

# **ASSESSING NETWORK RAIL'S ENHANCEMENT PROGRAMME**

**Final Report**

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**Prepared for:**

Tim Griffiths  
The Office of Rail Regulation  
One Kemble Street  
London WC2B 4AN

**Prepared by:**

Steer Davies Gleave  
28-32 Upper Ground  
London  
SE1 9PD

+44 (0)20 7910 5000  
[www.steerdaviesgleave.com](http://www.steerdaviesgleave.com)

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## 1. INTRODUCTION

### Background

- 1.1 The Office of Rail Regulation (ORR) regulates Network Rail through Periodic Reviews, the next of which (Periodic Review 2008 or PR2008) will relate to Control Period 4 (CP4), the five-year period from April 2009 to March 2014. In anticipation of PR2008 ORR sought, through Invitations to Tender on 29 June 2007, Engineering Advice and Strategic Planning Advice on Network Rail's Enhancement Programme. On 1 August 2007 ORR appointed Arup, to provide Engineering Advice, and Steer Davies Gleave, to provide Strategic Advice.

### The Department for Transport's High Level Output Statement

- 1.2 DfT's HLOS is set out in "*Schedule to Appendix A: High Level Output Specification Metrics*" which forms part of the 24 July 2007 White Paper "*Delivering a sustainable railway*". ORR drew our attention to the fact that this largely self-contained Schedule has a specific legal status under the Railways Act 2005, and that we should assess the SBP only against this Schedule, and in particular three sets of metrics for safety, performance and capacity.

### Safety

- 1.3 ORR said that safety was outside the scope of our work.

### Performance

- 1.4 ORR said that performance would be studied primarily by advisors Winder Phillips. We had contact with Winder Phillips in a number of areas and did not attempt to duplicate their work.

### Capacity

- 1.5 DfT's HLOS Schedule sets out in Tables A3, A4 and A5, capacity metrics for:
- A3: Total demand to be accommodated by each of the 26 Strategic Routes (see Appendix B)
  - A4: Peak demand to be accommodated by the end of CP4 in major urban areas (Birmingham, Bristol, Cardiff, Leeds, Leicester, Liverpool (excluding Merseyrail), Manchester, Newcastle, Nottingham and Sheffield)
  - A5: Peak demand to be accommodated by the end of CP4 at main London termini
- 1.6 ORR asked us to focus initially on the peak demand capacity metrics of Table A4 and A5, which contain not only passenger numbers but also load factor targets, and hence implicitly form a quantified capacity requirement. Table A3, in contrast, does not contain load factors and the interpretation of the capacity it requires is therefore dependent on judgement.

## The Scottish Ministers' High Level Output Statement

- 1.7 The “*Scottish Ministers' High Level Output Statement*”, published on 13 July 2007, focuses on the delivery of specific schemes and enhancements arranged into 3 “Tiers”:
- Tier 1, broadly maintenance of existing infrastructure and services through CP4, with a Public Performance Measure (PPM) of 92% by the end of CP4
  - Tier 2, completion of Glasgow Airport Rail Link, Airdrie-Bathgate, and Borders Railway
  - Tier 3, preparation of delivery plans for a number of further improvements
- 1.8 Safety in Scotland is specified through the DfT HLOS, and performance through the Tier 1 specification, and there are no specific capacity metrics for Scotland.

### ORR's timetable, duties and objectives

- 1.9 Table 1.1 summarises key dates in the regulatory process. Appendix A also provides a more detailed chronology of our work during the period shaded in the Table.

**TABLE 1.1 KEY DATES FOR WORK PROGRAMME**

Date	Agent	Action
13 July 2007	Scottish Ministers	Publication of High Level Output Specification
24 July 2007	DfT	Publication of High Level Output Specification
1 November 2007	Network Rail	Publication of SBP
6 November 2007	ORR	Launch of consultation on the SBP
23 November 2007	Advisors	Interim report assessing the SBP
20 December 2007	ORR	Initial assessment of whether the outputs required by the HLOSs can be funded by the SoFAs
30 January 2008	DfT	Publication of Rolling Stock Plan (RSP)
14 February 2008	ORR	Update on the framework for setting access charges and SBP assessment
11 March 2008	Advisors	Report assessing the SBP
28 March 2008	Steer Davies Gleave	Report extended with further material requested by ORR
4 April 2008	Network Rail	Publication of SBP Update
23 May 2008	Advisors	Final Report assessing the SBP
5 June 2008	ORR	Draft determinations on Network Rail's revenue requirement, access charges and outputs for CP4
June 2008	Advisors	Appointment ends, but with possible extension
30 October 2008	ORR	Final determinations, following consultation on the draft determinations
18 December 2008	ORR	Final access charges audited and approved
5 February 2009	All	Final date for objections to ORR review notice starting implementation
31 March 2009	Network Rail	Publish CP4 delivery plan

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**Network Rail's Strategic Business Plan (SBP)**

- 1.10 On 1 November 2007 Network Rail published its Strategic Business Plan (SBP) explaining how it will contribute to meeting the High Level Output Specifications (HLOSs) of Scottish Ministers and the Department for Transport (DfT).
- 1.11 Our approach to assessing the SBP builds on that we developed to review Network Rail's June 2006 Initial Strategic Business Plan (ISBP), modified to reflect:
- ORR's terms of reference
  - Updates to our approach and work programme
  - ORR requests emerging in the course of our work
- 1.12 In the course of our work Network Rail provided a range of supporting documentation relating to the SBP and attended informal and "challenge meetings" with ORR. Information provided by Network Rail in response to our questions and at the challenge meetings has been taken into account in our comments on specific schemes and our general observations on its approach and work plan.
- 1.13 On 11 March 2008 we completed our assessment of the SBP and submitted a report to ORR. Following discussions with ORR we then completed a number of additional analyses and tabulations which were included in an "extended" report delivered to ORR on 28 March 2008.

**The Department for Transport's Rolling Stock Plan (RSP)**

- 1.14 On 30 January 2008 DfT published its Rolling Stock Plan (RSP). This took the form of a short (13 page) document which reconfirmed the indicative number of additional vehicles required by 2014 as 1,300, below Network Rail's SBP estimate of 1,519 (see 4.25). DfT's procurement of new vehicles and its cascade plan are essential to the delivery of the HLOS capacity metrics and it is important that infrastructure and rolling stock plans are aligned.
- 1.15 However, while the RSP contained a mix of new vehicles and cascades in its table of requirements, and identified the total number of electric multiple unit (EMU) and diesel multiple unit (DMU) vehicles allocated to each operator, it did not detail either where and in what formations existing stock would be operated, or the specification, capacity, delivery date and use of new stock.
- 1.16 It was clear that the RSP is at a relatively early stage of development and will be subject to detailed commercial negotiation. Our analysis of depot and stabling arrangements depends on rolling stock assumptions, as we discuss in greater detail in Section 4. These, and other uncertainties in what rolling stock capacity will be delivered and where, make it difficult to be confident that Network Rail's proposed capacity enhancement schemes will actually deliver the expected capacity during CP4, as we discuss in greater detail in Section 6.
- 1.17 Network Rail had some opportunity to absorb and discuss DfT's proposals before completing the SBP Update, but can only reflect them to the extent of the available information.

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**Network Rail's Strategic Business Plan Update (SBP Update)**

1.18 On 4 April 2008 Network Rail published its Strategic Plan Update (SBP Update) incorporating changes to the SBP to reflect further work including the comments of ORR and industry stakeholders. ORR asked us to focus our analysis of the SBP Update on a limited number of specific areas of analysis:

- The progress of Network Rail's proposals through its processes (see Section 4)
- Network Rail's assessment of the need for planning permission (see Section 4)
- Depots and stabling (see Section 4)
- The treatment of pricing and risk (see Section 5)
- The delivery of the capacity metrics set out in DfT's HLOS (see Section 6)

1.19 Accordingly, much of this report reflects and documents our relatively detailed analysis of the SBP, updated where necessary to reflect specific changes emerging in the SBP Update in these areas.

**This Final Report**

1.20 The remainder of this Final Report is structured as follow:

- Section 2 describes Network rail's enhancement schemes
- Section 3 reviews the schemes' origins and development
- Section 4 examines the schemes' deliverability
- Section 5 reviews Network Rail's treatment of pricing and risk
- Section 6 examines whether schemes to add capacity are sufficient and necessary
- Section 7 examines other schemes
- Section 8 summarises our findings

## 2. NETWORK RAIL'S ENHANCEMENT SCHEMES

### Introduction

2.1 Table 2.1 and Table 2.2 below, adapted from SBP Figure 6.25 and Figure 6.29, list the enhancement schemes in the SBP. Network Rail categorised its schemes as either:

- Capacity schemes, with a primary focus on increasing capacity
- Performance schemes, with a primary focus on improving performance

2.2 Network Rail also identified a number of optional schemes and “*enhancements to renewals*”.

2.3 Network Rail explained that it had estimated costs on four different bases:

- **Allocation**, typically referring to a fund for a particular type of work, or a contribution to a particular scheme. Allocations cannot be linked unambiguously to a specific scope of work for which a risk assessment can be made.
- **Allocation + IPI**, referring to an allocation adjusted by an Input Price Index (IPI) or inflation. Arup advised us that IPI is generally expected to grow around 1% per annum faster than inflation during CP4, although we comment briefly below on industry capacity (see 4.44). The costs of the Birmingham New Street scheme and one performance scheme have been included on this basis.
- **P80 + IPI**, referring to Network Rail’s use of risk modelling to estimate the 80<sup>th</sup> percentile cost that there is an 80% probability will not be exceeded, adjusted by IPI.
- **Modelled**, referring to a package of 59 DfT schemes, the cost of which has been quoted as a “point estimate”, without any specific contingency or allowance for risk. Network Rail then carried out a “risk adjustment” to this portfolio of schemes to calculate the aggregate “risk adjustment” line appearing in SBP Figure 6.25 under “HLOS output projects”.

2.4 We discuss the implications of these different cost bases in greater detail in Section 5.

2.5 We agreed with ORR that we should not examine a number of schemes, including:

- Access for All, Kings Cross, the Thameslink programme and the National Stations Improvement Programme (NSIP): ORR advised us that these schemes were already covered by other processes or would be analysed in house.
- Intercity Express Programme (IEP): the SBP does not contain sufficient information on the programme for quantitative analysis.
- Network Rail Discretionary Fund (NRDF): this is a fund which has not been allocated in advance to specific schemes.
- Strategic Freight Network: the SBP does not contain sufficient information on the programme for quantitative analysis.
- Other schemes including optional enhancement: we were asked to comment only on whether and how these schemes were linked with other schemes, which was an issue for all of the schemes in the Reading area.
- DfT seven day rail railway: analysis of this proposal would only be relevant if it appeared likely that the available funds would be sufficient to take it forward.

TABLE 2.1 DFT ENHANCEMENT PROJECTS (SBP FIGURE 6.25) COST BASIS

Project	Sub-total CP4 £m	Scheme CP4 £m	Cost basis			
			Allocation (no IPI)	Allocation + IPI	P80 + IPI	Modelled + IPI
<b>Total</b>	<b>8,353</b>					
<b>Baseline projects:</b>	<b>1,221</b>					
Access for All		197	✓			
Kings Cross		153			✓	
Stafford to Colwich		483			✓	
Bletchley Milton Keynes		116			✓	
Power supply upgrade		272			✓	
<b>Other specified projects:</b>	<b>4,036</b>					
Thameslink programme		2,589			✓	
Birmingham New Street		134		✓		
Reading station		455			✓	
IEP		260	✓			
NSIP		156	✓			
NRDF		234	✓			
Strategic Freight Network		208	✓			
<b>HLOS output projects:</b>	<b>1,978</b>					
Capacity schemes		1,324	✓			✓
Performance schemes		368		✓		✓
Risk adjustment		287	See text paragraphs 2.3 & 5.26			
<b>Other projects:</b>	<b>447</b>					
Redhill remodelling		25	✓			
West Croydon capacity		15	✓			
Reading Oxford Road		47		✓		
Reading Platforms 1-8		31		✓		
Reading station concourse		26		✓		
Didcot-Oxford capacity		38				✓
Crewe remodelling		10	✓			
Bolton corridor package		10				✓
Buxton remodelling		5				✓
Manchester Hub		60	✓			
Development funds for CP5		180	✓			
<b>DfT performance</b>	<b>400</b>		✓			
<b>DfT seven day railway</b>	<b>270</b>		✓			

TABLE 2.2 SCOTTISH ENHANCEMENT PROJECTS (SBP FIGURE 6.29) COST BASIS

Project	Sub-total CP4 £m	Scheme CP4 £m	Cost basis			
			Allocation (no IPI)	Allocation + IPI	P80 +IPI	Modelled + IPI
<b>Total</b>	<b>380</b>					
Airdrie-Bathgate		145			✓	
Glasgow Airport Rail Link		170			✓	
Borders (Waverley)		3		✓		
Tier 3 project development		13	✓			
Small projects fund		20	✓			
Seven day railway		30	✓			

### General comments on the SBP

- 2.6 Network Rail has produced a wide range of documentation describing its plans, including the SBP and ISBP, Route Plans and RUSs. Maintaining consistency between all these documents, particularly while producing a “snapshot” of its plans at any one time, is likely to be difficult. In the period between the publication of the HLOSs and the SBP, Network Rail had to develop proposals for meeting the HLOS metrics, in some cases without the benefit of the detailed analysis which the operators would normally carry out before agreeing to a particularly operational solution. It also had to take into account, inter alia, decisions on Edinburgh Airport Rail Link, Manchester Hub, Crossrail and a number of TIF schemes. We expected to find some minor differences between the SBP and other documents, and that these would result from the complexity of the process, or the need to make some assumptions without full consultation, rather than necessarily implying any underlying errors or inconsistency in approach.
- 2.7 Network Rail standardised the format of much of its SBP documentation, which helped improve consistency, but in many cases the information provided was extremely limited.
- 2.8 A specific consequence of this limited information was that while we examined, as described in Sections 4 and 5 below, changes in scheme costs or GRIP Stage between the ISBP and the SBP, we were often unable to determine whether or how these related to changes in scheme scope.
- 2.9 In general, however, the SBP appeared to have “thinned” the range of schemes offered in the ISBP, and to be more consistent in its focus on schemes delivering specific objectives.

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**General comments on the SBP Update**

- 2.10 The format of the SBP Update was generally similar to that of the SBP, enabling relatively easy comparison of the key points of the two documents.
- 2.11 The SBP Update appeared to have addressed a number of our concerns regarding the SBP and in particular provided useful additional analysis on the GRIP Stage reached by each scheme, the need for planning consent, and the requirements for depot and stabling, which we discuss in Section 4 below. It also revealed changes in the list of enhancement schemes, including some wholly new schemes, as well as the costs of individual schemes and an updated risk analysis, which we discuss in Section 5 below. However, changes in the output of some schemes were not described in sufficient detail to enable us to calculate the exact capacity which would be provided in CP4, and we were therefore unable to update fully our analysis of the delivery of DfT HLOS capacity metrics in Section 6.
- 2.12 In general the SBP Update represents further convergence in the overall projected cost of enhancements, but not necessarily in the list of enhancement schemes or their cost. The turnover or “churn” of schemes and the continuing changes in some of their costs raises some concerns, in particular regarding Network Rail’s ability to “freeze” its proposals for detailed design and implementation.

### 3. THE DEVELOPMENT OF THE ENHANCEMENT SCHEMES

#### Introduction

3.1 ORR wished to understand the analysis underpinning the enhancement schemes and asked us to examine how Network Rail had developed them. We examined data including:

- Network Rail's Route Plans
- Network Rail's June 2006 Initial Strategic Business Plan (ISBP) and November 2006 "Refresh"
- Network Rail's Route Utilisation Strategies

3.2 We discuss each of these sources in turn below.

#### Network Rail's Route Plans and ISBP

3.3 We compared the SBP with the Route Plans supplied with it by Network Rail as part of the same package. In many cases one or both of them provided too little detail to identify whether they were consistent, and we concluded that Network Rail's Route Plans could not be treated as a cross-check of the SBP.

3.4 We compared the SBP with the June 2006 ISBP and the November 2006 "Refresh". We identified a number of schemes which had been carried forward from the ISBP or "Refresh" to the SBP but, as we noted in Section 2 above, we were often unable to determine how changes in scheme costs or GRIP Stage between the ISBP and the SBP related to changes in scheme scope. In general, however, the SBP appears to have "thinned" the range of schemes offered in the ISBP and to be more consistent in its focus on schemes delivering specific objectives.

#### Strategic Routes with a Route Utilisation Strategy (RUS)

3.5 We collated all the Route Utilisation Strategies:

- Prepared by the Strategic Rail Authority (SRA) before responsibility was transferred to Network Rail.
- Prepared by Network Rail and published before we began work.
- Prepared by Network Rail and emerging in the course of our work, including:
  - Greater Anglia RUS (19 December 2007)
  - South London RUS Draft for Consultation (15 January 2008)
  - Yorkshire & Humber RUS Scoping Document (22 February 2008)
  - East Coast Main Line RUS (27 February 2008)
  - Kent RUS Scoping Document (13 March 2008)
  - Sussex RUS Scoping Document (13 March 2008)
  - South London RUS (26 March 2008)
  - Lancashire & Cumbria RUS Draft for Consultation (23 April 2008)

3.6 Network Rail gave us access to pre-publication drafts of some of these documents.

- 3.7 We compared all the schemes proposed in the SBP with the RUSs and found, in general, that where a RUS existed, the schemes were described in it and set in the context of a wider strategy for the Strategic Route. However:
- Given the current focus on the HLOS, and the changing background of other schemes, a scheme which was appropriate at the time of the RUS might not be now (and vice versa).
  - Even without this factor, scheme scope can change or, in some cases, is so unclear that it is impossible to be sure that the scheme is the same.
  - One or two schemes did not appear to “read across” between RUS and SBP.
- 3.8 However, we did note that neither proposals to remodel Redhill nor proposed enhancements at Gatwick Airport had appeared in either the draft South London RUS or the SRA’s earlier Brighton Main Line RUS.

### **Strategic Routes with no Route Utilisation Strategy (RUS)**

- 3.9 ORR wished to understand how Network Rail had developed schemes on Strategic Routes for which there was no current or recent RUS. We held a challenge meeting with Network Rail to discuss the development of three schemes on the Midland Main Line (MML, Strategic Route 19):

- Nottingham station area resignalling
- Nottingham station masterplan
- St Pancras to Sheffield line speed improvements

#### ***Nottingham station area resignalling***

- 3.10 This GRIP Stage 2 scheme, with a projected CP4 cost of £17 million in the SBP, would provide bidirectional signalling on the four lines into Nottingham Station from the west, improving operation flexibility, allowing separation of movements to Mansfield and other routes, and allowing some journey time savings. It would also provide a turnback facility east of the station, removing the need for some local services to terminate and reverse there. Network Rail told us that the scheme had originated through stakeholder criticism of earlier schemes which did not make such provision.
- 3.11 We challenged Network Rail on whether single leads at Trent East Junction would remain a constraint and were told that these would be removed in 2009 under an NRDF scheme. We also asked if the station area resignalling scheme was necessary and were told that, without the scheme, Network Rail did not expect to be able to operate reliably services already committed for introduction in the December 2008 timetable. We have not seen any documentation on these services, how they came to be committed, or how much capacity (if any) they would contribute to DfT’s “other urban areas” HLOS capacity metrics discussed in 6.23 below.

#### ***Nottingham station masterplan***

- 3.12 This GRIP Stage 1 scheme, with a projected CP4 cost of £20 million in the SBP, would provide a range of improvements to Nottingham station. Network Rail stated

that the scheme was proposed by Nottingham City Council and had a total cost of around £60 million, of which the £20 million was the rail industry contribution, and that the scheme documentation had advanced to GRIP Stage 4. There are a number of elements to the scheme including new car parking, a new station entrance, integration with the Nottingham Express Transit LRT system and improvements to interchange with other modes, but none involve track or signalling work. Network Rail stated that the scheme was not required to deliver the timetable or capacity, but would ease passenger congestion which would otherwise suppress demand.

- 3.13 We challenged Network Rail on how the scheme would be affected by East Midlands Parkway station, now under construction and scheduled to open in December 2008. We concluded that it is too early to predict the number of passengers it abstracts from Nottingham, which will be sensitive to the operators' future patterns of service.

#### ***St Pancras to Sheffield line speed improvements***

- 3.14 This GRIP Stage 4 scheme, with a projected CP4 cost of £73 million in the SBP, would enable journey time and/or performance improvements on services on the MML. Network Rail explained to us that the scheme had been examined in 2001 and progressed by its predecessor, Railtrack, to a level broadly equivalent to GRIP Stage 4. In 2007 DfT Rail had used another team within Steer Davies Gleave to review the existing work and develop a business case. Network Rail also described a range of work which had been carried out to examine which elements of the work provided the greatest return.

- 3.15 We challenged Network Rail on a number of issues, including whether higher line speeds for long distance trains were compatible with Thameslink timetables south of Bedford, consistency with assumptions in other work regarding transfer of freight between the East Coast Main Line (ECML) and MML, the balance of activity between track and signalling work, the scope for some works to be carried out in conjunction with renewals, and the attitudes of stakeholders. Arup noted that the proposals generally addressed the specific line speed restrictions that they would expect to be prioritised, and that the scheme appeared to offer a high benefit-cost ratio (BCR).

#### ***Other schemes on Strategic Routes with no RUS***

- 3.16 We also challenged Network Rail on the development of a number of other schemes on Strategic Routes with no RUS:

- Strategic Route 1 power supply enhancements
- Strategic Route 10 and 11 platform lengthening
- Strategic Route 13 Swindon to Kemble redoubling
- Strategic Route 21 Liverpool James Street and Liverpool Central

- 3.17 Network Rail produced a detailed document examining power supply enhancements throughout the network, prepared on a consistent basis and itemising enhancements on each route. We understand that Arup included a technical review of these itemised enhancements in their report, but note that the actual requirement may depend on the service operated, the length of trains, the stock used and whether technologies such as regenerative braking are activated.

- 3.18 In the event, DfT's subsequent Rolling Stock Plan (RSP) assumed that Class 465 EMU vehicles would be returned from South Central to Southeastern and that capacity would be increased at least partly through the introduction of high speed domestic services. Without details of the future fleet, it may not be possible to establish exactly what power supply enhancements are necessary.
- 3.19 Network Rail provided a list of the stations at which platforms would be lengthened in West Yorkshire around Leeds (Strategic Route 10) and in South Yorkshire around Sheffield (Strategic Route 11). Arup examined detailed schedules of the platforms to be lengthened and produced its own estimates for the cost of the work, which are considerably lower than Network Rail's. In addition, as we discuss below (see Table 6.4), it may not be necessary to lengthen all the platforms considered to provide sufficient capacity to meet the DfT HLOS capacity metric in Leeds.
- 3.20 Network Rail produced a number of documents relating to Swindon to Kemble redoubling, including documentation of discussion with, and support from, DfT and operators, and a summary business appraisal.
- 3.21 Network Rail provided written answers to a number of questions about the two schemes in Liverpool on the Merseyrail system. They indicated that they were intended to deal with passenger demand which had already exceeded forecasts, and might be exacerbated by future developments, and that they were therefore being developed in parallel with the RUS.

#### Developments between the SBP and the SBP Update

- 3.22 The publication of Network Rail's SBP Update provided a further "snapshot" of how individual schemes were being identified and progressed and how the overall portfolio of schemes was developing. In general Network Rail had continued its approach to identifying, developing and refining schemes, although changes had been made to all the schemes we investigated above, as summarised in Table 3.1.

**TABLE 3.1 CHANGES IN SAMPLE SCHEMES BETWEEN SBP AND SBP UPDATE**

Change in costs	Schemes
	Scheme removed Nottingham station masterplan
-- Major reduction	St Pancras to Sheffield line speed improvements Strategic Route 21 Liverpool James Street and Liverpool Central
- Minor reduction	Strategic Route 1 power supply enhancements Strategic Route 10 and 11 platform lengthening
+ Minor increase	Nottingham station area resignalling
++ Major increases	Strategic Route 13 Swindon to Kemble redoubling

- 3.23 The majority of the schemes sampled had been retained in the SBP Update and in most cases further work had led to a reduction Network Rail's estimate of their CP4 costs.
- 3.24 We were surprised at the removal of the Nottingham station masterplan, which we had previously been told had broad local stakeholder support. We noted the major

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increases in costs of the Swindon to Kemble redoubling, but these were consistent with Arup's finding that the costs had been underestimated in the SBP.

### Summary

- 3.25 With few exceptions, such as at Redhill and Gatwick Airport, the schemes in the SBP and SBP Update were traceable to, and consistent with, a RUS which examined them in the context of a coherent strategy and other schemes.
- 3.26 Where no RUS existed, the objectives and development of schemes such as power supply enhancement and platform lengthening were often self-explanatory as means of achieving their objectives. On Strategic Route 19 at least, Network Rail had a firm basis for proposing schemes based on stakeholder requirements or initiatives or prior investigation of opportunities. More widely, the mere absence of a RUS did not appear to mean that Network Rail had not examined and developed possible enhancements.
- 3.27 When planning power supply enhancements, Network Rail may have no details of either the future rolling stock or how it will be used, and it might be prudent to allow for some over-provision, particularly if this can be done at small additional cost.
- 3.28 Our greatest concern was that the absence of a RUS may mean that interactions between schemes, such as stations at Nottingham and East Midlands Parkway, had not been fully thought through.

## 4. THE DELIVERABILITY OF THE ENHANCEMENT SCHEMES

### Introduction

4.1 In this Section we summarise our analysis of some of the strategic aspects of the delivery of the enhancement schemes, dealing in turn with:

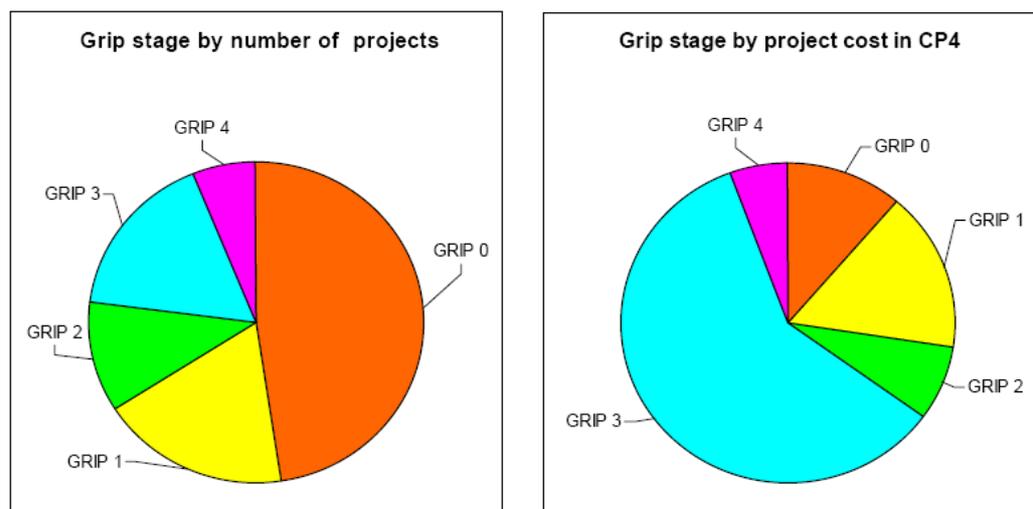
- Progress of the schemes through Network Rail's GRIP Stages
- Planning consent
- Depots and stabling
- Industry capacity

4.2 We have not, however, commented on the engineering and project management of the enhancement schemes, on which ORR is being advised by Arup.

### GRIP Stage in the SBP

4.3 In Figure 6.20 (Page 141) of the SBP, Network Rail identified the proportion of CP4 enhancements at each GRIP Stage, both by number of projects and by value. We reproduce this figure below as Figure 4.1.

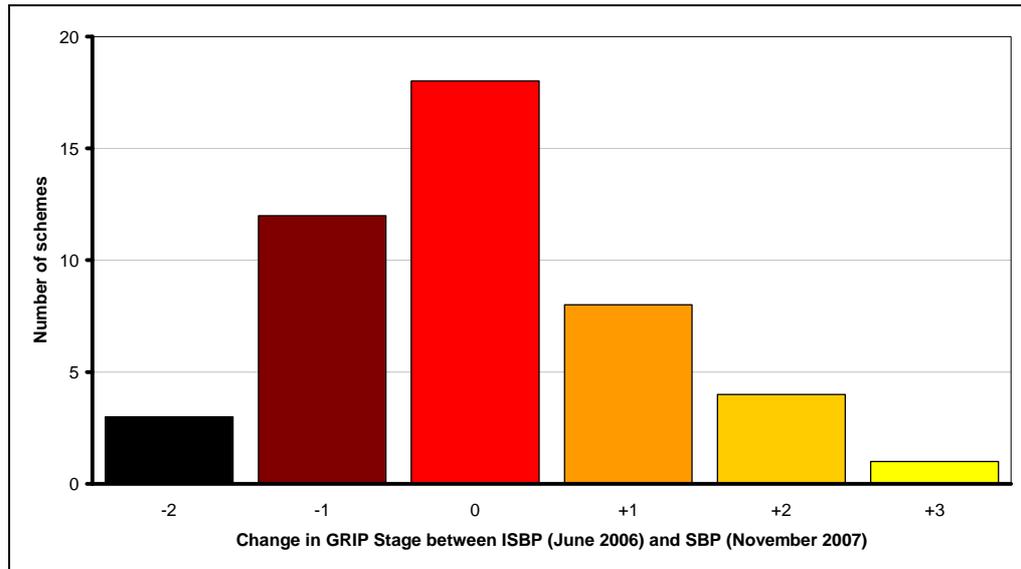
**FIGURE 4.1 GRIP STAGE OF PROJECTS (FROM SBP FIGURE 6.20)**



4.4 Network Rail reported that nearly half the projects were at GRIP Stage 0, but around 70% of the projects by value were at GRIP Stage 3 or 4.

4.5 We compared the list of schemes in the SBP with those in the June 2006 ISBP, and identified 47 schemes which had appeared in both documents. We compared the GRIP Stage of each of these schemes described in the ISBP and the SBP published 17 months later. Figure 4.2 overleaf summarises the results.

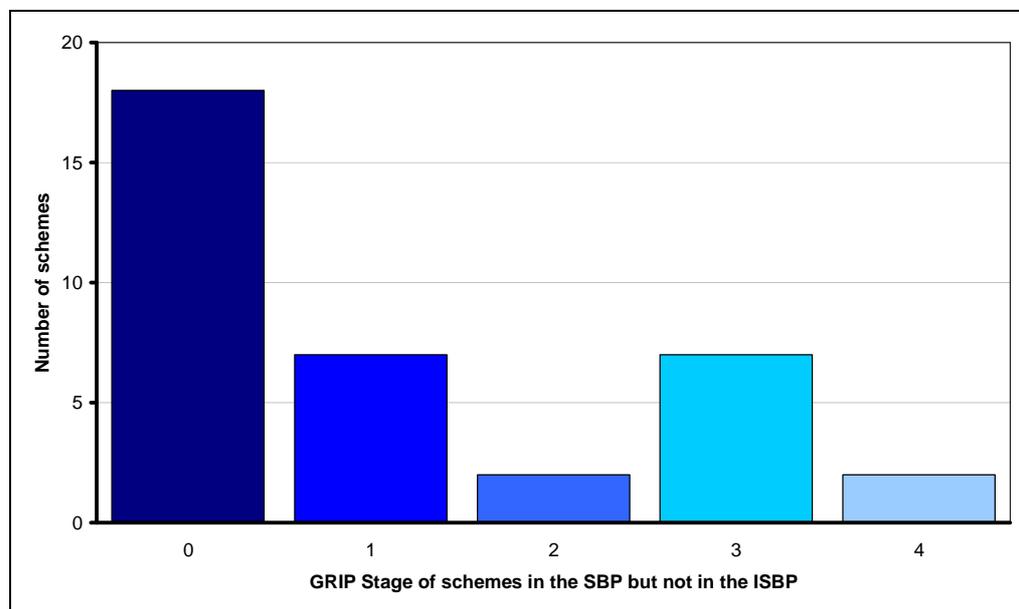
**FIGURE 4.2 GRIP STAGE CHANGES BETWEEN ISBP AND SBP**



4.6 Over the 17 months between the two documents, just over a quarter of the schemes have advanced by one or more GRIP Stages, but over one third of the schemes have regressed by one or more GRIP Stages. There is no evidence of consistent progress: in practice, schemes seem equally likely to have advanced and regressed.

4.7 We also examined the GRIP Stage in the SBP of schemes which had not been in the ISBP, as shown in Figure 4.3.

**FIGURE 4.3 GRIP STAGE OF SCHEMES FIRST APPEARING IN THE SBP**



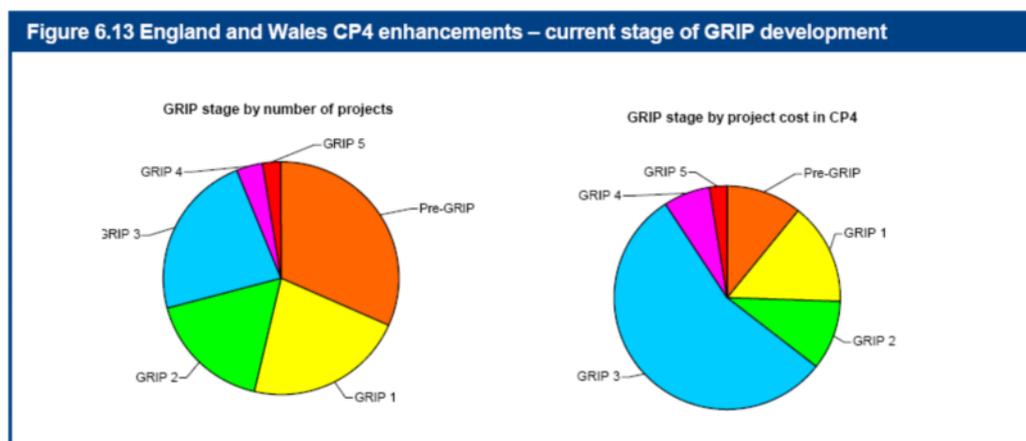
4.8 Half the new schemes are at GRIP Stage 0 and only two, Great Eastern electrification and MML line speed improvements (see 3.14 above), have progressed to GRIP Stage 4.

- 4.9 It is probably reasonable that schemes which have only recently been added to Network Rail’s programme, to deal with emerging customer needs or to address the specific requirements of the HLOSs, should be at a low GRIP Stage. It is also reassuring that at least some schemes not in the ISBP have progressed as far as GRIP Stage 4.
- 4.10 Our greatest concern is that, taken as a programme, there is no evidence that schemes appearing in both the ISBP and the SBP are collectively making progress through the GRIP Stages. As we noted in our review of the ISBP, whatever the merits of refining schemes to reflect changing requirements or to optimise design, Network Rail cannot deliver outputs unless it can progress schemes through the system.

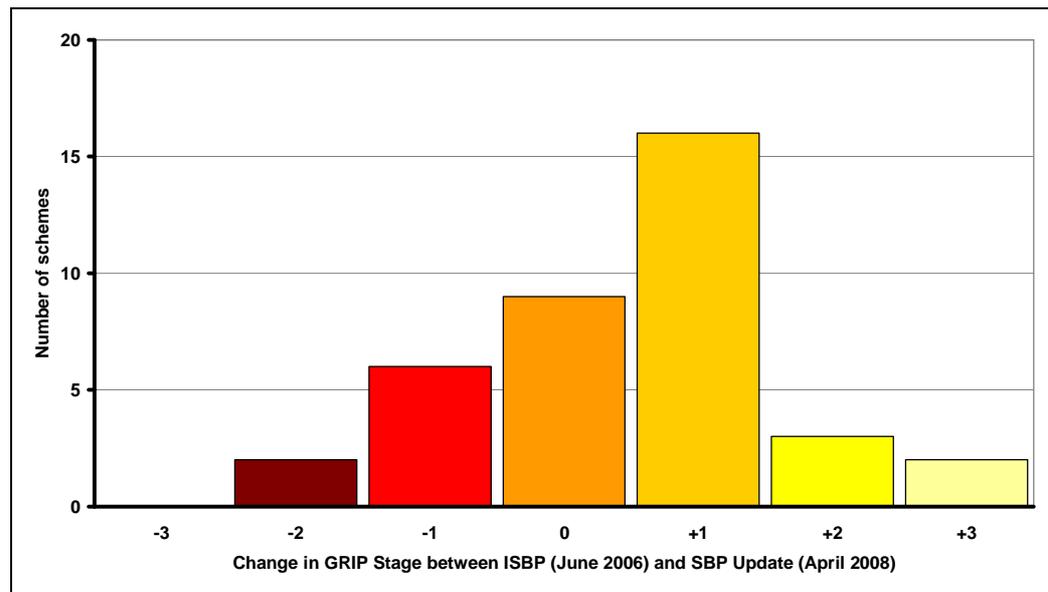
#### GRIP Stage in the SBP Update

- 4.11 In Figure 6.13 (Page 63) of the SBP Update, Network Rail identified the proportion of CP4 enhancements at each GRIP Stage, both by number of projects and by value. We reproduce this figure below as Figure 4.4.

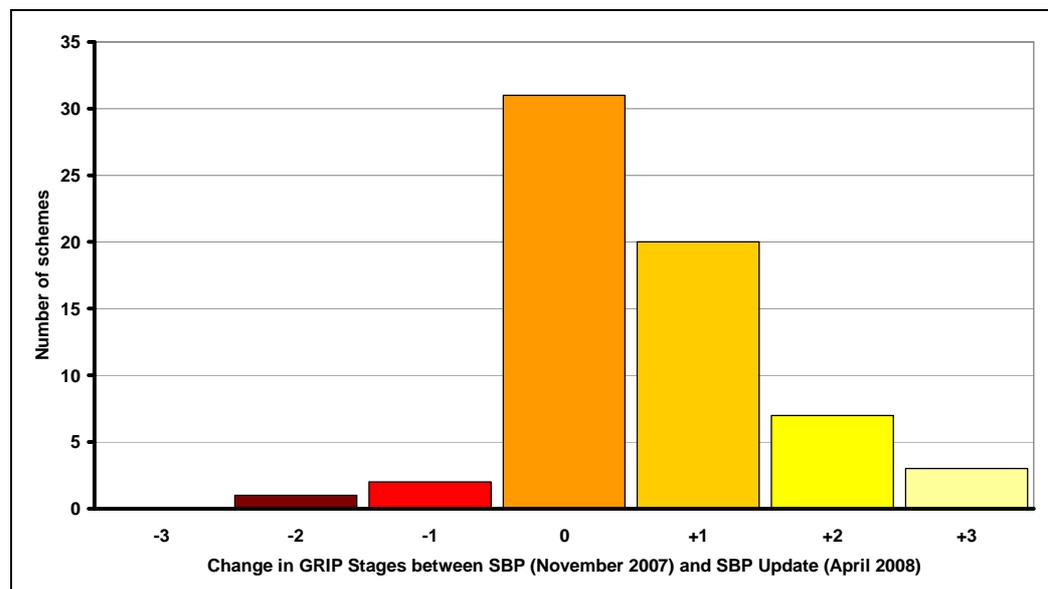
**FIGURE 4.4 GRIP STAGE OF PROJECTS (FROM SBP UPDATE FIGURE 6.13)**



- 4.12 Comparing SBP Update Figure 6.13 with SBP Figure 6.20, reproduced as Figure 4.1 of this report, we noted that:
- Network Rail had replaced the description of “GRIP 0” with the more correct “Pre-GRIP”
  - The number of projects which had not passed GRIP Stage 1 had fallen between SBP and SBP Update from around 70% to around 55% of the total.
  - The value of projects which had not passed GRIP Stage 1 had fallen slightly between SBP and SBP Update to just over 25% of the total.
- 4.13 Network Rail provided with the SBP Update a new analysis of how individual schemes had progressed through the GRIP Stages since the SBP, but we remained concerned at the overall rate of progress. There were insufficient new schemes in the SBP Update for it to be appropriate to update Figure 4.3, but we repeated the analysis in Figure 4.2 to identify the progress in GRIP Stage of schemes which had progressed between ISBP, SBP and SBP Update. Figure 4.5 overleaf shows, in the same format as Figure 4.2, the changes in GRIP Stage between the ISBP and the SBP Update.

**FIGURE 4.5 GRIP STAGE CHANGES BETWEEN ISBP AND SBP UPDATE**

- 4.14 In contrast to Figure 4.2, showing no net progress over the 17 months between ISBP and SBP, Figure 4.5 suggests that a relatively large number of schemes had progressed by at least one GRIP Stage over the 22 months between ISBP and SBP Update.

**FIGURE 4.6 GRIP STAGE CHANGES BETWEEN SBP AND SBP UPDATE**

- 4.15 Figure 4.6 shows the changes in GRIP Stage between the SBP and the SBP Update, a period of only 5 months, during which Network Rail claims that 30 schemes have progressed by one or more GRIP Stages and only three have regressed. We were surprised at the apparent rapid progress over this short period relative to that in the preceding 17 months.

### Planning consent in the SBP

- 4.16 During our work on the SBP, Arup noted that Transport and Works Act (TWA) applications can take two years from application to confirmation of orders, which can result in delays to otherwise simple schemes. We were concerned that this might be a source of delay, and reviewed references by Network Rail to schemes needing any form of planning consent. Network Rail only identified this need for the eight schemes, on three Strategic Routes, listed in Table 4.1 below.

**TABLE 4.1 REQUIREMENTS FOR PLANNING CONSENT IDENTIFIED IN SBP**

Strategic Route	Scheme	"Target delivery year/range"	TWA Orders	Planning consent	Listed building consent
	ECML capacity relief Peterborough to Doncaster	2012-2013	✓		
	Hitchin grade separation	2013	✓		
8	ECML level crossings	2013	✓	✓	
	Shaftholme Junction remodelling	2013	✓		
	Kings Cross	2013/14		✓	✓
13	Swindon to Kemble redoubling	2009		✓	
18	Bletchley to Milton Keynes	2012/13	✓		
	Stafford to Colwich	2013/14	✓		

- 4.17 We doubted that this resulted from a consistent review of whether planning consent would be needed, and so reviewed the SBP Project Summaries document and identified schemes which seemed likely to involve works outside the envelope of the working railway which might, prima facie, need consent.

- 4.18 We identified a further 13 schemes which seemed, prima facie, likely to need some element planning consent, as listed in Table 4.2 below.

**TABLE 4.2 OTHER CP4 SCHEMES WHICH MAY NEED PLANNING CONSENT**

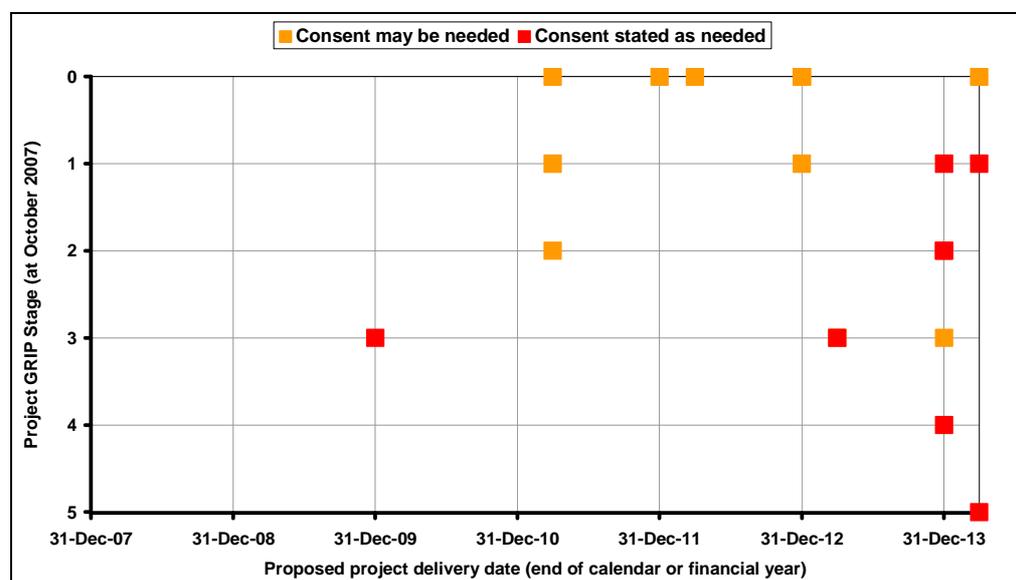
Strategic Route	Scheme	"Target delivery year/range"	GRIP Stage	Cost (CP4 £m)
10, 12, 20	Stabling for Northern	2010/11	0	39
19	Nottingham station masterplan	2010/11	1	20
Freight	Humber Ports freight schemes	2010/11	2	8
20	Salford Central new platforms	2009-2011	0	13
2	West Croydon station and track	2011/12	0	20
20	Bolton corridor package	2009-2012	0	10
3	Clapham Junction station	2010/11	0	30
20	Salford Crescent new station	2010/11	1	25
2	East Croydon passenger capacity	2012	0	12
8	Peterborough station redevelopment	2012/13	3	28
15	Cardiff Queen Street to Cogan Junction	2012-2013	3	36
20	Manchester Hub	2010-2014	0	60
13	Reading station area redevelopment	2010-2016	3	435
<b>Total</b>				<b>736</b>

Note: all costs are CP4 costs as quoted in SBP Project Summaries.

- 4.19 On these calculations nearly half (by value) of the schemes described in the SBP Project Summaries may be at risk of planning delay, although there might be delays to completing, or achieving the capacity and performance benefits of, further interdependent schemes.
- 4.20 Network Rail identified a potential need for TWA consent for the Swindon to Kemble redoubling, which has a target delivery date of "2009", at most 26 months away at the time of the SBP. We understand that this would be needed to construct a new station on this line, which is an aspiration of Swindon Borough Council. However the redoubling itself, with passive provision for the station, would not require TWA consent, which should therefore not be critical to the timing of the key output proposed for the SBP.

- 4.21 Figure 4.7 summarises the delivery dates, and current GRIP Stages, of the Swindon to Kemble redoubling and other schemes due to be completed by the end of CP4.

**FIGURE 4.7 SCHEMES WHICH MAY NEED PLANNING CONSENT: DELIVERY DATES**



- 4.22 After the end of 2009, the next delivery date for a scheme for which Network Rail identified a need for TWA consent is “2012/2013”, which we have taken to mean March 2013, for Bletchley to Milton Keynes. However our investigations (Table 4.2) found nine schemes due to be completed earlier, all of which may need consent. Three of these schemes are scheduled for delivery by “2010/11”, which we have taken to mean March 2011. The Humber Ports freight schemes do not deliver passenger capacity and we confirmed that Nottingham station masterplan (see 3.12) is not critical to the delivery of infrastructure capacity. The earliest scheduled scheme which may be critical to the delivery of DfT’s HLOS capacity metrics is therefore the provision of new stabling for Northern, in up to ten locations, which is still at GRIP Stage 0. Without this stabling it may not be possible to meet the metrics in one or more urban areas, which we discuss in Section 6 below.

#### Planning consent in the SBP Update

- 4.23 Network Rail provided with the SBP Update a new analysis of which schemes were likely to require each type of planning consent. There was evidence of a systematic approach to the issue, and the findings were broadly consistent with our expectations, although Network Rail also identified a potential need for planning consent for many third party schemes, where it would be reliant on other stakeholders to progress the applications.
- 4.24 Network Rail also included indicative estimates of the potential delays resulting from the process, although these do not appear to have been used directly in the modelling of the effect of delays on cost (see Section 5) or whether and where delays would jeopardise delivery of capacity by the end of CP4 (see Section 6).

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## Depots and stabling in the SBP

- 4.25 ORR was concerned that delivery of large increments of capacity through longer trains would mean that a larger rolling stock fleet would need not only to be specified and purchased but also maintained and stabled from the beginning of its operational life. ORR asked us to examine the provision for depots and stabling within the SBP, particularly given Network Rail's expectation, in SBP Figure 3.10, that 1,698 "additional" vehicles, 179 in Scotland and the remaining 1,519 in England and Wales, would be required by the end of CP4. This represents an increase of around 15% in the size of the total fleet.
- 4.26 Network Rail has not, in the past, been involved in provision of and for rolling stock, which has been the responsibility of the operators. It explicitly stated in the SBP that it had not included the costs of depots (and apparently stabling) for the new rolling stock, with the exception of stabling for Northern on Strategic Routes 10, 11 and 20.
- 4.27 The SBP's focus of capacity expansion through longer trains means that it will be necessary not only to maintain and stable more rolling stock but also to do so in longer formations, such as 10-car or 12-car instead of 8-car. We identified a number of existing stabling points on the affected routes, such as Bedford, where it appeared that sidings designed to stable trains of the current length could not be extended within the existing site. We also identified stabling points such as Selhurst with fewer, longer sidings but on a constrained site with no apparent scope for expansion.
- 4.28 From our work for bidders for rail franchises, we are aware of the range and complexity of preparatory work for a franchise bid, and that this focuses on the core bid, any required options, and any additional proposals developed by the bidder, but does not necessarily include further expansion of capacity beyond that specified or judged desirable.
- 4.29 We spoke to an operator who had recently been awarded a franchise on a routes on which the SBP proposes expansion. The operator confirmed that they had not carried out any analysis of how trains would be extended in the way envisaged. We discussed how they would approach this issue and they indicated that, where existing depot and stabling points were constrained, it would be necessary to consider more splitting and joining of trains and/or stabling at less convenient locations. Either change would require the reworking of train and train crew diagrams and have operational, performance and cost implications which would be likely to include additional consumption of capacity, empty running, fuel and crew cost. In some cases, we were told, the additional time required for longer trains to cross the throat of a major terminus could also reduce the number of trains which could reliably be operated.
- 4.30 We also considered the practicalities of extending train lengths in stages, and in particular from 8-car to 10-car and then to 12-car. As with lengthening platforms at Reading or other stations, lengthening stabling in stages from 8-car to 10-car and then to 12-car could entail additional costs, particularly if 10-car facilities could not subsequently be extended. There would also be issues of how a fleet of 4-car sets could be marshalled into 10-car trains. We would expect extension to 12-car to be more cost-effective than extension to 10-car and then to 12-car, and in some circumstances to be more cost-effective than extension to 10-car alone.

- 4.31 In summary, operation of longer trains could, in some cases, require a complete reworking of the timetable and train and crew diagrams and additional operating and performance costs. The complexity of the analysis required means that it is not normally carried out unless investigation of lengthening was essential to DfT's franchise specification or the operator's aspirations.
- 4.32 We raised the specific example of the Thameslink scheme, affecting Strategic Routes 2 and 19 and, to a lesser extent, 1, 3 and 8, and asked what analysis had been done of future depot and stabling requirements. We were told that, even though the scheme now has financial approval, detailed depot and stabling arrangements have not yet been defined.
- 4.33 ORR asked Network Rail to provide an analysis of depot and stabling costs requirements in its SBP Update.

#### Depots and stabling in the SBP Update

- 4.34 Network Rail provided with the SBP Update a new analysis of the need for depots and stabling across the network, taking account not only of DfT's Rolling Stock Plan (RSP) but also discussions with operators of the optimal approach to capacity, depots and stabling. Working from its own estimates (see 4.25) of the additional rolling stock which would be required, it developed a point estimate of £211.7 million for depots and stabling and a risk analysis indicating that there was only a 20% chance that this cost would exceed £302 million.
- 4.35 Network Rail's proposals, and our suggested adjustments to them, are summarised in Table 4.3, and the rationale for our adjustments to them are set out below.

**TABLE 4.3 DEPOT AND STALING COSTS IN CP4: POINT ESTIMATES**

Strategic Route(s)		Network Rail estimates	Steer Davies Gleave estimates (if different)
1	Kent	£40.8m	
2	Brighton Main Line	£39.4m	
3	South Western Main Line	£24.9m	
5, 6, 7	Anglia	£21.6m	£20.6m
10, 11, 20	Northern	£25.0m	Nil
13	Great Western	£15.0m	Nil
17	West Midlands	£50.0m	£30.0m
	Leicester	£5.0m	
<b>Total</b>		<b>£211.7m</b>	<b>£160.7m</b>

Note: all costs are CP4 costs as quoted in SBP Update documentation.

- 4.36 One route 2, Network Rail proposed expenditure of £21.9 million "to provide between 20 and 40 10-car sidings" at Three Bridges. While we recognised that the introduction of 10-car formations on inner services was an effective means of delivering additional capacity, Three Bridges lies well outside the area in which these trains would operate and Network Rail admitted that Thameslink was also looking at the site for a similar

use. We also note that (see 5.19) that Network Rail's estimates of the costs, and by implication the other details, of 10-car operation on Route 2 were not yet clear. We accepted that the projected expenditure, which seemed reasonable when expressed as a cost per additional vehicle, would probably be necessary, but were not convinced that Three Bridges would prove to be a satisfactory solution.

- 4.37 On Route 5 Network Rail had proposed £1 million of expenditure on provision for lengthening West Anglia inner suburban services from 8 to 9 car. As we discuss in 6.52 below, we considered that it may be poor value to lengthen, as late as 2012, platforms at stations from Northumberland Park to Cheshunt inclusive (7 stations), which might be modified or even removed as early as 2014. We concluded that no expenditure should be incurred to cater for longer trains on these routes without evidence of the lasting benefits of the work, and accordingly removed this £1 million from Network Rail's estimates.
- 4.38 On Routes 10, 11 and 20 on the Northern network, the SBP had identified a need for stabling facilities costed at £39 million at up to 10 locations, but in the depot analysis provided with the SBP Update it argued that an additional £25 million would be required. We examined the overall level of expenditure requested per additional vehicle, which was much higher than projected on other routes, and also noted that, as we describe in Section 6 below, not all of the capacity envisaged in the Leeds area was necessary to deliver the capacity metrics of the DfT HLOS. We concluded that, without further evidence, Network Rail had not made the case for any of the proposed additional £25 million.
- 4.39 On Route 13, Great Western, Network Rail had proposed £5 million of facilities at Bristol and £10 million at Reading. At Bristol, Network Rail's own calculations of how capacity would be increased did not include any new rolling stock after the end of CP3 and we concluded that there was no justification for expenditure in CP4. At Reading, the SBP included proposals for lengthening to 3/4 cars, which the SBP Update replaced with "up to 7 cars", but we understand that it is now proposed that these services would be replaced with InterCity Express (IEP) stock during CP5 and would be unlikely to be cost-effective to build new stabling for a short-lived expansion of the existing fleet. We concluded that any increases in the fleet should either be accommodated within the overall budget for the Reading station area redevelopment scheme or deferred until the fleet was replaced.
- 4.40 On Route 17, West Midlands, Network Rail envisaged a need for an additional 69 vehicles, adding 11,130 spaces in the 3-hour AM peak period, although we concluded that in practice only 6,942 spaces, implicitly equivalent to around 45 vehicles, would be needed to meet the capacity metric of the DfT HLOS. Network Rail proposed an expenditure of £50 million at Duddleston, a location close to Birmingham New Street which had been identified in the ISBP, Kings Norton and Worcester Shrub Hill, at each of which it appeared that space for stabling was available. Even assuming that the overall cost per additional vehicle was broadly reasonable, we concluded that the overall provision should be reduced in line with the actual additional capacity required and that a more reasonable budget would be £30 million.

- 4.41 Finally Network Rail had proposed an additional £5 million to support CrossCountry services at Leicester. We did not modify this figure, but have not seen convincing evidence that additional facilities would be required.
- 4.42 We also reviewed Network Rail’s risk analysis so as to provide ORR with estimates of the Mean and 80<sup>th</sup> percentile (P80) estimates associated with Network Rail’s and our point estimates, drawing on the analysis of risk we describe in Section 5 below. Table 4.4 summarises the results.

**TABLE 4.4 DEPOT AND STABLING COSTS IN CP4: ESTIMATES OF MEAN AND P80**

	Point estimate	Mean	P80
Network Rail	£220-225m	£260m	£300-305m
Steer Davies Gleave (pro rate)	£160m	£190m	£215-220m
Steer Davies Gleave (allowance for Three Bridges)		£195m	£225-230m

Note: all costs are CP4 costs as quoted in SBP Update documentation.

- 4.43 We concluded that the mean expenditure on depots and stabling should be around £190 million with an 80<sup>th</sup> percentile (P80) not exceeding £215-220 million. Allowing for the uncertainty associated with Three Bridges, however, we suggest an indicative figure of a mean of £195 million and an 80th percentile not exceeding £225-230 million.

#### Industry capacity

- 4.44 As part of our review of Network Rail’s ISBP we examined evidence on the capacity of the construction industry to deliver the enhancements, reviewing reports produced during 2006 by Franklin + Andrews, OGC and EC Harris.
- 4.45 Since then EC Harris published a further winter 2006/07 review “*Research – Economics Survey*”, which was consistent with its earlier report but focused mainly on short term trends to 2009. The impact of the 2012 Olympics was noted, with annual tender price increases of around 4% nationally and 6% in London projected to 2010. EC Harris noted that “*Crossrail and Thameslink 2000 will have a huge effect on the market if and when they go ahead*” but gave no further details. The DfT HLOS includes financial approval for Thameslink and, on 5 October 2007, the Prime Minister announced a decision to proceed with Crossrail.
- 4.46 On 21 November 2007 we received a number of documents, provided by Network Rail, describing their matrix organisation, investment delivery and “*SOP analysis*”. We reviewed the documents briefly and considered the likely impact of Crossrail on industry workload. While we note that Arup may be better placed to comment on these issues, we expect that the focus of Crossrail works during CP4 is likely to be on preparatory work, utilities diversions, tunnelling and station construction rather than on railway-specific areas such as track laying, signalling and electrification. We were more concerned about the potential workload implications of the provision of additional depots and stabling works which we discuss below.

- 4.47 However, CITB ConstructionSkills' recent "*Blueprint for UK Construction Skills 2008 to 2012*" takes into account in its projections Thameslink, Crossrail, London Underground upgrades, Docklands Light Railway Expansion, the Olympics and Heathrow Terminal East. It expects the infrastructure construction sector to grow at 5.7% per annum, and identifies a projected shortfall of skilled construction workers over the period 2008-2012.
- 4.48 We note that ORR has separately commissioned further studies to review Network Rail's capability to deliver the CP4 enhancement programme.

### Summary

- 4.49 Network Rail made little progress in progressing enhancement schemes in the 17 months between ISBP and SBP but it claims considerable progress in the subsequent 6 months between the SBP and SBP Update. If this progress is genuine, it is welcome, but it is unclear whether this is a realistic representation of the actual progress made over the period.
- 4.50 Network Rail has made, in the SBP Update, a relatively thorough attempt to identify schemes which may need planning consent, and acknowledged that this may result in delays which may jeopardise its ability to complete schemes and hence to deliver capacity and performance. It may be prudent for it to continue to develop, and incur costs in association with, some additional or alternative schemes, so as to be sure that overall delivery of the DfT HLOS capacity metrics is not prevented by planning delays.
- 4.51 Industry capacity is likely to tighten during CP4, although the balance of supply and demand of particular skills by time and place is difficult to predict. A general shortfall of skilled construction workers over the period 2008-2012 may, however, make delivery of infrastructure schemes more difficult or more costly.
- 4.52 The capacity and capability provided by Network Rail's investments cannot be fully exploited without timely provision of suitable rolling stock and associated depot and stabling facilities. Network Rail has attempted to estimate the associated costs, and we have indicated where we believe that these may be overestimated, but the overall details of the programme will be uncertain until rolling stock procurement, deployment and redeployment plans across the network are finalised. This is particularly a concern on Route 2 where Three Bridges may not be a satisfactory depot and, as we discuss below (in 5.19) Network Rail continues to make changes in the cost estimate for the scheme.

## 5. THE TREATMENT OF PRICING AND RISK

### Price bases and comparability

5.1 We understand that the Statements of Funds Available (SoFAs) produced by DfT and Scottish Ministers are expressed in nominal terms and were told by Network Rail that:

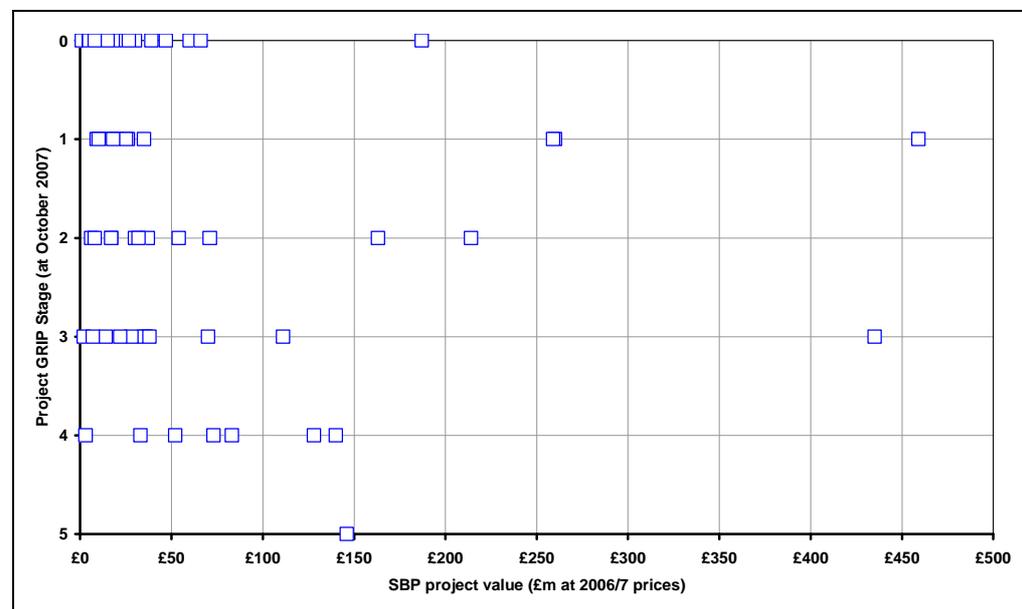
- The ISBP and its February and May 2007 publications are in 2005/6 prices
- The SBP is in 2006/7 prices
- 2006/7 prices exceed 2005/6 prices by almost 4% (201.1/193.6 in RPI (CHAW))

5.2 However, while the SBP itself appears to use a consistent price base, some of the supporting documents quote different values for what are apparently the same cost. We have not systematically attempted to reconcile the minor differences between these numbers, with the result that costs quoted in the remainder of this report may not be calculated on a consistent basis. In practice, unexplained differences in costs for the same item were typically less than 5%. Of greater importance was the much larger potential difference, of up to 50%, between “allocation”, “point estimate”, mean and “P80” costs (described in 2.3) and which we discuss further below.

### GRIP Stage and uncertainty in cost in the SBP

5.3 On receipt of the SBP we repeated an analysis from our work reviewing Network Rail’s June 2006 ISBP, to create a scatter diagram of schemes by GRIP Stage and value. The results are shown in Figure 5.1 below.

**FIGURE 5.1 GRIP STAGE AND VALUE**



Note: all costs are CP4 costs as quoted in SBP Project Summaries.

5.4 All other things being equal, schemes with a low GRIP Stage and high cost contribute the greatest uncertainty in overall cost. Figure 5.1 shows seven schemes with a cost of £150 million or more, only one of which has progressed beyond GRIP Stage 2.

5.5 As shown in Table 5.1 below, the total projected cost of these schemes is almost £2 billion.

**TABLE 5.1 LOW GRIP STAGE HIGH VALUE SCHEMES**

Scheme	GRIP Stage	CP4 scheme cost (£m)
Stafford to Colwich remodelling	1	459
Reading station area redevelopment	3	435
Intercity Express Programme (IEP)	1	260
Power supply upgrade (West Coast auto transmission)	1	259
Capacity relief to the East Coast Main Line	2	214
10-car SWML suburban railway	0	187
Glasgow Airport Rail Link	2	163
<b>Total</b>		<b>1,977</b>

Note: all costs are CP4 costs as quoted in SBP Project Summaries.

#### Network Rail's cost estimates

5.6 Arup provided ORR with detailed engineering advice on how Network Rail has developed its cost estimates, but we joined them at a meeting at which the details of the estimation process for illustrative schemes were discussed. Network Rail provided detailed documentation of how it had estimated the costs of two schemes:

- GRIP Stage 4: provision of a fourth line at York Holgate Junction
- GRIP Stage 0: 10-car suburban operations on the South Western network

5.7 In each case we were able to establish an audit trail from estimates of quantities and unit costs to the total line item of £1,324 million for capacity schemes in SBP Figure 6.25.

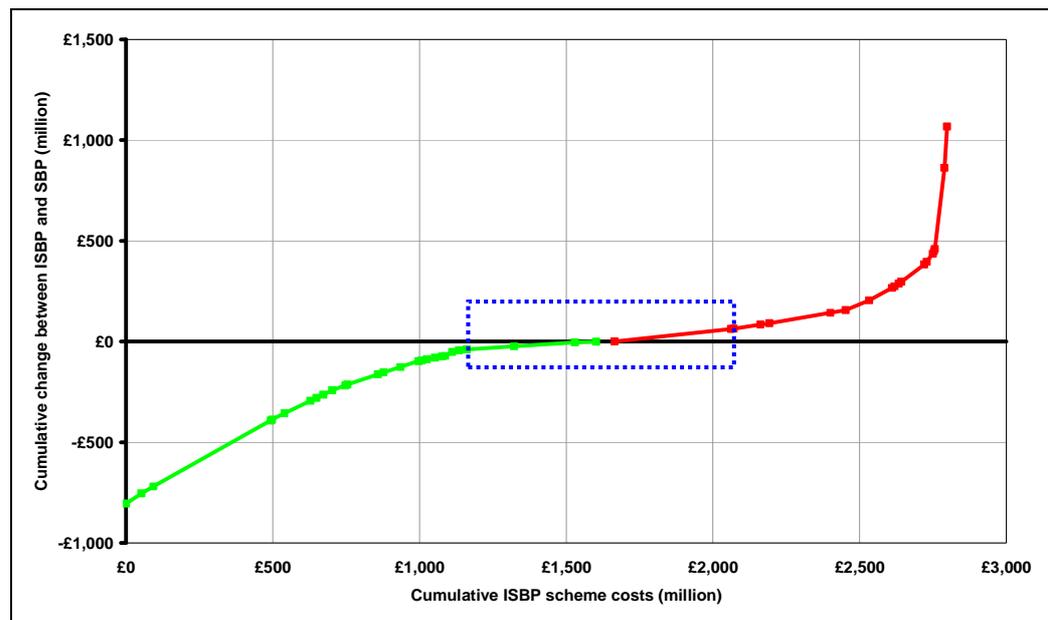
5.8 Network Rail set out in Figure 6.21 of the SBP (which we summarise in Table 5.4 below) the confidence intervals typically associated with schemes developed to each GRIP Stage. In practice, the cost estimate for York Holgate Junction was based on detailed itemised quantities, and that for 10-car suburban operations was based on more detailed analysis than would be typical of a GRIP Stage 0 scheme, incorporating unit costs based on the experience of the Southern New Trains Programme, and estimates of civils, signalling, track and electrification estimated platform by platform along the route. Network Rail indicated to us that this level of analysis was more typical of a GRIP Stage 1 scheme.

5.9 On the limited evidence provided by these two schemes, it appears that Network Rail's costs estimates are at least as developed as is required by the GRIP Stages that the schemes have reached.

### Changes in scheme costs between ISBP and SBP

- 5.10 We repeated an analysis from our work reviewing the ISBP, examining how scheme costs had changed between the June 2006 ISBP and the November 2006 “Refresh”.
- 5.11 We compare in Figure 5.2 below the estimated costs of 46 schemes for which costs appear in both the ISBP (originally in 2005/6 prices, but converted to 2006/7 prices) and the SBP (in 2006/7 prices). Schemes costing less than in the ISBP form the green part of the line (to the left) and schemes costing more than in the ISBP form the red part of the line (to the right).

**FIGURE 5.2 CHANGES IN COSTS FROM ISBP TO SBP (2006/7 PRICES)**



Note: all costs are CP4 costs as quoted in ISBP and SBP Project Summaries, but converted to 2006/7 prices.

- 5.12 The costs of nearly £1 billion worth of schemes, enclosed within the dotted blue rectangle, have changed by less than 20% between the ISBP and the SBP. However, while schemes (to the left) which have become cheaper have contributed over £0.8 billion of cost reductions, schemes (to the right) which have become more expensive have contributed over £1 billion of cost increases. The result is a net increase, on a £2.8 billion portfolio, of over £250 million or 9%.

- 5.13 A large part of this change is due to a small number of schemes listed in Table 5.2 below.

**TABLE 5.2 MAJOR COST CHANGES BETWEEN ISBP AND SBP**

Scheme	GRIP Stage			Estimated scheme cost (£m)				
	ISBP	SBP	Progress			ISBP	SBP	Change
			-	0	+			
<b>Reductions of £50 million or more</b>								
Waterloo station	2	2		0		399	71	-328
Route 2 suburban 10-car	1	0	-1			88	27	-62
North London Line capacity	1	2			+1	105	54	-51
Greenwich 12-car operation	1	0	-1			52	2	-50
<b>Increases of £50 million or more</b>								
West Coast power supply	3	1	-2			208	259	+51
Airdrie to Bathgate	3	4			+1	78	140	+62
Stafford to Colwich	1	1		0		396	459	+63
Glasgow Airport Rail Link	3	2	-1			78	163	+85
ECML capacity relief		2		0		9	214	+205
Reading station	2	3			+1	32	435	+403
<b>Total</b>						<b>1,410</b>	<b>1,824</b>	<b>+379</b>

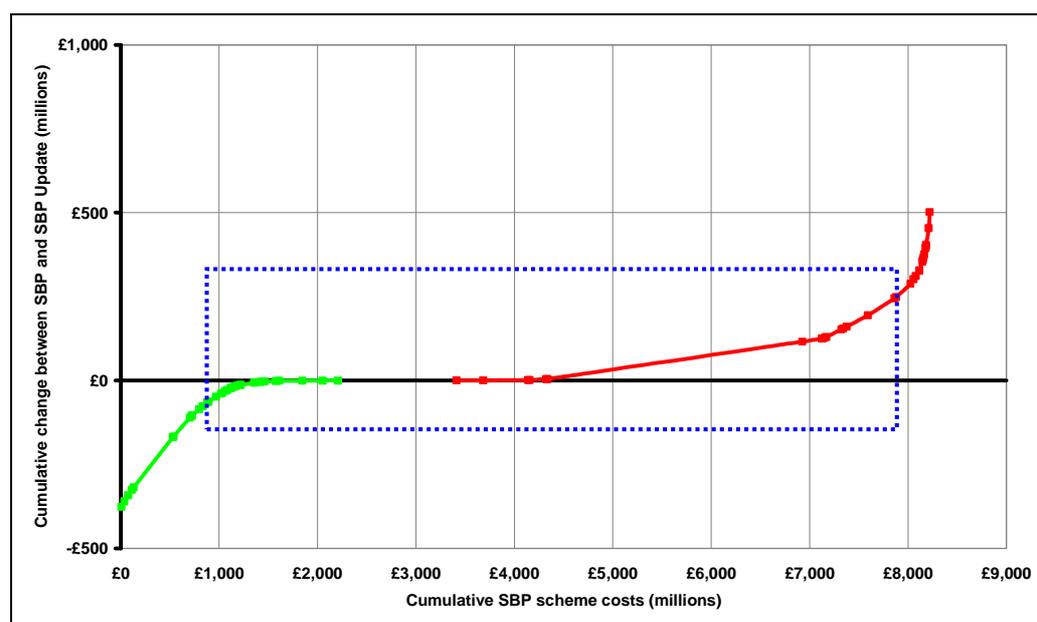
Note: all costs are CP4 costs as quoted in ISBP and SBP Project Summaries, but converted to 2006/7 prices.

- 5.14 We noted above (Figure 4.2) that there is little evidence that schemes are consistently progressing through Network Rail's GRIP Stage processes. Of these nine schemes, three have advanced by one GRIP Stage but four have regressed by one or more.
- 5.15 We accept that the schemes described in the ISBP and the SBP may not be strictly comparable, or that their CP4 cost may have changed as a result of retiming, optimisation and efficiency gains, or changing customer requirements. Nonetheless, the evidence appears to support Network Rail's own working assumptions that the range of cost uncertainty in schemes at a low GRIP Stage is high.

#### **Changes in scheme costs between SBP and SBP Update**

- 5.16 On receipt of the SBP Update we repeated the above analysis to examine the changes in costs of schemes from the SBP. Figure 5.3 below shows the results.

FIGURE 5.3 CHANGES IN COSTS FROM SBP TO SBP UPDATE (2006/7 PRICES)



Note: all costs are CP4 costs as quoted in SBP Project Summaries and SBP Update.

- 5.17 Figure 5.3 is broadly analogous to Figure 5.2 but includes the much larger volume of schemes which are common to both SBP and SBP Update. The costs of over £7 billion worth of schemes, enclosed within the dotted blue rectangle, have changed by less than 20%. While schemes (to the left) which have become cheaper have contributed around £375 million of cost reductions, schemes (to the right) which have become more expensive had contributed around £500 million of cost increases. The result is a net increase, on a £8.2 billion portfolio, of £125 million or only 1.5%.
- 5.18 Within this larger portfolio there have also been a few large changes of over £50 million, as shown in Table 5.3 below.

TABLE 5.3 MAJOR COST CHANGES BETWEEN SBP AND SBP UPDATE

Scheme	GRIP Stage			Estimated scheme cost (£m)				
	SBP	SBP Update	Progress			SBP	SBP Update	Change
			-	0	+			
<b>Reductions of £50 million or more</b>								
Projects required to deliver 92.6 PPM						400	250	-150
Route 3 suburban 10-car	0	2			+2	166	110	-55
<b>Increases of £50 million or more</b>								
Route 2 suburban 10-car	0	0		0		26	76	+50
Projects to support move towards a seven day railway						270	320	+50
Thameslink						2,589	2,700	+111
<b>Total</b>						<b>3,451</b>	<b>3,457</b>	<b>+6</b>

Note: all costs are CP4 costs as stated by Network Rail in the SBP Update documentation.

- 5.19 The only scheme to have large changes both between ISBP and SBP and between SBP and SBP Update is 10-car suburban operation on Route 2. As the scheme's scope changed, its costs changed from £88 million at GRIP Stage 1 in the ISBP to £26-27 million at GRIP Stage 0 in the SBP and then to £76 million at GRIP Stage 0 in the SBP Update. As we noted above in our comments on depots and stabling, a clear scope of, and approach to, this scheme may not yet have emerged.
- 5.20 The only other individual scheme to have large changes between SBP and SBP Update is 10-car suburban operation on Route 3. Network Rail's estimate of CP4 costs was £166 million in the SBP but following a review and challenge by Arup this was reduced to £110 million in the SBP Update. The remaining items on which large cost changes are reported between SBP and SBP Update are all programmes: projects required to deliver of 92.6 PPM, projects to support the move to a seven day railway, and Thameslink.
- 5.21 The overall impression is that Network Rail's estimates of overall costs are converging, but that this convergence is a balance not only between savings on some schemes being offset by increases on others, but also of withdrawal of some schemes being offset by the introduction of others. A notable exception is the apparent lack of convergence of costs on the Route 2 10-car suburban operation scheme.

#### Network Rail's treatment of risk

- 5.22 Network Rail set out in Figure 6.21 of the SBP the typical confidence level for the costs at each GRIP Stage, which we summarise below in Table 5.4.

**TABLE 5.4 CONFIDENCE LEVEL BY GRIP STAGE (SBP FIGURE 6.21)**

GRIP Stage	Definition	Cost estimate	Confidence level
1 Output definition	Development remit	High level based on previous historical rates or estimate templates	±40%
2 Pre-feasibility	Functional specification & high level option assessment	Based on unit rates or estimate templates	±30%
3 Option selection	Project design specification & option selection report	Based on unit rates or estimate templates	±20%
4 Single option development	Reference design	Based on unit rates or resource based rates	±15%
5 Detailed design	Detailed design	Based on unit rates or resource based rates	±10%

- 5.23 Network Rail summarised the costs of its enhancement schemes in SBP Figure 6.25. All costs were in 2006/7 prices but, as described in paragraph 2.3 and summarised again below, they were calculated on four different bases.

TABLE 5.5 DFT ENHANCEMENT PROJECTS (SBP FIGURE 6.25) COST BASIS

Project	Sub-total CP4 £m	Scheme CP4 £m	Cost basis			
			Allocation (no IPI)	Allocation + IPI	P80 + IPI	Modelled + IPI
<b>Total</b>	<b>8,353</b>					
<b>Baseline projects:</b>	<b>1,221</b>					
Access for All		197	✓			
Kings Cross		153			✓	
Stafford to Colwich		483			✓	
Bletchley Milton Keynes		116			✓	
Power supply upgrade		272			✓	
<b>Other specified projects:</b>	<b>4,036</b>					
Thameslink programme		2,589			✓	
Birmingham New Street		134		✓		
Reading station		455			✓	
IEP		260	✓			
NSIP		156	✓			
NRDF		234	✓			
Strategic Freight Network		208	✓			
<b>HLOS output projects:</b>	<b>1,978</b>					
Capacity schemes		1,324	✓			✓
Performance schemes		368		✓		✓
Risk adjustment		287	See text paragraphs 2.3 & 5.26			
<b>Other projects:</b>	<b>447</b>					
Redhill remodelling		25	✓			
West Croydon capacity		15	✓			
Reading Oxford Road		47		✓		
Reading Platforms 1-8		31		✓		
Reading station concourse		26		✓		
Didcot-Oxford capacity		38				✓
Crewe remodelling		10	✓			
Bolton corridor package		10				✓
Buxton remodelling		5				✓
Manchester Hub		60	✓			
Development funds for CP5		180	✓			
<b>DfT performance</b>	<b>400</b>		✓			
<b>DfT seven day railway</b>	<b>270</b>		✓			

**TABLE 5.6 SCOTTISH ENHANCEMENT PROJECTS (SBP FIGURE 6.29) COST BASIS**

Project	Sub-total CP4 £m	Scheme CP4 £m	Cost basis			
			Allocation (no IPI)	Allocation + IPI	P80 + IPI	Modelled + IPI
<b>Total</b>	<b>380</b>					
Airdrie-Bathgate		145			✓	
Glasgow Airport Rail Link		170			✓	
Borders (Waverley)		3		✓		
Tier 3 project development		13	✓			
Small projects fund		20	✓			
Seven day railway		30	✓			

5.24 The inclusion of costs calculated on different bases raised the issue of whether Network Rail's SBP Figure 6.25 and Figure 6.29 are internally consistent and what, if anything, their totals should be taken to mean.

5.25 Network Rail told us that they had generally built up "point estimates" of costs from which they had used either contingency allowances or structured modelling to estimate the value of other costs such as the mean and 80<sup>th</sup> percentile (P80).

**TABLE 5.7 POINT ESTIMATE, MEAN AND P80 COSTS**

Cost	Derivation
Point estimate	Built up from available data, with level of detail varying from indicative estimates and percentage allowances to itemised bills of quantities.
Mean	Higher than the point estimate, typically by a margin reflecting the extent to which past project outturn costs had exceeded the point estimate.
P80	80 <sup>th</sup> percentile, higher than the mean by a margin reflecting the past variability in costs about the mean.

5.26 Network Rail told us that their aim had been to include all costs on a consistent basis of P80 + IPI calculated, wherever possible, on the basis of a Quantified Risk Assessment (QRA). In the case of modelled schemes, we concluded that it could be assumed that IPI was implicitly included in the risk distribution applied to the point estimate. However, as explained above, this approach was not relevant or possible for the costs of programmes, such as Access for All, for which only an allocation could be quoted. The result was that schemes had been treated in three main ways:

- Allocations for schemes where Network Rail did not expect to pay all the costs, with or without an adjustment for inflation (IPI)
- Major schemes, typically modelled in a QRA
- Other modelled schemes, modelled as a package in a single QRA

5.27 We discuss the treatment of major and modelled schemes in greater detail below.

### Major schemes in the SBP

5.28 In SBP Figure 6.25, the costs of six major schemes were presented on a P80 + IPI basis. Network Rail subsequently provided point estimate, mean and P80 (with IPI for Thameslink only) costs which are summarised in Table 5.8.

**TABLE 5.8 POINT ESTIMATE, MEAN AND P80 COSTS OF SIX MAJOR SCHEMES**

Scheme	GRIP Stage	Point estimate (£m)	Mean		P80		Estimated confidence interval around mean
			Cost (£m)	% above point estimate	Cost (£m)	% above mean	
Power supply upgrade	1	173	216	25%	259	20%	±47%
Reading station	3	357	401	13%	435	8%	±19%
Thameslink	3	3,170	3,349	6%	3,552	6%	±14%
Stafford to Colwich	1	376	440	17%	459	4%	±10%
Kings Cross	?	126	142	13%	146	3%	±7%
Bletchley Milton Keynes	2	102	109	6%	111	2%	±4%

Note: all costs appear to be at 2006/7 prices but only Thameslink has been adjusted by IPI.

5.29 Each scheme was subjected to a different calculation, with different results. For the power supply upgrade scheme, for example, the mean is exactly 25% above the point estimate and the P80 is 20% above the mean or 50% above the point estimate. While there is no clear relationship between GRIP Stage and the differences between the various costs, there is at least some variation in the apparent confidence interval, which we assume reflects details of the assessment of each scheme. In addition, for all but the power supply upgrade scheme, the confidence interval is narrower than ± 20%.

### Modelled schemes in the SBP

5.30 For 59 “capacity”, “performance” and “other schemes” in the SBP, Network Rail carried out a systematic QRA. The planned (point estimate) costs of the 59 schemes modelled was £1,478 million, the mean was £1,669 million (13% higher) and the P80 was £1,764 million (19% higher). The difference between the planned and P80 costs, £287 million, appears in SBP Figure 6.25 as “risk adjustment”.

5.31 Network Rail explained that the modelling of the schemes had taken into account not only the aggregate effect of the uncertainty in the costs of each scheme but also:

- The effect of delays to the schemes: these would result in increases in the time-based elements of the scheme costs and hence increase the variation in costs.
- The effect of correlation between the costs of schemes: these would reduce the extent to which the variations in costs of different schemes would cancel out, and hence increase the variation in costs.

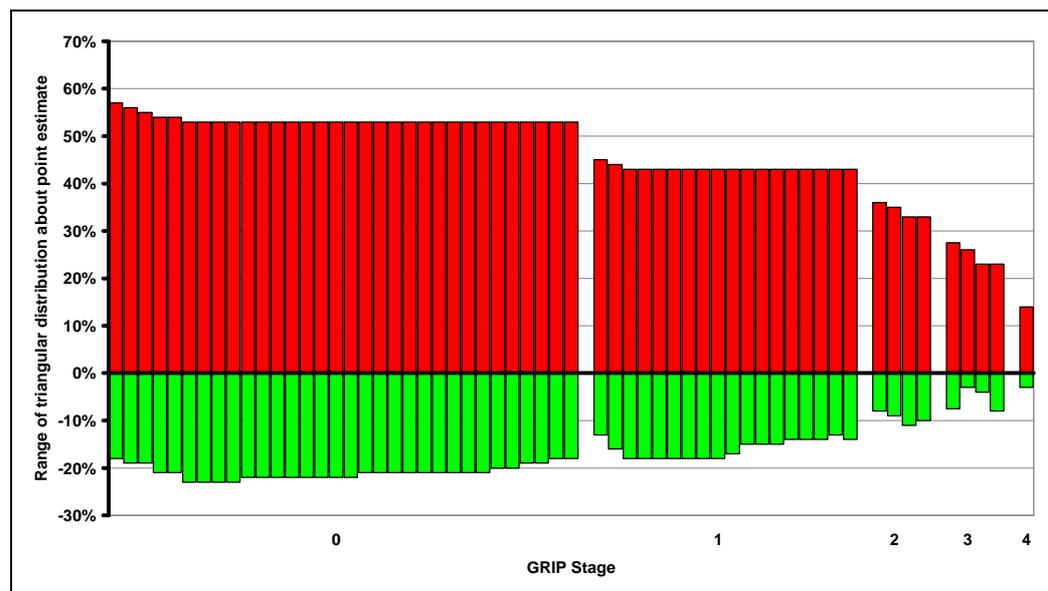
5.32 Network Rail had assumed that the outturn cost of each modelled scheme would be distributed about the point estimate in a triangular distribution. We calculated that the 95% confidence interval of Network Rail’s estimates for almost all schemes at GRIP Stages 0 and 1 was within the range of  $\pm 40\%$  of the mean. However, the modelled confidence level for every scheme at GRIP Stages 3 and 4 was wider than Network Rail’s own targets for the confidence level shown in Table 5.4.

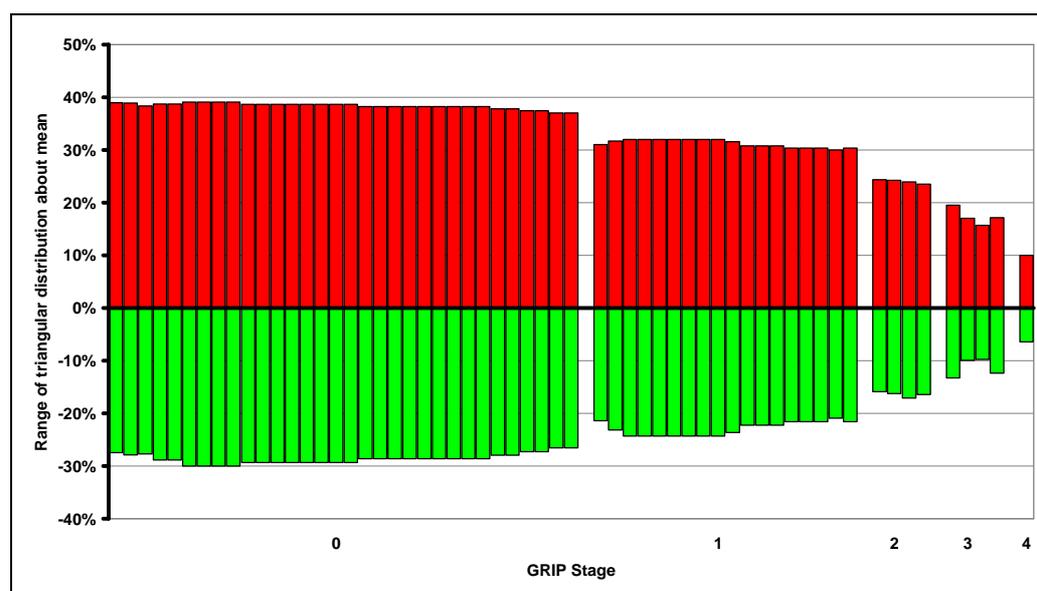
5.33 We identified in Figure 4.2 above how Network Rail was not consistently progressing schemes through the GRIP Stage process. This analysis suggests further that, even where schemes had advanced to GRIP Stages 3 and 4 in the SBP, Network Rail had not been able to improve the accuracy of its cost estimates as rapidly as it intended to.

**Modelled schemes in the SBP Update**

5.34 In the SBP Update Network Rail repeated the systematic QRA on a slightly different portfolio of 59 schemes. Figure 5.4 shows the assumed bounds of the triangular distribution of costs about the point estimate and Figure 5.5 shows the implied upper and lower bounds of costs about the mean.

**FIGURE 5.4 MODELLED SCHEMES IN SBP UPDATE, AROUND POINT ESTIMATE**



**FIGURE 5.5 MODELLED SCHEMES IN SBP UPDATE, AROUND MEAN**

5.35 Compared with the modelling in the SBP, the range of costs about the mean is much more in accordance with the typical range shown in Table 5.4, declining gradually with GRIP Stage. We asked Network Rail what explained the changes, and were told that in the SBP Update the ranges had been based largely on generic drivers for the GRIP Stage and the type of asset and that this approach was less judgemental, and more structured, than the approach used at the time of the SBP. Without subjecting each scheme to detailed review, we are unable to say which approach is more reasonable, or even whether the resulting differences in the estimated total costs of the modelled schemes are material.

#### Further modelling of the range of costs

5.36 While the above analysis improved our understanding of how Network Rail had modelled costs and risks, it did not enable ORR to:

- Develop consistent estimates of the likely range of outturn costs.
- Re-estimate this range if the cost, scope or status of individual enhancement schemes changed.

5.37 ORR therefore asked us to carry out further analysis to inform their understanding of the actual range of uncertainty in the costs presented by Network Rail.

5.38 We did not have sufficient information to duplicate Network Rail's own modelling, or to develop a rigorously correct statistical approach, but developed a simplified means of estimating the range of costs associated with the portfolio of schemes modelled by Network Rail or with one or more schemes removed. For example, for the portfolio of 59 schemes modelled in the SBP with point estimates totalling £1,478 million, we estimated that there was a 95% confidence that the total outturn cost would lie between £1,400 million and £1,800 million, with a mean of around £1,600 million.

## Summary

- 5.39 Network Rail's proposed list of enhancement schemes, and their scope and costs, have continued to change between the ISBP, SBP and SBP Update. However, on average the withdrawal of some schemes is offset by the introduction of others, and cost savings on some schemes are offset by cost increases on others. The overall effect is increasing stability of the estimated cost of the enhancement packages as a whole, although the costs of some schemes appear still to be uncertain.

Network Rail has not estimated costs on a wholly consistent basis, making it difficult for ORR to assess the reasonable outturn cost of its proposals. However, its approach to modelling risk appears broadly reasonable and takes into account key issues such as the likelihood of correlation between the costs of different schemes. The risk ranges associated with the schemes seem reasonable and the estimates of the overall range of possible outturn costs is unlikely to be unduly sensitive to the assumptions made about any individual scheme.

## 6. CAPACITY SCHEMES

### Introduction

- 6.1 This Section deals with the schemes in England and Wales put forward in the SBP which appeared, in principle at least, to be capable of contributing to the peak 1-hour and peak 3-hour capacity at the end of CP4, as specified by DfT in Tables A4 and A5 of its HLOS and summarised in Table 6.1 below.

**TABLE 6.1 SUMMARY OF DFT HLOS PEAK CAPACITY METRICS (SPACES)**

Peak demand to be accommodated	London	Other urban areas	Birmingham	Cardiff	Leeds	Manchester
<b>1-hour peak</b>						
Forecast 2008/9	248,300	12,300	15,400	4,000	11,300	10,700
Extra 2013/14	34,000	2,000	2,400	600	2,700	2,200
Average end CP4 load factor	76%	46%	55%	43%	70%	49%
<b>Spaces needed</b>	<b>371,447</b>	<b>31,087</b>	<b>32,364</b>	<b>10,698</b>	<b>20,000</b>	<b>26,327</b>
<b>3-hour peak</b>						
Forecast 2008/9	497,000	27,700	32,000	8,500	23,400	22,100
Extra 2013/14	64,900	3,600	4,600	900	5,100	4,100
Average end CP4 load factor	67%	41%	48%	39%	64%	45%
<b>Spaces needed</b>	<b>838,657</b>	<b>76,341</b>	<b>76,250</b>	<b>24,103</b>	<b>44,531</b>	<b>58,222</b>

Note: “Other urban areas” are Bristol, Leicester, Liverpool (excluding Merseyrail), Newcastle, Nottingham and Sheffield. See White Paper “*Delivering a sustainable railway*”, pages 150-153, for further details.

- 6.2 ORR instructed us, before the publication of the SBP, that it had been agreed that the end CP4 load factor targets for London termini (Table A5) and other urban areas (Table A4) are aggregates for all the termini included and need not be met at each terminus. This aggregation means that, to achieve the metrics, the industry need not necessarily deliver the capacity at the time, the route, the station or (in the case of “other urban areas”) even the city in which it is needed.
- 6.3 Network Rail provided calculations of total capacity from the capacity and delivery dates of individual schemes, although the “*target delivery year/range*” could extend over several years (for examples, see Table 4.1 and Table 4.2), often with no detail of how capacity would be added over time. Accordingly, we assumed that additional capacity would only become available at the end of the “*target delivery year/range*”. Using this and other “mechanistic” assumptions, which might not reflect operational reality, we used Network Rail’s calculations to answer two key questions set by ORR:
- Are schemes sufficient to provide the capacity required?
  - Are schemes necessary to provide the capacity required?

### Are the schemes in the SBP sufficient?

- 6.4 Our analysis of whether the schemes in the SBP are sufficient to deliver the capacity metrics is summarised in Table 6.2 below.

**TABLE 6.2 SUMMARY OF ACHIEVEMENT OF DFT HLOS CAPACITY METRICS**

Table	Location	Achievement of metrics
A3	Strategic Route totals	Presumed met by increased load factors and/or (except on Routes 21, 22 & 23, see 6.6) by increases at termini described below.
	Cardiff	Met in December 2008
	Leeds	Met in December 2011
A4	Birmingham	Initiatives delivered by "2014" are sufficient. Network Rail cannot guarantee that they will be delivered by end of CP4, but infrastructure enhancements are scheduled to be complete by then.
	Manchester	Initiatives delivered by "2014" are sufficient. Network Rail cannot guarantee that they will be delivered by the end of CP4. Even if they are, the combined margin is only 27 seats in the 1-hour peak, well within the margin of error of assumptions on stock capacity, although a single extra or longer train anywhere might offset this.
	Other urban areas	Initiatives delivered by "2014" are sufficient, but Network Rail cannot guarantee that they will be delivered by end of CP4. London Bridge contributes 22-23% of capacity, and target requires that almost all of London Bridge's capacity in 2012 remains available, in addition to the December 2013 capacity increases elsewhere.
A5	London	Initiatives delivered by "2014" are sufficient, but Network Rail cannot guarantee that they will be delivered by end of CP4. London Bridge contributes 22-23% of capacity, and target requires that almost all of London Bridge's capacity in 2012 remains available, in addition to the December 2013 capacity increases elsewhere.

- 6.5 Infrastructure enhancements within the control of Network Rail normally precede and act as enablers for rolling stock fleet expansion, so we have not attempted to identify whether any infrastructure schemes would be on the critical path to achieving the capacity metrics. We discuss our analysis and conclusions in further detail below.

#### ***The total demand metric***

- 6.6 We discussed with ORR the requirements for the total level of demand to be accommodated, set out in Table A3 of the capacity metrics, which lacks a load factor target and is therefore difficult to analyse or interpret. We agreed that it should generally be possible to carry the required additional passenger-kilometres on 20 Strategic Routes, on which the principal constraint is likely to be a major station or London terminus at which capacity is to be expanded to meet the Table A4 or A5 metrics. However, we looked specifically at the requirements in Table A3 for the remaining three Strategic Routes not affected by Table A4 or A5:

- On Strategic Route 21, Merseyrail, growth of 5.3%
- On Strategic Route 22, North Wales and Borders, growth of 12%
- On Strategic Route 23, North West Rural, growth of 8%

- 6.7 On Strategic Route 21 the SBP includes specific schemes to relieve passenger congestion at two key central Liverpool stations, James Street and Central, and notes the interaction between these schemes and the additional capacity provided by platform lengthening on Strategic Route 20.

- 6.8 On Strategic Routes 22 and 23 it does not identify any specific schemes, although the relevant Route Plans, which we have not examined in detail, describe a number of initiatives. We have assumed that the relatively small demand increases envisaged on all three Strategic Routes can be accommodated with these changes with existing or appropriate new rolling stock, but have carried out no specific checks to confirm this.
- 6.9 We discuss further below (see 6.46) the issues of meeting the Table A3 total demand metric on Strategic Route 8, the East Coast Main Line.

#### ***The peak demand metrics***

- 6.10 We compared Network Rail's calculations with the capacity metrics and consequential capacity requirements set out above, and discuss in turn below our findings for:
- London, which dominates the total capacity requirement
  - Other urban areas
  - Birmingham
  - Cardiff
  - Leeds
  - Manchester
- 6.11 We assumed that infrastructure schemes completed during a year might not deliver additional capacity until the main timetable change in December. However, much of the additional capacity, whether requiring new infrastructure or not, involves new rolling stock which may be brought into service over a period of months or years. The delivery pattern of new stock on Chiltern is set out in detail in Route Plan 16 (Figure 11), apparently on the basis of Chiltern Railways' Business Plan (which we have not been able to check). For other new stock, where Network Rail identified no delivery pattern, we assumed that no additional capacity would be available until the end of the "target deliver year/range".
- 6.12 These are conservative assumptions, but only affect the "end of CP4" capacity for infrastructure schemes and rolling stock deliveries completed in "2014", which may not deliver additional capacity before the end of CP4 in March 2014.

#### ***London***

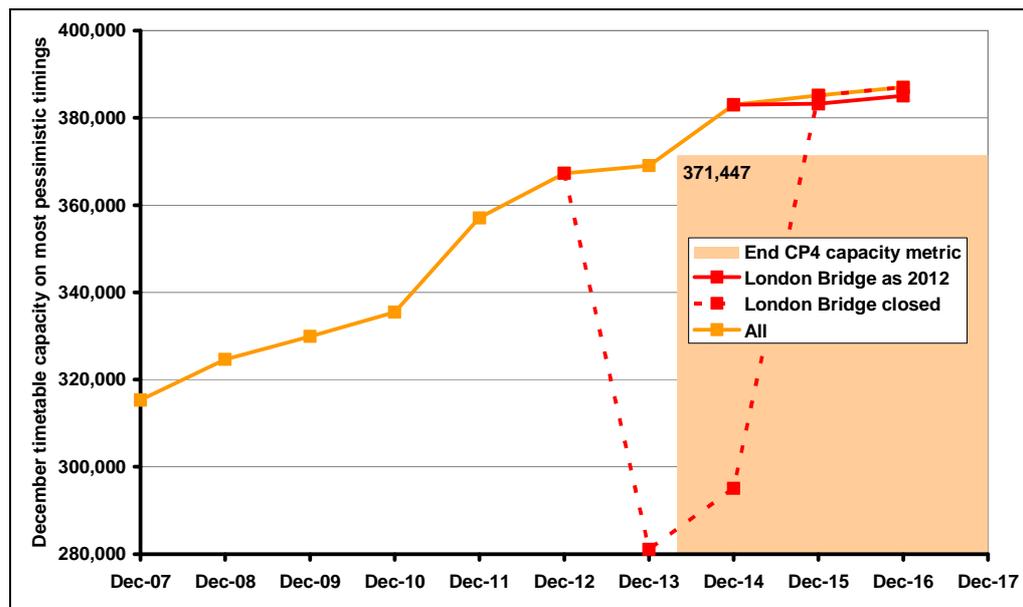
- 6.13 We identified in Network Rail's modelling a total of 74 distinct elements of capacity at the 12 London termini. These included the "current capacity" at the termini and 62 capacity initiatives, each of which we checked could be identified with one or more initiatives in Network Rail's Route Plans. We adjusted the dates at which initiatives would be completed to the first December after the end date specified in the spreadsheet or Route Plan, unless there was a specific statement that it would be completed by the end of CP4, in which case we assumed it took place in December 2013. We sorted these capacity initiatives into date order and calculated the cumulative build-up of capacity over time. In some cases it was unclear whether "current" capacity or CP3 initiatives related to 2007/08 or 2008/09, but this was immaterial to the cumulative capacity at the end of CP4.

### 1-hour peak capacity

6.14 Our analysis of the build-up of total capacity in the 1-hour period 0800-0859 is show below. On Network Rail’s assumptions, capacity continues to grow after the end of CP4 as a result of:

- The Thameslink Key Output 2 Programme
- Delivery of additional Chiltern rolling stock completed in “2015”
- Lengthening of the Class 390 “Pendolino” fleet completed in “2016”

**FIGURE 6.1 LONDON TERMINI 1-HOUR CAPACITY (SPACES)**



6.15 Assuming that London Bridge is fully operational at the time, the total capacity in December 2013 will be 369,041 spaces, compared with the end CP4 capacity metric of 371,447 (see Table 6.1), a shortfall of 2,406 spaces, equivalent to around 24 additional vehicles, unless additional capacity is introduced by March 2014. We concluded that sufficient schemes due for completion by “2014” were likely to be at least partially complete by the end of CP4 for the capacity metric to be met.

6.16 However, the Thameslink Key Output 2 Programme will involve considerable work at London Bridge after 2012 and running through the end of CP4. This will deliver 1,940 extra spaces by December 2015, in the absence of which the capacity delivered from December 2015 onwards would be that shown by the solid red line. While the DfT HLOS specifically approves the Thameslink scheme, the additional capacity from Key Output 2 is not delivered during CP4 and does not help to meet the end CP4 capacity metric.

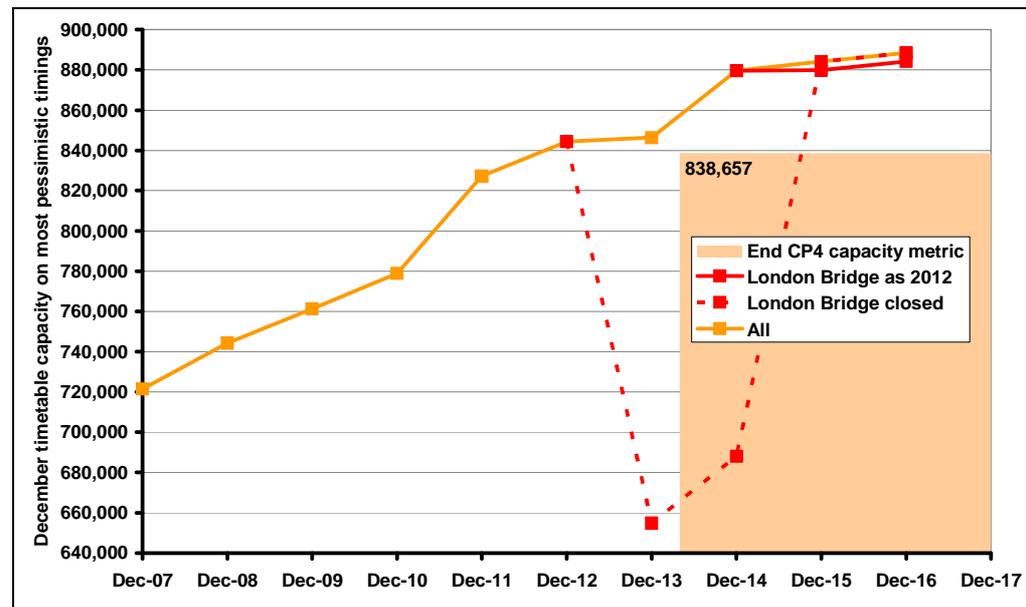
6.17 In practice, this work at London Bridge is likely to result in a temporary reduction of capacity during the end of CP4, but Network Rail cannot yet confirm what timetable it will operate, or what capacity will be provided. To illustrate the issue we have also shown, with the dotted red line, the “worst case” effect of a sustained blockade of London Bridge, with all trains towards London terminating at suitable reversing

facilities before they reach London Bridge. This would reduce the total 1-hour capacity into London to 281,089 spaces, far beneath that required by the capacity metric. To achieve the capacity metric of 371,477 spaces at the end of CP4, London Bridge will need to continue to provide almost all the capacity achieved by December 2012. Doing so while carrying out major engineering works may be technically difficult.

### 3-hour peak capacity

- 6.18 Our analysis of the build-up of total capacity in the 3-hour period 0700-0959 is shown below.

**FIGURE 6.2 LONDON TERMINI 3-HOUR CAPACITY (SPACES)**



- 6.19 The total capacity in December 2013, with all schemes achieved as planned, will be 846,347 spaces, slightly above that required by the HLOS of 838,657 (see Table 6.1). However, we have again plotted the capacity with London Bridge unchanged after 2012 (the solid red line) and the “worst case” capacity with a sustained blockade at London Bridge (the dotted red line). We calculate that a complete closure of London Bridge at the end of CP4 would reduce the total 3-hour capacity into London to 654,801 spaces, again far beneath that required by the end CP4 capacity metric. To achieve the capacity metric of 838,657 spaces at the end of CP4 it will be necessary for London Bridge to continue to provide almost all the capacity achieved by December 2012. As with the 1-hour capacity metric, doing so while carrying out major engineering works may be technically difficult.
- 6.20 However, we stress that our “worst case” analysis is inherently pessimistic. Thameslink affects primarily the central “Charing Cross” lines through London Bridge and we would expect that most of the terminating and Cannon Street lines could be kept open and that some Charing Cross and Thameslink services could be diverted onto them. The phasing of the programme might also allow the CP4 capacity metric to be delivered, at least briefly, before the end of CP4.

- 6.21 We also note that London Bridge provides around 20% of the total capacity into London and that, if the Key Output 2 works did require a complete blockade, the capacity metric could only be met if total London capacity were expanded by a further 20% before the end of CP4. To provide such a large increment of capacity merely to provide short term “cover” for the closure of one terminus would require massive works for brief benefit and probably not to be value for money.
- 6.22 In summary, Network Rail’s proposals are more than sufficient to deliver the Table A5 capacity metrics, but without details of the capacity provided at each stage of the Key Output 2 works, we cannot be sure whether and when they will be delivered before the end of CP4. Even if, in the event, the metric cannot be delivered during CP4, we would not recommend the provision of costly additional capacity elsewhere merely to cover short term closures at London Bridge.

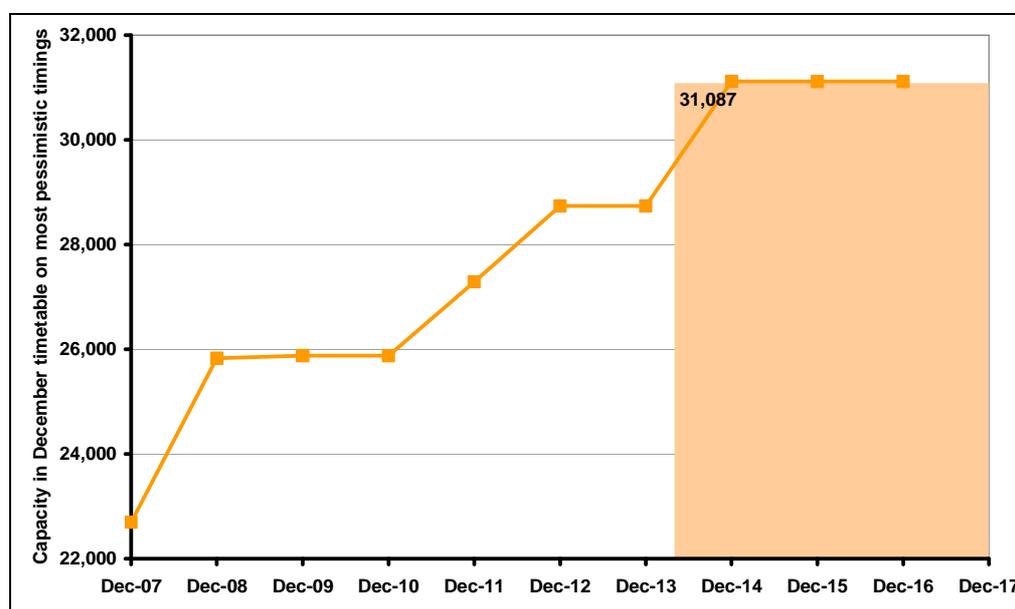
### **Other urban areas**

- 6.23 DfT’s HLOS Table A4 specifies a single capacity metric for six other urban areas: Bristol, Leicester, Liverpool (excluding Merseyrail), Newcastle, Nottingham and Sheffield.

#### *1-hour peak capacity*

- 6.24 Our analysis of the build-up of total capacity in the 1-hour period 0800-0859 is show below.

**FIGURE 6.3 OTHER URBAN AREAS 1-HOUR CAPACITY (SPACES)**



- 6.25 The capacity metric of 31,087 (see Table 6.1) will not be delivered until “2014”, which could be as late as December 2014, when on pessimistic assumptions a total of 1,053 extra spaces will be delivered through train lengthening at Newcastle, requiring no additional infrastructure, and 1,326 extra spaces will be delivered through platform lengthening at Liverpool. Without more details of the proposed timings we cannot confirm that these extra spaces will be available by the end of CP4, although we note

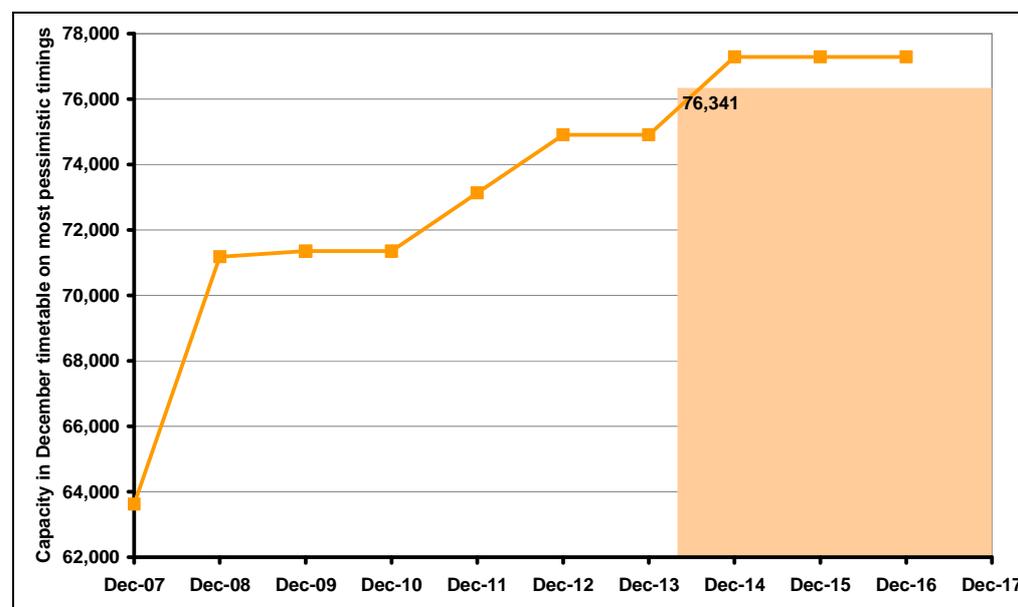
that earlier delivery of the Newcastle element is not dependent on infrastructure and on balance we conclude that it should prove possible to operate the planned number and length of trains.

- 6.26 However, even when these initiatives are delivered, we calculate that the total capacity across the six urban areas will exceed the capacity metric by a margin of only 27 seats or the equivalent of less than one vehicle. Even minor changes in the seating layout of individual trains, relative to the notional rolling stock capacity assumed by Network Rail, could result in the metric not being met. Conversely, even a single additional train arriving during the 1-hour peak would considerably expand this headroom on the metric: for example, a Class 390 “Pendolino” arrival at Liverpool Lime Street before 0859 would provide several hundred additional seats.

#### *3-hour peak capacity*

- 6.27 Our analysis of the build-up of total capacity in the 3-hour period 0800-0859 is show below.

**FIGURE 6.4 OTHER URBAN AREAS 3-HOUR CAPACITY (SPACES)**



- 6.28 The capacity metric of 76,341 (see Table 6.1) will not be delivered until “2014”, through the addition of the extra 1-hour peak capacity at Newcastle and Liverpool described above. Again, without more details of the proposed timings we cannot confirm that the additional spaces will be available by the end of CP4, but there is no infrastructure constraint on delivering the Newcastle capacity earlier and on balance we conclude that it should prove possible to operate the planned number and length of trains. It might also be possible to operate extra shoulder peak trains in one or more of the six urban areas.

#### ***Birmingham***

- 6.29 The 1-hour peak capacity requirement for Birmingham is 32,364 spaces. Network Rail proposes that CP3 schemes will deliver 28,118 spaces and further schemes during CP4

will take this to 36,698, although we cannot identify exactly what proportion of this capacity will be available by the end of CP4. However, Network Rail intends to complete the necessary infrastructure works by February 2012, and we calculate that the capacity metric will be met once 60% of the resulting potential capacity increase is realised.

- 6.30 The 3-hour peak capacity requirement is 76,250 spaces. We calculate that the CP3 initiatives identified by Network Rail will provide a capacity of 69,913 (probably by December 2008), and that further initiatives will increase this to 81,042. However, these capacity increases are dependent on platform lengthening for 6-car and 8-car trains for which neither the SBP Project Summaries nor the Route Plan specifies firm dates other than “2014”, which might at worst mean as late as December 2014. We are not yet able to confirm whether the capacity metric will be met by the end of CP4 without further details of the timing of this programme.

### **Cardiff**

- 6.31 For Cardiff, we calculate that the 1-hour peak capacity metric should be met and exceeded by December 2008 and the 3-hour peak capacity metric will be already be met by the end of CP3. There therefore appears to be no need for further work during CP4.
- 6.32 Network Rail included in their capacity calculations a proposal to lengthen platforms at six stations on the Maesteg branch from 3-car to 4-car and to add a new bay platform at Cardiff. This proposal does not appear to be necessary to the HLOS and does not appear to have been included elsewhere in the SBP.

### **Leeds**

- 6.33 We calculate that both metrics for Leeds will be met by December 2011 and that a number of the schemes to be provided thereafter resulted in material over-supply relative to the metric, as we discuss further below.

### **Manchester**

- 6.34 In Manchester, as in Birmingham, the CP4 initiatives, all of which relate to platform lengthening, provide sufficient capacity to meet both metrics by “2014”, which we have taken to mean December 2014. While Network Rail intends to complete the infrastructure works by April 2013, we have no positive confirmation that the resulting capacity will be available by the end of CP4.

### **Are the schemes in the SBP necessary?**

- 6.35 We discussed with ORR the above issues, and in particular the resulting uncertainties in what capacity will be delivered by any given date, either with or without any given infrastructure enhancement. Nonetheless, ORR asked us to examine not only the extent to which the capacity schemes in the SBP were sufficient, but also the extent to which they were necessary.
- 6.36 We reconstructed Network Rail’s calculation of the build-up of capacity ultimately provided on each route, still assuming that capacity only became available at the end

of the “target delivery year/range”. We then examined the extent of capacity which was “surplus” to that required.

- 6.37 London’s surplus dominated, with around 12,000 extra spaces in the 1-hour peak and 40,000 in the 3-hour peak. This suggested that it would be possible to remove around 120 vehicles from the 1-hour peak, ideally where expensive capacity is needed to provide them. We assumed that omission of the infrastructure required by these vehicles would also preclude capacity expansion in the shoulder peak, removing further vehicles and capacity, and that there could be some further trimming of vehicles still providing excess capacity in the shoulder peak.
- 6.38 “Other urban areas” had no material spare 1-hour peak capacity. It would in theory be possible to cut around 900 spaces from the shoulder peak, but this is equivalent to fewer than 10 vehicles across the six urban areas concerned.
- 6.39 Cardiff and Leeds faced similar issues to London but on a smaller scale, with scope to cut 1-hour peak capacity and perhaps to trim further in the shoulder peak. In Birmingham, the surplus 1-hour peak capacity was almost as large as the total surplus. If platform lengths limit 1-hour peak capacity, then they will also limit shoulder peak capacity, and it might be necessary to have surplus peak capacity to provide sufficient shoulder-peak capacity. In Manchester this effect was even more pronounced, and there was less surplus capacity in the 3-hour peak than in the 1-hour peak.
- 6.40 For each element of the capacity metrics, we considered removing:
- Infrastructure enhancements, and losing the additional capacity they would provide in the 1-hour and 3-hour peaks. In doing so, we prioritised schemes which, per unit of cost, delivered the fewest additional spaces in the 1-hour peak.
  - Rolling stock which was not needed to deliver the capacity metric in either the 1-hour peak or 3-hour peak.
- 6.41 We stress that our approach to this analysis was “mechanistic” and, was not intended to identify a realistic and balanced programme of schemes to deliver the capacity metrics. Nonetheless, it enabled us to estimate the costs associated with capacity not needed to meet them.
- 6.42 As shown in Table 6.3, we estimated that it would be possible to achieve the end CP4 capacity metrics while omitting schemes costing around £800 million, with theoretical further scope for reduction in the costs of associated power supply and stabling schemes. We estimated that these schemes would remove 1-hour peak capacity equivalent to around 400 vehicles relative to Network Rail’s assumptions, but that it would also be possible to remove around 200 further vehicles from the shoulder peak.

**TABLE 6.3 SCOPE FOR REDUCTIONS IN INFRASTRUCTURE AND ROLLING STOCK**

	Rolling stock	Enhancement scheme cost
Retain all rolling stock which can be operated	400 vehicles	£800-850 million
Remove rolling stock in excess of the capacity metric	600 vehicles	

6.43 An illustrative means of achieving these savings is summarised in Table 6.4.

**TABLE 6.4 ILLUSTRATIVE INFRASTRUCTURE AND ROLLING STOCK REDUCTIONS**

Metric	Infrastructure capacity schemes which could be omitted	Shoulder peak rolling stock which could be omitted
London	Lengthened & extra services to Kings Cross	Shoulder peak lengthening to London Bridge, Victoria, Marylebone, Liverpool Street (Great Eastern) & Fenchurch Street
	Lengthened inner services to Liverpool Street on West Anglia route	
	Lengthened inner services to Waterloo	
Other urban areas		10 vehicles to Bristol, Leicester, Newcastle, Nottingham & Sheffield
Birmingham	Lengthening & extension on cross-city route	
	Lengthening on 3 other routes	
Cardiff	Lengthening on 2 routes	
Leeds	Lengthening on 7 routes	
Manchester	Lengthening on 4 routes	

6.44 In London we were not convinced that all the elements of Network Rail’s proposed capacity scheme and optional enhancement at West Croydon were necessary to deliver capacity. However, most of the theoretically possible cost savings relate to routes to Kings Cross, Waterloo and Liverpool Street. Figure 6.5 and Figure 6.6 below show the effect of omitting these schemes and hence 400 additional vehicles, but retaining the further 200 vehicles to provide additional capacity in the shoulder peak, giving an eventual margin of around 20,000 spaces on the 3-hour capacity metric.

**FIGURE 6.5 LONDON TERMINI 1-HOUR CAPACITY (SPACES) TRIMMED TO METRIC**

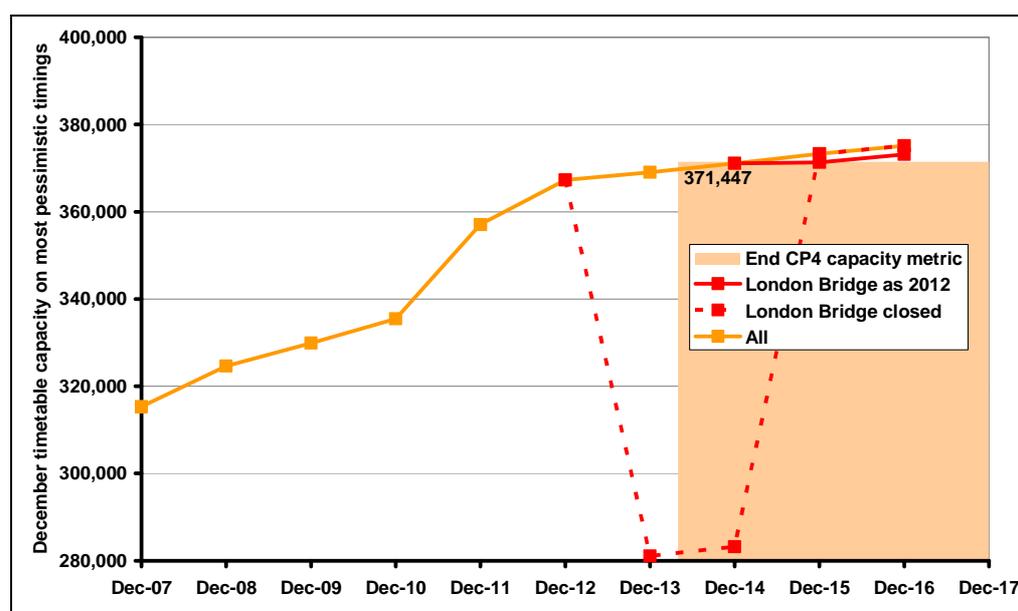
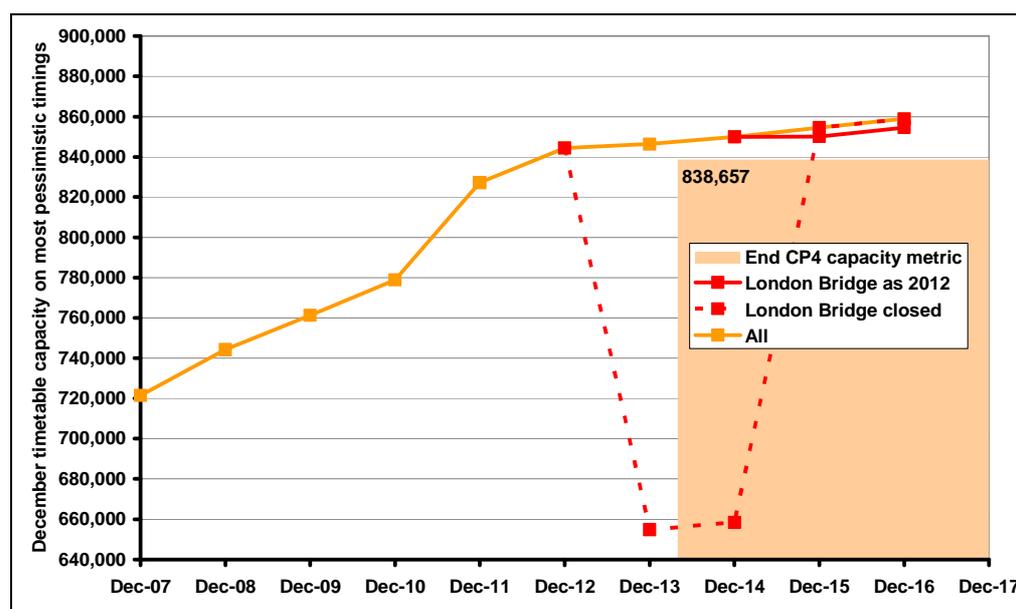


FIGURE 6.6 LONDON TERMINI 3-HOUR CAPACITY (SPACES) TRIMMED TO METRIC



6.45 We discuss in greater detail below our assessment of the rationale, and scope, for removing each of the schemes listed in Table 6.4 which could, in principle, be omitted and still deliver the capacity metrics.

#### ***East Coast Main Line schemes***

6.46 Network Rail's SBP proposals to add capacity at Kings Cross include:

- Provision for an additional hourly arrival from York or Lincoln, which it estimates would add 540 spaces per hour.
- Progressive lengthening of outer suburban services (other than Thameslink) from 8-car to 12-car, which it estimates would add 2,060 spaces in the 1-hour peak and a further 1,648 spaces in the shoulder peak.

6.47 The net result is 5,328 additional spaces, or nearly 5% of the additional peak spaces required in London before the end of CP4. To provide this capacity would, according to Network Rail, require a large number of expensive schemes including not only the proposal for capacity relief between Doncaster and Peterborough but also work at Alexandra Palace to Finsbury Park, at Hitchin, at Peterborough station, and possibly on the Hertford Loop. This package of infrastructure work appears to be more expensive, per additional peak space provided, than that on any other route.

6.48 We discussed this finding with ORR in the context of our other discussions of these schemes. We also drew ORR's attention to the possibility that some or all of this infrastructure would be required to meet the total demand capacity metric (HLOS Table A3) to increase total passenger kilometres from 6,375 million forecast for 2008/09 by a further 975 million by 2013/14, an increase of over 15%, but did not analyse this further.

6.49 We also note that Arup had investigated alternative means of providing capacity relief between Peterborough and Doncaster and had concluded that provision of loops on the

existing line might prove cheaper than the development of the GE/GN route. We suggest that the GE/GN route may be the better option as, while not electrified, it would potentially provide better performance and more of it could be constructed without interfering with the main line. It would also provide a permanent diversionary route and could have a significant role in the Strategic Freight Network.

#### ***Schemes on the West Anglia main line***

- 6.50 A second major package of schemes in the London area which could, in principle, be omitted is the proposed lengthening to 9-car of West Anglia inner services to Liverpool Street from Enfield Town, Chingford, Hertford East and Cheshunt. Platform lengthening works costed at £33 million would be completed by “2012”, but the full rolling stock fleet would not arrive until “2014”, when we have assumed that the additional capacity would be available.
- 6.51 Network Rail expected this scheme to allow the provision of 5,253 additional spaces in the 3-hour peak, or nearly 5% of the additional peak spaces required in London by the end of CP4. This is cheaper, per peak space provided, than the schemes on the routes from Kings Cross and Waterloo, but still more expensive than those on other routes, many of which require no new infrastructure.
- 6.52 However, on 3 March 2008 the Secretary of State for Transport announced, in a Written Ministerial Statement, that she was asking Network Rail to develop and bring forward proposals for enhancing the West Anglia main line, and in particular to consider a potential four-tracking option from Tottenham Hale to south of Cheshunt. On 11 March 2008 BAA lodged a planning application for the construction of a second runway at Stansted airport, which is served by this line. The Secretary of State expects development work and powers to be completed within CP4 with a view to targeting delivering during CP5. In the absence, as yet, of a clear strategy for how four-tracking would be carried out CP5, and in particular whether existing platforms could be retained, it may be poor value to lengthen, as late as 2012, platforms at stations from Northumberland Park to Cheshunt inclusive (7 stations), which might be modified or even removed as early as 2014.

#### ***Schemes on the South Western network***

- 6.53 Network Rail’s SBP proposals for the South Western network include 10-car operation of all suburban services to Waterloo. To achieve this during CP4 would require £288 million of expenditure:
- £166 million for an extensive programme of platform lengthening
  - £71 million for conversion of Waterloo International Terminal for domestic use
  - £30 million of works at Clapham Junction
  - £21 million of works on the “Southern” platforms at Reading, which are largely independent of the main scheme there
- 6.54 The SBP Update reduced the total estimated cost of the above items from £288 million to £240 million, but also included an estimate of £25 million (see Table 4.3) for stabling on the South Western network.

- 6.55 These schemes allow the provision of 19,065 additional spaces in the 3-hour peak, or nearly 17% of the additional peak spaces required in London by the end of CP4. However, the total cost of providing this capacity would be over £250 million which is more expensive, per peak space provided, than that on most other routes.

***Other urban areas***

- 6.56 As we noted in 6.26 above, our analysis suggested that the total capacity provided over the six urban areas will exceed the 1-hour capacity metric by a margin of only 27 seats and it would not be possible to remove any infrastructure schemes. It would, however, in theory be possible to meet the 3-hour capacity metric with around 10 fewer vehicle arrivals than Network Rail has provided for, although no infrastructure savings would result from doing so.

***Birmingham, Cardiff, Leeds and Manchester***

- 6.57 Network Rail’s proposals for all four major urban areas outside London were more than sufficient to meet the capacity metrics, in the case of Leeds providing 18% more seats than required in the 1-hour peak and 14% more than required in the 3-hour peak. We examined the capacity provided by individual schemes and concluded that it would be possible to omit proposed lengthening on seven routes in Leeds. It would also be possible to omit lengthening and extension of Birmingham’s cross-city route to and lengthening on three other routes, on four routes in Manchester and both routes in Cardiff (as noted in 6.32). In each case, removal of the infrastructure delivering surplus 1-hour peak capacity would also remove any material capacity surplus in the 3-hour peak.

**Are the schemes in the SBP Update sufficient?**

- 6.58 In the SBP Update, Network Rail proposed a number of detailed changes to its proposals for capacity on:
- Routes 1 and 2 in London
  - Routes 10 and 20, serving Leeds and Manchester, in the Northern franchise area.
- 6.59 On Routes 1 and 2, Network Rail did not provide detailed estimates of the resulting changes in capacity, and so we were not able to repeat the checks on the delivery of the London capacity metric, and the scope to omit specific schemes, set out above. However, the above analysis shows that in the 3-hour peak these schemes would provide 5,328 spaces into Kings Cross, 5,253 spaces into Liverpool Street and 19,065 spaces into Waterloo, a total of almost 30,000 spaces. Retention of any of these schemes, and in particular the lengthening of suburban services into Waterloo, would provide “headroom” to allow for any minor capacity changes on Routes 1 and 2.
- 6.60 On Routes 10 and 20, Network Rail informed us that they had had further discussions with a franchisee which had led to a reworking of their proposals. Their revised approach was to make use of turnbacks to allow vehicles to return or “bounceback” to the same urban area within the peak and hence contribute more than once to capacity. In principle, this approach had the potential to deliver greater capacity through more efficient use of rolling stock.

- 6.61 At Leeds, on Route 10, we noted above that Network Rail’s SBP proposals would result in an oversupply of 18% in the 1-hour peak and 14% in the 3-hour peak. Network Rail stated that the revised approach has broadly the same costs, is consistent with the RUS, would offer a better spread of capacity across the 3-hour peak, and could be achieved with slightly fewer additional vehicles, but we calculate that it would increase the oversupply to around 22% throughout the 3-hour peak. We conclude that while, if as operationally robust as platform lengthening, the approach might have its merits, it is not required to meet the capacity metric, which could be met at lower cost.
- 6.62 At Manchester, on Route 20, the revised proposals would use the same number of vehicles but, at an additional infrastructure cost of around £4 million, reduce the imbalance of capacity (see 6.39) between the 1-hour to the 3-hour peak, providing an additional 2,732 spaces overall but increasing 3-hour peak oversupply from 5% to 10%. As with the proposals at Leeds, the approach may have its merits, but the capacity metric could be met at lower cost.

### Rolling stock requirements

- 6.63 ORR also asked us to review DfT’s and Network Rail’s assumptions regarding the volume of additional rolling stock required to meet the capacity metrics, and in particular to clarify how many additional vehicles would be required. DfT has said that 1,300 extra vehicles will be provided although we have not examined in detail how, and relative to what base, this number has been defined.
- 6.64 In Figure 3.10 (Page 44) of the SBP, Network Rail identifies “*additional rolling stock required in CP4*” as 1,698 vehicles, 179 of them in Scotland and the remaining 1,519 in England and Wales. We reconciled this figure of 1,519 with documentation provided by Network Rail, as shown in Table 6.5 below.

**TABLE 6.5 NETWORK RAIL ANALYSIS OF NET EXTRA VEHICLE REQUIREMENTS**

	0700-0959 extra vehicle arrivals	0800-0859 extra vehicle arrivals	“Extra vehicles in traffic”
<b>Total (SBP Figure 3.10)</b>			<b>1,698</b>
<b>Scotland</b>			<b>179</b>
<b>England and Wales</b>			
CP3 & CP4 initiatives	1,999	976	<b>1,519</b>
CP4 initiatives	1,625	806	1,412

- 6.65 Network Rail has based its capacity calculations on the vehicle arrival figures in the left hand columns, but there is no simple means of calculating, from the extra vehicle arrivals in the peak period, the “extra vehicles in traffic” in the right hand column, which has been quoted in SBP Figure 3.10 as an estimate of incremental fleet size. This raises a number of issues.
- 6.66 First, the total of 1,519 includes some vehicles from initiatives committed in CP3, and others from initiatives taken in CP4, some of which will not arrive until CP5. For example, Network Rail assumes that 60 extra Great Eastern vehicles will, in

conjunction with lengthening platform 10A at Stratford, produce 76 extra peak vehicle arrivals at Liverpool Street (1.26 per extra vehicle), but describe this as occurring during CP3. It is not clear whether this rolling stock is already in the operator's fleet, is to be transferred from elsewhere, or has yet to be built. Conversely, our analysis suggests that only around 1,430 of the 1,519 vehicles will actually be in service by the end of CP4, so that around 90 will not be in service until CP5.

- 6.67 Second, the total of 1,519 includes all vehicles, whether they contribute to the peak capacity metric or not. Fleets require spares, so that more vehicles must be ordered and built than will be in use at any one time. However, even trains which are in use may not contribute to peak period arrivals. Network Rail assumes that Class 390 "Pendolino" lengthening will require 106 vehicles (2 in each of 53 sets) which contribute, in the 3-hour peak, 48 vehicle arrivals at Euston, 24 in Birmingham and 12 in Manchester (none arrive at Liverpool before 0959). Overall, 106 vehicles are expected to contribute only 84 peak arrivals (0.79 per extra vehicle).
- 6.68 Third, and conversely, some vehicles will contribute more than one arrival to the capacity metrics between 0700 and 0959:
- Where a vehicle returns to the same urban area within the peak through "bounceback". For example, Thameslink is assumed to have 240 extra vehicles which produce 200 arrivals at St Pancras and 104 arrivals at Blackfriars (1.26 extra peak vehicle arrivals per extra vehicle in the fleet).
  - Where a vehicle arrives in more than one urban area within the peak. Some TransPennine Express vehicles successively "arrive" at Manchester, Leeds and Newcastle between 0700 and 0959. (3 extra peak vehicle arrivals per extra vehicle on the relevant services).
- 6.69 In summary, Network Rail has made multiple judgements in linking additional arrivals capacity to additional vehicles in the fleet, and the range of 3-hour peak capacity delivered per vehicle varies by around one-third. Its conclusions may be correct, but we are not in a position to audit them without further data and time. We note, however, that Network Rail has not generally added an allowance for spares.
- 6.70 In practice, identification of the actual number of additional vehicles required is likely to emerge only after detailed discussions with, and studies by, the operators, of the type referred to above.

#### **Uncertainties in the delivered capacity**

- 6.71 The above analysis suggests that, with the exception of the loss of capacity at London Bridge, Network Rail's proposals are sufficient to meet all the 1-hour and 3-hour capacity metrics, providing that both infrastructure works and the subsequent rolling stock are in service on time. There are, however, a number of uncertainties in these calculations, which we discuss below.
- 6.72 First, the uncertainties in the timing of the provision of the infrastructure enhancements and the subsequent arrival of the rolling stock. Even if Network Rail has identified a precise target delivery date, which is rarely the case, slippage in capacity schemes, particularly as a result of delays in the planning process, could delay the achievement of the capacity metrics.

- 6.73 Second, the actual capacity of existing, reallocated and new rolling stock:
- Existing rolling stock will dominate the future fleet and hence the capacity it provides. Network Rail has calculated the spaces provided by existing stock from the 2007/08 timetable, but we have not been able to check this calculation.
  - Reallocated rolling stock may have materially different capacity from that it replaces, particularly given the differences between fleets and the existence of “high capacity” variants in some fleets. Network Rail estimates that the capacity of rolling stock in London varies from 24 to 119 spaces, but had to assume, in the absence of other information, that any reallocation of the existing fleet, for example replacing 3-car units of one stock with 4-car units of another, would have no effect on average capacity per vehicle. This is unlikely to be the case.
  - New rolling stock may also have different capacity to that it replaces. Again, Network Rail assumed that the capacity of new stock is identical to that of the existing stock, but this is unlikely to be the case.
- 6.74 To illustrate the effect on delivery of the capacity metric of even minor changes, we note that the total margin by which Network Rail calculates that the London 3-hour capacity metric will be met by the end of CP4 is equivalent to one row of seats per vehicle. We conclude that there must be considerable uncertainty in how, when and potentially whether the capacity metrics are met, at least until the details of the rolling stock to be sourced and allocated to each route are clearer.
- 6.75 For all these reasons we note that it is likely to be prudent for Network Rail’s enhancement programme to include margins of capacity to reflect both:
- Schemes being delayed beyond CP4
  - Schemes delivered within CP4 providing less capacity than projected, whether through delays in the arrival, or lower than assumed capacity, of rolling stock

### Summary

- 6.76 Network Rail’s proposals are broadly sufficient to deliver DfT’s HLOS capacity metrics for CP4, although in the six “other urban areas” the estimated total capacity provided in the 1-hour peak exceeds the metric by the equivalent of less than one vehicle. There is a risk that delivery of the London metrics is delayed by Thameslink Key Output 2 works until after the end of CP4, but it is unlikely to be cost-effective to provide additional capacity merely to cover the temporary closures required for these works.
- 6.77 Elsewhere, a large element of the “capacity” schemes in Network Rail’s SBP might not be needed to deliver the end CP4 capacity metrics. However, we drew to ORR’s attention the risks of taking our “mechanistic” analysis at face value, not only because any or all of these schemes may in practice be essential for reasons outside the scope of our work, but also because of the many uncertainties in what capacity will actually result. A prudent approach might be to allow slight over-provision of infrastructure, but to ensure that additional rolling stock was only commissioned and brought into service when and where it was required.
- 6.78 In the case of services to Kings Cross, an additional path to York or Lincoln adds little additional London commuter capacity and would need to be justified by the need to

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provide capacity over longer distances. However, while it may in theory be possible not to expand suburban capacity, there is a risk that this results in a serious mismatch between demand and capacity around London, and in particular in serious under-provision for the actual demand on the route.

- 6.79 In the case of services to Waterloo, it might be prudent to provide additional infrastructure rather than to assume that 8-car operation will be sufficient until the end of CP4.
- 6.80 In the case of services to Liverpool Street, we also concerned that lengthening of the platforms used by inner services might involve considerable work which would have only limited life before four-tracking. Unless Network Rail can confirm that the proposed scheme, or a variant restricted to platforms unaffected by four-tracking, would be cost-effective, it may be better to defer lengthening until it can be incorporated into a wider four-tracking scheme.
- 6.81 In Birmingham, Cardiff, Leeds and Manchester the absolute size of the capacity metrics are much smaller than in London, the relative importance of individual vehicles and trains is relatively large, and any practical means of expanding capacity may mean some excess over the metric. Nonetheless, Network Rail's proposals, particularly at Leeds, provide more capacity than has been specified by DfT and means should be found of delivering the metrics at lower overall cost.

## 7. OTHER SCHEMES

### Introduction

7.1 In this Section we comment on some of the remaining schemes in the SBP, listed in Table 7.1.

**TABLE 7.1 OTHER SCHEMES**

Strategic Route	Scheme	GRIP Stage	CP4 cost (£m)
	East Croydon passenger capacity	0	12
2	Redhill remodelling	0	25
	Gatwick remodelling and passenger capacity	2	30
6	North London Line capacity enhancements	2	45
8	Shaftholme Junction	2	37
	Reading station concourse	0	26
	Reading station platforms 1-8	0	31
13	Reading Oxford Road Junction to Southcote Junction	0	47
	Didcot to Oxford	3	38
17	Round Oak to Walsall reopening	0	10
18	Crewe remodelling	1	10
	Manchester Hub	0	60
20	Bolton corridor package	0	10
	Buxton remodelling	0	5
	Liverpool James Street	0	10
21	Liverpool Central passenger capacity	0	19
	<b>Total</b>		<b>423</b>

Note: all costs are CP4 costs at 2006/7 prices but bases vary. See 2.3 for details.

7.2 We discuss these schemes below, expressing costs on the basis set out in Table 5.5, and commenting on any changes in the SBP Update. We deal in order with:

- Manchester Hub
- Schemes which appear to be freight-related and hence could be funded through TIF or as part of the Strategic Freight Network
- Optional schemes which appear to be candidates for NRDF

### Manchester Hub

- 7.3 The SBP included an optional scheme for the “Manchester Hub” of Piccadilly and Victoria stations which appears to reflect DfT’s announcement, on 4 October, that “*Network Rail has agreed to begin a detailed study on how best to increase the number of trains that are able to run through Manchester*”.
- 7.4 The SBP listed a range of schemes which, with development, might contribute to a longer term solution but noted that “*In the short term, it is envisaged that Victoria station will be improved to a standard comparable to Piccadilly, enabling operational, performance and customer benefits, and enabling Piccadilly and Victoria to be treated as equally attractive alternative locations*”. It described enhancements at Victoria with an allocation of £60 million for delivery “2010 to 2014”.
- 7.5 As part of the risk analysis discussed in Section 5, Network Rail included a “*Route 20 Manchester Victoria Station Capacity Development*” but this was costed at £20 million. It is not clear either why £60 million is required when the only scheme identified appears to cost £20 million, or even whether any such scheme would be consistent with the longer term strategy emerging from Network Rail’s detailed study. Arup also queried whether the SBP’s £13 million scheme for new platforms at Salford Central would be consistent with the longer term strategy.
- 7.6 While there may be strong arguments for major works in the Manchester area, we have seen no evidence that Network Rail yet has any coherent plans for how and where the £60 million would be spent. In the SBP Update Network Rail describes this scheme as “*North West Feasibility Study (Manchester Hub)*” reinforcing our concern that Network Rail has not yet identified or developed specific schemes.

### TIF or Strategic Freight Network (SFN) schemes

- 7.7 We identified two schemes which might, in principle, better be considered as candidates for TIF funding or as components of the Strategic Freight Network.
- 7.8 Shaftholme Junction remodelling (£37 million, GRIP Stage 2) was presented as part of the overall package of works on the East Coast Main Line but it would be used by, and most directly benefit, freight services. We suggest that if it proceeds it might be appropriate to consider TIF funding or possibly to include it as part of the Strategic Freight Network (SFN). In the SBP Update the scheme has advanced to GRIP Stage 1 and the cost estimate has risen to £42 million.
- 7.9 Round Oak to Walsall Reopening (£10 million, GRIP Stage 0) was a proposal to reopen a line which Network Rail said could also be used for Centro’s proposals for tram-train services, which have been the subject of a road pricing TIF application. We note that it may not prove practical or attractive to mix freight and (as yet untested) tram-train services on a single line, but the scheme does appear to have benefits as a diversionary route for freight. The SRA’s West Midlands RUS of February 2005 “*does not propose to promote the reinstatement of the Road Oak-Bescot route but confirms the need for the route to be protected in the longer term. The case for this freight link beyond 2011 will be considered as part of [the RPA]*”. It may be appropriate to consider TIF funding or inclusion in the Strategic Freight Network

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(SFN) during CP4. In the SBP Update the scheme has advanced to GRIP Stage 3 but the cost estimate is unchanged.

**Optional schemes which appear to be candidates for NRDF**

- 7.10 The SBP included two small optional schemes which we considered might better be treated as NRDF schemes.
- 7.11 Bolton corridor (£10 million, GRIP Stage 0) was described as a package of schemes “to increase capacity, improve performance and reduce journey times down the Bolton corridor through the removal of Permanent Speed Restrictions (PSRs) and restrictive signals and the provision of new passing loops for slower traffic”. If the package of schemes is necessary to provide capacity in the Manchester area, we would expect it to be presented as such, but if not it may be more appropriate to put forward individual schemes for NRDF funding. In the SBP Update the scheme cost has declined to £7 million.
- 7.12 Buxton remodelling (£5 million, GRIP Stage 0), not mentioned in Network Rail’s ISBP, was a proposal to redesign the track layout at Buxton, which currently requires extensive reversals. The proposed scheme appears to be a simple means of improving operational flexibility but improvements at this remote location are not needed to achieve the DfT HLOS capacity or performance metrics. In the SBP Update documentation, Network Rail said that the scheme would allow the saving of a 4-car train, which could be used elsewhere to increase capacity, but as we discuss above, the existing proposals to provide capacity in the Manchester area already exceed the requirements of the metric. In addition, the scheme cost has risen to £15 million in the SBP Update.

## 8. OUR FINDINGS

### Context

8.1 For this Final Report we have repeated and updated the findings set out in our Interim Report which was produced, as required by ORR, within four weeks of our receipt of the SBP and supporting documents. We have also taken into account the SBP Update to the extent possible with the time and information available. Our findings remain subject to review and modification in the light of further information.

8.2 ORR asked us to provide an initial answer to a number of specific questions, either reflecting our original terms of reference, and hence anticipated by our work programme, or emerging during the course of our work. We deal with each of these specific questions in turn below.

### How the capacity metrics are to be delivered

8.3 We set out in Section 6 our detailed analysis of Network Rail's SBP proposals to deliver the capacity metrics and our conclusions that, if the enhancement schemes were completed, and suitable rolling stock were brought into service, the capacity metrics could be met by the end of CP4, with three major caveats:

- Achieving the London termini capacity metrics is highly dependent on London Bridge, scheduled to deliver 22-23% of the capacity but undergoing redevelopment through the later part of CP4. Network Rail could not confirm that there would be a period during CP4 during which the metrics to be met.
- On Network Rail's calculations, the margin by which the capacity metrics will be met is small, especially in "other urban areas", and in the case of London equivalent to less than one row of seats on each vehicle. In practice, the combined uncertainties in delivery dates and the capacity of cascaded or new rolling stock mean that it is still not possible to determine exactly how and when the capacity metrics will be met.
- Meeting the metrics will require not only new rolling stock but also suitable depot and stabling facilities, as we discuss below.

8.4 We also identified that, subject to these caveats, not all the proposed schemes are necessary to deliver the peak capacity metrics. In particular we draw attention to:

- Schemes on the East Coast Main Line which contribute only a small increment of capacity to the Table A5 London metrics, and which would need to be justified by reference to the Table A3 total demand metric or other factors outside the scope of our work.
- Provision for lengthening of West Anglia inner services, the phasing of some of which should be re-examined in the context of the Secretary of State's recent requirement for proposals including four-tracking.
- Provision for lengthening of Waterloo suburban services, which appears not to be strictly necessary to meet the capacity metrics but which in practice may be essential to cater for emerging demand.
- Overprovision of capacity in other major centres and in particular Leeds.

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### **The dependencies between schemes**

- 8.5 Network Rail provided, in support of the SBP, project summaries which tabulate the interaction between major schemes. This is evidence that there has been a systematic approach to identifying interdependencies, at least on Strategic Routes where a RUS exists, but we have not checked whether each group of interdependent schemes have been optimised as a package.

### **The scope for economies of scale**

- 8.6 We have not examined whether Network Rail's detailed approach to project planning and costing reflects the scope for economies of scale. However we draw attention to the extensive programmes of platform lengthening in several parts of the network, where the volume of work may offer scope for economies of scale or even for a major shift in some aspects of the technology.
- 8.7 We have also identified locations on the network, such as Reading and Clapham Junction, where Network Rail proposes several schemes with distinct outputs but similar inputs, and would expect the scheme planning and programming to achieve economies of scale between schemes, in particular in the volume of possessions and disruption to customers.

### **Dependencies with non-infrastructure schemes**

- 8.8 A large proportion of Network Rail's infrastructure enhancements are platform lengthening proposals which will, in themselves, provide little increase in capacity without subsequent expansion, by the passenger train operators, of their rolling stock fleet. Network Rail has identified a total additional need for almost 1,700 vehicles in CP3 and CP4, but we estimate that it might be possible to meet the capacity metrics with between 400 and 600 fewer vehicles (see 6.42) We stress, however, that these estimates are sensitive to the exact assumptions made and in particular to the operational issues, associated with the delivery of a practicable timetable, which are outside the scope of our work.
- 8.9 Expansion of the rolling stock fleet is also likely to require upgrading to power supplies, provision of suitable depot and stabling facilities, and possibly gauge clearance. Network Rail identified a number of power supply schemes, but we have not attempted to identify whether these are sufficient and necessary for the proposed fleet expansion or whether, if the expansion did not proceed, it would be possible to reduce or avoid their costs. To achieve the capacity metrics it will also be necessary to deal with the wider issues of procuring additional and new rolling stock, including obsolescence and interoperability.
- 8.10 Network Rail provided with the SBP Update a more detailed analysis of the need for, and costs of, depots and stabling. While this represents progress towards an eventual solution, it also revealed the wide range of options which may need to be examined and discussed with operators, and the risk that convergence of proposals for infrastructure, rolling stock and operations on an eventual solution may be difficult.

### Alternative packages/options to provide the specified outputs

- 8.11 Network Rail's RUS processes, its earlier ISBP, the SBP and the SBP Update all document the identification and evaluation of a wide range of options for capacity enhancements. For example, Network Rail provided documentation examining a wide range of options at Reading station, Arup pointed out that the proposals for additional capacity between Peterborough and Doncaster clearly reflect an examination of options on alternative routes, and we have seen evidence of extensive study of schemes on the Midland Main Line, even in the absence of a Network Rail RUS.
- 8.12 Network Rail's strategy of lengthening platforms appears to be largely self-explanatory means of increasing capacity to meet DfT's capacity metrics. However, these aggregate capacity metrics do not specify on which routes, or even in which urban area, capacity must be provided. In Leeds, changes in Network Rail's proposals between the SBP and the SBP Update suggest that it may be possible, or even necessary, to examine a wide range of options to identify the optimum approach. To meet the Table A5 capacity metrics for the London termini, Network Rail has identified more than 60 capacity initiatives, not all of which involve infrastructure, and not all of which are necessary. Many different combinations of these initiatives would provide sufficient capacity to meet the metrics.

### The strategic fit of the schemes

- 8.13 The impression given by comparing the SBP and SBP Update with the earlier ISBP is of a convergence of schemes around the HLOSs although we have not, for example, carried out a detailed comparison of the schemes in the SBP and the RUSs. We note above that platform lengthening is generally a "safe bet", offering capacity increases with minimum effect on performance, and is unlikely to create new constraints, provided that suitable depot and stabling facilities are available.
- 8.14 We also note, however, that the capacity metrics for the end of CP4 may divert attention from longer term forecasts and needs. Network Rail proposes major works at some key nodes such as Reading, Clapham Junction and, through the Thameslink programme, London Bridge, but schemes such as Glasgow Airport Rail Link may leave little spare capacity and there are other areas where no longer term strategy for capacity has yet been set out. Our wider concern is that potential longer term constraints on the network may not yet have been examined, particularly at key nodes such as Oxford, Doncaster (the ECML RUS notes that "*layout of the through routes at Doncaster is restrictive, with a large number of crossing movements at both the north and south ends*") and, in the longer term, Clapham Junction and on the West Coast Main Line such as at Crewe. We also recognise that Network Rail's proposals for Redhill and Gatwick Airport may be necessary in the longer term.

### The reasonableness of Network Rail's work plan

- 8.15 We have not examined Network Rail's work plan but note that Arup may be commenting on engineering and project planning documentation provided.

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**Evidence of close working with TOCs**

- 8.16 Network Rail described a credible process of working with the train operators and we have seen documentation of detailed discussions at a working level.
- 8.17 We understand from Winder Phillips, ORR’s advisors on performance issues, that there has been constructive engagement between operators and Network Rail on future performance improvements. However, industry stakeholders have also pointed out to us that operators near the end of their franchise may have no incentive to forecast future growth, and have active disincentives to support infrastructure work during their franchise to deliver safety, capacity and performance benefits beyond it. While discussion with the operators may be necessary to the planning process, it is unlikely to be sufficient, and Network Rail will need to consider longer term views and forecasts from other sources.
- 8.18 Network Rail also faces the practical difficulty that most of the DfT HLOS capacity metrics do not specify which operator or operators are to provide the extra capacity. The London termini metrics, for example, relate to the aggregate capacity of services at 12 termini provided by a similar number of franchised and open access operators.
- 8.19 Given an objective of finding the optimum pattern of meeting the metrics, Network Rail could in principle hold iterative discussions with the operators, on an “open book” basis, until a consensus was reached. In practice, as we have discussed above, certain operators might have no incentive, or even active disincentives, to contribute to such discussions and others, even if willing, would not be able to identify the practicalities and costs of proposals for capacity expansion without detailed study. In the limited time available since the publication of the HLOS, and in the absence of specific rolling stock plans for each operator, Network Rail has therefore inevitably had to make assumptions which may be inconsistent with constraints known to, or likely to be imposed by, the operators.

**The consistency of the programme with Network Rail’s demand forecasts**

- 8.20 Network Rail provided us with an overview of its demand forecasts, which we understand are higher than those adopted by DfT on some routes, but at ORR’s request we focused on whether its proposals would provide sufficient capacity to meet the DfT HLOS capacity metrics. We established that they would do so, subject to the comments above, and in some cases would provide additional capacity. If and where outturn demand is lower than expected, and subject to procurement lead times, savings may be possible by deferring expansion of the rolling stock fleet. If and where outturn demand is higher than expected, there may be a need for further infrastructure enhancement work to meet demand during CP4 or beyond. A systematic review of Network Rail’s planned level of development funds for CP5 is beyond the scope of our work.

**Overall deliverability of the programme**

- 8.21 Network Rail identified in the SBP a number of schemes which might need planning consent and the SBP Update included a more systematic review. Our own examination suggested that planning consent may be needed on several schemes with delivery

dates as early as “2010/11”, some of which might be critical to the delivery of key outputs including achieving the DfT HLOS capacity metrics. The difficulty of obtaining consent may be increased by the fact that many of these schemes are still at GRIP Stages 0 (“pre-GRIP”, not formally yet within the GRIP process), 1 or 2, and it may be some time before their definition is sufficiently clear either to support a planning application or even to establish whether one is needed.

- 8.22 Winder Phillips are ORR’s advisors on performance issues and we have not duplicated their work. In passing we note, however, that the programme even for major schemes such as Thameslink does not yet appear to identify exactly what performance and capacity will be provided during the closing years of CP4, particularly through the critical node of London Bridge. We also share Arup’s concern that it may be difficult to maintain performance and capacity around the large number of proposed schemes on Strategic Route 2, the Brighton Main Line.
- 8.23 In addition to the issue for Network Rail’s internal capacity of the need to provide stabling and depots for passenger rolling stock, we also noted delays to its RUS programme. The Greater Anglia and ECML RUSs, both programmed for October 2007, were published two and four months late respectively (see Appendix A). We recognise that delays in the preparation of the high level RUSs do not necessarily mean delays in the individual schemes which they describe, but slippage in any part of Network Rail’s overall programme may have implications for the remainder.
- 8.24 Our greatest concern, however, is whether Network Rail can progress schemes through the GRIP Stages from output definition to single option development and thence to detailed design, construction and delivery. Where Network Rail cannot define or develop schemes, it will not be able to deliver them.

### **The treatment of programme risk and uncertainties**

#### **The possible range of CP4 costs**

- 8.25 We set out in Section 5 comparisons of the cost estimates for apparently similar schemes in the ISBP, SBP and SBP Update. We also reviewed Network Rail’s risk analysis and developed estimates of the confidence limits of the cost estimates. The former suggests that costs may vary considerably as the objectives, scope and timing of a scheme evolve, and the latter suggests that there can be considerable uncertainty in the outturn costs of schemes even at GRIP Stages 3 and 4.
- 8.26 As noted above, there is evidence of convergence in the estimated cost of Network Rail’s proposed enhancements, despite changes in the list of schemes included or their individual costs. However, at their current degree of development, and given the uncertainties in future industry capacity, there remains considerable uncertainty in the possible range of outturn costs.

**APPENDIX A**  
**CHRONOLOGY OF EVENTS**

## A1. CHRONOLOGY OF EVENTS

A1.1 The principal events up to the preparation of our Interim Report and a subsequent Update are summarised below.

Date (2007)	Event
18 October	ORR forwarded Network Rail, in confidence, drafts of sections of SBP
19 October	ORR forwarded a range of documentation from various sources
29 October	ORR forwarded SBP
31 October	Meeting with ORR and Network Rail to provide initial feedback
1 November	Network Rail published SBP Meeting with ORR and Arup to agree SBP review process and tasks
2 November	ORR forwarded Network Rail papers on demand
12 November	Network Rail provided initial responses for challenge meeting
13 November	Challenge meeting with ORR, Arup and Network Rail on enhancements ORR forwarded Network Rail papers on Tier 2 Scottish HLOS schemes Network Rail provided presentation on Reading area schemes
14 November	ORR forwarded further papers on Tier 2 Scottish HLOS schemes Network Rail provided TIF documentation on ECML capacity enhancement
15 November	ORR forwarded Network Rail papers on Reading and Birmingham
16 November	ORR specified priorities for content of Interim Report
19 November	Challenge meeting with ORR, Arup and Network Rail on cost and risk
20 November	ORR forwarded Network Rail QRA for Thameslink Network Rail provided QRA data on other major schemes
21 November	ORR forwarded Network Rail papers on deliverability
22 November	Arup and Steer Davies Gleave shared draft Interim Reports
<b>23 November</b>	<b>Arup and Steer Davies Gleave Interim Reports</b>
27 November	ORR forwarded Network Rail papers on Reading maintenance/renewal
6 December	Discussions with operators and bid teams on depot and stabling plans
10 December	ORR requested consolidation of subsequent work into Interim Report
12 December	ORR forwarded Winder Phillips Interim Report
<b>14 December</b>	<b>Steer Davies Gleave Interim Report Update</b>
19 December	Network Rail publishes Greater Anglia RUS

A1.2 The principal events up to the preparation of this Final Report are summarised below.

<b>Date (2008)</b>	<b>Event</b>
15 January	Network Rail published South London RUS Draft for Consultation
17 January	Meeting with ORR to review progress and plan work programme
22 January	Meeting with ORR, Arup and Network Rail on the treatment of risk
24 January	ORR forwarded results of consultation in SBP
30 January	Department for Transport published Rolling Stock Plan (RSP) Meeting with ORR, Arup and Department for Transport
1 February	Arup Interim Report
13 February	Meeting with ORR and Arup: fortnightly progress meeting
15 February	Arup Interim Report updated
22 February	Network Rail published Yorkshire & Humber RUS Scoping Document
27 February	Network Rail published East Coast Main Line RUS Meeting with ORR, Arup and Network Rail: Midland Main Line schemes
3 March	Written Ministerial Statement on West Anglia main line schemes
5 March	Meeting with ORR on capacity analysis and to agree Final Report content
<b>11 March</b>	<b>Steer Davies Gleave Draft Final Report</b>
13 March	Network Rail publishes Kent RUS Scoping Document Network Rail publishes Sussex RUS Scoping Document
26 March	Network Rail publishes South London RUS
<b>28 March</b>	<b>Steer Davies Gleave Final Report extended version</b>
4 April	Network Rail publishes SBP Update Meeting with ORR, Arup and Network Rail
8 April	Steer Davies Gleave provides initial views on SBP Update
9 April	Steer Davies Gleave provides list of challenge questions on SBP Update
23 April	Network Rail published Lancashire & Cumbria RUS Draft for Consultation
<b>23 May</b>	<b>Steer Davies Gleave Final Report</b>

**APPENDIX B**  
**NETWORK RAIL'S STRATEGIC ROUTES**

## B1. NETWORK RAIL'S STRATEGIC ROUTES

B1.1 Network Rail's 26 Strategic Routes are listed in below.

**APPENDIX: TABLE B1.1 NETWORK RAIL'S STRATEGIC ROUTES**

Strategic Route	Name	Major station(s)
1	Kent	London Bridge, London Victoria
2	Brighton Main Line Sussex	Blackfriars, London Victoria
3	South West Main Line	London Waterloo
4	Wessex Routes	London Waterloo
5	West Anglia	Liverpool Street
6	North London Line, Thameside	Fenchurch Street
7	Great Eastern	Liverpool Street
8	East Coast Main Line	Kings Cross, Moorgate, Leeds, Newcastle
9	North East Routes	Newcastle
10	North Trans-Pennine, North & West Yorkshire	Leeds
11	South Trans-Pennine, South Yorkshire & Lincolnshire	Sheffield
12	Reading to Penzance	
13	Great Western Main Line	Paddington, Bristol, Cardiff
14	South & Central Wales & Borders	
15	South Wales Valleys	Cardiff
16	Chilterns	Marylebone
17	West Midlands	Birmingham New Street
18	West Coast Main Line	London Euston, Birmingham, Liverpool, Manchester
19	Midland Main Line East Midlands	St Pancras International, Leicester, Nottingham, Sheffield
20	North West Urban	Manchester, Liverpool
21	Merseyrail	
22	North Wales & Borders	
23	North West Rural	
24	East of Scotland	
25	Strathclyde South West Scotland	
26	Highlands	

## CONTROL SHEET

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1	11 March 2008	Draft for internal review, copied to ORR and Arup
2	28 March 2008	Extended version with further material requested by ORR
3	23 May 2008	Final version including work on SBP Update

## REVIEW

Originator: Dick Dunmore

Other Contributors: Jim Collins, Vernon Baseley, Gordon Bird, Simon Ellis, Damian Flynn, Rob Pilkington, Ricard Anguera, Peter Schwinger, Martin Dannhauser, Kevin Dadswell, Chris Whitehouse

Review By: Print: Gordon Bird

Sign: .....

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