Network Rail and Office of Rail Regulation

Independent Reporter (Part A)

AO/032: Check of NR's HLOS Capacity Metrics for CP4 and CP5

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This report responds to Mandate AO/032 and covers a review of the HLOS Capacity Metrics for Control Period 4 (CP4) and Control Period 5 (CP5). The purpose is to validate the actual capacity metrics from the CP4 enhancement projects by checking that Network Rail has updated its forecast capacity metrics for the end of CP4. The review also checks that the projects proposed in the SBP for Control Period 5 deliver the forecast capacity metrics specified in the 2012 HLOS.

The specification of capacity metrics in the HLOS has changed between CP4 and CP5. Most notably this is due to the absence of a load factor target in the 2012 HLOS, which means there is not an implied minimum level of capacity specified.

In addition, Network Rail has updated its approach to calculating capacity metrics for CP5 by using a different measure of capacity. For the CP5 capacity metric a "20-minute rule" has been applied, which only permits a standing allowance on services where the penultimate stop is less than 20 minutes from the destination terminal or city. For the CP4 capacity metric, capacity was measured by assuming an allowance for standing on all trains and not just those stopping within 20 minutes of the terminating station. This change in approach means that minor model adjustments are required to compare the CP4 metrics accurately with the 2007 HLOS specification.

Our detailed review of the capacity metrics model has concluded that it is fit for purpose and does not contain any computational errors. The outputs contained in the model are consistent with the output submitted as part of the Network Rail Strategic Business Plan (SBP)

A check of the CP4 metrics shows that load factor targets specified in the 2007 HLOS are no longer forecast to be achieved for London in aggregate or for the regional cities. However, capacity targets were based on an assumed increase in rolling stock provision, and were measured in terms of additional passenger arrivals at terminal stations. Because the Department for Transport reduced the rolling stock provision during CP4, the actual capacity provision for 2014 will be less than originally targeted. Appendix D provides a high level overview of where CP4 metrics are no longer expected to be met. Whilst Network Rail has not specifically quantified the amount of capacity that will not be delivered due to non-delivery of rolling stock (DfT responsibility) and non-delivery of infrastructure (Network Rail responsibility) it is clear from this narrative, and from discussions with Network Rail and ORR, that it is reasonable to assume that the non-delivery of rolling stock is the primary reason for the CP4 metrics not being met.

The absence of a load factor target in the 2012 HLOS makes it difficult to provide a simple pass/fail for the CP5 capacity metrics. Network Rail have used the approach of comparing load factors at the end of CP4 to the end of CP5 load factors (based on the same definition of demand and capacity) to demonstrate that load factors can be broadly maintained at a similar level. We consider this to be a reasonable approach to assessing whether demand can be accommodated.

Based on the assumption planned capacity interventions for CP5 are delivered the additional "demand to be accommodated" in the HLOS can be met. This assumes

that the rolling stock required to maximise the infrastructure enhancements is delivered, which is the responsibility of DfT via the franchising process. Over 90 % of the additional peak capacity in the plan is delivered by "committed" schemes, "named" schemes, or operational changes that do not require specific infrastructure upgrades. The remaining 10% is delivered by a number of industry nominated enhancement schemes, required to meet growth anticipated by the HLOS.

1 Introduction

Arup is the appointed Part A Independent Reporter, with responsibility for providing assurance as to the quality, accuracy and reliability of the data and processes used by Network Rail to report performance to ORR, the DfT and the wider industry.

This report responds to Mandate AO/032 and covers a review of the HLOS Capacity Metrics for Control Period 4 (CP4) and Control Period 5 (CP5). The purpose is to validate the actual capacity metrics from the CP4 enhancement projects by checking that Network Rail has updated its forecast capacity metrics for the end of CP4 (as set in the 2007 High Level Output Specification), and that the methodology, calculations, inputs and assumptions are sufficiently robust.

The review also checks that the projects proposed in the SBP for Control Period 5 deliver the forecast capacity metrics specified in the 2012 HLOS.

The mandate for the review is provided in Appendix A.

Following this Introduction this report is structured as follows:

Section 2 provides an overview of the review process and the documentation reviewed;

Section 3 provides a definition of the HLOS capacity metrics for CP4 and CP5 as specified in the 2007 HLOS and 2012 HLOS;

Section 4 provides a review of the model developed by Network Rail and the inputs and calculations that underpin the capacity metrics;

Section 5 covers the validation and output checks of CP4 metrics;

Section 6 considers the CP5 interventions and summarises the forecast CP5 metrics; and

Section 7 summarises our conclusions.

There are 5 appendices included with this report (TBC on Monday):

- Appendix A – Mandate for the review;
- Appendix B – Extracts on Capacity Metrics from HLOS 2007 and HLOS 2012;
- Appendix C – Detailed Map of the Capacity Metrics Spreadsheet Model;
- Appendix D – Network Rail narrative explaining differences between the PR08 HLOS / SBP, and the PR13 SBP; and
- Appendix E - Summary of capacity interventions by HLOS Terminal.

2 Review Process

The HLOS capacity metrics review has been undertaken in five overall stages:

1. **Inception Phase** – An initial meeting with Network Rail and ORR was held to agree the overall approach and exchange relevant information. In this stage the project team also reviewed all the background documentation and models provided;
2. **Model Review** – detailed review of the capacity metrics model;
3. **Principal Strategic Planner Meetings** – meetings with route planners to discuss each HLOS terminal and the capacity interventions underpinning the calculation of the capacity metrics;
4. **Capacity Metric Output Checks** – review of the outputs for CP4 and CP5 capacity metrics; and
5. **Reporting –** in addition to this report a presentation of draft findings was held on 4th March with Network Rail and ORR.

2.1 Meetings

To support the review a series of meetings were held with Network Rail at both national and local levels, involving key personnel involved in the production of the HLOS Capacity Metrics.

The table below summarises the meetings that have informed the review.

Date	Meeting name	Location
14th Jan 2013	Inception Meeting	London
24th Jan 2013	Meeting with URS and Nichols	London
29th Jan 2013	Meeting with DfT and Nichols	London
6th Feb 2013	Model Review Meeting	London
11th Feb 2013	Route Planner Meeting-Western	Swindon
14th Feb 2013	Follow-up Meeting with URS and Nichols	London
18th Feb 2013	Route Planner Meeting-LNW	Birmingham
20th Feb 2013	Route Planner Meeting-LSE	London
25th Feb 2013	Route Planner Meeting-LNE	York
4th Mar 2013	Draft Findings Presentation	London

Table 1 Review Meetings and Dates

The model review meeting was arranged with the lead modeller from Network Rail responsible for the development of the passenger capacity metrics spreadsheet model. The objective of the meeting was to clarify areas of uncertainty regarding the model. It also provided the opportunity to confirm Arup's understanding of the model was accurate.

Meetings with Principal Strategic Planners were arranged with representatives from each of the routes. This formed part of the input check and was mainly concerned with the reviewing the capacity interventions for each of the HLOS terminals.

2.2 Documentation Received

As part of the inception phase Network Rail highlighted the following documents from the Strategic Business Plan (SBP) documentation as being relevant to the review. Access to all SBP documents has been made available to the Office of Rail Regulation and their reporters via the Sharepoint site.

Tier 1 Docs

- SBPT101 Network Rail SBP (E&W) Page 66

Tier 2 Docs

- SBPT201 Industry SBP (E&W) Section 4.4
- SBPT231 Passenger Capacity Summary

Tier 3 Docs

- SBPT3310 Passenger Capacity Plan
- SBPT3310 Passenger Capacity Metrics Spreadsheet

Enhancements Projects Data

- SBPT3170 Overarching CP5 Enhancements Plan
- SBPT3182 Enhancements Projects SBP Master List

Route Plans

- SBPT210 Anglia Route
- SBPT211 East Midland Route
- SBPT212 Kent Route
- SBPT213 London North Eastern Route
- SBPT214 London North Western
- SBPT216 Sussex Route
- SBPT218 Wessex Route
- SBPT219 Western Route

In addition to the information provided in the SBP documentation the following documents have been used to inform the review:

- Network RUS-Electrification Strategy (June 2009)
- London and South East (July 2011)
- Northern (May 2011)
- West Midlands and Chilterns (May 2011)
- Sussex (January 2010)
- South West Main Line (March 2006)

3 HLOS Capacity Metric Definitions

This section provides definitions for the HLOS capacity metrics for CP4 and CP5 as set out in the 2007 HLOS and 2012 HLOS respectively. It is important to note that there are differences in the way the two metrics have been specified by DfT.

3.1 HLOS 2007 Capacity Metric

An extract from the 2007 HLOS is included in Appendix B providing the full definition of the CP4 capacity metric. The points below summarise the definition of the CP4 capacity metric:

- The metric covers central London stations and large regional cities. In the case of regional cities capacity metrics are specified by city and not for specific terminals within the city;
- A one and three hour weekday morning peak metric was specified;
- Demand to be accommodated includes all (First and Standard) passengers on arrival at major terminating stations;
- HLOS load factors were expressed assuming an allowance for standing passengers on all trains; and
- Services provided by open access operators and Merseyrail were excluded;

In 2007, a "maximum average load factor" to be met by the end of CP4 was specified. This allows for a minimum level of capacity provision to be inferred.

3.2 HLOS 2012 Capacity Metric

An extract from the 2012 HLOS is included in Appendix B providing the full definition of the CP5 capacity metric. The points below outline the CP5 capacity metric. **Differences in the definition compared to the 2007 HLOS are shown in bold**:

- The metric covers central London stations and large regional cities. In the case of regional cities capacity metrics are specified by city and not for specific terminals within the city;
- **Some stations have been disaggregated since HLOS 2007 (e.g. London Bridge is split into Kent and Sussex);**
- A one and three hour weekday morning peak metric was specified;
- Demand to be accommodated includes all (First and Standard) passengers on arrival at major terminating stations;
- **Capacity has been measured using the "20 minute rule". This means that standing capacity is only included for trains that stop within 20 minutes of the HLOS terminal;**
- **Cardiff has not been included in the 2012 HLOS; and**
- Services provided by open access operators and Merseyrail were excluded;

In 2012, the specification **does not include a "maximum average load factor" to be met by the end of CP5,** and therefore a minimum level of capacity cannot be inferred.

3.3 Measurement of Capacity and Demand

Since 2007, the measurement of capacity and demand has been defined in different ways. This section provides an explanation of the concepts of demand and capacity and how these have been applied for the capacity metrics.

3.3.1 Capacity

For the CP5 capacity metric a "20-minute rule" has been applied, which permits standing on services where the penultimate stop is less than 20 minutes from the destination terminal or city. The amount of standing capacity provided is determined by the amount of floor space available for standing passengers and an acceptable level of standing passenger density (typically a minimum of 0.45m^2 per standing passenger). The standing capacity available therefore varies depending on the rolling stock type.

For the CP4 capacity metric, capacity was measured by assuming an allowance for standing on all trains and not just those stopping within 20 minutes of the terminating station.

3.3.2 Demand

While the capacity of a train is generally fixed throughout its journey, the passenger loading will vary. This raises the question at what point should demand be measured. The Initial Industry Plan (IIP), undertaken in September 2011, used the most heavily loaded point on a train's journey, which is not necessarily always the terminating station. For example, morning peak loads on arrival at London Waterloo are typically 15% lower than on arrival at Clapham Junction.

In both the 2007 and 2012 HLOS, the approach taken has been to use demand measured at the terminating station regardless of whether it is the most heavily loaded point.

Demand forecasts (i.e. demand to be accommodated as stated in the HLOS) comes from DfT's Network Modelling Framework (NMF). Since 2007, the demand forecasts have been refined, and for this reason the demand forecasts for the end of CP4 included in the Passenger Capacity Metrics Model are different to those published in the 2007 HLOS. Additionally the figures for Crossrail demand have been adjusted based on outputs from the TfL Crossrail RailPlan model. Auditing of these source models for demand data was not within the scope of this Reporter Mandate

4 Model Review

4.1 Purpose of the Model

The passenger capacity metrics spreadsheet model (SBPT3310 Passenger Capacity Metrics Spreadsheet.xls), which Network Rail submitted with the SBP, is used to determine the capacity that is expected to be provided by the end of CP4 and CP5 at each of the stations/cities defined in the 2012 HLOS. The outputs of the model can then be used to confirm whether the projects proposed in the SBP are expected to deliver the specified capacity metric.

4.2 Model Format and Functionality

The model that has been reviewed is a Microsoft Excel workbook and is titled SBPT3310 Passenger Capacity Metrics Spreadsheet.xls. It was submitted as part of Network Rail's Strategic Business Plan on 7th January 2013.

A functional specification was not provided with the model; however the workbook itself contains a note that gives a brief description of each of the sheets and outlines the general conventions that have been adopted.

The spreadsheet's main function is quantifying the impact of capacity interventions on the number of vehicle arrivals at selected stations. The model in its original form is capable of producing load factors for the end of CP4 and CP5 based on the PR13 SBP definition of capacity and demand; however it is not possible to validate the original CP4 metrics that were set in the 2007 HLOS without first making alterations to the model. The required changes to achieve this comparison are covered in further detail in Section 5 of this report.

4.3 Approach to Model Review

The model review has been undertaken in the following stages:

1. Detailed model mapping to confirm the flow of data in the model and to establish precisely how the model works;
2. Use of "Excel Analyst" spreadsheet software to confirm the dimensions and size of the model. The software generates statistics on the model, and formulas, to indicate areas of high and low computational risk. Outputs are used to focus more detailed computational checks.
3. Detailed computational checks;
4. Input checks and output checks; and
5. Review meeting with Network Rail to confirm our understanding and clarify detailed questions on data flow and model functionality.

4.4 How the Model Works

The model is comprised of four key stages which can be seen in Figure 1. Simplistically the model calculates the base year capacity using 2009 timetable data, and then applies capacity interventions incrementally in order to forecast the

capacity that is expected to be provided at each of the HLOS terminals (or cities) by the end of CP4 and CP5.

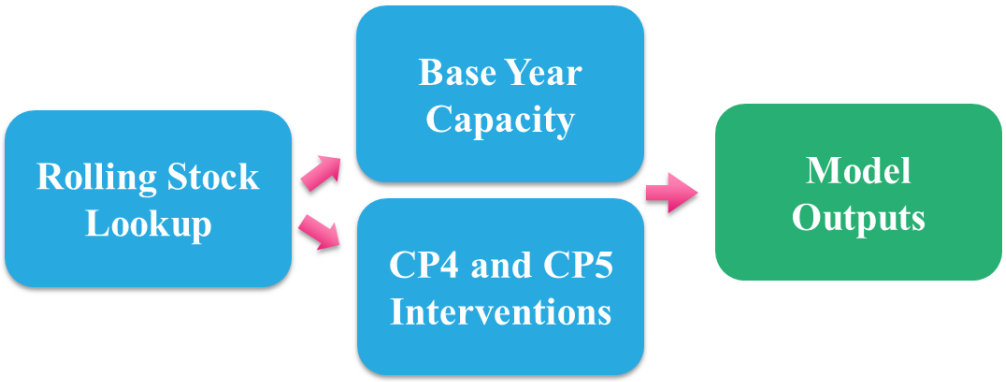

Figure 1 Overview of key model stages

A detailed map of the model is included in Appendix C. The following sections provide a more detailed summary of each of the four model stages.

4.4.1 Rolling Stock Lookup

The spreadsheet contains functionality to accommodate a number of different rolling stock scenarios. A drop down menu has been included in the model which is located in the 'HLOS City Summary' sheet. This menu allows the user to select the relevant rolling stock scenario depending on their desired output (i.e. IIP, PR08 SBP, PR13 SBP).

Four different Rolling Stock capacity lookup tables are available including the rolling stock data used for PR08 SBP, IIP 2011, PR13 SBP and a placeholder for additional capacity data titled 'SPARE'. Each table contains a complete list of the rolling stock types that appear in the model with its associated number of vehicles per unit, seats per unit and seats plus standing per unit. This data is used to calculate the average seats and capacity per vehicle for each rolling stock type. The model also reflects changes to rolling stock capacities as a result of layout reconfigurations such as the refurbishment of the LOROL class 378's (see appendix D).

4.4.2 Base Year Capacity

In order to estimate the capacity provided at each HLOS terminal/city at the beginning of CP4 a base case has been developed using the December 2009 timetable. It has been assumed that any CP4 enhancements that occurred between the end of CP3 (31st March 2009) and December 2009 are accounted for in the base year capacity. Each HLOS city/terminal has an individual 'base year capacity' sheet which outlines the number of passenger vehicles arriving in the morning peak at that particular station. The model groups the number of passenger vehicle arrivals by rolling stock type and by the number arriving in the high peak. This information is then used alongside the rolling stock capacity lookup tables to estimate capacity provided in the base year.

Capacity is calculated using the three different definitions that have been described in Section 3.3 (i.e. number of seats, "20 minute rule" and total

capacity). In order to determine capacity as defined by the 20 minute rule, it is necessary to identify whether the arriving vehicle calls at a location less than 20 minutes away from the station/city of interest or not. This information is included in the model as part of the base December 2009 timetable data.

4.4.3 CP4 and CP5 Interventions

Each HLOS terminal/city is assigned an individual sheet that outlines the capacity interventions which impact the number of vehicle arrivals at that particular station. An intervention is interpreted as any service change that has taken place or is expected to take place since the December 2009 timetable was published. These service changes often rely upon an enabling infrastructure enhancement; however in many cases the service change is the result of an operational change only. As capacity is ultimately delivered in the form of more frequent services or lengthened rolling stock this is how it is presented in the model.

Each capacity intervention outlines the extra vehicle arrivals provided by the intervention in the high and 3 hour peak and the vehicle arrivals are again split in a manner that facilitates the different measurements of capacity. Each intervention is allocated a specific rolling stock type and by using the rolling stock lookup tables an estimation of the additional capacity provided is determined. It should be noted that in the same way an intervention can provide extra vehicles arriving at a station an intervention can also reduce the number of vehicle arrivals. This is necessary in situations such as rolling stock cascades where the rolling stock being replaced has a lower capacity per vehicle than the rolling stock being introduced. Negative values also represent the expected transfer of demand due to the introduction of Thameslink and Crossrail service patterns.

The additional capacity is then added to the base year capacity in order to calculate the expected end of CP4 and CP5 capacity at that HLOS station/cities and it is these figures that provide the main model output.

It should be noted that a number of the CP4 capacity interventions account for service changes that have already occurred and are therefore in a re-basing from the December 2009 timetable to the current December 2012 position.

4.4.4 Model Outputs

Once the capacity at the end of CP4 and CP5 has been determined this data is then summarised in a number of output sheets alongside the 2012 HLOS demand figures. This data is used to determine end of CP4 and CP5 load factors which form the final outputs from the spreadsheet.

4.5 Inputs

The following table provides a summary of the core inputs and the checks undertaken as part of the model review.

Input	Description	Outcome from Check
December 2009 Timetable	The base year capacity is calculated based on the December 2009 timetable data. Capacities are entered into the model as numbers of vehicles arriving at HLOS terminals and are	Values were found to be consistent across all HLOS terminals. Where differences exist

	therefore derived based on the timetable and rolling stock formations. Base capacities have been compared against equivalent values in RUSs (noting that the LSE RUS is based on the December 2010 TT), which define capacity in the same way.	these can be explained by capacity improvements delivered in the December 2010 timetable.
Rolling Stock Capacities	Rolling Stock capacities have been sourced by from the Network Modelling Framework (NMF). These values are consistent with the capacity assumptions used in other capacity regimes such as franchise "PIXC" regimes. In some cases it has been necessary to make capacity assumptions for new rolling stock that was not included in the NMF list (e.g. IEP rolling stock). Rolling stock capacity changes as a result of refurbishment have also been reflected in the model.	Rolling stock capacities are in line with expectations and clearly documented in the capacity metrics spreadsheet.
Capacity Interventions	Each "intervention" that changes the number of vehicle arrivals, or the capacity of a service, into a terminal is included in the model so that the incremental change in capacity can be modelled. Meetings with Principle Strategic Planners were arranged with representatives from each of the routes. This formed an important part of the input check and provided the opportunity to consider each capacity intervention.	Capacity interventions are accurately reflected in the model, and infrastructure solutions are expected to deliver the incremental output assumed.
HLOS Demand Forecasts	Appendix A to the 2012 HLOS titled "Capacity Metric" includes tables specifying the number of passengers to be accommodated into major cites (Table 2) and London Termini (Table 3). These figures have been compared to the capacity metrics model inputs.	No discrepancies identified

Table 2 Summary of Model Inputs and Check

4.6 Calculations

A computational check of the spreadsheet has been performed in two stages. The first stage tested the model using the spreadsheet review tool "Excel analyst". "Excel Analyst" generates statistics on the model and highlights areas of high computational risk. The risk report produced by "Excel analyst" is shown in Figure 2.

The results of the model concluded that "Indirect" functions and "Nested If Statements" had been used in the model, which are factors that suggest that complex logical modelling has been used. Due to the complexity that is often associated with these functions and the fact that "Indirect" functions are inherently difficult to audit (Excels in-built auditing tools, such as trace precedent, cannot follow indirect functions) these formulas were flagged as areas that should receive particular attention during the detailed computational check. The XLAnalyst results also provide the location of the potential risk which simplifies this task.

Following the application of the "Excel Analyst" software a detailed computational check of the spreadsheet was performed. This more detailed check

reviewed each sheet and examined all calculations, focussing on the higher risk areas identified by the "Excel Analyst" report.

As a result of testing using "Execl Analyst" and detailed computational checks we have not identified any computational errors in the model.

XLAnalyst by Codematic Ltd — Test Date: 15 January 2013 - 11:51:57

Workbook name: SBPT3310 Passenger Capacity Metrics Spreadsheet.xls

Overall Risk Rating = 51% — Higher value means more chance of defects. Low risk rating is not the same as defect free.

Help	Summary Potential Risk Report	Results	Info	Example address	Example formula	Weighting (0-10, 10 =
	Factors suggesting a high risk of an error					
?	Circular References	Not Found				10
?	Cells Displaying A Number But Storing Text	Not Found				10
?	Mixed Formulas And Values	Found		Rolling Stock Lookup!$D$5	=IF('HLOS City Summary'!$N$12=1, IIP!D5, IF('HLOS City Summ	10
?	Formulas Evaluating To An Error	Found		Summary (Hidden)!$D$28	=INDIRECT($B28&"!R"&MATCH("Total",INDIRECT($B28&"!$A$1	10
?	Vlookups Expecting An Ordered List	Not Found				8
?	Hlookups Expecting An Ordered List	Not Found				8
	Factors suggesting a significant risk of an error					
?	Links To External Workbooks	Not Found				5
?	Presence Of Very Hidden Sheets	Not Found				5
?	Hidden Rows Or Columns	Found		PR13 SBP!Column I:I	is hidden	3
?	"=+" Construct	Not Found				3
?	Conditional Formatting	Found		Base Year Capacity!$G$8	=OFFSET(Summary!E$5, MATCH($C8, Stations_Summary,0),0	3
?	Use Of Pivot Tables	Not Found				3
	Factors suggesting complex logical modelling					
?	Array Formulas	Not Found				8
?	Nested If Statements	Found		Rolling Stock Lookup!$D$5	=IF('HLOS City Summary'!$N$12=1, IIP!D5, IF('HLOS City Summ	6
?	Use Of Sumif	Found		BFS_T2!$D$21	=SUMIF($A$5:$A$7,"CP4",Q$5:Q$7)	5
?	Use Of Database Functions (Dsum Etc)	Not Found				5
?	Use Of Indirect	Found		Summary (Hidden)!$D$6	=INDIRECT($B6&"!R"&MATCH("Total",INDIRECT($B6&"!$A$1:$A	5
	Measures					
?	Longest Formula	Above Limit	309	Peak 3 hours summary!$B$3	=IF('Base Year Capacity'!P12=1, "IIP Rolling Stock Capacity Loc	7
?	Most Complex Formula	Above Limit	19	Rolling Stock Lookup!$D$5	=IF('HLOS City Summary'!$N$12=1, IIP!D5, IF('HLOS City Summ	7
?	Total Number Of Formulas	Above Limit	13,845			5
?	Total Number Of Unique Formulas	Above Limit	447			5
?	Workbook Size	Above Limit	2,304 Kb			5
?	No Of Worksheets	Above Limit	82			5
?	Total All Lines of VBA Code	Within Limit	99/86	99 Lines	In 86 Components	8
?	Largest Formula Result	Above Limit	1.2E+06	Peak 3 hours summary!$Z$28	=SUM(Z9:Z27)	0
	System messages					
?	Protected Worksheets	Not Found				
?	Protected Workbook Structure	Not Found				
?	Other	Not Found				

Figure 2 "Excel Analyst" Summary Report

5 Validation of CP4 Capacity Metric

As part of the Mandate, Arup are required to validate the actual capacity metrics for the end of Control Period 4 as established through Periodic Review 2008, by checking how the level of capacity expected to be provided by the end of CP4 compares to the capacity metric as set in the 2007 HLOS.

The model does not contain the functionality to perform these checks without first making some adjustments. These adjustments ensure that the model:

1. Measures capacity in a manner consistent with the PR08 SBP and HLOS; and
2. Uses PR08 HLOS demand forecasts.

5.1 Model Adjustments

The model adjustments required to validate the CP4 capacity metric are outlined in the following steps:

- **Step 1**: Change the rolling stock lookup so that the SBP Periodic Review 2008 rolling stock capacity values are used. This is a straightforward adjustment as the spreadsheet has built in functionality to accommodate a number of different rolling stock scenarios. This change is performed by selecting the SBP PR08 rolling stock capacity data from the drop down menu located in the 'HLOS City Summary' sheet.
- **Step 2**: A different set of capacity results must be used in order to match the capacity definition adopted for SBP PR08. The spreadsheet calculates the capacity provided at each HLOS terminal/city using three different measurements of capacity and the results of this are presented in the 'Peak 3 hours summary' and 'Peak hour summary' sheets. The model in its original form takes the '20 min rule' capacity and passes this data through to the 'Load Factor Tables' sheet to calculate the final Load Factors. This flow of data has to be altered so that the total capacity (i.e. seats + standing for all services) values are used instead. This alteration is made for both the three hour and high peak hour.
- **Step 3**: Demand forecasts in the model need to be consistent with the 2007 HLOS. In the model the 'HLOS Demand' sheet summarises the HLOS 2012 forecast demand for both 2013/14 and 2018/19 in the peak three hours and high peak hour. This data is then fed through to the 'Load Factor Tables' sheet to calculate the expected load factors for the end of CP4 and CP5. To check the CP4 capacity metrics, the 2012 demand data has to be replaced by the 2007 demand forecasts. The red boxes in the Figure 3 show the values that have been adjusted.

Once these changes are complete the capacity for each HLOS terminal/City can be reviewed and load factors compared to the 2007 HLOS specification.

	Peak Three Hours			High Peak Hour		
	Forecast demand in 2013/14	Extra demand to be met by 2018/19	Implied demand 2018/2019	Forecast demand in 2013/14	Extra demand to be met by 2018/19	Implied demand 2018/2019
London						
Blackfriars (All Routes)	25,400	8,000	8,000	12,400	3,800	3,800
Blackfriars (through E & C)	0	-8,600	12,500	0	-5,000	5,800
London Bridge (Kent Routes)	0	13,600	105,900	0	8,000	56,700
London Bridge (All Routes)	140,200	24,600	69,900	73,000	11,800	35,300
Euston	27,200	2,400	26,700	12,200	1,200	12,700
Fenchurch Street	28,500	2,000	26,100	15,500	900	13,900
Kings Cross	20,600	-4,600	12,700	9,100	-3,300	4,700
Liverpool Street (All Routes)	84,900	-4,400	62,400	41,600	-2,300	32,300
Liverpool Street (Crossrail)	0	33,000	33,000	0	16,500	16,500
Marylebone	10,100	1,000	12,400	5,200	500	5,600
Paddington (All Routes)	27,000	-2,400	23,900	12,900	-1,900	10,200
Paddington (Crossrail)	0	23,600	23,600	0	11,800	11,800
St. Pancras (All routes)	36,800	Not specified	Not specified	18,800	Not specified	Not specified
via St. Pancras - Low Level	0	15,400	35,100	0	6,500	17,000
St Pancras - High Speed 1	0	Not specified	Not specified	0	Not specified	Not specified
Victoria (All Routes)	64,000	900	21,000	32,100	400	10,500
Victoria (Southern)	0	6,700	54,400	0	1,300	24,500
Moorgate	13,700	-2,300	10,900	7,800	-1,100	6,300
Waterloo	83,500	9,700	109,800	41,700	4,900	50,600
London total	561,900	119,000	658,300	282,300	54,200	322,700
Birmingham	36,600	3,900	41,400	17,800	1,800	21,000
Manchester	26,200	6,200	34,300	12,900	2,600	16,200
Leeds	28,500	5,100	30,500	14,000	2,800	15,800
Other urban areas	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Liverpool	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Newcastle	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Sheffield	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Leicester	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Nottingham	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Bristol	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Other urban areas total	31,300	4,900	39,700	14,300	2,000	18,500
	HLOS 2007 Demand			HLOS 2007 Demand		

Figure 3 2013/14 Demand forecast based on HLOS 2007

5.2 CP4 Capacity Metrics Summary Results

This section presents the capacities and load factors that have been calculated in the adjusted capacity metrics model and compares them to the planned capacity figure in Network Rail's PR08 SBP. It is necessary to compare back to the PR08 SBP because the CP4 load factor targets for London (specified in the 2007 HLOS) apply to Central London as a whole. Therefore to make a meaningful capacity by London termini it is necessary to consider how planned capacity increases for CP4 were broken down in the PR08 SBP. As part of this review Network Rail has provided a breakdown of planned capacity by HLOS Terminal from the PR08 SBP.

Figure 4 below provides a summary of the 2007 HLOS Capacity Metric and compares this to the forecast of capacity for the end of CP4 that was included in Network Rail's 2008 business plan. This is then compared to the updated forecast for the end of CP4. The final two columns show the difference between the PR08 planned capacity and the latest CP4 forecast to show where planned capacity is and isn't expected to be meet the implied capacity target specified in the 2007 HLOS.

Figure 5 shows the same information for the three hour peak.

Note that the 2007 HLOS specified maximum average load factors for Cardiff. The SBP version of the capacity metric model did not contain enhancement data for this city and has therefore not been validated as part of this review. Network Rail has clarified that the CP4 exit point for Cardiff has been calculated in the Initial Industry Plan (IIP) 2011 and has not been refreshed for the PR13 SBP. The IIP results revealed that the capacity metric is expected to be achieved for Cardiff in both the high peak and the 3-hour peak.

		2007 HLOS Capacity Metric			Planned end-CP4 Capacity		Forecast end-CP4 Capacity			
Route/HLOS City	Sub Route/City	DfT's PR08 HLOS end-CP4 Demand forecast	DfT PR08 HLOS max avg. load factor	Implied minimum capacity	PR08 SBP end-CP4 capacity (planned)	Resulting avg. load factor	PR13 SBP end-CP4 capacity (forecast)	Resulting avg.load factor	Capacity Difference	Load Factor Difference
London	Blackfriars	12,400			14,500		11,500		-3,000	
	London Bridge	73,000			89,900		84,500		-5,400	
	Euston	12,200			19,600		21,500		1,900	
	Fenchurch Street	15,500			20,900		16,600		-4,300	
	King's Cross	9,100			17,400		16,900		-500	
	Liverpool Street	41,600			60,900		57,900		-3,000	
	Marylebone	5,200			8,800		9,200		400	
	Paddington	12,900			13,500		13,300		-200	
	St Pancras	18,800			24,200		21,300		-2,900	
	Victoria	32,100			48,800		43,400		-5,400	
	Moorgate	7,800			7,800		7,900		100	
	Waterloo	41,700			60,600		59,000		-1,600	
London total		282,300	76%	371,400	386,900	73%	363,000	78%	-23,900	-2%
Birmingham		17,800	55%	32,400	36,700	49%	28,700	62%	-8,000	-7%
Manchester		12,900	49%	26,300	29,400	44%	23,500	55%	-5,900	-6%
Leeds		14,000	70%	20,000	23,700	59%	18,200	77%	-5,500	-7%
Other Urban Areas E&W		14,300	46%	31,100	31,100	46%	30,900	46%	-200	0%

Figure 4 CP4 Capacity Metrics Comparison - High Peak Hour

		2007 HLOS Capacity Metric			Planned end-CP4 Capacity		Forecast end-CP4 Capacity			
Route/HLOS City	Sub Route/City	DfT's PR08 HLOS end-CP4 Demand forecast	DfT PR08 HLOS max avg. load factor	Implied minimum capacity	PR08 SBP end-CP4 capacity (planned)	Resulting avg. load factor	PR13 SBP end-CP4 capacity (forecast)	Resulting avg.load factor	Capacity Difference	Load Factor Difference
London	Blackfriars	25,400			35,400		26,200		-9,200	
	London Bridge	140,200			195,900		184,200		-11,700	
	Euston	27,200			42,500		45,000		2,500	
	Fenchurch Street	28,500			42,500		35,500		-7,000	
	King's Cross	20,600			39,500		36,500		-3,000	
	Liverpool Street	84,900			141,700		134,900		-6,800	
	Marylebone	10,100			18,200		20,800		2,600	
	Paddington	27,000			32,700		32,700		0	
	St Pancras	36,800			62,400		47,100		-15,300	
	Victoria	64,000			111,000		101,400		-9,600	
	Moorgate	13,700			18,200		20,200		2,000	
	Waterloo	83,500			148,500		145,200		-3,300	
London total		561,900	67%	838,700	888,500	63%	829,700	68%	-58,800	-1%
Birmingham		36,600	48%	76,300	81,000	45%	73,300	50%	-7,700	-2%
Manchester		26,200	45%	58,200	61,200	43%	53,800	49%	-7,400	-4%
Leeds		28,500	64%	44,500	50,700	56%	40,300	71%	-10,400	-7%
Other Urban Areas E&W		31,300	41%	76,300	77,200	41%	77,500	40%	300	1%

Figure 5 CP4 Capacity Metrics Comparison – Three Hour Peak

Note: The load factor difference shown in figure 4 and 5 is the difference between the specified end of CP4 maximum average load factor and the actual end of CP4 load factor.

Figures 4 and 5 show that load factor targets specified in the 2007 HLOS are no longer forecast to be achieved for London in aggregate or for the regional cities.

However, capacity targets were based on an assumed increase in rolling stock provision, and were measured in terms of additional passenger arrivals at terminal stations. Because the Department for Transport reduced the rolling stock provision during CP4, the actual capacity provision for 2014 will be less than

originally targeted. These changes will have been agreed with train and freight operators in terms of the specific projects.

Network Rail has provided a narrative explaining the difference in end CP4 capacity between the PR08 HLOS / SBP, and the PR13 SBP. This narrative is included in Appendix D.

Whilst Network Rail has not specifically quantified the amount of capacity that will not be delivered due to non-delivery of rolling stock (DfT responsibility) and non-delivery of infrastructure (Network Rail responsibility) it is clear from this narrative, and from discussions with Network Rail and ORR, that it is reasonable to assume that the non-delivery of rolling stock is the primary reason for the CP4 metrics not being met.

6 CP5 Capacity Interventions & Capacity Metrics Output Checks

In this chapter we provide an overview of the approach to forecasting capacity metrics for CP5 and a summary of the capacity interventions included in the CP5 forecast.

6.1 Overall Approach and Governance

Network Rail has consulted extensively with TOCs and other stakeholders on capacity schemes for CP5. The document "SBPT3301 Summary of Industry SBP engagement" documents this process and the industry wide meetings that have taken place. Appendix C of that document records the 'local' (i.e. route based) one-to-one engagement with TOCs, with the key meetings covering capacity including:

- Route Investment Review Groups (RIRGs)
- 1-1s with TOC MDs (& others)
- The September industry forum (England & Wales)

The overall process outlined in the document "SBPT3301 Summary of Industry SBP engagement" demonstrates that throughout the SBP production there has been a clear set of structured meetings and engagement with stakeholders that has underpinned the selection of capacity enhancements.

In addition to this it is important to note that expected outputs for major enhancements are underpinned by assumptions developed in cross industry working groups or as part of the RUS planning process. Good examples of this are Thameslink, Crossrail and the Northern Hub.

This overall approach provides confidence in the schemes included and the expected outputs incorporated in the capacity metrics model.

6.2 CP5 Interventions

Capacity interventions for CP5 fall into one of the following categories:

- "Committed" schemes: the HLOS committed to fund enhancement schemes already announced by government, including schemes first funded through PR 2008. e.g. Thameslink and GW Main Line
- "Named schemes": schemes named in the HLOS e.g. East West Rail;
- "Other" enhancement schemes (nominated by NR in the SBP), required to meet growth anticipated by the HLOS
- Operational interventions are also included to take account of expected timetable and rolling stock changes during CP5

Over 90 % of the additional peak capacity in the plan is delivered by "committed" schemes, "named" schemes or operational changes that do not require an infrastructure enhancement. The remaining 10% is delivered by a number of

industry nominated enhancement schemes that have been identified through the RUS planning process and SBP production process.

Appendix E to this report provides a tabulated summary for each of the HLOS terminals/cities showing the base year capacity, CP4/CP5 interventions and their expected incremental contribution to capacity, and the forecast capacity for the end of CP4 and CP5. SBP enhancements are referenced in these tables to demonstrate the linkage between capacity interventions and the SBP enhancements. These tables are summaries based on the capacity metrics model outputs and the supporting information provided alongside the model.

As part of this review meetings have been held with Principal Strategic Planners and their teams to review the capacity interventions in the model. As part of these meetings each capacity intervention has been reviewed. We are satisfied that the expected outputs included in the model are accurate and based on reasonable planning assumptions.

6.3 Assessing Compliance

The absence of a load factor target in the 2012 HLOS makes it difficult to provide a simple pass/fail for the CP5 capacity metrics. Network Rail have used the approach of comparing load factors at the end of CP4 to the end of CP5 load factors (based on the same definition of demand and capacity) to demonstrate that load factors can be broadly maintained at a similar level or in some cases significantly reduced. We consider this to be a reasonable approach to assessing whether demand can be accommodated.

Figures 6 and 7 provide a summary of this comparison for the high peak hour and three hour peak. The final column indicates whether the load factor is expected to "broadly" go up, down or stay the same when you compare the end of CP4 position with the end of CP5 position. The threshold for indicating a positive or negative change is set at +/- 5% movement in the average load factor. Therefore if the load factor difference for a particular station/city is less than 5% then the table will display this as staying broadly the same.

	End CP4		End CP5				
	Capacity	Demand	Capacity	Demand	End CP4 average load factor (%)	End CP5 average load factor (%)	Broad change over CP5
Blackfriars (terminating and through via Elephant & Castle)	10,600	10,800	14,600	9,600	102%	66%	▼
London Bridge (Kent Routes)	60,800	48,700	70,700	56,700	80%	80%	=
London Bridge (Sussex Routes)	25,500	23,500	37,000	35,300	80%	80%	=
Euston	18,500	11,500	19,700	12,700	62%	64%	=
Fenchurch Street	15,900	13,000	21,400	13,900	82%	65%	▼
King's Cross	13,700	8,000	10,000	4,700	58%	47%	▼
Liverpool Street2 (terminating & Crossrail)	55,400	34,600	89,900	48,800	62%	54%	▼
Marylebone	8,100	5,100	8,900	5,600	63%	63%	=
Paddington (terminating & Crossrail)	12,000	12,100	29,700	22,000	101%	74%	▼
St. Pancras (East Midlands Trains & Southeastern)	10,700	4,300	11,600	4,500	40%	39%	=
St. Pancras (Thameslink)	12,800	10,500	36,400	17,000	82%	47%	▼
Victoria (Southeastern)	12,100	10,100	14,100	10,500	83%	74%	▼
Victoria (Southern)	30,000	23,200	32,100	24,500	77%	76%	=
Moorgate	7,600	7,400	7,600	6,300	97%	83%	▼
Waterloo	52,800	45,700	56,400	50,600	87%	90%	=
London total2	346,500	268,500	460,100	322,700	77%	70%	▼
Birmingham	29,000	19,200	32,500	21,000	66%	65%	=
Manchester	23,100	13,600	35,100	16,200	59%	46%	▼
Leeds	18,100	13,000	20,600	15,800	72%	77%	=
Other urban areas3	31,000	16,500	38,100	18,500	53%	49%	=

Figure 6 CP5 Capacity Metrics for High Peak Hour

	End CP4		End CP5				
	Capacity	Demand	Capacity	Demand	End CP4 average load factor (%)	End CP5 average load factor (%)	Broad change over CP5
Blackfriars (terminating and through via Elephant & Castle)	24,800	21,100	44,000	20,500	85%	47%	▼
London Bridge (Kent Routes)	133,800	92,300	158,500	105,900	69%	67%	=
London Bridge (Sussex Routes)	55,500	45,300	89,900	69,900	69%	67%	=
Euston	39,300	24,300	40,500	26,700	62%	66%	=
Fenchurch Street	34,500	24,100	43,100	26,100	70%	61%	▼
King's Cross	31,000	17,300	21,900	12,700	56%	58%	=
Liverpool Street2 (terminating & Crossrail)	129,600	66,800	242,800	95,400	52%	39%	▼
Marylebone	18,200	11,400	20,400	12,400	63%	61%	=
Paddington (terminating & Crossrail)	29,900	26,300	83,900	47,500	88%	57%	▼
St. Pancras (East Midlands Trains & Southeastern)	22,000	9,600	24,100	10,000	44%	41%	=
St. Pancras (Thameslink)	29,200	19,700	109,000	35,100	67%	32%	▼
Victoria (Southeastern)	32,000	20,100	34,000	21,000	63%	62%	=
Victoria (Southern)	66,600	47,700	68,900	54,400	72%	79%	▲
Moorgate	19,800	13,200	19,800	10,900	67%	55%	▼
Waterloo	133,400	100,100	144,200	109,800	75%	76%	=
London total2	799,600	539,300	1,145,000	658,300	67%	57%	▼
Birmingham	73,900	37,500	79,500	41,400	51%	52%	=
Manchester	52,800	28,100	85,900	34,300	53%	40%	▼
Leeds	39,500	25,400	50,600	30,500	64%	60%	=
Other urban areas3	76,300	34,800	93,500	39,700	46%	42%	=

Figure 7 CP5 Capacity Metrics for Three Hour Peak

Figures 6 and 7 show that based on the assumption planned capacity interventions for CP5 are delivered the specified demand in the HLOS can be accommodated. This also assumes that the rolling stock required to maximise the infrastructure enhancements is delivered, which is outside of Network Rail's control.

There is one exception shown in Figure 7 for Victoria (Southern) where the load factor at the end of CP5 is expected to increase from 72% to 79%. The

79% load factor reflects the HLOS passenger forecast growth of 14% across the three hour peak. However, the 14% growth in the three hour peak period compares to 6% in the peak hour, which appears incorrect because it implies shoulder peak growth of 22% (i.e. 14% across 3 hours). Network Rail has attributed this to a coding error in the NMF demand model, which we are not in a position to confirm. However, we agree that the demand forecasts for Victoria (Southern) are counter intuitive.

7 Conclusions

Based on the overall review we have arrived at the following conclusions:

- A check of the CP4 metrics shows that load factor targets specified in the 2007 HLOS are no longer forecast to be achieved for London in aggregate or for the regional cities. However, capacity targets were based on an assumed increase in rolling stock provision, and were measured in terms of additional passenger arrivals at terminal stations. Because the Department for Transport reduced the rolling stock provision during CP4, the actual capacity provision for 2014 will be less than originally targeted. Appendix D provides a high level overview of where CP4 metrics are no longer expected to be met. Whilst Network Rail has not specifically quantified the amount of capacity that won't be delivered due to non-delivery of rolling stock (DfT responsibility) and non-delivery of infrastructure (Network Rail responsibility) it is clear from this narrative, and from discussions with Network Rail and ORR, that it is reasonable to assume that the non-delivery of rolling stock is the primary reason for the CP4 metrics not being met.
- It is evident from meetings with Network Rail's route planners that a fair and robust method has been adopted during the enhancement selection process. Selection has largely been based on the recommendations made in the various Route Utilisation Strategies which has ensured that the most efficient and beneficial schemes have been chosen.
- There is no evidence to suggest that any individual routes into HLOS terminals will be unduly neglected whilst the overall capacity metric for the city is met.
- Based on the proposed capacity interventions in the SBP, forecasted HLOS peak growth can be accommodated.
- Load factors at the end of CP5 are anticipated to be broadly similar to and in some cases significantly reduced from the load factors at the end of CP4.
- The Capacity metrics model "SBPT3310 Passenger Capacity Metrics Spreadsheet.xls" is functional and fit for purpose.
- The outputs contained in the capacity metrics model (e.g. load factor tables, station summary tables) are consistent with the documentation that has been submitted as part of the Network Rail Strategic Business Plan (SBP).

Appendix A

Mandate for Review

Independent Reporter (Part A) Mandate

Check of NR's HLOS capacity metrics for CP4 and CP5

Ref: AO/032

Version: 5

Issued by ORR on 23 October 2012

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1. Purpose

We need to validate the actual capacity metrics from the Control Period 4 enhancement projects by checking that Network Rail has updated its forecast capacity metrics for the end of CP4 (as set in the 2007 High Level Output Specification), and that the methodology, calculations, inputs and assumptions are sufficiently robust.

We also need to validate that the projects to be proposed in the SBP for Control Period 5 deliver the forecast capacity metrics specified in the 2012 HLOS.

2. Background

In 2008, the England & Wales Government set HLOS capacity targets to be achieved by the end of CP4, and during the Periodic Review process in 2008 we set the efficient cost for the enhancement projects that delivered them.

The E&W capacity targets were based on an assumed increase in rolling stock provision, and were measured in terms of additional passenger arrivals at terminal stations. Because the Department for Transport reduced the rolling stock provision during CP4, the actual capacity provision for 2014 will be less than originally targeted. These changes have been agreed with train and freight operators in terms of the specific projects that will be delivered by 2014. This was done through the formal Delivery Plan change control process which updates the plan every quarter.

ORR now wishes to ensure that the forecast capacity metrics for the end of CP4 have been fully updated, and represent an accurate position for the end of CP4.

As part of PR13, a further phase will validate the forecast capacity metrics to be delivered by the end of CP5 through the suite of enhancement projects to be proposed by NR in its SBP for CP5.

3. Scope of the Review

This mandate covers the CP4 capacity metrics as set out in the HLOS that informed PR08, and the on-going work to establish the CP5 capacity metrics as part of the PR13 process.

The review will be in two stages as follows.

CP4 phase (stage 1)

This work will involve the following:

- a meeting to commence the study;

- a review of NR's methodology, algorithms, calculations, inputs and assumptions;
- a review of supporting submissions/evidence;
- a presentation of the findings to ORR and NR.

The Reporter should satisfy himself that the methodology is robust and draw out any perceived errors identified during the study.

CP5 phase (stage 2)

This will be developed with NR during the period leading up to publication of NR's SBP for CP5. The work will involve the following:

- a meeting to commence the study;
- a review of NR's methodology, algorithms, calculations, inputs and assumptions;
- a review of supporting submissions/evidence;
- a check that the engineering solution for each project delivers the incremental output that the model uses. This is likely to be a mix of expert judgement supported by evidence that NR has adequately consulted with and has support of relevant passenger and freight operators;
- a presentation of the findings to ORR and NR.

Additional Information

The Reporter's attention is drawn to the following:

- NR has updated its assumptions in how it calculates capacity metrics for CP5. The Reporter should satisfy himself that the methodology is still robust and draw out any perceived errors identified during the study. He should also provide a concordance between the CP4 and CP5 methodology in a format to be agreed, so that the equivalence is clear.

The Reporter shall submit a short draft report to ORR and NR within one week of completing both stages 1 and 2. Following comments from ORR and NR which shall be made within two weeks, the Reporter shall issue a final report within a further one week.

4. Timescales and Deliverables

ORR wishes the Reporter to complete as much of stage 1 as soon as possible in advance of SBP publication (7 January). Ideally, it should be possible to start the review in November or December (planning meetings, kick off meetings, exchange of some preliminary information) to ensure that stage 2 emerging findings can be presented to ORR and NR by 15 February, and to complete the whole review by issuing the draft report by 22 February and the final report by 15 March 2013.

However, this is subject to the availability of resources and NR being sufficiently ready prior to the SBP submission, and it may not be possible to carry out the bulk of stage 1 until after 7 January. The project plan will be firmed up during discussions with NR during development of the reporters draft proposal.

The only fixed date for ORR is the requirement to receive the final report by 15 March 2013.

5. Resources

An initial guide is included below, but is subject to agreement of the final mandate.

Activity	**Man-days**
CP4 phase	10
CP5 phase	20
Report	10
TOTAL	40

6. Response from Reporter

The reporter shall issue a short proposal confirming the staff (with CVs) that will work on the project, the proposed fee and key milestones.

The response should also confirm whether there are any conflicts of interest and if so how they will be handled.

If the response is accepted the reporter will be expected to start work as soon as possible.

Appendix B

Extracts on Capacity Metrics from HLOS 2007 and HLOS 2012

B1 HLOS 2007 Extract

(2) Numbers of arriving passengers to be accommodated, and city maximum average load factors, on services into Birmingham, Cardiff, Leeds, Manchester and other urban areas by the end of CP4, on a weekday morning in the three hour peak and in the high peak hour are shown in Table A4.

Table A4: **Peak demand to be accommodated in major urban areas by end of CP4**

City	Peak three hours			High-peak hours		
	Forecast demand in 2008/9	Extra demand to be met by 2013/14	Maximum average load factor at end CP4 (%)	Forecast demand in 2008/9	Extra demand to be met by 2013/14	Maximum average load factor at end CP4 (%)
Birmingham	32,000	4,600	48	15,400	2,400	55
Cardiff	8,500	900	39	4,000	600	43
Leeds	23,400	5,100	64	11,300	2,700	70
Manchester	22,100	4,100	45	10,700	2,200	49
Other urban areas	27,700	3,600	41	12,300	2,000	46

City station definitions

- Birmingham stations are: New Street, Snow Hill and Moor Street.
- Cardiff stations are: Cardiff Central and Queen Street.
- Manchester stations are: Oxford Road, Piccadilly and Victoria.
- Leeds is the single station.
- Other urban areas evaluated were Bristol, Leicester, Liverpool (excluding Merseyrail), Newcastle, Nottingham and Sheffield, because these cities are current significant users of rail for commuting.

For definitions of peak periods and load factors see notes below.

(3) Numbers of arriving passengers to be accommodated on services into the main London termini and London city maximum average load factors by the end of CP4, on a weekday morning in three hour peak and in the high peak hour are shown in Table A5.

Table A5: **Peak demand to be accommodated at the main London termini by end of CP4**

London Terminus	Peak three hours			High-peak hours		
	Forecast demand in 2008/9	Extra demand to be met by 2013/14	Maximum average load factor at end CP4 (%)	Forecast demand in 2008/9	Extra demand to be met by 2013/14	Maximum average load factor at end CP4 (%)
Blackfriars	21,900	3,500	67	11,200	1,200	76
Euston	23,800	3,400		10,600	1,600	
Fenchurch Street	26,000	2,500		13,900	1,600	
Kings Cross	18,300	2,300		8,000	1,100	
Liverpool Street	74,300	10,600		36,700	4,900	
London Bridge	127,600	12,600		65,200	7,800	
Marylebone	9,100	1,000		4,600	600	
Moorgate	13,000	700		7,400	400	
Paddington	24,100	2,900		11,500	1,400	
St. Pancras	25,900	10,900		13,100	5,700	
Victoria	58,700	5,300		29,300	2,800	
Waterloo	74,300	9,200		36,800	4,900	

London stations definitions

- St Pancras values include Thameslink services, Midland Mainline and the Channel Tunnel Rail Link domestic services but exclude international services.
- Kings Cross values cover terminating services only and do not include through Thameslink services.
- Moorgate values are only for services using the Northern City Line. Thameslink is excluded.
- London Bridge values cover services terminating there and services continuing to Cannon Street, Charing Cross and Blackfriars.
- Blackfriars values are only for those services coming via Elephant and Castle.

Load factor

- The load factor is calculated as the forecast passenger demand divided by train capacity, expressed as a percentage.
- Train capacity on commuter stock has generally been calculated on the basis of the total number of passengers that can be accommodated, seated or standing, allowing 0.45 sq. m of space per person.
- In a minority of cases of commuter rolling stock for which no information on 'furnishable space' was available, train capacity has been estimated at a ratio of 1.4 times the number of seats.
- For all inter-city rolling stock, train capacity has been estimated at a ratio of 1.2 times the number of seats.
- The load factor causes a minimum volume of total train capacity to be provided into the identified station(s) during the peak period and sets a cap on the average level of peak train crowding across the city.

Forecasts

- All figures relate to franchised passenger services.
- The forecasts of demand and the load factors listed are the Department's best assessment using available models and based on available information and plausible assumptions.
- The Department is at risk for the forecast at the start of CP4 and any variance in the forecasts between the start and end of CP4.
- Should better evidence of forecast demand at the start of CP4 become available during the course of the periodic review, the values will be adjusted accordingly.

Peak three hours and high-peak hour

- The peak three hours covers all services timetabled to arrive in the morning between 0700 and 0959.
- The high peak hour covers all services timetabled to arrive in the morning between 0800 and 0859.
- Where two or more stations are included, e.g. Birmingham Snow Hill and Moor Street, the first station called at determines whether the train falls within the peak.

Evening peak

- Only the morning peak is used for HLOS. The evening peak is typically between 6 per cent and 20 per cent less in demand over both the high peak and the peak three hours. The train capacity provided for the morning peak is expected to be used for the evening peak with the load factors maintained or bettered for passenger comfort.

Timing of capacity delivery

- Delivery of some of the specified capacity may be brought forward before the start of CP4 if this is feasible and value for money.

B2 HLOS 2012 Extract

Appendix A – Capacity Metric

1. Numbers of arriving passengers to be accommodated on services into Birmingham, Leeds, Manchester and other urban areas by the end of CP5, on a weekday morning in the three hour peak and in the high-peak hour, are shown in Table 2.

Table 2: Number of passengers to be accommodated into major cities

	Peak Three Hours		**High-Peak Hour**	
Major Cities	Forecast demand in 2013/14	Extra demand to be met by 2018/19	Forecast demand in 2013/14	Extra demand to be met by 2018/19
Birmingham	37,500	3,900	19,200	1,800
Leeds	25,400	5,100	13,000	2,800
Manchester	28,100	6,200	13,600	2,600
Others	34,800	4,900	16,500	2,000

City station definitions

- Birmingham stations are: New Street, Snow Hill and Moor Street
- Manchester stations are: Oxford Road, Piccadilly and Victoria
- Leeds is the single station
- Other urban areas are Bristol, Leicester, Liverpool (excluding Merseyrail), Newcastle, Nottingham and Sheffield, because these cities are current significant users of rail for commuting.

For definitions of peak periods see notes below.

2. Numbers of arriving passengers to be accommodated on services into the main London termini by the end of CP5, on a weekday morning in three hour peak and in the high-peak hour, are shown in Table 3 below.

Table 3: Number of arriving passengers to be accommodated into London termini

	Peak Three Hours		High-Peak Hour	
London	Forecast demand in 2013/14	Extra demand to be met by 2018/19	Forecast demand in 2013/14	Extra demand to be met by 2018/19
Blackfriars Terminating	0	8,000	0	3,800
Blackfriars Through via Elephant & Castle	21,100	-8,600	10,800	-5,000
Euston	24,300	2,400	11,500	1,200
Fenchurch St	24,100	2,000	13,000	900
Kings Cross	17,300	-4,600	8,000	-3,300
Liverpool St Terminating	66,800	-4,400	34,600	-2,300
Liverpool St Crossrail	0	33,000	0	16,500
London Bridge Kent routes	92,300	13,600	48,700	8,000
London Bridge Sussex routes	45,300	24,600	23,500	11,800
Marylebone	11,400	1,000	5,100	500
Moorgate	13,200	-2,300	7,400	-1,100
Paddington Terminating	26,300	-2,400	12,100	-1,900
Paddington Crossrail	0	23,600	0	11,800
St.Pancras Terminating	9,600	400	4,300	200
St. Pancras Thameslink	19,700	15,400	10,500	6,500
Victoria (Southeastern)	20,100	900	10,100	400
Victoria (Southern)	47,700	6,700	23,200	1,300
Waterloo	100,100	9,700	45,700	4,900
London Total	**539,300**	**119,000**	**268,500**	**54,200**

London stations definitions

- St Pancras values include Thameslink services, Midland Mainline and the Channel Tunnel Rail Link domestic services but exclude international services.
- London Bridge values cover services terminating there and services continuing to Cannon Street, Charing Cross and Blackfriars.
- Values exclude Heathrow Express and Hull Trains.

Forecasts

- All figures relate to franchised passenger services.
- The forecasts of demand are the Department's best assessment using available models and based on available information and plausible assumptions.
- The Department is at risk for the forecast at the start of CP5 and any variance in the forecasts between the start and end of CP5.
- Should better evidence of forecast demand at the start of CP5 become available during the course of the periodic review, the values will be adjusted accordingly.
- Negative values show the expected transfer of demand with the introduction of Thameslink and Crossrail service patterns.
- The figures for Crossrail demand comes from the TfL Crossrail Demand Model. Demand into Paddington includes all demand on Crossrail services when the full service commences in late 2019. Demand at Liverpool Street is taken as the demand from Stratford to Whitechapel and does not include Crossrail services coming from Canary Wharf.
- The figures for the Paddington and Liverpool Street terminating demand come from the DfT Network Modelling Framework. This may be a high estimate of demand because it does not fully capture the abstraction to Crossrail from national rail services that will occur in late 2019 when Crossrail is fully operational through central London. The Liverpool Street terminating demand includes the 6 trains an hour Gidea Park to Liverpool Street service that is currently assumed to be operated by Crossrail.

Peak three hours and high-peak hour

- The peak three hours covers all services timetabled to arrive in the morning between 0700 and 0959.
- The high peak hour covers all services timetabled to arrive in the morning between 0800 and 0859.
- Where two or more stations are included, e.g. Birmingham Snow Hill and Moor Street, the first station called at determines whether the train falls within the peak.

Evening peak

- Only the morning peak is used for HLOS. The evening peak is typically between 6% and 20% less in demand over both the high peak and the peak three hours. The train capacity provided for the morning peak is expected to be used for the evening peak with the level of crowding maintained or bettered for passenger comfort.

Timing of capacity delivery

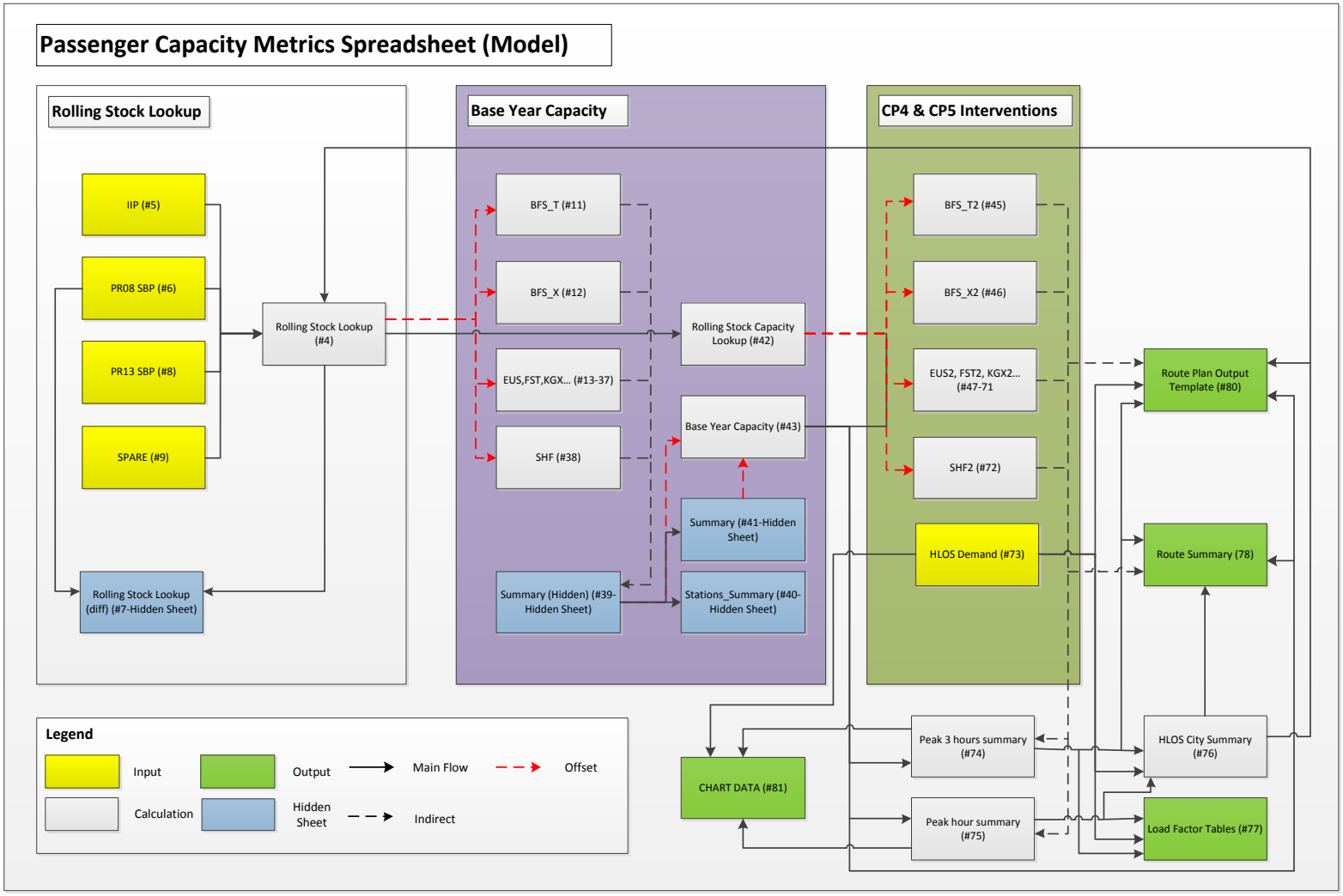
- Delivery of some of the specified capacity may be brought forward before the start of CP5 if this is feasible and value for money.

- Delivery of capacity linked to Crossrail is expected to be phased and will extend into early CP6 with full Crossrail services planned for late 2019.

Appendix C

Detailed Map of the Capacity Metrics Spreadsheet Model

1.1 Model Flow Diagram



1.2 Model Flow Diagram Commentary

Worksheet Number	Name	Purpose
4	Rolling Stock Lookup	Contains the lookup table of rolling stock seats and capacities used to estimate the base year capacity and the additional capacity provided by each intervention in the plan. The lookup table is linked to sheets 5, 6, 8 and 9 which contain lookup tables for different outputs and can be selected in the *HLOS City Summary* sheet.
5	IIP	Contains the lookup table of rolling stock capacities used for the IIP 2011.
6	PR08 SBP	Contains the lookup table of rolling stock capacities used for SBP during Periodic Review 2008.
7	Rolling Stock Lookup (diff)	Calculates the difference in capacity between the PR08 SBP rolling stock lookup and the currently selected rolling stock lookup. (Hidden Sheet).
8	PR13 SBP	Contains the lookup table of rolling stock capacities used for SBP during Periodic Review 2013.
9	SPARE	Placeholder for additional capacity lookup table.
11-38	BFS_T, BFS_X, EUS, FST…	Determines Network Rail's estimate of capacity provided at each HLOS station/city using the December 2009 timetable and the rolling stock lookup tables.
39	Summary (Hidden)	Summarises the base year capacity in the form of a table. (Hidden Sheet).
40	Stations_Summary	Summarises the base year capacity in the form of a table. (Hidden Sheet).
41	Summary	Summarises the base year capacity in the form of a table. (Hidden Sheet).
42	Rolling Stock Capacity Lookup	Linked and equal to sheet 4, *Rolling Stock Lookup.*
43	Base Year Capacity	Linked and equal to sheet 41, *Summary*
45-72	BFS_T2, BFS_X2, EUS2, FST2…	Contains individual service changes and determines the extra capacity provided at each HLOS station/city as a result of these interventions.
73	HLOS Demand	Contains the number of arriving passengers to be accommodated as specified in the PR13 HLOS by the DfT.
74	Peak 3 hours summary	Summarises the capacity provided by HLOS station/city in the peak 3 hours.
75	Peak hour summary	Summarises the capacity provided by HLOS station/city in the peak hour.
76	HLOS City Summary	Provides a summary of capacity, demand and average load factor for the selected HLOS station/city. This sheet also includes the rolling

		stock lookup menu.
77	Load Factor Tables	Contains the load factor summary tables that are included in the PR13 SBP documentation.
78	Route Summary	Contains a detailed summary for the HLOS station/city that is selected in sheet *HLOS City Summary*.
79	Route Plan Output Template	Used to develop the summary capacity statistics included in the Route Plans.
81	CHART DATA	
82	CHARTS	

Appendix D

Network Rail narrative explaining differences between the PR08 HLOS / SBP, and the PR13 SBP

Narrative explaining the difference in end CP4 capacity between the PR08 HLOS / SBP, and the PR13 SBP (March 2013)

This narrative explains why the end CP4 capacity position developed for the PR13 SBP (and following conversion into PR08 'currency') differs from PR08 capacity assumptions (see DfT's White Paper "*Delivering a Sustainable Railway*", July 2007, and Network Rail's PR08 SBP).

1. Euston (provided by Tony Rudge, Lead Strategic Planner)

35 x 11-car Class 390 sets are now in operation from the December 12 timetable. 31 of the 9-car sets were extended to 11-car formation, and 4 new 11-car sets were delivered, making a total of 35 sets (the other sets remained in 9 car formations).

All LOROL Class 378 3-car units have been extended to 4-car units during CP4. (It should be noted that some seats were removed from these units as part of the refurblishment work).

Additional London Midland Class 350 units required for CP4 HLOS capacity will not be delivered during CP4. Instead LM utilised existing units and introduced additional train services from Watford Junction into Euston to create extra capacity. Two new services from Watford Jnc 0755hrs Watford Jnc to Euston (arr. 0818hrs) and 0815hrs Watford Jnc to Euston (arr 0838hrs) were introduced in December 2011 timetable, both are running as 8 car formations.

Further LM Class 350 units are in the process of being procured/delivered for CP5.

2. Fenchurch Street (provided by Tim Havill, Senior Strategic Planner)

The Plan: The strategy was to run additional 12-car trains during peak hours. This required additional rolling stock that was assumed in the original DfT rolling stock plan – a cascade of Class 321 EMUs from London Midland – with associated infrastructure works that included platform extensions on the Tilbury Loop and traction power supply enhancement.

What has happened: The DfT rolling stock plan changed and the additional rolling stock envisaged did not materialise, although the supporting infrastructure was delivered as planned.

3. King's Cross (provided by Debra Armitstead, Lead Strategic Planner)

The capacity increase at King's Cross was to be achieved by a mixture of train lengthening and additional services. The necessary platform lengthening to accommodate the longer trains will be undertaken in CP4. Due to constraints relating to the availability of rolling stock, power supply and path / platform availability it has not been possible to accommodate the planned volume of suburban traffic.

4. Liverpool Street (provided by Tim Havill, Senior Strategic Planner)

West Anglia route

The Plan: The strategy was for 9-car operations on WA Inner Services, lengthened services on the WA Outers following the purchase of new Class 379 EMUs and 12-car operation in the peaks from Stansted Airport with a cascade of existing Class 317s to other services and a Cheshunt-Seven Sisters peak shuttle.

What has happened: The TOC agreed a HLOS Plus deal with DfT. The Class 379 EMUs were procured and delivered and have now entered service but today's Stansted Airport-Liverpool Street services continue to operate at 8-car length albeit they are all new Class 379 EMUs. A limited number of Cambridge-Liverpool Street peak services now operate at 12-car length utilising new Class 379 EMUs originally intended for the Stansted Airport-Liverpool Street 12-car services. The cascaded Class 317s from the former Stansted Airport-Liverpool Street services have been used to lengthen some WA Inner Services to 8-car length and therefore 9-car operations on WA Inners were not introduced. Also the TOC did not introduce a peak Cheshunt-Seven Sisters shuttle service.

Great Eastern route

The Plan: The strategy was for additional services on GE Outer services, replacement of Intercity rolling stock used between Norwich-Liverpool Street and additional capacity on the GE Inner Services enabled by construction of a turnback at Chadwell Heath.

What has happened: The TOC agreed a HLOS Plus deal with DfT. Additional EMUs were cascaded to the GE route from London Midland. The timetable for GE route was completely rewritten introducing additional services not previously envisaged, i.e. Stowmarket-Liverpool Street. The replacement of the Intercity rolling stock did not take place however the TOC through its rewritten timetable was able to break up an existing Intercity set and use coaches from that to lengthen other Intercity sets. The turnback at Chadwell Heath has since been subsumed into the Crossrail project and will now be delivered in CP5.

5. London Bridge (provided by Richard Howkins, Senior Strategic Planner)

The most significant difference between PR13 and PR08 assumptions is the Southeastern suburban train lengthening programme. Physical works including platform lengthening and signalling changes are due for completion by the end of CP4, however the rolling stock and subsequent cascade across the DC network is now planned for CP5.

6. Blackfriars (services via Elephant & Castle) (provided by Chris Rowley, Lead Strategic Planner)

The original expectation at the start of CP4 was that Network Rail would have completed Thameslink Key Output 1 (KO1) works and the DfT would have completed the first tranche of Thameslink rolling stock procurement.

Network Rail has completed KO1 works on time (12-car platforms in the core), however DfT has not completed the rolling stock procurement.

The result is trains in the high peak hour and the shoulder peak that we expected to be 12-car by now are still 8-car.

7. St Pancras (provided by Kerry Collingwood, Senior Strategic Planner)

St. Pancras Low Level is adjusted as a result of the delivery of new rolling stock moving into CP5. The St. Pancras High Level plan showed no additional capacity to be provided in CP4, however 4 additional 4-car 222s (Pioneers) were provided to support the additional Corby service and the extension of the Derby semi-fast to Sheffield in CP4. The additional Corby service was shown originally against CP3.

8. Victoria (provided by Richard Howkins, Senior Strategic Planner)

As with London Bridge, the rolling stock for the Southeastern suburban train lengthening strategy is expected to be delivered during CP5. Similar comments apply to elements of the Southern 10-car suburban strategy into Victoria. In addition to these issues, the South London line train lengthening strategy has not been developed as anticipated due to the changes engendered by the introduction of East London Line phase 2 in late 2012.

9. Waterloo (provided by Josie Rogers, Senior Strategic Planner)

It has been agreed by Network Rail, DfT and SWT that the southside platforms at Waterloo will not be lengthened during CP4 and only platform 20 in WIT will be in operational use. Instead, the remaining platforms of WIT and platforms 1-4 will be dealt with as part of a strategic intervention at Waterloo in CP5.

As a result, there will be no main suburban capacity increase during CP4, with the exception of a few main suburban trains that use platforms 5 and 6 at Waterloo that are already 10-car capable.

10. Paddington (provided by Claire Mahoney, Lead Strategic Planner)

The most significant difference between the SBP and PR08 is the new 2tph Reading to Paddington semi-fast service. This was based on the West Ealing bay platform enhancement scheme, which would have seen existing Greenford branch services terminate at West Ealing instead of running into Paddington. This would have enabled a new service from Reading which would have utilised the two paths into Paddington. This scheme was due to be implemented in CP4, but was subsequently incorporated into the Crossrail programme, and is now due for completion in December 2015.

On a lesser scale, the capacity per vehicle figure for Class 166s was higher in the PR08 assumptions (119 per vehicle) than in the SBP calculations (112 per vehicle). In addition, the Arup findings refer to the changes to the rolling stock plan that did not take place during CP4, which may have been relevant to some/all of the PR08 train lengthening assumptions.

11. Birmingham (provided by Tony Rudge, Lead Strategic Planner)

The contract variation clause to allow for all Class 390 sets to be lengthened to 11-car formations was not invoked by the DfT during CP4. Only 35 sets operate in 11-car formation.

Platforms were lengthened to enable Class 323 6-car operation to take place on various lines. However, due to London Midland procuring less rolling stock then expected, fewer services have been lengthened.

Extended services to Bromsgrove and Redditch are now a CP5 deliverable which will provide additional capacity.

12. Leeds, Sheffield, Newcastle (provided by David Phillips, Senior Strategic Planner)

The number of additional vehicles for Northern Rail started at circa 180 vehicles with a small increase for Inter Urban services. The final DfT operational plan that was signed off with the TOCs and Network Rail only contained an additional 72 vehicles for Northern Rail and no extra Inter Urban vehicles. The scope and cost of infrastructure interventions needed to meet the agreed DfT operational plan was thus considerably reduced.

13. Manchester (provided by David Phillips, Senior Strategic Planner and Tony Rudge, Lead Strategic Planner)

The number of additional vehicles for Northern Rail started at circa 180 vehicles with a small increase for Inter Urban services. The final DfT operational plan that was signed off with the TOCs and Network Rail only contained an additional 72 vehicles for Northern Rail and no extra Inter Urban vehicles. The scope and cost of infrastructure interventions needed to meet the agreed DfT operational plan was thus considerably reduced.

The scope of lengthening 390s to 11-cars has been reduced and TPE train lengthening has been moved to CP5.

Appendix E

Summary of capacity interventions by HLOS Terminal

Capacity Interventions by HLOS Terminal

1.1 Blackfriars (Terminating)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		0		
No planned capacity interventions		0		
Forecast end CP4		0	0	N/A
Thameslink KO2 2018 timetable introduction	**TL001**-Committed scheme	23,200	8,000	
Forecast end CP5		23,200	8,000	34%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		0		
No planned capacity interventions		0		
Forecast end CP4		0	0	N/A
Thameslink KO2 2018 timetable introduction	**TL001**-Committed scheme	7,700	3,800	
Forecast end CP5		7,700	3,800	49%

1.1.1 CP5 Enhancements Projects

TL001-Thameslink Programme-Introduction of the 2018 Thameslink timetable will provide 24 train paths per hour between St Pancras International (low level) and Blackfriars stations. 8tph are expected to terminate at Blackfriars station.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Defintion of CP5 Enhancments*

1.2 Blackfriars (via Elephant and Castle)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		24,800		
No planned capacity interventions		0		
Forecast end CP4		24,800	21,100	85%
Thameslink KO2 timetable introduction	**TL001**-Committed scheme	-3,950	-8,600	
Forecast end CP5		20,850	12,500	60%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		10,600		
No planned capacity interventions		0		
Forecast end CP4		10,600	10,800	102%
Thameslink KO2 timetable introduction	**TL001**-Committed scheme	-3,700	-5,000	
Forecast end CP5		6,900	5,800	84%

1.2.1 CP5 Enhancements Projects

TL001-Thameslink Programme-Introduction of the 2018 Thameslink timetable will provide 24 train paths per hour between St Pancras International (low level) and Blackfriars stations. 8tph are expected to terminate at Blackfriars station.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

1.3 London Bridge (Kent Routes)

		Peak 3 hours		
	Fundi Funding / Dependencies ng	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		131,600		
CP4 train lengthening to 12-car	CP4 platform lengthening	2,200		
Forecast end CP4		133,800	92,300	69%
CP5 Kent Main Line train lengthening to 12-car	Requires power supply enhancement. **DP011**- Priority 2	13,000	13,600	
CP5 train lengthening to 12-car beyond Gravesend	East Kent Re-signalling scheme. **SE006**-Priority 1	1,450		
Introduction of new Thameslink rolling stock	**TL001**-Committed scheme	10,200		
Forecast end CP5		158,450	105,900	67%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		58,600		
CP4 train lengthening to 12-car	CP4 platform lengthening	2,200		
Forecast end CP4		60,800	48,700	80%
CP5 Kent Main Line train lengthening to 12-car	Requires power supply enhancement. **DP011**- Priority 2	6,050	8,000	
CP5 train lengthening to 12-car beyond Gravesend	East Kent Re-signalling scheme. **SE006**-Priority 1	500		
Introduction of new Thameslink rolling stock	**TL001**-Committed scheme	3,400		
Forecast end CP5		70,750	56,700	80%

1.3.1 CP5 Enhancements Projects

DP011-Kent Traction Power Supply Upgrade-Enables full operation of the 2018 post-Thameslink KO2 timetable with trains running at maximum length. Works include substation and traction power upgrades.

Project Category: Priority 2

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

SE006-East Kent Re-Signalling Phase 2: Enhancements-Facilitates the full future timetable (December 2018) through the Medway towns. Works include a new station at Rochester and provision of 12-car platforms.

Project Category: Priority 1

Reference: *Kent RUS (January 2010), Strategic Business Plan: Definition of CP5 Enhancements*

1.4 London Bridge (Sussex Routes)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		53,900		
ELL2-Reallocation of existing South London Line rolling stock	Construction of the East London Line (Phase 2) to Clapham Junction	-1,800		
CP4 train lengthening	CP4 platform extensions	3,750		
CP4 rolling stock replacement	No infrastructure enhancements required	-350		
Forecast end CP4		55,500	45,300	82%
Introduction of new Thameslink rolling stock	**TL001**-Committed scheme	33,050		
Uckfield train lengthening (within existing infrastructure)	No infrastructure enhancements required	650		
Uckfield train lengthening	**SE011**-Priority 1 scheme	650	24,600	
Forecast end CP5		89,850	69,900	78%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		24,200		
ELL2-Reallocation of existing South London Line rolling stock	Construction of the East London Line (Phase 2) to Clapham Junction	-900		
CP4 train lengthening	CP4 platform extensions	2,100		
CP4 rolling stock replacement	No infrastructure enhancements required	50		
Forecast end CP4		25,450	23,500	92%
Introduction of new Thameslink rolling stock	**TL001**-Committed scheme	10,550	11,800	
Uckfield train lengthening (within existing infrastructure)	No infrastructure enhancements required	450		
Uckfield train lengthening	**SE011**-Priority 1 scheme	450		
Forecast end CP5		36,900	35,300	96%

1.4.1 CP5 Enhancements Projects

TL001-Thameslink Programme-Introduction of the 2018 Thameslink timetable will provide 24 train paths per hour between St Pancras International (low level) and Blackfriars stations. 8tph are expected to terminate at Blackfriars station.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

SE011-Uckfield Line Train Lengthening-Enhancements will provide the infrastructure to allow 10-car trains serve the eight station locations between Edenbridge and Uckfield.

Project Category: Priority 1 scheme

Reference: *Option 2.3 in the Sussex RUS (January 2010), Strategic Business Plan: Definition of CP5 Enhancements*

1.5 Euston

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		34,000		
CP4 train lengthening London Midland-110 mph project	No infrastructure enhancements required Funded by London Midland	3,900 1,400		
Forecast end CP4		39,300	24,300	62%
CP5 train lengthening	No infrastructure enhancements required	1,150	2,400	
Forecast end CP5		40,450	26,700	66%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		15,400		
CP4 train lengthening London Midland-110 mph project	No infrastructure enhancements required Funded by London Midland	2,150 950		
Forecast end CP4		18,500	11,500	62%
CP5 train lengthening	No infrastructure enhancements required	1,150	1,200	
Forecast end CP5		19,650	12,700	65%

1.6 Fenchurch Street

	Funding / Dependencies	Peak 3 hours		
		Capacity (20-min rule)	Demand	Load Factor (%)
Base Year (December 2009 TT)		34,600		
CP4 timetable change	No infrastructure enhancements required	-100		
Forecast end CP4		34,500	24,100	70%
CP5 train lengthening	Infrastructure funded in CP4	8,500	2,000	
Forecast end CP5		43,000	26,100	61%

	Funding / Dependencies	Peak Hour		
		Capacity (20-min rule)	Demand	Load Factor (%)
Base Year (December 2009 TT)		15,700		
CP4 Timetable Change	No infrastructure enhancements required	150		
Forecast end CP4		15,850	13,000	82%
CP5 Train Lengthening	Infrastructure funded in CP4	5,500	900	
Forecast end CP5		21,350	13,900	65%

1.7 Kings Cross

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		30,500		
CP4 Train Lengthening	Platform extensions on Great Northern Route required	3,500		
CP4 rolling stock changes	No infrastructure enhancements required	-3,000		
Forecast end CP4		31,000	17,300	56%
Introduction of IEP (2015)-rolling stock change	IEP capability works and power supply enhancement required (**NE001+NE028**)-Committed scheme.	1,800	-4,600	
Reallocation of rolling stock to Thameslink core	**TL001**-Committed scheme	-15,800		
Introduction of new East Coast services	No infrastructure enhancements required	4,900		
Forecast end CP5		21,900	12,700	58%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		12,500		
CP4 Train Lengthening	Platform extensions on Great Northern Route required	800		
CP4 rolling stock changes	No infrastructure enhancements required	400		
Forecast end CP4		13,700	8,000	58%
Introduction of IEP (2015)-rolling stock change	IEP capability works and power supply enhancement required (**NE001+NE028**)-Committed schemes.	750		
Reallocation of rolling stock to Thameslink core	**TL001**-Committed scheme	-7,400		
Introduction of new East Coast services	No infrastructure enhancements required	2,800	-3,300	
Forecast end CP5		9,850	4,700	48%

Note: The East Coast Main Line Connectivity fund is required in order to meet the capacity metric for London Kings Cross (**NE023**).

1.7.1 CP5 Enhancements Projects

(NE001+NE028)-Intercity Express Programme (IEP) - The scheme includes the development, design and implementation of works in preparation for the introduction of new Intercity Express trains.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

1.8 Liverpool Street (Terminating)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		114,300		
Additional Capacity on GE Main Lines	Extension of Stratford Platform 10A funded in CP4	4,000		
Additional Capacity on WA Lines	No infrastructure enhancements required	11,200		
Forecast end CP4		129,500	66,800	52%
Additional Capacity on GE Main Lines	No infrastructure enhancements required	7,850		
Additional Capacity on WA Lines	No infrastructure enhancements required	14,450		
Transfer of services to Crossrail	**CR001**-Committed scheme	-15,550		
GE Main Line Infrastructure Improvement	**SE021**-Priority 1 scheme	10,550	-4,400	
Forecast end CP5		146,800	62,400	43%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		48,100		
Additional Capacity on GE Main Lines	Extension of Stratford Platform 10A funded in CP4	2,800		
Additional Capacity on WA Lines	No infrastructure enhancements required	4,500		
Forecast end CP4		55,400	34,600	62%
Additional Capacity on GE Main Lines	No infrastructure enhancements required	700		
Additional Capacity on WA Lines	No infrastructure enhancements required	2,900		
Transfer of services to Crossrail	**CR001**-Committed scheme	-8,650		
GE Main Line Infrastructure Improvement	**SE021**-Priority 1 scheme	3,500	-2,300	
Forecast end CP5		53,850	32,300	60%

Note: The West Anglia Main Line capacity increase fund is required in order to meet the capacity metric for Liverpool Street (**SE022**).

1.8.1 CP5 Enhancements Projects

CR001-Crossrail Programme-New Crossrail services will provide direct links from Maidenhead and Heathrow to Paddington in the West to Shenfield and Abbey Wood in the east. A 24tph service is expected to operate in each direction at peak times.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

SE021-Great Eastern Main Line Capacity Improvement-This project is to provide optimum use of the capacity released on the electric lines into Liverpool Street Station following the diversion of most peak suburban services through the Crossrail tunnel. Works include the reconstruction of Bow Junction and the provision of turnback facilities at Chelmsford and Wickford.

Project Category: Priority 1

Reference: *Option D2 in the London and South East RUS (July 2011), Strategic Business Plan: Definition of CP5 Enhancements*

1.9 Liverpool Street (Crossrail)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		0		
No planned capacity interventions		0		
Forecast end CP4		0	0	N/A
Introduction of Crossrail	**CR001**-Committed Scheme	96,000		
Forecast end CP5		96,000	33,000	34%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		0		
No planned capacity interventions		0		
Forecast end CP4		0	0	N/A
Introduction of Crossrail	**CR001**-Committed Scheme	36,000		
Forecast end CP5		36,000	16,500	46%

1.9.1 CP5 Enhancements Projects

CR001-Crossrail Programme-New Crossrail services will provide direct links from Maidenhead and Heathrow to Paddington in the West to Shenfield and Abbey Wood in the east. A 24tph service is expected to operate in each direction at peak times.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

1.10 Marylebone

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		14,600		
Evergreen 3-Phase 1	Funded by Chiltern Railways	3,600		
Forecast end CP4		18,200	11,400	63%
Evergreen 3-Phase 2 Chiltern Main Line train lengthening	Funded by Chiltern Railways **(NW006) -** Priority 1 scheme	1,450 700	1,000	
Forecast end CP5		20,350	12,400	61%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		6,300		
Evergreen 3-Phase 1	Funded by Chiltern Railways	1,750		
Forecast end CP4		8,050	5,100	63%
Evergreen 3-Phase 2 Chiltern Main Line train lengthening	Funded by Chiltern Railways **(NW006) -** Priority 1 scheme	500 350	500	
Forecast end CP5		8,900	5,600	63%

1.10.1 CP5 Enhancements Projects

NW006-Chiltern Main Line Train Lengthening-Platform extensions to accommodate 9-car operations on the Chiltern route. Based on an initial assessment of the proposed operational plan, platform extensions would be required at Beaconsfield, Bicester North, Haddenham and Thame Parkway, High Wycombe, and Princes Risborough.

Project Category: Priority 1

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

Evergreen 3-Phase 2-Project led by Chiltern Railways that provides a new London Marylebone to Oxford service, with the service pattern planned to be two trains per hour all day in each direction. The new service requires a chord at Bicester joining the Oxford to Bicester line to the Chiltern main line.

Project Category: Third Party Funded

1.11 Paddington (Terminating)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		27,400		
Refurbished rolling stock	No infrastructure enhancements required	150		
CP4 rolling stock changes	No infrastructure enhancements required	2,350		
Forecast end CP4		29,900	26,300	88%
Introduction of IEP (2015)	Great Western Main Line Enhancement Schemes	3,000	-2,400	
GWML Electrification (2015)	Great Western Main Line Enhancement Schemes	-850		
Reallocation and introduction of Rolling Stock	**CR001**-Committed scheme	6,800		
Forecast end CP5		38,850	23,900	62%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		11,200		
Refurbished rolling stock	No infrastructure enhancements required	50		
CP4 rolling stock changes	No infrastructure enhancements required	750		
Forecast end CP4		12,000	12,100	101%
Introduction of IEP (2015)	Great Western Main Line Enhancement Schemes	600		
GWML Electrification (2015)	Great Western Main Line Enhancement Schemes	-200		
Reallocation and introduction of rolling stock	**CR001**-Committed scheme	2,250	-1,900	
Forecast end CP5		14,650	10,200	70%

1.11.1 CP5 Enhancements Projects

CR001-Crossrail Programme-New Crossrail services will provide direct links from Maidenhead and Heathrow to Paddington in the West to Shenfield and Abbey Wood in the east. A 24tph service is expected to operate in each direction at peak times.

Project Category: Committed Scheme

Reference: Strategic Business Plan: Definition of CP5 Enhancements

Great Western Main Line Enhancement Schemes

CR002-Reading Station Area Redevelopment- Project will provide a minimum of four additional passenger train paths per hour in each direction and five additional platforms. Enhancement also includes a new train maintenance facility to the west of Reading station to cater for HLOS and IEP trains.

Project Category: Committed Scheme

Reference: Strategic Business Plan: Definition of CP5 Enhancements

DP001-Great Western Electrification-Electrification of the Great Western Main Line.

Project Category: Committed Scheme

Reference: Strategic Business Plan: Definition of CP5 Enhancements

WW007-Oxford Station Area Capacity and Station Enlargement-The objective of the scheme is to increase capacity and capability on the Oxford Corridor. Works include revised Oxford station platform arrangements, enhancements to the Botley Road Bridge, bi-directional signalling between Didcot North and Aynho Junction and improvements to line speeds.

Project Category: Named Scheme

Reference: Strategic Business Plan: Definition of CP5 Enhancements

WW009-Dr Days Junction to Filton Abbey Wood Capacity Improvements-The scheme provides capacity between the two major stations in Bristol and also delivers capacity for additional trains to London.

Project Category: Named Scheme

Reference: Strategic Business Plan: Definition of CP5 Enhancements

(WW027+WW028)-Intercity Express Programme (IEP)-The scheme includes the development, design and implementation of works in preparation for the introduction of new Intercity Express trains.

Project Category: Committed Scheme

Reference: Strategic Business Plan: Definition of CP5 Enhancements

1.12 Paddington (Crossrail)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		0		
No planned capacity interventions		0		
Forecast end CP4		0	0	N/A
Introduction of Crossrail	**CR001**-Committed Scheme	45,000	23,600	
Forecast end CP5		45,000	23,600	52%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		0		
No planned capacity interventions		0		
Forecast end CP4		0	0	N/A
Introduction of Crossrail	**CR001**-Committed Scheme	15,000		
Forecast end CP5		15,000	11,800	79%

1.12.1 CP5 Enhancements Projects

CR001-Crossrail Programme-New Crossrail services will provide direct links from Maidenhead and Heathrow to Paddington in the West to Shenfield and Abbey Wood in the east. A 24tph service is expected to operate in each direction at peak times.

Project Category: Committed Scheme

Reference: Strategic Business Plan: Definition of CP5 Enhancements

1.13 St Pancras (High Level)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		5,400		
No planned capacity interventions		0		
Forecast end CP4		5,400	Not specified	N/A
Change of rolling stock and train lengthening -Corby to London Services	**DP005+NE029**-Named schemes	2,100	Not specified	
Forecast end CP5		7,500	Not specified	N/A

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		2,400		
No planned capacity interventions		0		
Forecast end CP4		2,400	Not specified	N/A
Change of rolling stock and train lengthening -Corby to London Services	**DP005+NE029**-Named schemes	950	Not specified	
Forecast end CP5		3,350	Not specified	N/A

1.13.1 CP5 Enhancements Projects

DP005-Midland Main Line Electrification-Project will provide an electrified route north of Bedford to the core centres of population and economic activity in the East Midlands and South Yorkshire.

Project Category: Named Scheme

Reference: *Option A19.1 in the Network RUS-Electrification (October 2009), Strategic Business Plan: Definition of CP5 Enhancements*

NE029-MML Capacity (Bedford-Sharnbrook-Kettering-Corby)-Scheme includes further interventions to the Midland Main Line in order to provide the required additional capacity to meet the desired timetable specification.

Project Category: Named Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

1.14 St Pancras (Low Level)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		28,100		
CP4 Train lengthening-Thameslink Key Output 1	Committed scheme	1,150		
Forecast end CP4		29,250	19,700	67%
Introduction of new Thameslink rolling stock	**TL001**-Committed scheme	79,850	15,400	
Forecast end CP5		109,100	35,100	32%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		12,000		
CP4 Train lengthening-Thameslink Key Output 1	Committed scheme	750		
Forecast end CP4		12,750	10,500	82%
Introduction of new Thameslink rolling stock	**TL001**-Committed scheme	23,600	6,500	
Forecast end CP5		36,350	17,000	47%

1.14.1 CP5 Enhancements Projects

TL001-Thameslink Programme-Introduction of the 2018 Thameslink timetable will provide 24 train paths per hour between St Pancras International (low level) and Blackfriars stations.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Defintion of CP5 Enhancments*

1.15 St Pancras (High Speed 1)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		16,000		
Extra Ashford service in the Peak Hour	No infrastructure enhancements required	650		
Forecast end CP4		16,650	Not specified	N/A
No planned capacity interventions		0		
Forecast end CP5		16,650	Not specified	N/A

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		7,700		
Extra Ashford service in the Peak Hour	No infrastructure enhancements required	650		
Forecast end CP4		8,350	Not specified	N/A
No planned capacity interventions		0		
Forecast end CP5		8,350	Not specified	N/A

1.16 Victoria (Southeastern)

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		32,000		
No planned capacity interventions		0		
Forecast end CP4		32,000	20,100	63%
Kent route CP5 train lengthening	Dependent upon Thameslink rolling stock cascade	1,950	900	
Forecast end CP5		33,950	21,000	62%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		12,100		
No planned capacity interventions		0		
Forecast end CP4		12,100	10,100	83%
Kent route CP5 train lengthening	Dependent upon Thameslink rolling stock cascade	1,950	400	
Forecast end CP5		14,050	10,500	75%

1.17 Victoria (Southern)

		Peak 3 hours		
	Fu Funding / Dependencies nding	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		61,300		
ELL2-Reallocation of existing South London Line rolling stock	Construction of the East London Line (Phase 2) to Clapham Junction	-1,700		
CP4 train lengthening	Platform extensions CP4 funded	5,750		
CP4 rolling stock replacement	No infrastructure enhancements required	1,300		
Forecast end CP4		66,650	47,700	72%
Redhill corridor extra capacity Train Lengthening between Caterham/Tattenham Corner and Victoria	**SE016**-Named scheme Network Rail Discretionary Fund (NRDF) Funded	1,600 650	6,700	
Forecast end CP5		68,900	54,400	79%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		26,400		
ELL2-Reallocation of existing South London Line rolling stock	Construction of the East London Line (Phase 2) to Clapham Junction	-850		
CP4 train lengthening	Platform extensions CP4 funded	4,500		
CP4 rolling stock replacement	No infrastructure enhancements required	-50		
Forecast end CP4		30,000	23,200	77%
Redhill corridor extra capacity Train Lengthening between Caterham/Tattenham Corner and Victoria	**SE016**-Named scheme Network Rail Discretionary Fund (NRDF) Funded	1,600 450	1,300	
Forecast end CP5		32,050	24,500	76%

1.17.1 CP5 Enhancements Projects

SE016-Redhill Additional Platform-Project will enable full operation of the proposed Thameslink 2018 timetable including additional Victoria services splitting and joining at Redhill.

Project Category: Named Scheme

Reference: *Options relating to Gap F in the Sussex RUS (January 2010)*

Caterham/Tattenham Corner (joining at Purley) Train Lengthening-Services between Caterham and Tattenham Corner and London Victoria lengthened from 8-car to a 10-car formation.

Project Category: NRDF Funded

Reference: *Option 2.1 in the Sussex RUS (January 2010)*

1.18 Moorgate

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		16,300		
CP4 train lengthening	CP4 infrastructure enhancements between Alexandra Palace and Finsbury Park	3,500		
Forecast end CP4		19,800	13,200	67%
No planned capacity interventions		0	-2,300	
Forecast end CP5		19,800	10,900	55%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		7,000		
CP4 train lengthening	CP4 infrastructure enhancements between Alexandra Palace and Finsbury Park	650		
Forecast end CP4		7,650	7,400	97%
No planned capacity interventions		0		
Forecast end CP5		7,650	6,300	82%

Note: Turnback facilities at Gordon Hill and Stevenage are also required to deliver the Moorgate capacity metric (**NE004**).

1.19 Waterloo

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		116,800		
CP4 train lengthening	No infrastructure enhancements required	7,400		
CP4 rain lengthening (10-car operation on Windsor Lines)	CP4 platform lengthening and power upgrade	6,750		
Additional Windsor line services	Requires the re-opening of platform 20 at Waterloo International	2,450		
Forecast end CP4		133,400	100,100	75%
CP5 train lengthening between Reading and Waterloo	**SE002**-Priority 1	1,850	9,700	
Additional Windsor line services	Requires further integration of Waterloo International and power upgrade. **SE028**-Named Scheme	9,000		
Forecast end CP5		144,250	109,800	76%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		46,100		
CP4 train lengthening	No infrastructure enhancements required	800		
CP4 rain lengthening (10-car operation on Windsor Lines)	CP4 platform lengthening and power upgrade	5,050		
Additional Windsor line services	Requires the re-opening of platform 20 at Waterloo International	800		
Forecast end CP4		52,750	45,700	87%
CP5 train lengthening between Reading and Waterloo	**SE002**-Priority 1	600	4,900	
Additional Windsor line services	Requires further integration of Waterloo International and power upgrade. **SE028**-Named Scheme	3,000		
Forecast end CP5		56,350	50,600	90%

1.19.1 CP5 Enhancements Projects

SE002-Reading, Ascot to London Waterloo Train Lengthening-Scheme will enable 10-car train services to operate between Reading, Ascot and London Waterloo. Expands upon committed CP4 platform lengthening which only extended as far as Virginia Water.

Project Category: Priority 1

Reference: *Windsor Line option in the London and South East RUS (July 2011)*

SE028-Waterloo – Details of scheme TBC during CP5 (full details not available at time of review)

Project Category: Named Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

1.20 Birmingham

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		69,000		
CP4 train lengthening	No infrastructure enhancements required	1,000		
CP4 rolling stock change December 2011 timetable introduction	No infrastructure enhancements required	1,850		
	No infrastructure enhancements required	2,050		
Forecast end CP4		73,900	37,500	51%
CP5 train lengthening	Infrastructure funded in CP4	2,350	3,900	
Walsall to Rugeley Electrification	**NW001**-Named Scheme.	600		
Snow Hill train lengthening	Dependent upon 172s rolling stock cascade	1,900		
Worcester/ Hereford via Bromsgrove train lengthening	Dependent upon 170 rolling stock cascade from Walsall to Rugeley Electrification	750		
Forecast end CP5		79,500	41,400	52%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		27,200		
CP4 train lengthening	No infrastructure enhancements required	350		
CP4 rolling stock change December 2011 timetable introduction	No infrastructure enhancements required	600		
	No infrastructure enhancements required	900		
Forecast end CP4		29,050	19,200	66%
CP5 train lengthening	Infrastructure funded in CP4	1,950	1,800	
Walsall to Rugeley Electrification	**NW001**-Named Scheme	50		
Snow Hill train lengthening	Dependent upon 172s rolling stock cascade	1,150		
Worcester/ Hereford via Bromsgrove train lengthening	Dependent upon 170 rolling stock cascade from Walsall to Rugeley Electrification	350		
Forecast end CP5		32,550	21,000	65%

Note: The Bromsgrove electrification scheme will be change controlled from CP4 to CP5 and as a result any benefit would contribute to the CP5 metric. In the capacity metrics model additional peak capacity associated with the Cross City electrification is included under the

CP5 Train lengthening schemes. Note that no additional peak capacity is assumed for the Cross City South (Redditch and Bromsgrove) as benefits are assumed to be outside of the peak.

1.20.1 CP5 Enhancements Projects

NW001-Walsall to Rugeley Electrification-This project includes electrification works between Walsall Station and Rugeley Trent Valley facilitating conversion to electric train operation. Forms part of the Electric Spine set of enhancements.

Project Category: Named Scheme

Reference: *Option B17.7 in the Network RUS-Electrification (October 2009) , Strategic Business Plan: Definition of CP5 Enhancements*

1.21 Manchester

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		51,100		
CP4 train lengthening	CP4 platform lengthening required	200		
CP4 Northern Rail interventions	CP4 platform lengthening required	700		
Rolling stock change (Norwich-Liverpool service)	No infrastructure enhancements required	800		
Forecast end CP4		52,800	28,100	53%
Increased capacity into Manchester Piccadilly	No CP5 infrastructure enhancements required	0	6,200	
Rolling stock change (Chat Moss)	**DP002**-Committed scheme	1,600		
Rolling stock change and train lengthening (Lancashire Triangle)	**DP002**-Committed scheme	3,600		
CP5 train lengthening	**DP003**-Committed scheme	0		
CP5 train lengthening	No CP5 infrastructure enhancements required	0		
All Northern Hub outputs	**DP003**-Committed scheme	20,250		
Trans Pennine Electrification Outputs	**DP022**-Committed scheme	7,700		
Forecast end CP5		85,950	34,300	40%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		22,000		
CP4 train lengthening	CP4 platform lengthening required	100		
CP4 Northern Rail interventions	CP4 platform lengthening required	950		
Rolling stock change (Norwich-Liverpool service)	No infrastructure enhancements required	0		
Forecast end CP4		23,050	13,600	59%
Increased capacity into Manchester Piccadilly	No CP5 infrastructure enhancements required	0	2,600	
Rolling stock change (Chat Moss)	**DP002**-Committed scheme	550		
Rolling stock change and train lengthening (Lancashire Triangle)	**DP002**-Committed scheme	250		
CP5 train lengthening	**DP003**-Committed scheme	0		
CP5 train lengthening	No CP5 infrastructure enhancements required	0		
All Northern Hub outputs	**DP003**-Committed scheme	8,100		

Trans Pennine Electrification Outputs	**DP022-**Committed scheme	3,100		
Forecast end CP5		35,050	16,200	46%

1.21.1 CP5 Enhancements Projects

DP002-North West Electrification-This programme facilitates the introduction of electric train operation on a number of routes in the North West.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

DP003-Northern Hub-Expected outputs include improved service frequencies, journey times and connectivity across the whole region. This is aimed at supporting economic growth in the North of England. This project has major interfaces with the Northern electrification schemes.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

DP022-North Trans Pennine Electrification-This programme facilitates the introduction of electric train operation on the North Trans Pennine route between Leeds and Manchester.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

NE024-North West Train Lengthening-Scheme includes platform lengthening at several stations in the North West.

Project Category: Priority 1

Reference: *5.3.5, 5.3.8 and 5.3.9 options in the North West RUS (May 2007), Strategic Business Plan: Definition of CP5 Enhancements*

1.22 Leeds

		Peak 3 hours		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		36,100		
Northern Rail train lengthening	CP4 platform extensions	1,300		
Additional Leeds-Doncaster service	No infrastructure enhancements required	450		
CP4 rolling stock change	CP4 platform extensions	850		
CP4 rolling stock consolidation	No infrastructure enhancements required	800		
Forecast end CP4		39,500	25,400	64%
Introduction of IEP (2015)	IEP capability works and power supply enhancement required **NE001+NE028**. North Transpennine Electrification **DP022**. Committed schemes.	400		
Introduction of new electric rolling stock on North Trans-Pennine inter-urban services	**DP022**-Committed scheme	2,650		
Train lengthening (Manchester-Hull Service)	No infrastructure enhancements required	1,450		
Introduction of electric rolling stock on Huddersfield to Leeds services	**DP022**-Committed scheme, **NE021**-Named Scheme and **NE025**-Priority 1	1,250		
Rolling stock replacement (Calder Valley services)	No infrastructure enhancements required	-900		
Rolling stock replacement (Blackpool-Scarborough via Leeds)	**NE024**-Priority 1	400		
Introduction of 2-car "peak buster" between Halifax and Leeds via Bradford	**DP020**-Priority 1, **NE021**-Named Scheme	400		
Train lengthening (Sheffield-Leeds via Barnsley and Moorthorpe)	**NE016** and **NE025**-Priority 1	1,700		
Rolling stock replacement (Doncaster-Leeds services)	**NE025**-Priority 1	200		
Withdrawal of rolling stock on a number of routes	No infrastructure enhancements required	-7,600		
Rolling stock replacement (Skipton/Ilkley-Leeds services)	**NE016** and **NE025**-Priority 1	3,800		
Additional Horsforth-Leeds service	**NE016**-Priority 1	400		
Train Lengthening (Knottingley/Castleford-Leeds services)	**NE016** and **NE025**-Priority 1	2,000		
Rolling stock replacement (Harrogate-Leeds services)	No infrastructure enhancements required	2,200		
New Manchester-Leeds via Brighouse service	No infrastructure enhancements required	700		
Additional Skipton-Leeds service	No infrastructure enhancements required	200		

Rolling stock replacement (Micklefield-Leeds services)	**DP022**- Committed scheme, **NE025**-Priority 1 scheme	1,900	5,100	
Forecast end CP5		50,650	30,500	60%

		Peak Hour		
	Funding / Dependencies	**Capacity (20-min rule)**	**Demand**	**Load Factor (%)**
Base Year (December 2009 TT)		16,000		
Northern Rail train lengthening	CP4 platform extensions	1,050		
Additional Leeds-Doncaster service	No infrastructure enhancements required	450		
CP4 rolling stock change	CP4 platform extensions	850		
CP4 rolling stock consolidation	No infrastructure enhancements required	-250		
Forecast end CP4		18,100	13,000	72%
Introduction of IEP (2015)	IEP capability works and power supply enhancement required **NE001+NE028**. North Transpennine Electrification **DP022**. Committed schemes.	0	2,800	
Introduction of new electric rolling stock on North Trans-Pennine inter-urban services	**DP022**-Committed scheme	300		
Train lengthening (Manchester-Hull Service)	No infrastructure enhancements required	500		
Introduction of electric rolling stock on Huddersfield to Leeds services	**DP022**-Committed scheme, **NE021**-Named Scheme and **NE025**-Priority 1	400		
Rolling stock replacement (Calder Valley services)	No infrastructure enhancements required	-400		
Rolling stock replacement (Blackpool-Scarborough via Leeds)	**NE024**-Priority 1	300		
Introduction of 2-car "peak buster" between Halifax and Leeds via Bradford	**DP020**-Priority 1, **NE021**-Named Scheme	200		
Train lengthening (Sheffield-Leeds via Barnsley and Moorthorpe)	**NE016** and **NE025**-Priority 1	300		
Rolling stock replacement (Doncaster-Leeds services)	**NE025**-Priority 1	100		
Withdrawal of rolling stock on a number of routes	No infrastructure enhancements required	-3,700		
Rolling stock replacement (Skipton/Ilkley-Leeds services)	**NE016** and **NE025**-Priority 1	1,950		
Additional Horsforth-Leeds service	**NE016**-Priority 1	0		
Train Lengthening (Knottingley/Castleford-Leeds services)	**NE016** and **NE025**-Priority 1	1,200		

Rolling stock replacement (Harrogate-Leeds services)	No infrastructure enhancements required	800		
New Manchester-Leeds via Brighouse service	No infrastructure enhancements required	100		
Additional Skipton-Leeds service	No infrastructure enhancements required	0		
Rolling stock replacement (Micklefield-Leeds services)	**DP022**- Committed scheme, **NE025**- Priority 1 scheme	550		
Forecast end CP5		20,700	15,800	76%

Note: The East of Leeds, Micklefield Turnback and East Coast Main Line Connectivity Fund are also required in order to meet the capacity metric for Leeds (**NE030, NE022 and NE023**).

1.22.1 CP5 Enhancements Projects

DP022-North Trans Pennine Electrification-This programme facilitates the introduction of electric train operation on the North Trans Pennine line between Leeds and Manchester.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

(NE001+NE028)-Intercity Express Programme (IEP) - The scheme includes the development, design and implementation of works in preparation for the introduction of new Intercity Express trains.

Project Category: Committed Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

NE025-West Yorkshire Train Lengthening- Scheme includes platform lengthening at several stations in West Yorkshire.

Project Category: Table 4.3 in the Yorkshire and Humber RUS (July 2009), Strategic Business Plan: Definition of CP5 Enhancements

NE024-North West Train Lengthening-Scheme includes platform lengthening at several stations in the North West.

Project Category: Priority 1

Reference: *5.3.5, 5.3.8 and 5.3.9 options in the North West RUS (May 2007), Strategic Business Plan: Definition of CP5 Enhancements*

NE016-Leeds Station Capacity-Scheme provides additional platform capacity by providing infrastructure that accommodates longer trains and additional services.

Project Category: Priority 1

Reference: *Gap 8 solutions in the Northern RUS (May 2011), Strategic Business Plan: Definition of CP5 Enhancements*

NE021-Huddersfield Station Capacity Improvement-Scheme is designed to enhance the value of the Trans Pennine Electrification project. Works include platform lengthening and station remodelling.

Project Category: Named Scheme

Reference: *Strategic Business Plan: Definition of CP5 Enhancements*

DP020-Bradford Mill Lane Capacity-Scheme required to facilitate an additional hourly service from Halifax to Leeds. Works include an additional crossover between platforms 1 & 2 at Bradford Interchange and the relocation of the existing Bowling junction crossover close to Mill lane junction together with bi-directional signalling.

Project Category: Priority 1

Reference: *Section 6.7.5 in the Northern RUS (May 2011), Strategic Business Plan: Definition of CP5 Enhancements*