records remain in the correct order.*

Apart from this error with the exporting process the rest of the matching process in the Access database was found to be functioning correctly. It was also noted that the remainder of the calculations in **1\_Sch4 cost – activity analysis 2011-12 v02** were correct right through to the summary table starting in cell CV32202, albeit with incorrect values for the first 225 rows for the reason identified above. One other minor query with this worksheet was the inclusion of the manual override table for unmatched lines, that was not being used. The reasoning behind the decision not to use it was unclear, with the only explanatory text being “not used in old, probably won’t be used in new”. We understand from Network Rail that the table is a ‘note to self’ used to maintain a running check on mismatches.

*Recommendation – It should either be explained more clearly on the worksheet why this table is not being used, to avoid potential confusion.*

### Forecast Model

The spreadsheet model entitled **5\_SBP Schedule 4 forecast route model Oct12 v13** was the central element of the review, as it is the main ACS calculation element, where all the data sources are combined and summary tables produced. For this reason, all worksheets within the model were rigorously checked. Where other data input spreadsheets have been checked as part of this process, they are highlighted in red in the text below.

#### *Assumptions* worksheet

All key values on this sheet were checked and found to be input and functioning correctly.

#### *2011-12 Pax Sch4 summary* worksheet

The matched possessions in ‘Table 1a’ were found to have been brought across correctly from the possession matching spreadsheet **1\_Sch4 cost – activity analysis 2011-12 v02** and transposed correctly. Sample numbers from Anglia and Scotland for Electrification and Track were traced back through to the possession matching spreadsheet and found to be correct. The same is true of the unmatched possessions in ‘Table 1b’.

‘Table 2a’ contains claims and other payments not included in detailed S4CS breakdowns. It is linked to the sheet ‘**Top Level Consolidation 2011-12v3**’ and has been transferred across correctly. The data in this sheet are obtained from another source that is not part of this review and so are assumed to be correct. ‘Table 2b’ summarises claims that have been incurred and provided for. This is linked to the worksheet entitled ‘**October 2 KPIs**’. It was initially unclear why only a single claim from this sheet (claim number 3062650) out of 144 separate claims had been carried forward into the model, but Network Rail explained that the allocation is correct, and that claims are listed in full for record purposes, most of them not being related to Schedule 4. It would be helpful if this were stated explicitly on the worksheet, however.

*Recommendation – additional explanation should be provided in the model as to why only this one claim has been included.*

The main table at the bottom of the sheet was thoroughly checked to ensure that the correct totals are being calculated for each route and asset type. Sample numbers from Anglia and Scotland were traced back through the whole sheet to ensure accuracy. The price year of 2012/13 was set correctly in the 'Assumptions' sheet and applied correctly to all values in this summary table.

#### *ETT worksheet*

This sheet is used to estimate the Schedule 4 payments associated with Emergency Timetables. The data for 2010/11 are linked to the spreadsheet **Draft SBP Schedule 4 forecast model Jun12 v02 JA** and the 2011/12 data are indexed from the previous worksheet *2011-12 Pax Sch4 summary*. Both sets of figures were checked, with a particular focus on Anglia and Western, and found to be correct. The average percentage allocations for each route for each year were correctly calculated and the subsequent weightings were found to be accurate. The figures in the final table were found to be correct, based on a £10m forecast spend per year for the last two years of CP4 and the whole of CP5.

The main question raised by this spreadsheet is the small amount of data the weightings are based upon (two years), in contrast to the seven years' data upon which the estimate of future expenditure is based. It is understood from Network Rail that only two years' data were readily available for the route weightings calculations, but that it should be possible to extend the analysis backwards to include years prior to 2010/11.

*Recommendation – if it is possible, it is recommended that data be acquired for years prior to 2010/11 to add to the dataset and thus produce more accurate weightings between the routes.*

#### *S4 Freight worksheet*

The purpose of this sheet is to estimate the Schedule 4 payments associated with freight. The freight km by route are taken from a pivot table in the worksheet entitled **6\_ Freight by commodity and route** and have been transferred across correctly. The raw data that feed the pivot table in **6\_ Freight by commodity and route** are hardcoded and therefore assumed to be correct. The pivot table itself is functioning correctly.

The total passenger Schedule 4 costs have been brought across correctly from the worksheet *2011-12 Pax Sch4 summary*. However, the total Schedule 4 freight cost has been hardcoded, with a small note saying it has been taken from 'base data.'

*Recommendation – further explanation should be included as to where this number has been derived from, as it is vital in calculating the freight costs split by route.*

Assuming that this figure is correct, it was found that the route estimations based upon it were calculated correctly.

#### *CostSourceData\_ICM1 & CostSourceData\_ICM2 worksheet*

These two sheets are not used, but provide a template for new datasets to be added to the model at a later date, with the facility to switch between them already built in.

#### *CostSourceData\_ICM3* worksheet

This is the active ICM sheet and the data in it are linked to [Schedule4\\_20121210 \(2\) re-spaced](#). The link between the sheets was checked with a sample audit on the Anglia and Western numbers, and these were found to be correct. The totals for England & Wales, Scotland, Unallocated and the Network Total from row 94 down were all checked and found to be correct.

The underlying spreadsheet, [Schedule4\\_20121210 \(2\) re-spaced](#) was also audited to ensure that the figures in 'Costs' have been accurately matched from *Sep renewals submissions* and *Sep civils maintenance*. All of the SUMIF calculations were checked from a sample section of LNE and LNW and found to be correct. However, there were some concerns about the majority of the maintenance data, which appeared to be hard-coded and were highlighted in green. It was clear that the civils maintenance figures are taken from *Sep civils maintenance*, but this left track maintenance, signalling maintenance and electrification maintenance unaccounted for. Network Rail subsequently explained that these data had been obtained from their Finance team, and pasted into the worksheet.

*Recommendation – it is suggested that the source and the reason for the hard-coding of the figures highlighted in green in the spreadsheet [Schedule4\\_20121210 \(2\) re-spaced](#) (track maintenance, signalling maintenance and electrification maintenance) should be made clear on the worksheet.*

#### *CostSourceData\_RFS12* worksheet

This sheet provides cost data for financial year 2011/12 and so cannot be used as a source for any other years. The data are linked to [6\\_RegulatoryAccsData2011-12](#) and have been matched correctly from it. The data contained in *PrepSheet2* in [6\\_RegulatoryAccsData2011-12](#) were found to have been correctly indexed, formatted and uplifted to 2012/13 prices through two appropriate preparation stages.

#### *VolSourceData\_ICM1 & VolSourceData\_ICM2* worksheet

In a similar way to the cost worksheets for ICM1 and ICM2, these two worksheets are not used but provide a template for new datasets to be added to the model at a later date, with the facility to switch between them built in.

#### *VolSourceData\_ICM3* worksheet

This is the active ICM sheet and the data in it are linked to [Schedule4\\_20121210 \(2\) re-spaced](#), which contains the forecast volumes data. The link between the spreadsheets was checked with a sample audit on the East Midlands and Wessex numbers, which were found to be correct. The totals for England & Wales, Scotland and the Network Total from row 62 down were all checked and again found to be correct.

The underlying spreadsheet, [Schedule4\\_20121210 \(2\) re-spaced](#), was also audited for functionality and to ensure that the figures in *Volumes* were accurately matched from *Sep renewals submissions*. All of the SUMIF calculations were checked from a sample section of Anglia and Kent, and found to be correct. It

should be noted that the actual forecast data are hardcoded in *worksheets Sep renewals submissions* and *Sep civils maintenance* within [Schedule4\\_20121210 \(2\) re-spaced](#). These figures were therefore assumed to be correct, since checking them is beyond the scope of this audit.

A sample of the 'track factors' in the hidden cells from row 81 were also checked to verify all the lookups to the worksheet *Track – Factors*, and no errors were found. It should also be noted that, unlike the 'Costs' sheet, there are no hard-coded elements in *Volumes* and so the sheet follows spreadsheet best practice.

#### *VolSourceData\_AR12rte* worksheet

This sheet provides underlying volume data from Network Rail's Annual Report for track renewals for the year 2011/12 and so cannot be used as a source for any other years or for signalling renewals. The data are linked to the sheet [6\\_Track renewals](#) and were found to be linked across correctly.

A sample of the data within [6\\_Track renewals](#) was also checked, and found to be correctly indexed from the individual sheets for rail, sleepers, ballast and S&Cs. The data in these individual sheets are mostly hard-coded and were therefore assumed to be correct.

#### *VolSourceData\_AR12tot* worksheet

This sheet provides volume data for renewals across the entire network from Network Rail's Annual Report, but the data are not disaggregated by route. The data are available for all three completed years of CP4, are linked to the spreadsheet [6\\_NRAnnualReports2010-12](#), and were found to have been linked across correctly.

Within [6\\_NRAnnualReports2010-12](#), it is stated that the data have been hard-coded from the Network Rail Annual Reports 2010, 2011 and 2012. These data were checked against the Network Rail Annual Report 2012 (which also contains the records for 2010 and 2011) and one apparent error was identified. The signalling renewals figure for 2004/5 had been input as 576 SEUs when it should apparently have been 1,578, and this had carried down into the totals table and in turn into the main forecast model. Network Rail explained that this anomaly was due to the way in which SEUs had been allocated under the West Coast Route Modernisation programme, and that the value of 576 was in fact correct. It was agreed that a comment to this effect should be added to the cell in question.

*Recommendation – a comment should be added to the cell containing the inconsistent value, explaining its derivation.*

#### *VolSourceData\_AR12SEU* worksheet

This sheet provides underlying volume data from Network Rail's Annual Report for signalling renewals for the year 2011/12, and so cannot be used as a source for any other years or for track renewals. The data are linked to the spreadsheet [6\\_SEU\\_data\\_2011-12](#) and were found to have been linked across correctly.

The internal processes within [6\\_SEU\\_data\\_2011-12](#) were checked, and it was established that the final figures have been indexed correctly from the preparation sheets. However, the original data in *Sheet1* are not adequately labelled, or their source adequately identified.



*Recommendation – it is recommended that ‘Sheet1’ be renamed to something more appropriate and the source of the hard-coded data within this sheet be either linked in or more clearly identified in the text.*

#### *Choice of Costs Source & Choice of Volumes Source* worksheet

These sheets provide an effective tool for selecting the cost and volume sources. It could be considered an unnecessary level of detail but follows spreadsheet best practice and may prove a useful tool for updating the model in the future.

It was noted that the titles at the top of the two sheets are the wrong way round. The Costs sheet has a statement at the top about volumes and vice versa. This is a minor error but could lead to user confusion at a later date.

*Recommendation – the statements at the top of each sheet should be switched round. For future spreadsheet models it should be considered whether this level of functionality is required before proceeding with it.*

#### *CostDataSelectedICMfeed & VolsDataSelectedICMfeed* worksheets

These sheets present the cost and volume data from the selected ICM feeds for the last year of CP4 and the five years of CP5. It is effectively an intermediate step preceding the actual selected costs and volumes sheets, but is functioning correctly.

#### *Selected\_Costs & Selected\_Volumes* worksheet

These sheets provide a definitive list of the costs and volumes from the selected feeds to be used in the model. A sample audit on the figures was conducted for Anglia and Western, and the data were found to be matched correctly from the various sources. The summations in all of the totals boxes were also checked and found to be without errors.

#### *S4unitrates* worksheet

This worksheet is the key to the model, as it calculates the Schedule 4 unit rates based on the selected costs and volumes from the preceding worksheets. The first pair of tables from row 5 to row 17 ascertain whether the costs or volumes sheet should be used for each asset type to establish the volume for 2011/12, collates the appropriate units, applies an efficiency factor and then reports the results split by Route. These values were checked and found to be correct. It was noted, however, that there are no data for the volume of S&C renewals. This is not an error in this sheet but is due to the absence of underlying data in any of the volume data sources. It was also noted that the network total for S&C renewals (333) was not consistent with the sum of the routes (44) as it is with all other asset types. This is due to inconsistencies in the selected data sources. It would appear that ‘VolSourceData\_AR12tot’ contains a value of 289 S&C units for England and Wales that is not reflected in the route split source (‘VolSourceData\_AR12rte’) and so only the figure for Scotland is being carried forward. It is understood that Network Rail have tried to obtain data on the volumes split, but have so far been unsuccessful.

*Recommendation – It should be established if any historical data for S&C volumes split by route in England & Wales are available from any other sources not currently considered in this model. If not, it should be investigated whether*

*an estimate could be made using the total for England & Wales, calculated pro rata for each route using the ICM figures for future years.*

The next set of two tables in the worksheet present the Schedule 4 spend for each asset type. There are no issues with units in this instance, because they are all presented in £S4. A sample of the numbers from M Signalling and R Track were traced back through to the source data in *2011-12 Pax Sch4 summary* and found to be correct.

The final set of two tables in the worksheet report the Schedule 4 unit rates. These are predominantly reported in £S4 per £m, except where other units are required for the volumes. This is a simple 'divide by' calculation and checks indicated the reported unit rates to be correct, based on the preceding tables. Errors are shown for S&C renewals by route due to there being no data in the volumes table. This can only be corrected with the addition of these data, as recommended two paragraphs above.

#### Individual Route Forecast worksheets (*Anglia, Kent, etc.*)

These sheets perform a number of tasks as described and summarised in the table below. The overall output is the forecast Schedule 4 spend by asset type, up to the end of CP5 for each Route. Different functional aspects of the group of sheets were checked in different Route sheets to provide a robust and representative check of all sheets.

Aspect of Sheet	Route Sheet Checked	Errors Found
Geographic mix overlay factors	<i>Anglia</i>	None
Notification efficiency overlay factor	<i>Kent</i>	None
Access efficiency overlay factors	<i>LNE</i>	None
ETTs – external cause	<i>LNW</i>	None
Links to input sheets providing all values	<i>Scotland</i>	None
Calculations based on base values and overlays	<i>Wales</i>	None
Grand totals and summaries	<i>Western</i>	None

#### *Summary* worksheet

This sheet simply summarises the outputs from the individual Route forecast sheets in the form of their grand totals, and then broken down by passenger Schedule 4 M&R work, emergency timetables and freight Schedule 4 work. All data were found to have been linked correctly from the individual Route sheets and all summations to have been carried out correctly. An additional check was carried out to ensure that the sums of the three elements of the 'breakdown' were equal to the totals shown in the 'grand total' table. This was found to be the case.

#### *S4 Output* worksheet

This worksheet separates the passenger elements (M&R and emergency timetables) from the freight element, in order to calculate forecast Schedule 4 ACS costs. This is done for the network as a whole, as well as each individual Route. All the tables were checked and no errors were found.

## 4 Conclusions

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Under Mandate AO/041, Network Rail's ACS calculation process was reviewed, together with the historic and forecast data used in the process. The calculation process was reviewed by means of 'hands on' process and calculation checks, while the historic data review drew upon the data cleansing processes employed in the calculation process, and the Reporter team's prior knowledge of PPS and S4CS data and their preparation. The review of the forecast data was based upon the findings of Independent Reporter Mandates AO/030 and BA/025.

### 4.1 Historic Possessions Data

The nature and quality of the historic data are outside the control of the ACS calculation team, and known inconsistencies in the data are handled through the data cleansing process. However, this is time-consuming, and the necessarily manual process introduces scope for error, and it would be preferable if the quality and consistency of the underlying data could be improved. As noted in Section 2.2, the use of a single year's historic data introduces the risk of bias to the forecast costs, in the event that the chosen year is not representative of activities over the Control Period. However, the use of multiple years from CP4 introduces further complications, and may not justify the effort involved. If the access strategy is more stable in CP5 than it has been in CP4, using multiple years should be feasible, and, if costs need to be disaggregated by route or route criticality level, will be desirable.

### 4.2 Forecast Volumes Data

The forecast volumes data are similarly beyond the control of the ACS calculation team, and the findings of Mandates AO/030 and BA/025 indicate a considerable degree of uncertainty as to the accuracy and consistency of the data, drawn as they are from a wide range of sources and processes. It would again be preferable if the data quality could be improved, although it is recognised that this is a non-trivial task.

### 4.3 Overall Approach to ACS Calculation

Despite the issues relating to the quality of the input data, the overall approach to and process of calculating unit cost rates on the basis of historic data, and applying them to forecast volumes, is considered to be appropriate, and no obvious alternative presents itself. Where possible, the model has been constructed using a bottom-up approach based on a Route-level disaggregation of the network. This has resulted in a high level of transparency throughout the model processes and a high level of detail. Where this has not been possible, such as in the calculation of the Schedule 4 freight costs, totals have been applied to Routes on a pro-rata basis using other factors such as train km. Further disaggregation would require the acquisition of more detailed data, and would further complicate the modelling process. It is essentially a trade-off, and it is concluded that a reasonable level of detail has been achieved given the data availability.

## 4.4 Detailed Calculations and Documentation

Network Rail's approach to calculating the ACS was found to be of generally good quality, and compliant with spreadsheet best practice; in particular, the four specific input reviews set out in the mandate brief were conducted, and no errors were found (but see below regarding unit costs). However, there are considerable uncertainties in relation to the historic and forecast input data, and the use of hard-coded data that are beyond the scope of this review. Also, some actual and apparent errors were found in the modelling process (these have since been resolved), and some queries were raised in the course of the review; these are noted in the preceding text, and consolidated recommendations are listed in the following section of the report. As noted at the start of sub-section 3.3.1.2, the provision of process documentation would be helpful for new users of the ACS calculation process, and would provide a useful record of the data and processes used, particularly if/when the ACS calculation process is repeated in future Periodic Reviews.

In order for the unit costs as calculated in the worksheet 's4unitrates' to be considered reasonable estimates (even allowing for the wider data uncertainties), the queries raised and recommendations made in the preceding text in relation to the specifics of the ACS calculation process will need to be satisfactorily resolved. As noted above, the calculated unit rates are currently based on a single year's possessions data; the adequacy and 'representativeness' of this should be reviewed ahead of the next Periodic Review, and additional years incorporated in the calculations if possible.

## 5 Recommendations

The following recommendations are made:

<i>No.</i>	<i>Recommendations</i>	<i>Location in Text</i>	<i>Data Champion Responsible</i>	<i>Due Date</i>
2013.ACS.1	Documentation of the ACS calculation process should be produced, listing the data sources and model components, indicating the flow of data through the calculation process, and describing the process used and steps taken. This should also include any lessons learnt from the CP5 process and notes of beneficial changes for CP6		ACS calculation team	December 2013
2013.ACS.2	Possessions Matching: clarify uncertainties raised in relation to possessions matching process and data use.	3.3.1.2	ACS calculation team	April 2013
2013.ACS.3	Forecast model: check on the availability of additional data; provide additional information on data sources and the reasons for hard coding; and label worksheets and worksheet tabs correctly and appropriately.	3.3.1.2	ACS calculation team	April 2013
2013.ACS.4	Review feasibility of using multiple years of historic possessions data to represent unit costs for future full Control Periods.	4	ACS calculation team	March 2014

Note: as recorded in the text of this report, there are significant issues in relation to (i) the consistency between PPS and S4CS data records, and (ii) the overall quality of the forecast volumes data. While these affect the quality of the ACS calculation inputs and outputs, they are beyond the direct control of Network Rail's ACS team, and are best dealt with through the findings and recommendations arising from Independent Reporter reviews specific to these areas.



## Appendix A

### Mandate





## Mandate for Independent Reporter Part A – Review of Network Rail's Access Charge Supplement calculation

Audit Title:	Review of Network Rail's Access Charge Supplement calculation
Mandate Ref:	AO 0XX
Document version:	Draft
Date:	14 February 2013
Draft prepared by:	Joe Quill
Remit prepared by:	Joe Quill
Network Rail reviewer:	TBC (James Angus?)

Authorisation to proceed

ORR	Andy Lewis	
Network Rail	Bill Davidson	

### Purpose

- To review Network Rail's (NR's) Access Charge Supplement (ACS) calculation
- To advise on the robustness of the ACS calculation, and associated uncertainties underpinning the calculation.

### Background

As part of its Strategic Business Plan (SPB) submission for Periodic Review 2013 (PR13) NR has presented ORR with a spread sheet model detailing its calculation of the ACS, and also the expected Schedule 4 costs relating to rail freight operators. The ACS is paid by franchised passenger operators; freight operators do not pay the ACS (although they can opt to in return for full Schedule 4 possession compensation payments). As part of PR13, ORR undertakes a review of this calculation.

To calculate the ACS, NR derives a Schedule 4 unit cost per asset type (e.g. track, signalling etc.). It then multiplies these unit costs by route level CP5 forecast maintenance and renewals volumes to derive total Schedule 4 possession cost over CP5. To estimate Schedule 4 unit costs, Network Rail undertakes an analysis of Schedule 4 payments in a base period. For each possession in the base year, Network Rail knows how much Schedule 4 was paid to each activity and what kind of work was carried out in each possession. From this it estimates how much Schedule 4 was paid in relation to each activity; and given that it knows the volume of each activity, dividing one by the other gives the Schedule 4 cost for each unit of activity. This is currently carried out at the national level, rather than, for example, route level. This is because Network Rail considers there is insufficient data at the route level to provide robust unit cost estimates for each activity at the route level.

The total projected Schedule 4 cost is then disaggregated into individual ACSs for each TOC divided pro-rata to historic schedule 4 payments paid by each franchised passenger operators in a selected base year (at the last periodic review the base year was 2006/07). A full explanation of how NR calculates the ACS is attached with this mandate is an explanation of NR's methodology for calculating the ACS.

## Scope / Methodology

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### Network Rail's ACS calculation spreadsheet

The independent reporter is required to critically review the methodology and calculations Network Rail has used to calculate ACS. The following sections provide more details of the scope of this review.

Reporter studies to assess M&R volumes in CP5 are already being carried out. Work under this mandate should draw on this work and not duplicate it.

- The Part A Reporter is conducting a review of M&R volumes for track, off-track, buildings, civils, drainage and fleet under mandate AO/030; and
- The Part B Reporter is conducting a review of M&R volumes for signalling, level crossings, telecoms and electrification & plant under mandate BA/025.

### ACS calculation

Network Rail will talk Arup through the process that it went through in order to calculate the ACS. Following this initial discussion Arup should:

- Review and comment on Network Rail's approach to calculating the ACS, including assumptions and whether an appropriate amount of route level disaggregation was used in the calculation.
- Review the worksheets within the spread sheet model for computational errors within and between worksheets.
- Review the inputs used, in particular:
  - an audit (on a sample basis) of the accuracy of the allocation of CP4 possession cost data from the possession payments system to TOCs as described at Table 1A in worksheet entitled, '2011-12\_Pax\_SCh4\_summary
  - the basis and accuracy for the allocation of possession costs described as 'claims other payments not detailed S4CS breakdowns' and 'claims incurred & Provided for (but not yet paid / put on 42 day statements) as detailed respectively in Tables 1b and 2 in worksheet entitled, '2011-12\_Pax\_SCh4\_summary
  - calculation of the Emergency Time Table element as part of schedule 4 costs estimate
  - Final calculation of schedule 4 unit cost per asset type as shown in in cells I38-I49 of work sheet entitled s4unitrates. Including an assessment of whether these unit costs are reasonable estimates.
- Propose any improvements in the methodology that it might be possible to implement for CP6 Deliverables

The Reporter should provide a report, including findings, conclusions and recommendations, expressed in quantitative terms where meaningful to do so. The report should be prepared in draft form and sent electronically to Network Rail and ORR, at the same time. The Reporter should facilitate and provide a revised

report with track changes. This should be followed by a final report, redacted if necessary, for publication on ORR's website.

### **Timescales / Resources**

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A fully costed proposal for this work is required by **8 March 2013**. The response should also confirm whether there are any conflicts of interest and if so how they will be handled.

Work is expected to commence shortly after, following approval by NR and ORR.

The deliverables are to be phased as follows:

- Draft report setting out whether the Reporter is satisfied with NR's initial analysis, any concerns it has, and the scale of uncertainty associated with different estimates by no later than close of business 8 April 2013
- Final report setting out whether the Reporter is satisfied with NR's initial analysis, any concerns it has, and the scale of uncertainty associated with different estimates by no later than close of business 22 April 2013

ORR and NR will aim to provide comments on the draft report by no later than close on business on **15 April 2013** (assuming the draft report is received on **8 April 2013**).

### **Independent Reporter remit proposal**

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The Independent Reporter shall prepare a fully costed proposal for review and approval by NR 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 and costs.

### **Confidence grades**

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Confidence grades are not required for this mandate.