

REVIEW OF NETWORK RAIL'S APPROACH TO FINANCIAL RISK ASSESSMENT AND MANAGEMENT IN ITS STRATEGIC BUSINESS PLANS FOR PR18

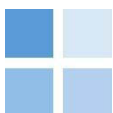
OFFICE OF RAIL AND ROAD

APRIL 2018

FINAL REPORT

Submitted by:

Cambridge Economic Policy Associates Ltd



CONTENTS

Executive summary	2
1. Introduction	4
1.1. Background	4
1.2. Our approach to the project	5
1.3. Report structure.....	6
2. Network Rail’s approach to risk in the Strategic Business Plans	7
3. Analysis of Network Rail’s approach to financial risk	11
3.1. Why does Network Rail need risk funding?.....	11
3.2. Comments on Network Rail’s high-level approach	15
3.3. Appropriateness of key assumptions in the SBPs.....	22
3.4. CEPA’s view on the reasonableness of the financial risk estimate	28
4. Conclusions	32

IMPORTANT NOTICE

This report was prepared by Cambridge Economic Policy Associates (CEPA) Ltd for the exclusive use of the client named herein.

The opinions expressed in this report are valid only for the purpose stated herein and as of the date of this report. No obligation is assumed to revise this report to reflect changes, events or conditions, which occur subsequent to the date hereof.

CEPA Ltd does not accept or assume any responsibility in respect of the report to any readers of the report (Third Parties), other than the client. To the fullest extent permitted by law, CEPA Ltd will accept no liability in respect of the report to any Third Parties. Should any Third Parties choose to rely on the report, then they do so at their own risk.

CEPA Ltd reserves all rights in the report.

EXECUTIVE SUMMARY

The Office of Rail and Road (ORR) commissioned Cambridge Economic Policy Associates (CEPA) to review Network Rail's approach to 'financial risk' in its business plan for the next regulatory period (CP6). With Network Rail now formally recognised as a public sector body, it is no longer able to borrow in the financial markets in order to manage variance in its costs and income from its Strategic Business Plan (SBP). The ORR has asked CEPA to review whether the alternative arrangements proposed by Network Rail are reasonable. CEPA's advice will form one of the sources of information that the ORR considers as it develops its policies for CP6.

Absent an allowance for financial risk (effectively a contingency fund), an important implication of the above change to Network Rail's financial control, is that unforeseen increases in cost and/or falls in revenue would force Network Rail to cancel the delivery of activities, which is likely to impact some of its outputs and lead to inefficiency. As such, we agree with Network Rail's overall approach of having dedicated risk funding, including "headroom" held by each route and a centrally held risk portfolio fund. However, we make the following observations about Network Rail's estimates of the financial risk funding that it requires:

- Within the funding envelope provided to Network Rail under the Statement of Funds Available (SoFA) for CP6, a greater share of total funds should be allocated to financial risk. This is because we consider that Network Rail's proposed cost baselines are likely to be too high, as they are based on some cost inefficiency from CP5 and on a significant increase in work volumes that may not be deliverable.
- The true range of risks in CP6 is likely to be higher than that estimated by Network Rail, particularly as some key risks (e.g. Brexit, supply chain constraints) are unaccounted for in Network Rail's methodology. Network Rail's business plan states that it targets a P80 confidence interval (i.e. 80% likelihood of delivering the business plan without requiring additional funding). However, we consider that there is a less than 80% probability that the CP6 business plan could be delivered within the proposed funding envelope without activities/outputs being cancelled.

Based on our review of financial risk in Network Rail's business plan, we have identified seven recommendations ahead of the ORR developing its CP6 determination:

Issue	Recommendation
Risk funding	The ORR's determination for CP6 should ensure that Network Rail has sufficient funding to absorb risk to its costs and income, so that it is not forced to re-plan its workbanks every time a risk materialises. We think that an amount of risk funding that is roughly equivalent to the P80 anticipated cost and income risk would provide reasonable contingency. It is appropriate for some of that risk funding to be held at route level and the remainder to be held centrally.
Risk allocation between the routes	Network Rail should ensure the routes have applied the business plan guidance consistently and that there is a clear line of sight from the each route's own risk assessment to the overall financial risk proposal. In particular, Network Rail should establish whether financial risk funding has been allocated appropriately between the routes, given the underlying risk assumptions, and noting the separate funding arrangements for Scotland.
Baseline costs	ORR should assess whether efficient costs are used in baselines. ORR may want to provide guidance to Network Rail on how efficient costs should be identified for the baseline, and request Network Rail to resubmit the relevant parts of its plan.
Deliverability of the business plan	ORR should ensure that the baseline only includes volumes of work that can be reasonably considered to represent P50. ORR may want to provide guidance to Network Rail on how efficient volumes should be identified for the baseline, and request Network Rail to resubmit the relevant parts of its plan.
Budgetary flexibility	Network Rail should produce a version of its 'bottom-up' Monte Carlo modelling in which no budgetary flexibility is assumed. It should state the impacts of this assumption on its financial risk estimates (i.e. what is the increase in the required risk funding).
Risks related to Brexit	The relevant parties (ORR, Network Rail, Department for Transport and Transport Scotland) should agree on a set of conditions that, should they materialise post-Brexit, would lead to the CP6 settlement being re-opened.
Estimate of financial risk	ORR should use an estimate of financial risk that better reflects P80 in its determination. This is likely to involve moving some of the cost from the baseline to risk funding and recalculating the risk estimate with all relevant risks accounted for (ORR may want to request Network Rail to resubmit the relevant parts of its plan and provide guidance on how the revised risk estimate should be calculated).

1. INTRODUCTION

This section sets out the context for the project, outlines the approach we took in delivering the project, and sets out the structure of the report.

1.1. Background

Network Rail's operations, support costs, maintenance and renewals expenditure is funded through a combination of direct grants from the Department for Transport (DfT) and Transport Scotland, track access charges on train operators and income from other sources (such as its portfolio of commercial properties). The Office of Rail and Road (ORR) is engaged in the process of delivering the 2018 Periodic Review of Network Rail (PR18), which will determine what Network Rail must deliver in control period 6 (CP6),¹ the funding it requires for this, and the incentives needed to encourage effective performance and delivery. The current phase of the process requires ORR to scrutinise Network Rail's Strategic Business Plans (SBPs) to assess whether they are likely to deliver the high-level outputs required by the Secretary of State for Transport and by Transport Scotland in an efficient manner.²

As Network Rail is now formally recognised as a public-sector body, the CP6 settlement must take account of its new financial environment. Network Rail currently operates within the confines of a multi-year borrowing limit agreed with DfT. But unlike most other government departments, Network Rail has flexibility to move budgets between years and between current and capital spending.

We understand that the framework of financial control for CP6 is likely to be different. In particular, we understand that the UK government is keen to establish greater budgetary control over Network Rail, consistent with how HM Treasury manages grants and spending on other public services – the departmental expenditure limits (DEL). Under the new DEL framework, in addition to income from track access charges, Network Rail will be grant-funded on an annual basis and it will no longer be able to borrow from DfT. It is also likely that it will have less flexibility to move budgets between years and between current and capital spending. This may restrict Network Rail's ability to manage fluctuations in costs and revenues from those predicted, and so the company may have to devise work schedules for each year that are deliverable within its funding.

Absent an allowance for financial risk (effectively a contingency fund), an important implication of the above changes to Network Rail's financial control is that unforeseen

¹ CP6 is scheduled to run from 1 April 2019 to 31 March 2024.

² These are set out in: [DfT, Railways Act 2005 Statement, High Level Output Specification, 20 July 2017](#) and [Transport Scotland, The Scottish Ministers' High Level Output Specification for Control Period 6, July 2017](#).

increases in costs and/or falls in revenues would force Network Rail to cancel the delivery of activities, which is likely to impact some of its outputs and lead to inefficiency.

In a departure from previous price controls, enhancement projects delivered during CP6 are to be funded separately outside the Statement of Funds Available (SoFA). Therefore the SoFA provides a budget for operations, maintenance and renewals expenditure only.³

Another distinctive feature of PR18 is the regulation of each of Network Rail's route businesses in a disaggregated way. This move to 'route-level regulation' will allow ORR to make greater use of comparative analysis between routes when assessing the company's plans. Because the Scotland route is already separately regulated (as it is separately funded by Transport Scotland), ORR must also consider the allocation of costs and funding to the Scotland route.

1.2. Our approach to the project

CEPA was commissioned by ORR to report on Network Rail's approach to assessing and managing financial risk in its SBPs for PR18. The report and its findings will feed into the ORR's considerations as it develops its approach to the financial framework for PR18.

CEPA's review has sought to assess whether Network Rail has adopted a reasonable approach to estimating financial risk (and related issues) associated with its operations, maintenance and renewals activities during CP6, at a route level and in total.⁴ We have also looked at the risk ranges that Network Rail estimated around income, although we note that there is considerably less detail on the latter and that the level of materiality is markedly lower than for costs.⁵

We have reviewed a range of relevant documents provided by Network Rail, including each of the route-level SBPs, and identified cross-cutting issues. We have also carried out a targeted, detailed analysis of Network Rail's approach in key areas. **Our review does not represent an audit of the financial risk assumptions in the SBPs or any of the data used by Network Rail to produce its financial risk estimates.**

In addition, we have not reviewed what risk management or mitigation actions that Network Rail might take (or is proposing to take).

³ The SoFA also includes some funding for enhancement work carried over from CP5. See: [ORR, Second consultation on the PR18 financial framework, 27 March 2018](#), p. 9-11.

⁴ For the avoidance of doubt, enhancements are outside the scope of this project.

⁵ For example, the assumptions used by Network Rail in its monte Carlo modelling of financial risk place the downside risk to income (from Schedule 4 and Schedule 8, as well as other single till income) at £775 million. This compares to an assumption of £4.1bn risk to renewals costs and an assumption of £1.4bn risk to operations and maintenance costs.

The issues that we consider are:

1. Network Rail's criteria for financial sustainability in the context of the revised funding structure and changed risk profiles.
2. Network Rail's approach to financial risk modelling.
3. Network Rail's approach to ensuring that route SBPs include appropriate amounts for financial risk, and whether the amounts are consistent across the routes.
4. Assessment of whether the ranges around spot expenditure levels that the routes have assumed are reasonable.
5. To what extent (if any) Network Rail's proposed financial risk allowances double count downside risk.
6. Whether Network Rail has been rigorous in identifying upside risk and taken account of the portfolio effect of having multiple routes.
7. The quality of the data systems that Network Rail has used to inform its analysis.
8. Network Rail's approach to identifying financial risks including:
 - macro-economic risks;
 - high impact low probability events (such as extreme weather events);
 - the potential impact of 'pipeline' enhancement decisions on operating, maintenance and renewals expenditure;
 - the need to respect the ring fencing of some funding in network grants for particular activities and how that could weaken the portfolio effect; and
 - commercial risks associated with its supply chain.
9. How other regulated companies quantify financial risks for planning purposes.
10. Use of conventional financial ratios as additional indicators to inform Network Rail's estimate of financial risk.

1.3. Report structure

The remainder of the report is structured as follows:

- Section 2 outlines Network Rail's approach to the SBP process. Specifically, it sets out what Network Rail thinks it can deliver within the SoFA, and summarises how Network Rail has estimated its cost baseline for CP6 and associated financial risk.
- Section 3 details the key issues we have identified in reviewing the financial risk estimate in Network Rail's SBPs.
- Section 4 provides our conclusions and sets out our recommendations.

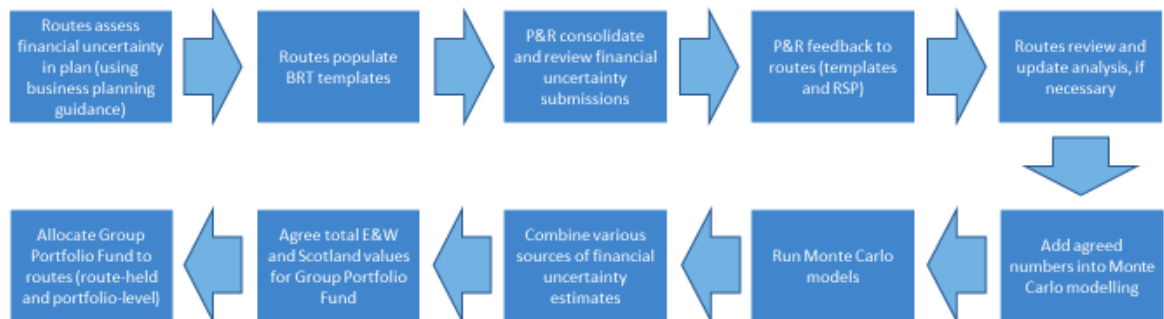
2. NETWORK RAIL'S APPROACH TO RISK IN THE STRATEGIC BUSINESS PLANS

This section summarises our understanding of the approach Network Rail took to its CP6 SBP, particularly with regard to estimating the financial risk in the plan. In conducting this project we reviewed Network Rail's published SBP documents, as well as a large number of relevant supporting documents and spreadsheets.⁶

Network Rail has developed SBPs for previous price controls, including one that was (notionally) at route level for control period 5 (CP5).⁷ We understand that Network Rail has followed a more detailed process to develop its CP6 business plan. In particular, the routes have been expected to take greater ownership of the development of their SBPs, although these were underpinned by centrally-provided guidance. This approach was also applied to the estimation of financial risk for CP6.

The process that Network Rail states that it followed is illustrated in Figure 2.1.

Figure 2.1: Network Rail's approach to estimating financial risk



Source: Network Rail

At a high level, Network Rail has taken a five-step approach to its assessment of financial risk:

- **Establishing the baseline.** The routes identified a range of possible unit rates, which they consider to be efficient. Most routes generally established their cost baselines using actual outturn rates from the first three years of CP5. Other sources of information used include national “book” rates provided by Network

⁶ For example, we reviewed: the SBP Financial Framework Assumptions report; Network Rail's Monte Carlo models for Great Britain and for Scotland; and the consolidated files for renewals, opex and income.

⁷ CP5 runs from 1 April 2014 to 31 March 2019.

Rail's centralised functions,⁸ rates benchmarked against other routes, and forecast CP5 exit rates. Within the baseline, the routes were asked to identify and factor the likely efficiencies/inefficiencies and any tailwinds/headwinds they are likely to face during CP6.⁹ The routes were asked to set their cost baselines such that the probability of delivering their plans was assessed to be between P45 and P55.¹⁰

- **Review of the main drivers of risk and uncertainty.** Working with the routes, Network Rail identified the main drivers of risk and uncertainty that it expects to face and estimated that these could lead to up to £4.3bn of additional cost in CP6.¹¹ Network Rail provided relatively little information on the different risk drivers it considered in this part of the SBP development work, but it accepts that it is unlikely all of these risks will materialise to their full extent (and that it would not be good value for money to hold funding for such a large risk allocation). Given that the total value of these drivers is significantly in excess of the proposed risk allocation, this analysis appears to have been less influential in Network Rail's assessment of financial risk.
- **Quantification of risk ranges.** In addition to their central forecasts, the routes were asked to provide estimates of the possible range of outturn income and costs covering approximately 95% of potential scenarios at a relatively detailed level, for example, at sub-asset categories for renewals expenditure.
- **Bottom-up Monte Carlo analysis.** Network Rail used 'bottom-up' estimates of uncertainty provided by the routes for broad cost categories (e.g. operations, maintenance, renewals) to create probability distributions for each of the main drivers of risk. Note that although we understand the process followed we were unable to directly reconcile these risk ranges to the routes' more granular risk ranges discussed above. The probability distributions were then fed into a Monte Carlo model to estimate the likelihood of delivering each route plan to the

⁸ According to Network Rail, these were the cost rates provided by Infrastructure Projects or the Business Review Team, which were advised to the routes to use for the CP6 submission. For example, see [South East Route Strategic Plan](#), p. 65.

⁹ Tailwinds and headwinds refer to any changes in the business environment – e.g. the nature of the activities undertaken by the routes – that would, respectively, either reduce or increase costs.

¹⁰ Network Rail refers to a range of between P45 and P55, rather than a point estimate of P50. Because different routes have taken different approaches to their estimates, Network Rail could not confirm with certainty that all routes applied exactly the same confidence intervals.

¹¹ Examples of the main drivers of risk and uncertainty identified included: inflation (specifically the difference between assumed an actual inflation rates when setting Network Rail's income – up to £1.2bn); outlier weather and other serious incidents (£400m); and availability of access to work sites (£500m). The full list of drivers are outlined by Network Rail in the 'SBP Financial Framework Assumptions' document, February 2018, p18-20.

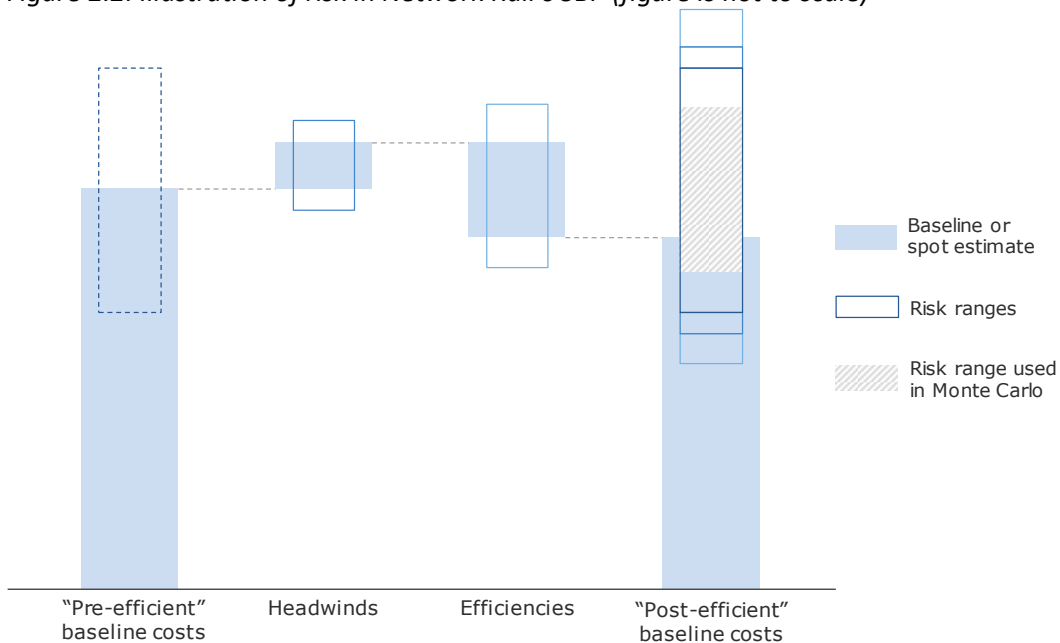
proposed budget. The outputs of this analysis suggest that Network Rail would require an allowance of between £2.5bn (P80) and £3.5bn (P95) for the consequences of risk and uncertainty.

- Top-down Monte Carlo analysis.** Network Rail also conducted a similar exercise using a more simplistic set of assumptions for uncertainty at a high level across the company as a whole. For each category of income and expenditure (support, operations, maintenance and renewals), Network Rail selected risk ranges of +/- 5%, 10% or 20%, based on a centrally-determined 'high level' view on the degree of uncertainty in each part of the plan. The outputs of this analysis suggest that Network Rail would require risk funding of £3.0bn in 80% of scenarios.

We note that, as would be expected, the results of the bottom-up and top-down Monte Carlo modelling were significantly lower than the figure suggested by Network Rail's review of the main drivers of risk and uncertainty (£4.3bn). This is because the Monte Carlo analysis incorporates the probabilities associated with certain risks, and can account for the likelihood that some will materialise whilst others will not.

Through our engagement with Network Rail, they indicated to us that the initial plans provided by the routes resulted in a total funding requirement which was materially above the SoFA envelope. To impose a more structured approach, Network Rail then used top-down analysis to apportion funding between the routes as the basis for the submission of the final route SBPs. However, this may have resulted in the overall risk ranges being narrower than the true risk faced by the routes, as illustrated in Figure 2.2.

Figure 2.2: Illustration of risk in Network Rail's SBP (figure is not to scale)



Source: CEPA interpretation of Network Rail's SBP

Network Rail generated its final financial risk estimate centrally, and tested it against the approach taken in other regulated sectors.¹² Network Rail's proposal is not, therefore, based on a single estimation technique. The amount proposed is at the lower end of the range of potential risk amounts, and in Network Rail's view is set to ensure that the amount of risk broadly reflects a plan that Network Rail can deliver in 80% of scenarios (P80) at a network-level.¹³ In total, the plan includes £2.6bn of risk funding.¹⁴

Network Rail has allocated this risk funding pot into two tiers. The first tier is an amount of headroom held by each route, which Network Rail anticipates they will manage directly. This headroom is in place to ensure that the plan allows for the routes to deliver at approximately P60. The amount of headroom allocated across all of the routes totals at £660m (2.1% of Network Rail's total proposed operations, maintenance and renewals costs for CP6).¹⁵ The remaining £1.9bn (6.2% of Network Rail's total proposed costs for CP6) of the risk fund would be held at a portfolio level – of which £1.7bn is allocated to England & Wales and £0.2bn to Scotland.¹⁶ This second tier is intended to cover greater variations in cost from the underlying assumptions in the plan.

¹² Network Rail's SBP does not specify which sectors it compared its estimates to, but states that equity returns on other sectors range from 9-22% of totex expenditure excluding financing costs. CEPA has not verified these figures.

¹³ Throughout this document we refer to P-estimates such as P50, P60 and P80. This refers to the *confidence level*, or frequency of outcomes, for which Network Rail is able to deliver the CP6 programme for less than the total available funding. It does not refer to the absolute size of the upside and downside risks relative to the baseline. That is, a P50 (median) confidence interval does not mean that the amount of over- and under-spend is equal. It simply means that Network Rail forecasts an equal likelihood of over- or under-spending its baseline.

¹⁴ Although Network Rail did not rely on a single approach to the estimation of financial risk, the £2.6bn figure is approximately consistent with P80 given the range of approaches considered and the evidence provided.

¹⁵ These percentage figures exclude non-controllable operating expenditure. We have excluded this expenditure category because, like the majority of enhancement expenditure, Network Rail is funded for these costs separately. For example: the cost of traction electricity is passed through to train operators; British Transport Police costs (for England and Wales) will be funded outside the SoFA. Depending on how they are treated in the CP6 determination, Network Rail may be exposed to the risk on some remaining industry costs (e.g. business rates and ORR fees). We note that non-controllable operating expenditure is not included in Network Rail's bottom-up Monte Carlo modelling.

¹⁶ Note that since the further £0.2bn is specifically earmarked for Scotland, it can be considered to effectively represent an additional amount of headroom for that route alone.

3. ANALYSIS OF NETWORK RAIL'S APPROACH TO FINANCIAL RISK

This section sets out our key findings in reviewing Network Rail's approach to and estimates of financial risk in the CP6 SBP. We begin by assessing whether it is appropriate for Network Rail to have dedicated funding for financial risk; we then comment on Network Rail's overall approach to financial risk in the SBP; and lastly we assess whether the detailed methodology Network Rail has used is likely to have resulted in reasonable estimates of financial risk. Where relevant, we present case studies of the approaches taken in other sectors.

3.1. Why does Network Rail need risk funding?

The HLOS and SoFA define the broad outputs Network Rail is required to deliver in CP6, and the total funding available to it to deliver these outputs. These outputs will be firmed up by ORR through the PR18 process, which will also establish the funding that Network Rail can earn through track access charges over the next five years.

Like all plans Network Rail's SBP is subject to risk and uncertainty that is difficult to predict up to the end of CP6 (six years from when the SBP is finalised). The costs of its activities may (and likely will) vary from the forecast. Some of the costs and timing of operations, maintenance and renewals work are at this stage uncertain and some risks are outside of Network Rail's control. For example, extreme weather events could require Network Rail to incur unforeseen additional costs to repair its network in order to enable a return to safe operation. Network Rail, therefore, requires some funding specifically to absorb risk, so that it is not forced to re-plan its workbanks every time a risk materialises.

UK government accounting rules do not generally permit the level of flexibility that a business, such as Network Rail, which undertakes multi-year investments typically requires. For instance, the government does not generally fund departments for risk. If government departments overspend they are expected to do less, and if they underspend against their plans, there is limited scope to carry forward surpluses to compensate for overspends in later years. Network Rail is unlike most other government departments in that it has a very substantial physical asset to operate and maintain, and any failure to manage the condition of the network appropriately can have long-term consequences for the performance of the rail system.

We note that enhancements, which are typically considered Network Rail's most uncertain type of expenditure, are funded separately and are outside the scope of this project. The next riskiest category of expenditure is renewals, some of which involves the complete replacement of existing assets, making certain kinds of renewals more akin to enhancement projects. Renewals investment is also Network Rail's main form of

expenditure in CP6, as it constitutes roughly 55% of the costs proposed in the SBP (excluding non-controllable costs, enhancement and risk funding). As such, renewals activity represents a significant but lumpy investment, which requires budgetary flexibility to facilitate effective management.¹⁷

Similar financial pressures apply to other government agencies that manage infrastructure assets with comparable risk profiles. Highways England (HE), for example, approached the first road investment period (RIS1) with a deliberately over-programmed capital programme, as it was expected that some projects would be delayed or drop out of the portfolio as it was refined. However, HE had not accounted for additional cost pressures, nor was it clear to everyone involved that not all projects included in the RIS were expected to be delivered. The National Audit Office (NAO) has been critical of this approach and its views are summarised in Box 1.

Box 1: Highways England (HE) RIS1 capital programme¹⁸

DfT set a RIS1 capital programme expected to exceed funding by £652 million. Over-programming such as this was usual in the Highways Agency (the precursor body to HE) when capital funding was provided on an annual basis, as it was expected that some projects would be delayed or drop out of the portfolio as it was refined. The Highways Agency would typically over-programme by about 10%, and the portfolio of 112 enhancement projects included in HE's RIS1 plan was broadly in line with this. The original investment plan did not include some capital costs such as post-project evaluations, capital investment in IT, costs associated with transforming the organisation, and works running over from 2014-15. Highways England estimated the costs of the above at £409 million.

The cost pressure built into the programme was, therefore, higher than DfT had understood it to be, and it had increased further to £1.2 billion by March 2016. HE has since made some progress in reducing the cost of the 112 projects. However, the combination of the original over-programming and the subsequent additional costs means that, by September 2016, forecast expenditure for the enhancements was £12,727 million - £841 million higher than the available funding of £11,886 million.

Because 69 of the 112 projects were at such an early stage of development when the plan was completed, cost estimates were inherently uncertain. In the NAO's view, it was not clear how far DfT and HE made provision in the cost estimates of the immature projects to account for optimism bias, and risks to scope and costs, as recommended by HM Treasury. A 2007 report

¹⁷ Operations and maintenance activity is more commonly undertaken by the route businesses themselves, whereas renewals and associated activities have historically been procured from the centralised Infrastructure Projects and Route Services functions. Although the routes are the 'customers' in this context, in practice they may have limited control over contractors' performance.

¹⁸ Paraphrased from: [NAO, Department for Transport and Highways England - Progress with the Road Investment Strategy, 22 March 2017](#)

commissioned by DfT concluded that costs for road projects tended to rise sharply because they were announced before there was a clear decision on the precise scope of the work, and recommended that DfT approve funding in stages. Increased scope and cost estimates without a corresponding increase in benefits, should they occur, would weaken the case for investment.

DfT and HE did not put in place a plan to mitigate the risks to the enhancement projects in the RIS at the outset. For example, no plans were made to assess the overall portfolio to identify which projects to prioritise and which to delay or cancel to control the level of over-programming and improve the overall affordability, deliverability and benefits relative to costs. This is despite there being plans to reassess the costs and benefits of individual projects as they developed.

Source: CEPA analysis of the NAO report on HE

DfT and HE are considering how to address the criticisms levelled by the NAO going forward and in the RIS2 business plan, which is currently in development. The NAO reported that:

*'[T]he establishment by the Highways England Board of a board-level investment committee to consider progress with, and risks to, delivery of the overall portfolio of enhancement and renewal projects is a positive step towards strengthening governance. However, to exercise its oversight role effectively, the Department also needs to improve its understanding of the position across the portfolio and offer effective challenge to Highways England. The Department has started to do this in its oversight of Network Rail, through the establishment of a board to consider the risks to the delivery of the plan and the affordability of Network Rail's overall portfolio.'*¹⁹

We consider that **if there were no allocation for risk within the CP6 determination** (i.e. if all the funding that is made available in the SoFA were to be allocated to individual schemes) **it is highly likely that Network Rail would be forced to re-plan and/or cancel activities, resulting in the inefficient delivery of outputs.** Without the flexibility to respond to emerging cost pressures, managers at route-level will have reduced incentive to pursue savings through more efficient work planning. Additionally, such an approach is likely to result in significant additional burden on the regulator as it seeks to monitor Network Rail's performance.

In Box 2 we provide a case study of Scottish Water – a publicly owned body that had dedicated risk funding in its previous regulatory arrangements.

¹⁹ [NAO, Department for Transport and Highways England - Progress with the Road Investment Strategy, 22 March 2017](#)

Box 2: Scottish Water's risk funding

Prior to 2015, Scottish Water had access to two risk funding mechanisms:²⁰

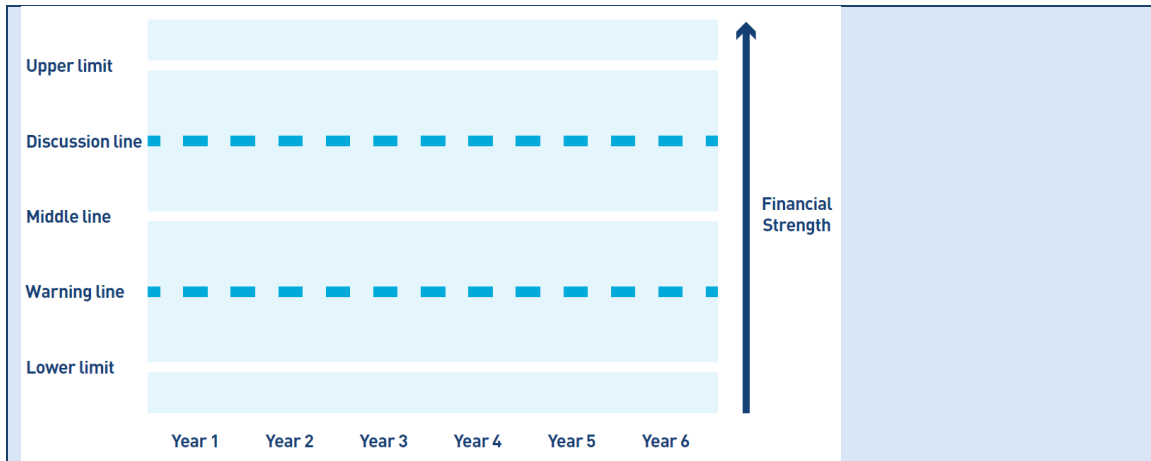
- The *financial reserve* allowed Scottish Water to retain a reserve of funds during each Strategic Review of Charges (SRC), if it outperformed its annual cost allowances. The financial reserve could be used to cover unexpected costs and cost overruns, subject to approval by the Scottish government.
- If Scottish Water was able to sustain any outperformance over the course of an SRC, it was allowed to invest in inflation-linked bonds issued by the UK government (gilts). This arrangement was known as the *gilt buffer*. It offered Scottish Water financial flexibility (subject to approval by the Scottish government) to respond to any unexpected cost pressures in subsequent SRCs.

We understand that the above mechanisms were deemed unnecessarily complex, particularly as Scottish Water has established a track record of outperforming its cost allowances (i.e. its reserves were accumulating). So for SRC 2015-21, the Water Industry Commission for Scotland (WICS) and the Consumer Forum looked for alternative ways of encouraging Scottish Water to take full ownership of its decisions. It was considered that greater financial flexibility afforded to Scottish Water could lead to better value for money for customers. However, WICS also sought to ensure that increased financial flexibility did not expose either current or future customers to any financial shocks.

To achieve these goals, a range for Scottish Water's allowed for level of financial strength was set consistent with long term sustainable funding of the industry. 'Financial tramlines' were established. The tramlines provide a transparent framework for the monitoring of Scottish Water's financial performance. They also allow WICS to assess whether Scottish Water is adequately funded to meet known future challenges. Scottish Water is expected to manage its financial performance within the limits agreed in the tramlines.²¹

²⁰ [WICS, Costs and performance 2007–08, 19 February 2009.](#)

²¹ [WICS, Our initial expectations: Note 7 for the Customer Forum - Financial tramlines, November 2012.](#)



WICS initially intended to set the tramlines to reflect the financial strength that a company would need in order to secure funding from capital markets. This was underpinned by an analysis of key financial ratios and by reference to the credit rating assigned to England and Wales water companies. However, for its final decision WICS decided to set the tramlines by reference to cash balances held by Scottish Water rather than on the basis of specific credit ratios, as this is considered a more accessible approach. Nevertheless, the cash balance figures used in the tramlines are informed by target credit ratios – particularly the ratio of funds from operations to net debt.

If Scottish Water reaches the Discussion line, and is forecast to remain above it for the rest of the SRC, the company is expected to discuss with the Customer Forum how that outperformance would be used (e.g. reduce customer charges or build up the financial reserve). If the Upper limit is hit, and performance is expected to remain above it for the rest of the SRC, outperformance would automatically be shared with customers. On the downside, Scottish Water would be expected to engage with the Customer Forum if it hits the Warning line, while hitting the Lower limit could result in cancellation of planned investment or increases in customer charges.

Source: CEPA analysis of information published by WICS

3.2. Comments on Network Rail’s high-level approach

Below we discuss four elements of Network Rail’s approach to estimating financial risk: (1) using Monte Carlo modelling; (2) targeting risk funding consistent with an 80% confidence interval (P80); (3) asking routes to estimate their own risk ranges as inputs into the Monte Carlo modelling; and (4) the approach to assessing income risk.

Use of Monte Carlo modelling

At a high level, Network Rail has adopted an established method for the quantification of financial risk in its SBP. Specifically, Network Rail’s own view on the required amount of

risk funding was informed by a quantitative risk assessment technique (Monte Carlo simulation). The company's estimate of financial risk is based on two Monte Carlo exercises: a 'bottom-up' simulation based on detailed risk estimated provided by the individual routes, and a 'top-down' simulation based on risk ranges around the various categories of Network Rail activity.²²

Network Rail's proposed risk allowance is consistent with the range of results provided by these models, although we note that it lies at the lower end of the ranges produced. It says that the required amount (£2.6bn, of which £0.3bn is earmarked for the Scotland route) is consistent with an 80% likelihood (P80) of being able to deliver its HLOS with no need for additional funding.²³

One stakeholder suggested that past attempts by Network Rail to estimate risk using Monte Carlo modelling had been ineffective. We have not sought to independently verify this claim, as assessing Network Rail's previous modelling approach is beyond the scope of this project. However, even if Network Rail's previous attempts at this form of modelling have not accurately identified the risk faced by the business, they do not invalidate the use of Monte Carlo modelling *per se*; rather, they bring into question the assumptions used in Network Rail's past models and/or the maturity of its plan at that time.

It is the case that the value of Monte Carlo modelling depends crucially on the quality of the data inputs and the assumptions used, and during the early stages of project development there is often limited available detail on project scope. This makes a robust risk assessment difficult and can justify use of a more pragmatic optimism bias adjustment for budgeting purposes.²⁴ We discuss optimism bias in Network Rail's SBP in section 3.3.

The choice of P80 for risk funding

The degree of required risk funding is ultimately a judgement call. Higher risk funding (e.g. to P95) would reduce the need for Network Rail to request additional funding or to cancel activities as risks materialise in CP6. On the other hand, it would mean that a larger share of public funds would be tied up with Network Rail and may ultimately prove not to have been needed. Put another way, the suitable level of risk funding for Network rail depends on the government's appetite to absorb cost pressures should costs escalate over and

²² Network Rail also told us that it had carried out its own high-level analysis of inflationary pressures in its cost base and the appropriate measure of indexation depending on the cost category. This analysis was used to derive an estimate of the additional costs that might be incurred as result of a decision to move away from indexing Network Rail's revenues to outturn inflation.

²³ This refers only to operations, maintenance and renewals expenditure. Enhancement funding is treated separately.

²⁴ [DfT, Optimism Bias Study – Recommended adjustments to optimism bias uplifts: Final report, 2017](#)

above the SoFA, or to accept the implications of delayed/deferred works for network sustainability and performance.

In our view, Network Rail’s proposal to set the required amount of headroom at approximately P80 is a reasonable approach. It is broadly consistent with some recent comparators including Crossrail (see Box 3 below) and High Speed 2 (HS2), where risk up to the P80 level is held by the delivery company.

Box 3: Crossrail risk funding

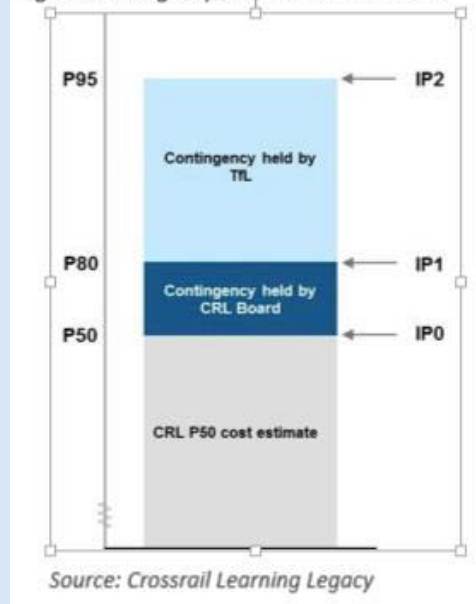
Crossrail is expected to deliver significant benefits to users and the economy more widely, so it is considered important that it be delivered on time to prevent these benefits being delayed. As a consequence, the project was funded up to the P95 cost estimate, but governance arrangements are in place to manage the risk fund – see diagram.

The Crossrail Board held a portion of the project contingency (up to P80) but the bulk of contingency was held by Transport for London (TfL). This gave the Crossrail company an incentive to manage over/underspends without recourse to project sponsors. Contingency was committed but ring-fenced, and there were governance arrangements before project management could access it.

Governance arrangements included ‘Intervention Points’ based on forecast costs. These provided the mechanism for the project sponsors to control cost overruns. Incentives for the management team and delivery partners to minimise spend were clear-cut and aligned behaviour with sponsors. This promoted effective delivery at lowest final cost, and ensured that the final costs did not exceed committed funding from the sponsors.

A Project Representative was appointed by the sponsors and helped to reduce information asymmetry when Crossrail asked for more money or for expenditure to be deemed efficient. Its responsibilities included: (i) advising the sponsors on any increase in the risk of triggering the Intervention Points; (ii) providing independent, informed advice to the sponsors on progress in respect of time, costs and quality; and (iii) providing the sponsors with oversight and analysis of any changes in scope of work.

Figure: Contingency and Intervention Points



Source: CEPA analysis of information published by Crossrail

As noted in section 2, Network Rail has split its risk funding into two tiers:

- each route was allocated specific “headroom” funding that it would control and would provide it with a buffer up to around the P60; and
- the remaining risk funding would be held in a central portfolio risk fund, which routes would have to request access to (the amount for the Scotland route would be ring-fenced).

We think such a split is reasonable – the headroom at route level allows routes to address risks efficiently without the bureaucracy that would be involved in centrally-held funds. At the same time, it is appropriate that not all risk funding is allocated to the routes because it would be inefficient to tie-up large sums of risk funding for each route when such risks are unlikely to materialise across all routes during CP6. By having a centrally held fund to manage the risk between the P60 and P80, the overall amount of risk funding required by Network Rail is lower. This is known as the ‘portfolio effect’. We also note that the two-tier approach is consistent with the approach to funding risk for Crossrail, as discussed in Box 2.

The cut-off point between route-level headroom and centrally-held risk funding is, ultimately, a judgement call. We have found no reason to reject Network Rail’s proposed split of route-level at the P60 and overall risk funding at the P80. Whatever the allocation of risk funding, it is important that appropriate and proportionate monitoring and governance arrangements are in place. It is beyond the scope of this project to comment on what those arrangements should be for CP6 but the WICS and Crossrail examples provide an indication of options.

Approaches taken by different routes

Our review of routes’ individual business plans, as well as some of the underlying data regarding baseline costs, volumes of work and risk parameters, points to substantial differences in the approaches taken by different routes to estimating financial risk. This highlights the gap in the maturity of each of the routes’ investment plans and where they are in the investment cycle.

It is reasonable for different routes to seek to best reflect their particular circumstances. For example, routes that are planning greater renewals activity during CP6 would be expected (all else being equal) to require more risk funding. However, we were unable to identify a clear link between how a route characterised its investment plans for CP6, and that route’s risk estimates. This lack of consistency between the routes then could undermine the Monte Carlo modelling that relies on routes’ estimates. Overall, it raises doubt over the accuracy of Network Rail’s risk estimate, although we note that Network

Rail has not solely relied on the modelling to derive its risk estimate, which may mitigate some of our concerns in this regard.²⁵

Table 3.1 provides a high-level summary of the investment plans described in each route SBP. London North West, for example, mentions that construction of HS2 will affect its route through increased train volume leading to greater wear and tear on its infrastructure, as well as the impacts of construction and the need to build new depots. The South East route notes that historically funding levels have not matched the economic and social significance of the route, suggesting that it might be facing a period of uncertainty as it tries to catch up with a legacy of underinvestment. Wales, on the other hand, discusses major investment during the CP5 and previous periods, suggesting that it will be entering a period of relative stability (steady state) in CP6.

Table 3.1: High level narrative of the routes' CP6 investment plans

Route	Route's own characterisation of its investment needs in CP6
Anglia	Many improvements were delivered during CP5, but some uncertainty remains around Elizabeth Line, particularly with new stations opening. As with other routes, more renewals will be completed in CP6 than in CP5, but overall, the SBP reflects the route being at a relatively stable stage in their investment cycle.
London North East and East Midlands	The SBP describes CP5 investment in three corridors: Midland Main Line, Transpennine and East Coast Main Line, but notes that in some cases the benefits are not being realised due to old infrastructure that needs replacing.
London North West	In CP6 London North West will be directly impacted by the construction of HS2. Their SBP mentions that increased train volume from HS2 trains will mean more wear and tear on infrastructure, as well as the impact of construction, building new depots, and increased freight volume. The SBP also notes the age of assets at Marylebone, suggesting these might require investment soon.
Scotland	The Scotland route claims improvements throughout CP5, including the Borders Railway (opened in 2015) and new high-speed trains, leading to big increases in capacity across the network. The SBP narrative reflects a steady-state business cycle, and suggests that most improvements will come from workplace safety and better customer experience, as well as increased weather resilience.
South East	South East's SPB notes that historically funding levels have not matched the economic or social significance of the route. Challenges for CP6 include asset condition, and the introduction of Thameslink. Like a number of other routes, the CP6 SBP includes a backlog of renewals owing to under-delivery in CP5.

²⁵ As part of discussions during this project, Network Rail commented that by taking a portfolio approach to risk funding the impact of any inaccuracies at the route level is reduced. However, we remain of the view that the bottom-up Monte Carlo analysis could be undermined by the lack of consistency between routes. For example, if certain routes have systematically over-/underestimated certain risks.

Route	Route's own characterisation of its investment needs in CP6
Wales	SBP notes there was high investment during CP5, including electrification of the Seven Tunnel, and re-signalling of the North Wales Coast. The plan focusses largely on the areas of safety, reliability, and affordability. Narrative suggests that, given recent investments, the route is in a steady state in their business cycle, and expect to experience some more stability during CP6.
Wessex	Large enhancement at Waterloo station was recently completed, however, some renewals were deferred from CP5 to CP6 due to cost constraints. SBP notes several proposed enhancements on the route for the next 10 years, such as Crossrail 2 and the Woking Flyover, which would require coordination with renewals work.
Western	There has been significant investment in the route during CP5, including the Elizabeth Line, electrification of major sections of the route, introduction of higher frequency, and new long-distance services. The SBP notes that in CP6 there will be some uncertainty around the construction of Old Oak Common station for HS2, which may impact performance.

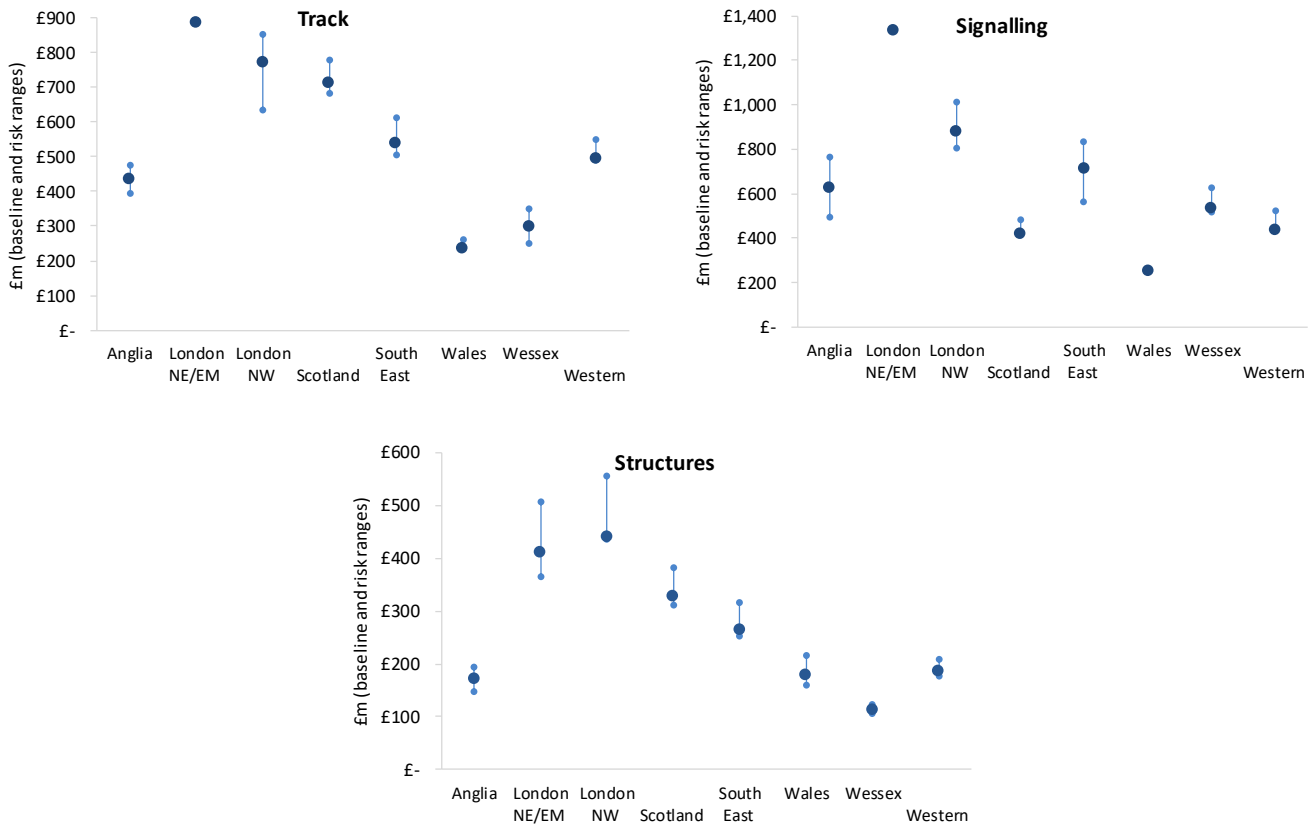
Source: CEPA review of route SBPs

Our review indicates, however, that the approach taken to estimation of risk at a route level, and the level of transparency of evidence provided, varies widely. By way of illustration Figure 3.1 shows the risk ranges around the baseline provided by the routes for their three largest categories of renewals costs – track, signalling and structures. Although we might expect that routes planning greater renewals activity during CP6 to have greater uncertainty ranges, the connection between these uncertainty ranges and the more qualitative characterisation of the investment cycle provided in the SBPs (and summarised in table 3.1) is not always clear. In some cases, such as the Wales route, there is relatively low uncertainty around the baseline costs, reflecting its characterisation of being in a steady state investment stage. In other cases, such as the South East route, we might expect to see wider uncertainty ranges given concerns about asset deterioration as a result of past underinvestment.

We also note that, as shown in section 2, Network Rail's assumed risk funding for England & Wales and for the Scotland route represents approximately the same proportion of forecast operations, maintenance and renewals costs.²⁶ we would have expected the proportion of risk funding required by the Scotland route to be larger than for England & Wales because Scotland is funded separately and, as such, is less able to benefit from the 'portfolio effect' that applies to Network Rail's other routes.

²⁶ Specifically: 8.2% for England and Wales; 8.5% for Scotland. These figures exclude non-controllable operating expenditure.

Figure 3.1: Risk ranges around routes' baseline costs



Source: CEPA analysis of Network Rail SBP data

Approach to income risk

In the sections above we have focused on risk in relation to the most material expenditure categories, and particularly the three largest types of renewals costs, as these are likely to have the largest impact on the risk estimate. Network Rail also faces certain income risks which could affect the amount of risk funding required. These include Schedule 4 and Schedule 8 payments, variable track access charges and non-regulated income sources (e.g. rental income from its property portfolio).

Network Rail told us that the routes had submitted ranges around the central income forecasts in their SBPs to ensure the same treatment as the other risk categories. These ranges were also factored into the Monte Carlo analysis. While we reviewed Network Rail's income risk as part of this project, we note that the materiality of income risk is significantly smaller for the purposes of assessing Network Rail's approach to financial risk, compared to expenditure on renewals and operating costs.

Network Rail’s assessment of income risk is overwhelmingly focused on the risk of income being lower than the baseline assumption. This does not change our overall assessment of the financial risk estimates in the SBP, as discussed in section 3.4.

3.3. Appropriateness of key assumptions in the SBPs

Having reviewed Network Rail’s high-level approach, we now comment on its detailed methodology for estimating financial risk. We discuss the following issues:

- risk factors that are omitted or underrepresented in Network Rail’s estimates;
- risks related to baseline volumes of work;
- risks embedded in baseline unit costs;
- risk ranges around headwinds and efficiencies;
- assumptions underpinning Network Rail’s Monte Carlo modelling;
- risks related to general inflation; and
- Network Rail’s assumption regarding budgetary flexibility.

Omitted risk factors

Our review of the business plan finds that Network Rail does not appear to have fully explored certain factors that are likely to have a material impact on the risk its business faces in CP6. In particular:

- **Supply chain capacity.** Delays related to the supply chain are one of the leading factors behind Network Rail’s underperformance of expectations in CP5. Route business plans make statements about better management of the supply chain in CP6.²⁷ But, with the exception of the South East and Western routes, we have found little evidence that the plans are underpinned by detailed consideration of supply chain capacity and risks. We think this is a significant omission from Network Rail’s risk assessment, particularly in light of growing competition for specific resources from other major infrastructure programmes (e.g. HS2).

²⁷ For example, the London North Eastern & East Midlands route states that one of the key assumptions underpinning its business plan is “The supply chain has the capacity to deliver the volume of work that is in the current plan” (see: [London North Eastern & East Midlands Route, Route Strategic Plan, January 2018](#), p. 115).

- **Brexit uncertainty.**²⁸ The impact of the UK’s decision to leave the European Union on Network Rail’s business is not yet known, but the potential consequences are wide-ranging and merit consideration. For example, changes in the Sterling exchange rate could affect the price of inputs. Changes in the availability of labour might place upward pressure on wages and/or constrain the supply chain’s ability to deliver the full scope of the SBP. Slower economic growth could reduce the volume of passenger and freight journeys.

We recognise that these impacts are too uncertain to forecast at the present time, but at a minimum there should be a discussion in the SBP of the potential outcomes for all aspects of Network Rail’s business. Putting numbers to this may be very difficult at present time so, as we discuss further in section 4, there may be a need for a specific uncertainty mechanism in the CP6 determination to deal with Brexit risk.

Overall, the omission of the risk factors discussed above would suggest that **(all else being equal) Network Rail’s risk estimate does not fully capture the financial risks the company could be exposed to in CP6.**

Volumes

The SBP sets out a vision for a large increase in operations, maintenance and renewals expenditure compared to CP5. Routes are forecasting a £4 billion (29%) increase in renewals compared to CP5; and a £1.5 billion (16%) increase in operating and maintenance expenditure.²⁹ Network Rail argues that this is required because the network is bigger and the number of people using it has been growing.³⁰ But it is also because there is a large backlog of activity that was planned for CP5 but has not been delivered and which the company expects to catch-up to in CP6.

Some of the increase in expenditure is due to higher unit costs (see next section), but there are also some substantial increases in the volume of work forecast by some routes – see Figure 3.2. For example, Anglia and Wessex are forecasting over 600% and 500% increases in signalling work volumes, respectively.³¹ With regard to track works – most routes’ largest category of renewals expenditure – large increases are forecast by London

²⁸ In discussions with Network Rail, the company stated that its uncertainty ranges for general inflation included some risks related to Brexit. We note that Brexit could have material impacts on Network Rail’s costs and revenues beyond general inflation.

²⁹ Both figures are after accounting for efficiencies and headwinds assumed by the routes.

³⁰ We note that, according to [data published by the ORR](#), total passenger journeys have increased by 9% since the start of CP5 and total passenger kilometres have increased by 7%. In the last ten years, these figures have grown by 51% and 36%, respectively.

³¹ This includes volumes for digital signalling.

North West and Wessex (over 60% and 70%, respectively), driven by significant increases in refurbishment work.

Figure 3.2: Summary of forecast volumes in routes' plans



Source: CEPA analysis of Network Rail SBP data

Based on Network Rail’s underperformance during CP5 and the substantial deferral of renewals that has occurred to date, we consider there to be a clear risk that the step up in work volumes forecast in Network Rail’s CP6 baseline would not be deliverable. This would suggest that the volume of investment that is assumed in the current plan may be higher than a true central estimate, and so **the baseline is likely to overstate the P50 total cost estimate** (put another way, some of the forecast volume would be better suited for inclusion in the risk estimate than in the baseline).

Additionally, we note that there appears to be little direct relationship between changes in volumes forecast by routes and the risk ranges estimated by the same routes around their cost baselines. Normally, we would expect a route that is forecasting a significant increase in a particular activity (as is the case, for example, for Anglia and Wessex with signalling work) to have correspondingly wide risk ranges. But this is not always the case, as evidenced when comparing Figures 3.1 and 3.2.

Unit rates

As a general rule, the routes have tended to use actual costs incurred in the first three years of CP5 to set the unit rates that underpin their forecast of the CP6 baseline.³² These are then adjusted by assumptions for headwinds and efficiencies (discussed in the next section). We note that in its latest annual assessment of Network Rail's efficiency, ORR found that the efficiency of Network Rail's core business activities had declined by 4% over the first three years of CP5 compared to the PR13 determination, which assumed a 14% improvement.³³ That increase in inefficiency is 17% for renewals over the same period.³⁴

Some of that inefficiency represents risk that materialised during CP5. By using CP5 figures to set baselines for CP6, and then estimating risk ranges about those baselines, it is likely that Network Rail's approach has resulted in double-counting of some risks. The result is that **Network Rail's figures likely overstate the P50 baseline cost estimate, with some of the costs included in the baseline better suited to being in the risk estimate.**

Headwinds and efficiencies

Having identified "pre-efficient" costs (for example, using actual costs in CP5), routes calculated their baseline costs for CP6 after accounting for their forecasts of efficiencies/inefficiencies and tailwinds/headwinds.³⁵ These are the factors that would either increase (headwinds) or decrease (efficiencies) costs compared to the "pre-efficient" level. Each of the routes quantified the impact of the headwinds and efficiencies on their operations, maintenance and renewals activity by asset type, and provided a range around the point estimate to reflect uncertainty.

Figure 3.3 plots routes' risk ranges for headwinds for the three largest categories of renewals. We observe that, more often than not, the routes have picked spot rates for headwinds that are at or towards the bottom of their estimated ranges.³⁶ That is, routes' baselines include assumptions of the lowest level of headwinds that they foresee. The consequence is that Network Rail's financial risk estimates include primarily the risk of

³² CP5 actuals were not the only source of cost baselines – as noted in section 2, routes also used national "book" rates provided by Network Rail's centralised functions, rates benchmarked against other routes, and forecast CP5 exit rates.

³³ [ORR, Annual efficiency and finance assessment of Network Rail 2016-17, October 2017](#)

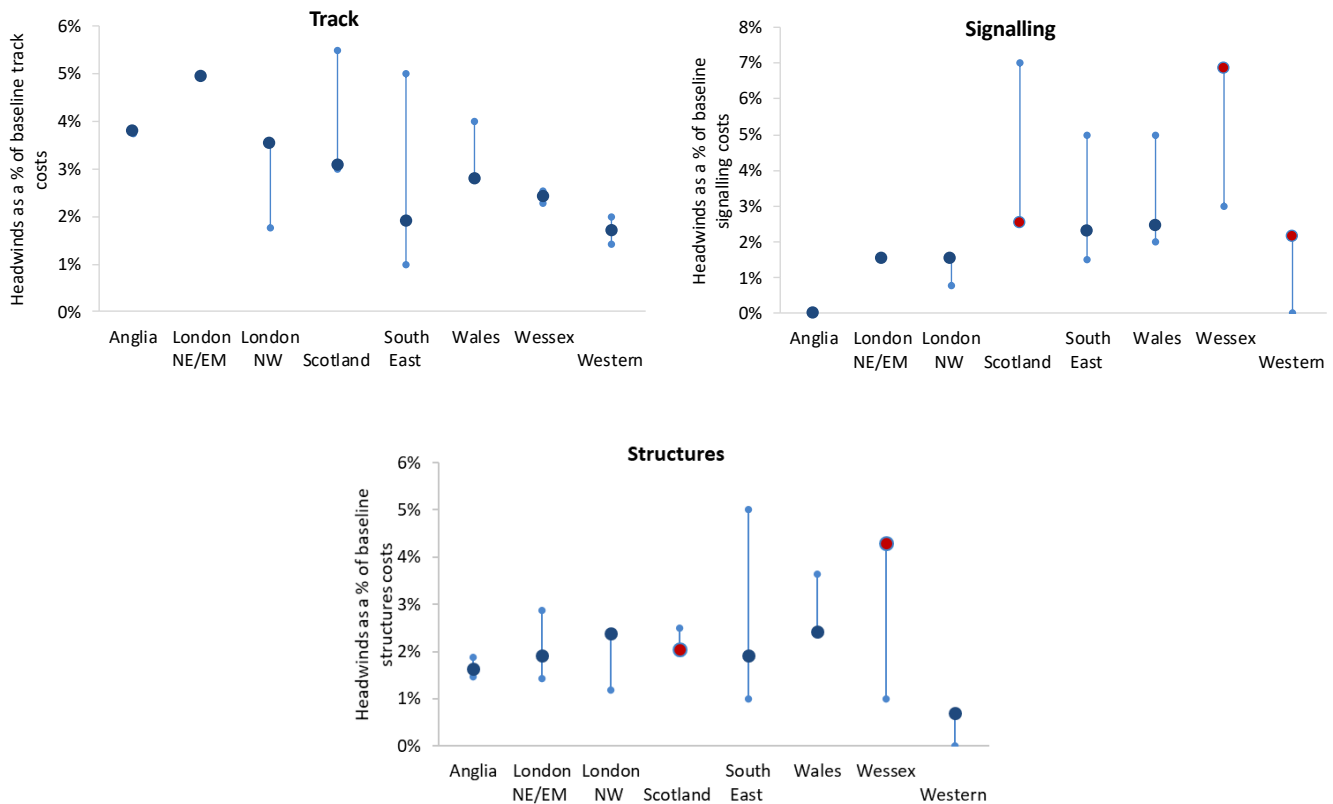
³⁴ As part of this review we engaged with Network Rail, who commented that its performance against the CP5 allowances was a function of allowances set for that period being unachievably optimistic, rather than representing growing inefficiency on Network Rail's part.

³⁵ We note that none of the routes have provided estimates for inefficiencies, nor for tailwinds.

³⁶ We note, however, that London North West, Wessex and Western actually used spot estimates that were at the top of their risk ranges for signalling and for structures.

higher headwinds. **All else equal, this increases Network Rail’s financial risk estimate, but the impact on the risk estimate is likely to be small.**

Figure 3.3: Uncertainty ranges around routes’ headwinds estimates

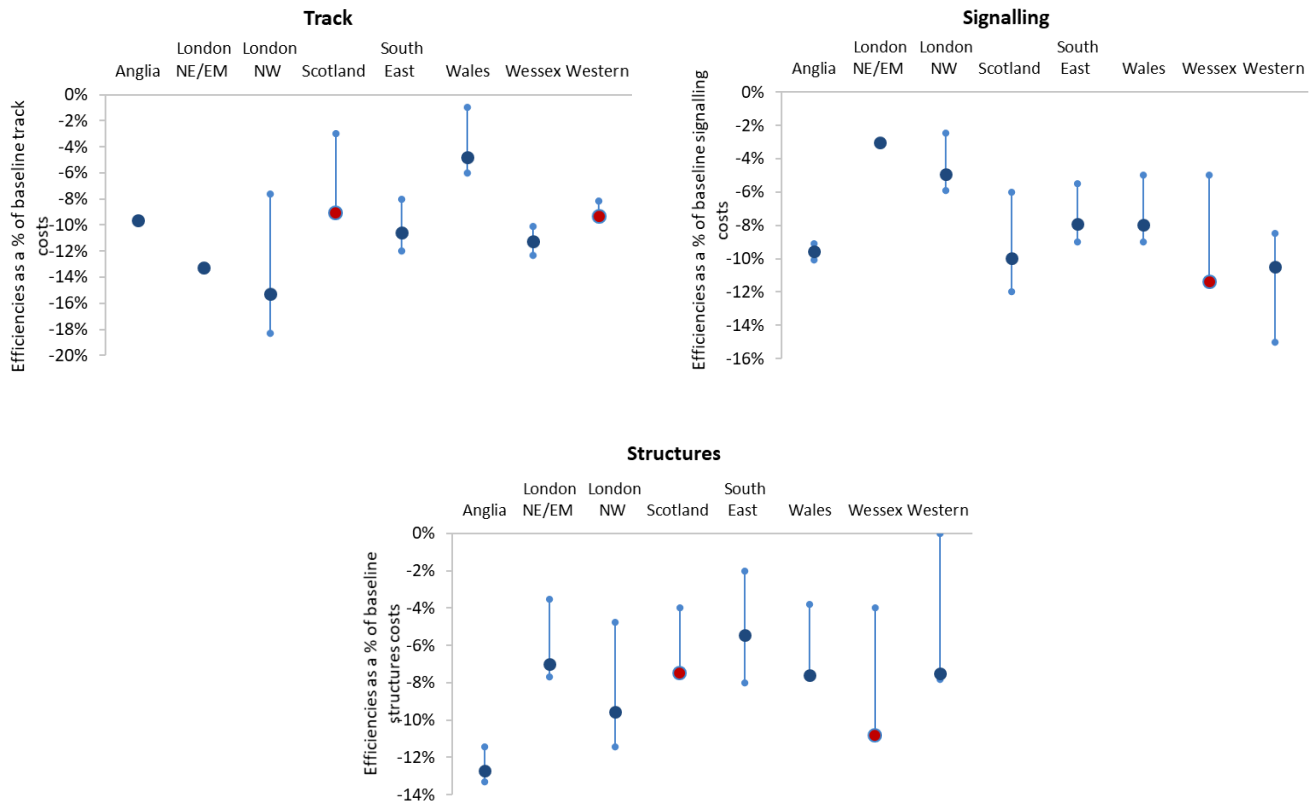


Source: CEPA analysis of Network Rail SBP data

Note that number of routes’ spot estimates were outside of their own risk ranges. Where that is the case, we show their spot rate in red in the charts above and place it at either the top or bottom of the risk range (as relevant). We estimate that these anomalies are likely to have a small impact on Network Rail’s overall risk estimate, although they do point to the need to ensure that the basis for risk estimates is accurate.

A similar pattern is observed when looking at the routes’ efficiency risk ranges for the three largest categories of renewals (see Figure 3.4). The routes’ baselines include spot rates for efficiencies that assume the largest (or near-largest) efficiencies that each route foresees. The consequence is to compound the effect observed about regarding headwinds – Network Rail’s financial risk estimate includes primarily the risk of lower efficiencies being achieved. **All else equal, this increases Network Rail’s financial risk estimate, but the impact on the risk estimate is likely to be small.**

Figure 3.4: Uncertainty ranges around routes' efficiency estimates



Source: CEPA analysis of Network Rail SBP data

Note that number of routes' spot estimates were outside of their own risk ranges. Where that is the case, we show their spot rate in red in the charts above and place it at either the top or bottom of the risk range (as relevant). We estimate that these anomalies are likely to have a small impact on Network Rail's overall risk estimate, although they do point to the need to ensure that the basis for risk estimates is accurate.

Correlations used in Network Rail's Monte Carlo modelling

Network Rail's Monte Carlo modelling was done at total cost level, so risks around the unit costs and volumes were not considered separately. The risk around unit costs can be expected to be positively correlated across routes and between cost categories – for example an increase in the price of labour or in imported materials would feed through to costs faced across Network Rail. But volumes may have negative correlation as a result of management decisions regarding sequencing and scoping of work. By modelling at total cost levels, this nuance is lost.

Network Rail's approach correlations is likely to result in a higher estimate of financial risk across the business as a result, all else equal. Although we recognise that attempting to model risk at a more granular level can produce a spurious sense of accuracy

(particularly given the inconsistencies in the underlying data), we would at least expect some discussion of this issue in the SBPs.

Risks related to general inflation

The SoFA is set in nominal terms using forecasts of general inflation (as measured by the Retail Prices Index (RPI)).³⁷ Network Rail has stated that many of its input costs (e.g. staff, contractors, plant and materials) are linked to measures of general inflation – either the RPI or the Consumer Prices Index (CPI).³⁸ Unless its income (both grant and access charges) is also linked to a measure of inflation, Network Rail could face the risk that outturn inflation is different from the SoFA assumptions.

Network Rail sought to capture this risk in its Monte Carlo modelling by including risk ranges that are 50% higher and lower than the central inflation forecast. We think it is appropriate for Network Rail to include general inflation risk in its estimate. By anchoring its risk ranges to a central forecast of inflation Network Rail’s approach is unlikely to account for very large variations in inflation as might be caused, for example, by Brexit. As such, **Network Rail’s approach may have captured a smaller inflation risk than the company might be exposed to in CP6.**

Budgetary flexibility

Network Rail has assumed that it will have full budgetary flexibility, both between years and between capital and resource spending. We do not comment on whether that is likely to be the case or not, but **all else being equal the assumption reduces Network Rail’s risk estimate** (i.e. if Network Rail did not have budgetary flexibility it would need more risk funding in each year).

3.4. CEPA’s view on the reasonableness of the financial risk estimate

In the previous section we reviewed the underpinning assumptions behind Network Rail’s financial risk estimates to assess whether the resulting estimates are reasonable. In our view, Network Rail has made a number of methodological decisions that could be reasonably debated. Some of the underpinning assumptions result in a *higher* risk estimate in its plan than would otherwise be the case, but we assess these to have a relatively small impact on the overall risk funding required by Network Rail. Conversely, other elements of Network Rail’s approach result in a *lower* risk estimate than would otherwise be the case, and we assess that these may have quite a material impact on

³⁷ The forecasts used are the Office for Budget Responsibility’s RPI forecasts from April 2017.

³⁸ See: ‘SBP Financial Framework Assumptions’, February 2018, p. 32.

Network Rail's required risk funding. These assumptions are summarised in Table 3.2, where we also set out the expected impact of correcting them.

Table 3.2: Summary of our assessment of Network Rail's risk estimates

Issue	Impact on Network Rail's financial risk estimate	Materiality
Omitted risk factors such as supply chain constraints and the impact of Brexit	Correcting for the missing risk factors would increase the required risk funding	Likely to be high
Assumed volumes of work	Volumes in the baseline are likely to overstate the P50 probability; moving them to the risk pot would increase the required risk funding	Low-medium ³⁹
CP5 actual costs used to set CP6 cost baselines	Some costs are likely to include inefficiency and materliased risk; adjusting for this would reduce the required risk funding	Difficult to say with confidence, but we expect the impact to be low-medium
Headwinds spot rates are in the lower end of corresponding risk ranges	To reflect P50 probability, spot rates should be closer to the middle of risk ranges; this would reduce the required risk funding	Very low
Efficiency spot rates are in the upper end of corresponding risk rates	To reflect P50 probability, spot rates should be closer to the middle of risk ranges; this would reduce the required risk funding	Very low
Modelling assumptions regarding the correlation between costs	Accounting for management ability to sequence work would reduce the required risk funding	Network Rail has argued that correlations have a very low impact on the overall risk estimate
Assumption of full budgetary flexibility	Assuming no flexibility between years or between resources and capital would increase the required risk funding	Difficult to say with confidence, but we expect the impact to be low-medium

Source: CEPA review of route SBPs

³⁹ On the one hand, more activity would be moved into the risk funding pot. On the other hand, the baseline would be smaller, so that the impact of routes' risk assumptions (expressed in percentage terms relative to the baseline) would be smaller in monetary terms.

Overall, we conclude that when the above factors are considered together it is likely that Network Rail's estimate of financial risk for CP6 is too low to provide an 80% likelihood that the SBP could be delivered without requiring additional funding. In Box 4 we compare Network Rail's estimates to ones derived from a conventional measure of financial risk.

Box 4: Variation in annual returns under Ofgem's price control periods

Both Ofgem and Ofwat use the metric 'return on regulatory equity (RoRE)' to estimate regulated companies' performance in terms of its impact on shareholder returns. RoRE is based on the assumption made by the regulator regarding the share of companies' assets that are financed by debt and equity ('notional gearing'). RoRE is averaged over the course of each price control period in order to minimise the impact of changes to the timing of expenditure. As such, RoRE may not perfectly match the returns that companies report in their annual accounts.

For the purposes of our analysis, however, we are interested in the annual variance in RoRE. Data provided by Ofgem for the current price control periods of energy network companies (RIIO-1) shows an annual variation in RoRE as a result of over- or under-spending by the companies ranging from around 15% (underspend) to -8% (overspend).⁴⁰

We note that Ofgem operates a 'sharing mechanism' for expenditure. Network companies retain between 43% and 70% of any over- or under-spend. The remainder is borne/retained by customers. If we exclude the impact of the sharing factor, the RoRE range widens to between 30% and -15.5%.

In the table below we illustrate how the downside RoRE figures listed above would translate to financial risk estimates for Network Rail and for each route.⁴¹ Our calculations use the estimated values of the regulatory asset base (RAB) in Network Rail's SBP, and assume that Network Rail's notional gearing is 62.5% - as per the PR13 final determination. The resulting risk ranges are £3.5bn - £6.8bn for Network Rail in total – notably higher than Network Rail's own risk estimates.⁴²

⁴⁰ The period in question covers 2013/14-2020/21 for gas distribution and electricity and gas transmission, and 2015/16-2022/23 for electricity distribution. The RoRE figures we use are based on actual expenditure figures for past years, and on companies' forecasts for future years. Note that we only consider here the RoRE impact of expenditure, whereas Ofgem's price controls also offer companies rewards/penalties for performance against a number of performance measures.

⁴¹ Our calculations exclude Network Rail's centralised functions.

⁴² As we note in Section 2, Network Rail has conducted its own analysis of the risk funding implied by equity returns achieved in other regulated sectors, which it estimates would give the company between £2bn and £6bn. This is outlined briefly in the 'SBP Financial Framework Assumptions' document, p. 23.

Route	CP6 opening RAB in Network Rail's SBP (£ million)	Risk funding based on RoRE downside (£ million)		Risk funding in Network Rail's SBP (£ million)
		8%	15.5%	
Anglia	5,132	257	497	245
LNE/EM	14,178	709	1,373	530
LNW	14,838	742	1,437	499
Scotland	7,162	358	694	399
South East	10,173	509	986	135
Wales	3,593	180	348	234
Wessex	4,984	249	483	246
Western	9,647	482	935	281
System Operator	80	4	8	18
Network Rail total	69,786	3,489	6,761	2,595*

Source: CEPA analysis of Ofgem and Network Rail data

* Note that Network Rail's risk funding estimate includes £8 million for the Freight and National Passenger Operations route.

4. CONCLUSIONS

In this section we summarise our findings and draw out recommendations for: the way the ORR accounts for financial risk in CP6, Network Rail's future estimates of financial risk, and the approach DfT and Transport Scotland should take to the funding of financial risk.

Network Rail's overarching approach to estimating financial risk is reasonable. It has used standard and, therefore, widely applied methodologies to produce a range of financial risk estimates. We think it is reasonable for Network Rail to draw on different estimation techniques, as a more deterministic approach to estimating financial risk may have given a spurious sense of accuracy that cannot be supported by the quality of the underlying estimates.

Network Rail appears to have given the greatest weight to the estimate produced by 'bottom-up' Monte Carlo modelling that was based on risk ranges provided by the routes for individual cost categories. Monte Carlo analysis is an established and accepted approach to the quantitative estimation of risk in this context.

We recognise that the SBPs were developed in a challenging and evolving context and that there are pressures on Network Rail to keep the financial risk amount low. Ultimately, the 'right' amount of risk funding is a judgement call for the ORR, DfT and Transport Scotland, but we consider that an amount roughly equivalent to the P80 anticipated cost provides a reasonable contingency that is broadly consistent with recent comparators, including Crossrail and HS2.

Recommendation 1: Risk funding

The ORR's determination for CP6 should ensure that Network Rail has sufficient funding to absorb risk to its costs and income, so that it is not forced to re-plan its workbanks every time a risk materialises. We think that an amount of risk funding that is roughly equivalent to the P80 anticipated cost and income risk would provide reasonable contingency. It is appropriate for some of that risk funding to be held at route level and the remainder to be held centrally.

There are areas where Network Rail's approach could be improved. In particular, despite planning guidance being issued, the approach taken and transparency of estimates at route level varies widely. Network Rail appears to have established a structured process to derive the risk estimates. However, we were not always able to trace a clear and consistent line between the detailed input assumptions provided by the routes and the values used to inform the Monte Carlo analysis and the published SBPs. Our sense is that the key documents covering financial risk (route-level SBPs; Monte Carlo modelling; and detailed cost baselines, headwinds and efficiencies, and risk estimates) were developed

in relative isolation from each other, serving different purposes. As such, we are concerned that the underlying business plans may not represent a consistent basis from which to develop an accurate risk profile of Network Rail's activities in CP6.

Routes should be applying a consistent approach to the estimation of risk, and Network Rail should build in processes to ensure consistency and comparability across routes. Nevertheless, the routes will face different risks and different levels of exposure to individual risk drivers, so even a more consistent approach would likely result in a degree of variation between routes. This would be appropriate given their different risk profiles.

Recommendation 2: Risk allocation between the routes

Network Rail should ensure the routes have applied the SBP guidance consistently and that there is a clear line of sight from the each route's own risk assessment to the overall financial risk proposal. In particular, Network Rail should establish whether financial risk funding has been allocated appropriately between the routes, given the underlying risk assumptions, and noting the separate funding arrangements for Scotland.

We also conclude that the cost baselines provided by Network Rail, which are primarily based on outturn costs in the first three years of CP5, include inefficiency that is due in part to risk that has materialised during CP5. This means some inefficiency and risk is already included in baseline costs. As a result, it is likely that Network Rail has double-counted some risks in its estimate.

Recommendation 3: Baseline costs

ORR should assess efficient costs for use in baselines (it may want to provide guidance to Network Rail on how efficient costs should be identified for the baseline, and request Network Rail to resubmit the relevant parts of its plan).

Moreover, given performance levels in CP5 so far, it is unclear whether the increase in workload envisaged by Network Rail for CP6 can be delivered in practice. The ORR should make sure that it has a clear understanding of what the impact on outputs envisaged for CP6 would be of certain works not being delivered. More importantly for this study, the increase in volumes assumed in the SBP is unlikely to represent a P50 confidence interval.

Recommendation 4: Deliverability of the business plan

ORR should ensure that the baseline only includes volumes of work that can be reasonably considered to represent P50 (it may want to provide guidance to Network Rail on how efficient volumes should be identified for the baseline, and request Network Rail to resubmit the relevant parts of its plan).

There is also uncertainty about how much budgetary flexibility Network Rail will have. From a government perspective it is clear that there is a strong expectation that current levels of flexibility will not continue to be available to Network Rail in CP6. However, the company has assumed full budgetary flexibility between renewals and opex, and across years. In the absence of final guidance from government, we cannot take a firm view on whether Network Rail's assumption is reasonable. We simply note that the assumption has the effect of reducing the range of financial risk, but Network Rail does not appear to have considered the impacts of a scenario in which this flexibility is not available.

Recommendation 5: Budgetary flexibility

Network Rail should produce a version of its 'bottom-up' Monte Carlo modelling in which no budgetary flexibility is assumed. It should state what the impact is on its financial risk estimates of this assumption (i.e. what is the increase in the required risk funding).

We also conclude that Network Rail has not fully explored some of the downside risks the company faces in CP6 and what this could mean for financial risk over that period, including the capacity of the supply chain to deliver the plan, and the impact of Brexit. The combined impact of this is that Network Rail's estimated risk ranges are likely to be narrower than the true range of risks it will be exposed to during CP6.

Some of these impacts, Brexit in particular, are too uncertain to be dealt with *ex ante* risk funding. Instead, we recommend that a regulatory mechanism is developed to deal with these risks should they materialise, or when their potential impacts are better known. Network Rail already has a general re-opener in case of material changes in its circumstances during the price control period. But there may be benefit in providing a re-opener specifically to deal with Brexit risks. For example, this might mean defining the circumstances under which the SoFA would be reopened to agree extra funding or a reprioritisation of outputs. A dedicated re-opener would also make it clearer what risks Network Rail could be exposed to during CP6, which would aid in determining the appropriate risk funding.

Recommendation 6: Risks related to Brexit

The relevant parties (ORR, Network Rail, DfT and Transport Scotland) should agree on a set of conditions that, should they materialise post-Brexit, would lead to the CP6 settlement being re-opened.

Overall, we make the following conclusions:

- Network Rail's proposed **cost baselines are likely to be too high** (i.e. not be P50), as they are based on some cost inefficiency from CP5 and on a significant increase in work volumes that may not be deliverable.
- Within the SoFA funding envelope, Network Rail's proposed **amount for financial risk is likely too small** (i.e. more of the funding should be moved from the baseline to the risk pot).
- The true range of risks is likely to be higher than estimated by Network Rail, particularly as some key risks are unaccounted for. This suggests that there is a **less than 80% probability that the CP6 business plan could be delivered within the proposed funding envelope without outputs being cancelled.**

Recommendation 7: Re-estimation of financial risk

ORR should use an estimate of financial risk that better reflects P80. This means moving some of the costs from the baseline to the risk pot, and recalculating the risk estimate with all relevant risks accounted for (ORR may want to request Network Rail to resubmit the relevant parts of its plan, and provide guidance on how the risk estimate should be calculated).