

**Network Rail October 2007 Strategic
Business Plan**

Supporting document

Response to LEK/OXERA study

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Network Rail

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Top Down Analysis

Executive summary

As well as developing specific plans for efficiency savings based on bottom up analysis, we have considered the level of savings that might be indicated by high level, top down analysis. The ORR has developed an initial view of top down efficiency savings based on a report prepared in December 2005 by its consultants, L.E.K. / Oxera. This focuses on efficiency in terms of catch-up and frontier shift, with catch-up relating to the elimination of identified inefficiencies in our cost base and frontier shift representing the natural drift in the costs of a notionally efficient infrastructure company.

Collating new information now available, we have built on the methodological foundation developed by the L.E.K. / Oxera report to refine the maximum plausible range of 2-8%. In the light of this new information, we believe that the reasonable and appropriate range for efficiency target-setting based on this top-down methodology is 2-3.2% per annum

The rationale behind this revised range is detailed in the following two parts:

- Response to L.E.K / Oxera Study
- Review of Historical Expenditure

The Response to L.E.K / Oxera Study replicates the ORR's consultants' methodology described in their December 2005 paper and then, based on internal Network Rail knowledge and specific data which can be provided to ORR, refines and tightens the range, enabling it to provide a more useful triangulation for target-setting going forward. Two specific refinements have been made:

- An adjustment to the estimation of long-term efficiency trends seen in other industries – which adjusts the implied cost reduction to a maximum of 2.6% per annum
- An adjustment for improved understanding of the level of justified OMR expenditure increases – which adjusts the level of additional catch-up implied by the LEK / Oxera study to a maximum of 0.6% per annum

The Review of Historical Expenditure document outlines the details behind the second of these adjustments. It summarises work carried out to examine recent trends in Network Rail's expenditure and builds on the L.E.K / Oxera's analysis used to inform their range of future cost efficiency savings.

This review sought to understand and explain the range of causal factors for expenditure increases, specifically over the period from 1999/00 to 2003/04. These causal factors are principally externally-driven or the result of the need to redress the long period of underinvestment and other output-driven factors.

A comprehensive set of data which would enable a full and precise picture to be formed of these cost increases is not available and so each causal factor that we address in the document fits into one of two categories:

- Those that we believe contributed to the cost increase over this period, the reasons for which we can explain but not quantify fully, and
- Those that we believe contributed to the cost increase over this period, **the reasons for which we can explain and are confident in quantifying.**

It is important to appreciate that our revised range for efficiency target-setting based on the top-down methodology of 2-3.2% per annum is based only on factors that fall into the second of these categories. We therefore believe the upper-limit of 3.2% to be an absolute maximum that can be implied by this methodology as it is derived from only the factors that we are confident in quantifying, and includes no assumptions, estimates or adjustments for those factors that we believe to be important but which we are unable to quantify fully.

It is also important to note that while this analysis has informed the overall judgement of potential efficiency savings in CP4, our assumptions are based more on specific bottom-up analysis, combined with an element of stretch and an adjustment for input price inflation. The analysis presented here is supportive of the resulting projections.

Part One – Response to LEK / Oxera study

Introduction

As part of its initial preparation for PR08, ORR commissioned consultants to advise on the plausible efficiency savings that might be expected of Network Rail over the course of CP4 (and CP5). The report by ORR's consultants (L.E.K. / Oxera, December 2005) was published alongside ORR's 'Initial assessment of Network Rail's CP4 revenue requirement and consultation on the financial framework'. The consultants' report estimated the plausible range of efficiency savings in CP4 to be 2-8% p.a.

ORR's consultants expressed no view on the appropriate target efficiency saving, only that the high and low case were (implicitly, equally) plausible outcomes. ORR, however, appears to have adopted an interpretation of the report somewhat different to this. In 'Periodic review 2008: Advice to Ministers and framework for setting access charges', ORR describes a *lower* estimate of 3.8% based Network Rail's own estimate of its *achievable* efficiency improvement described in the ISBP. Further, ORR appears to treat the *upper* estimate as a target when challenging Network Rail to explain any deviation from it ('Periodic review 2008: Advice to Ministers and framework for setting access charges', paragraph 5.24, page 67). We do not feel that these are appropriate interpretations of Network Rail's efficiency target as set out in the ISBP and, in particular, of the work undertaken by ORR's consultants. We therefore recognise the importance of our thoughtful response to it.

Network Rail has considered this study carefully and recognises its contribution to the efficiency debate. In particular, Network Rail notes that the analytical framework established by this study, defined by ORR and its consultants, is one of the ways in which a top-down assessment of the range of plausible efficiency targets for the next control period could be approached, but we would also note that any such top-down approach should be treated with caution due to the many assumptions inherent and implicit in the method.

It should be borne in mind that there are a number of potentially problematic issues with this type of top-down assessment, including:

- the comparability of the industries taken to be analogous to Network Rail: there are significant structural differences between Network Rail and the other industries considered. As such, the results from these industries may not be transferable to Network Rail
- the comparability of other industries' performance over different time periods with Network Rail's CP4: the analyses of other industries are based on efficiency performance during various different prior time periods. This means that the results may not be transferable to CP4, for example, due to differences in the underlying macro-economic environment between time periods
- the nature of actionable efficiency saving opportunities: although a theoretical calculation of the quantum of opportunity for efficiency savings may have been undertaken, the precise sources and means of achieving these savings may vary significantly between industries, and an assessment of the practicability of doing so needs to be developed through a bottom-up approach

Purpose and Approach

In order to engage properly in the debate initiated by ORR's paper, Network Rail has replicated ORR's consultants' methodology described in their December 2005 paper, based on the publicly available information identified in the paper.

Network Rail believes that the analytical framework established by this study is very helpful for top-down assessment of the range of plausible efficiency targets for the next control period (noting however our concerns with placing reliance on top-down assessments). The study was, however, undertaken solely on the basis of publicly available information, available at that time. We have therefore adopted this framework as an input to our efficiency work and built on it by refining its assumptions based on information now available to us which was not available to the consultants at the time of their study.

Two specific refinements have been made:

- An adjustment to the estimation of long-term efficiency trends seen in other industries
- An adjustment for improved understanding of the level of justified OMR expenditure increases.

In order to calculate the second of these adjustments, Part Two of this document identifies the factors that have caused additional expenditure from 1999/00 to 2003/04 and which we consider to be “justified”. We consider expenditure to be justified if:

- it can be explained by external circumstances that are largely beyond management’s control
- it was and remains necessary in order to deliver the outputs required of the railway infrastructure

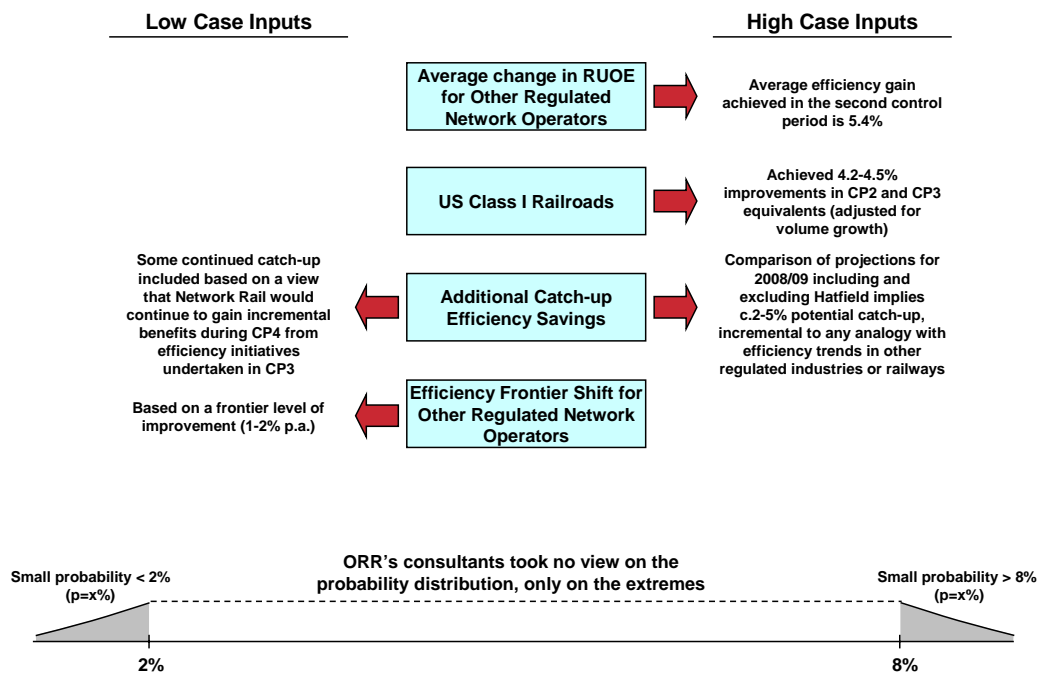
We explain our approach to this work in the subsequent sections via the use of schematics: we use a first set of schematics to illustrate the approach taken and assumptions made by the ORR’s consultants in identifying the 2-8% range of plausible efficiency gains: The reader will note that this is a rather complex and subtle argument, and we hope that taking the effort to break this down step-by-step will prove helpful. Subsequently, the schematics build on this understanding to explain Network Rail’s perspective and illustrate the efficient level of long run expenditure, before showing the refinements that Network Rail has made to the analytical framework.

Explanation of ORR’s consultants’ analysis

ORR’s consultants made use of historical cost data in assessing Network Rail’s potential future efficiency. In particular, the consultants have used the 1996/7 historical costs as the starting point of their assessment of the plausible range of possible cost trends. These trends are then used as the basis for estimating the range of future expenditure efficiency savings targets.

The study establishes a framework for calculating future cost efficiency targets. The methodology is based on an estimation of a baseline ‘efficient’ spending level followed by comparison to (then) current spending to establish the estimated potential cost saving.

At a high level, the methodology and the assumptions taken to arrive at the 2-8% range of annual savings targets are illustrated in the diagram below.



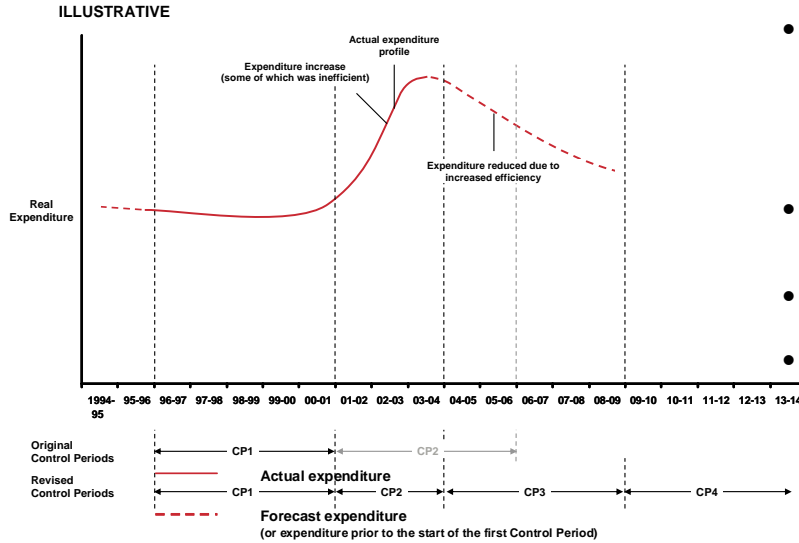
The analysis undertaken by ORR's consultants is quite complex, and Network Rail has sought to explain our understanding of it through the series of schematics presented below.

On the following pages, the schematic is located on the left hand side with accompanying explanatory text beside it on the right. The series of schematics is designed as a step-wise explanation of the methodology: each diagram builds on the previous one to explain the incremental steps of the argument.

It is important to note that all of the schematics are illustrative and are not to scale.

The first schematic, Schematic 1 below, shows the core underlying historical and forecast expenditure that is the basis for the subsequent hypotheses and analysis.

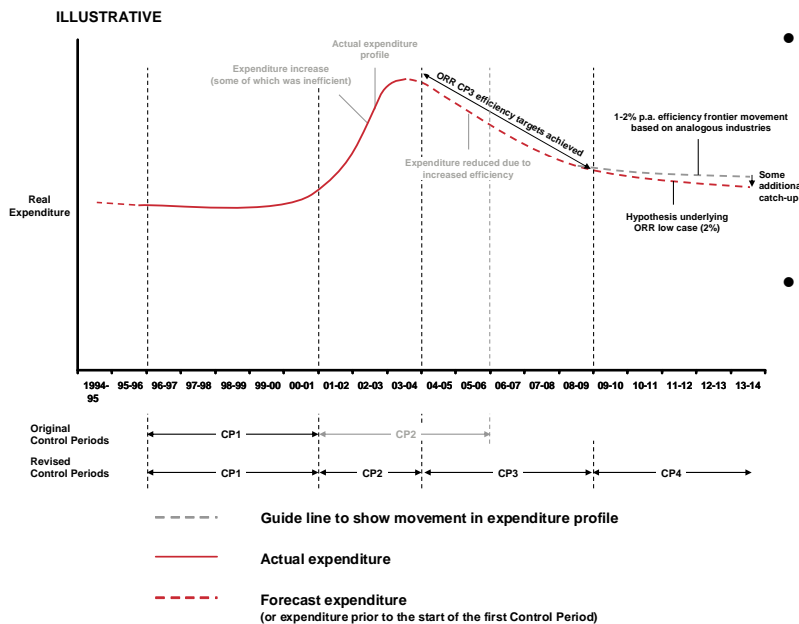
1. Actual and forecast expenditure



- The schematic shows a simplified representation of the real expenditure from 1994/95 through to 2008/09. At the bottom of the chart are details of both the original control periods and the revised control periods following ACR 2003 (and Network Rail’s acquisition of Railtrack)
- The solid red line shows the actual level of expenditure since 1994/95 through to 2003/04
- Expenditure increased significantly prior to Network Rail acquiring Railtrack in 2002
- Some of this increase may have been through inefficiency, and subsequently costs have and are forecast to decline as shown by the dashed red line that ends in 2008/09 as Network Rail has worked to improve the efficiency of its expenditures

ORR’s consultants developed two separate cases, a high and a low case, based on two separate hypotheses. Initially, in Schematic 2 below, we explain the assumptions and analysis that ORR’s consultants used to derive the ORR low case (2%).

2. Development of the ORR low case (2%)



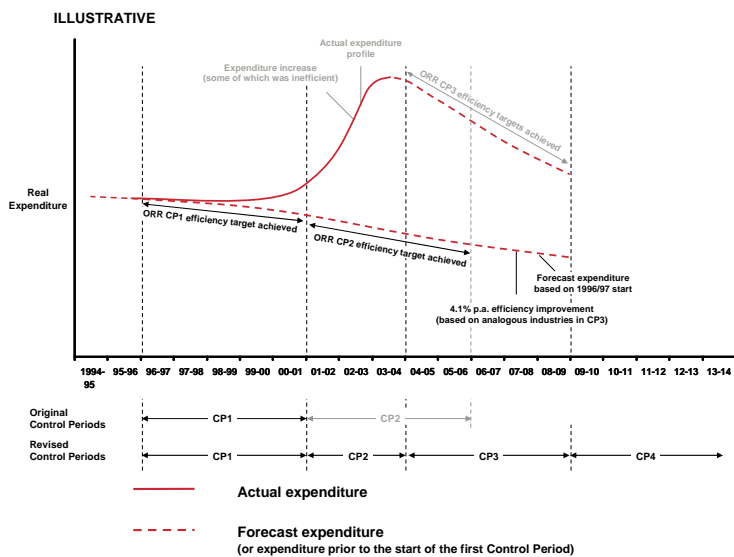
- This schematic illustrates the hypothesis used by ORR’s consultants to develop the ORR low case (2%)
- This case assumes that there are primarily only efficiency frontier improvements left after CP3, as well as a small level of additional catchup (identified by the vertical arrow) reflecting the momentum of cost saving initiatives carried out in CP3
- The assumed efficiency frontier movements are shown with the dashed grey line, which ORR’s consultants based on the rates achieved in other industries

As illustrated above, the ORR low case is based on two relatively simple assumptions regarding the efficiency frontier movement in other industries with some additional “catch- up” provided by the momentum from initiatives undertaken in CP3. It does not depend on assessments of Network Rail’s historical cost trends (and the impact of Hatfield), which are important in developing the ORR high case. We recognise that this is the type of efficiency target appropriate for a business already operating to high levels of efficiency and is therefore increasingly relevant to Network Rail as our existing improvements bed in and deliver results for the business.

The following three schematics (Schematic 3-5) progressively build up the further incremental assumptions used by ORR’s consultants to develop the ORR high case (8%). Essentially this case is based on assessing the historical expenditure trends and expectations before the Hatfield accident and considering how these might have continued beyond that point.

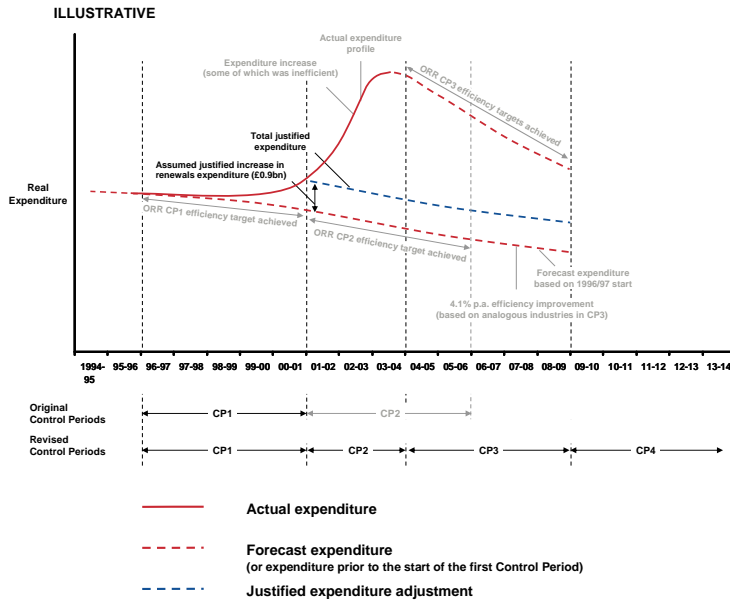
It is also important to note that the assumed frontier shift referred to here is derived from other infrastructure businesses and therefore represents the combination of catch-up and frontier-shift observed in those industries. The ORR consultants’ methodology implies an additional element of catch-up due to the apparent Hatfield effect. Please refer to Chapter 5 on Changes in Input Prices and Productivity for more information.

3. Development of the ORR high case (8%) – Forecast expenditure based on 1996/97 levels



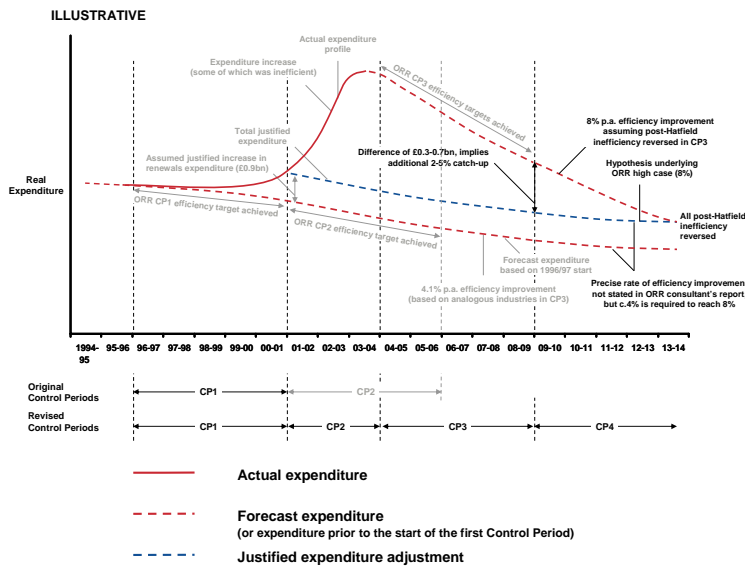
- Based on the historical expenditure curve shown in solid red, ORR’s consultants produced two separate forecasts of total expenditure which are shown with the dashed red lines shown on the schematic
- One starts from the actual 1996/97 level of expenditure and assumes that the ORR efficiency targets are achieved in CP1 and CP2, followed by efficiency improvements of 4.1% p.a. in CP3 based on achievements in other industries; and
- The other, starting from the higher actual base in 2003/04, assumes that ORR’s challenging CP3 targets are achieved (leading to the low case shown in Schematic 2)

4. Development of the ORR high case (8%) – Adjustment for justified additional expenditure



- ORR’s consultants then adjusted the high base case for additional, justified, Renewals expenditure, represented by the blue dashed line
- The assumption was that 100% of the real renewals expenditure increase between 1996/97 and 2003/04 was justified by increased levels of activity
- Consequently the blue line is above the bottom dashed red line, implicitly recognising some of the cost drivers experienced by the business over this time, and then assuming that the same efficiency improvements can be achieved over time
- No adjustments were made to the forecast level of Controllable Opex or Maintenance expenditure, which therefore treats these increases as if they were wholly unjustified (the consultants are careful to note that this is an assumption to derive the high case estimate)

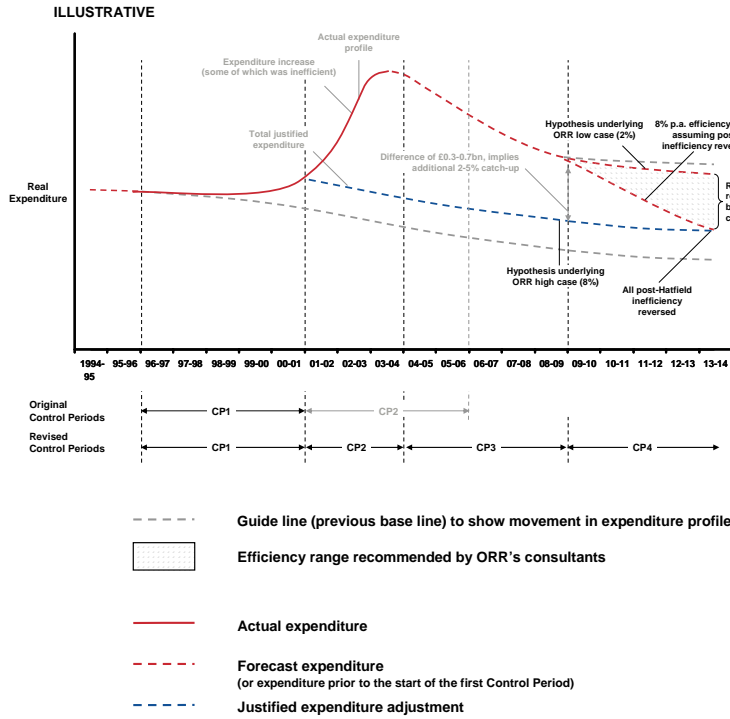
5. Development of the ORR high case (8%) – CP4 forecast



- The dashed lines are now extended to show the forecast expenditure in CP4
- The difference in expenditure in 2008/09 between the two forecasts that ORR’s consultants developed (one starting from a 2003/04 base (the upper dashed red line) and the other from a 1996/97 base (the dashed blue line) represents the level of Hatfield related inefficiency
- The level of Hatfield related inefficiency in 2008/09 was calculated at £0.3-0.7bn. If all of this Hatfield related inefficiency was caught up by the end of CP4 that would imply “catch-up” efficiency savings of 2-5% p.a.
- The consultants did not report the level of underlying efficiency improvement assumed in CP4, however, a figure of c.4% is consistent with the ORR high case (8%)
- In 2013/14 the two forecast lines meet, this implies that all post Hatfield inefficiency has been reversed at this point

Combining the ideas and analysis built up in the previous five schematics, we can now show the ORR’s consultants’ conclusions diagrammatically in Schematic 6 below. This summarises the analysis in one diagram, and shows the range of efficiency targets identified.

6. ORR's consultants' range of efficiency targets



- This schematic combines the hypotheses underlying the ORR low and high cases that have been explained in the previous schematics
- The red and blue dashed lines from the previous schematic for the high case are combined with the relatively flat red dashed line from schematic 2 for the low case
- The light grey shaded area represents the range of plausible efficiency targets, from 2% p.a. to 8% p.a. suggested by ORR's consultants for CP4

Interpretation of the Efficiency Target Range

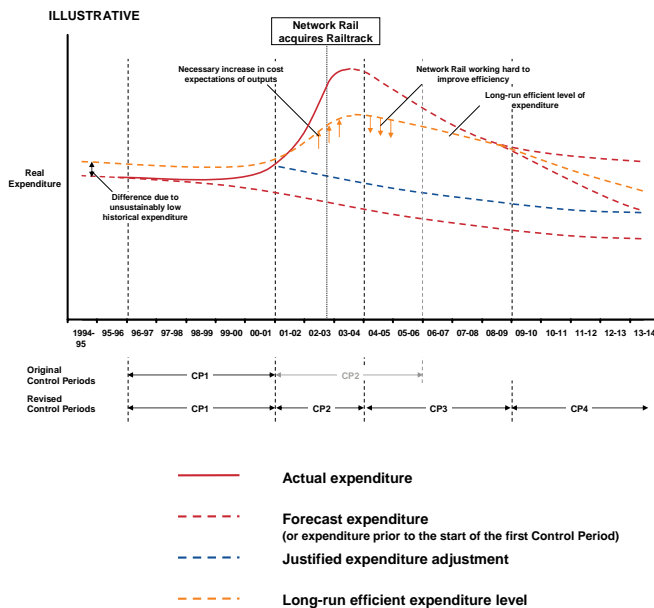
Network Rail has considered the 2-8% p.a. efficiency target range in light of the analysis presented in the previous section.

The size of this variation is mainly due to the inclusion in the high case target of a significant level of “catch-up” (i.e., 2-5% p.a.) in addition to the underlying efficiency improvements from other industries. This is assumed to be achievable since the level of expenditure in the base year, 2003/04, could include a significant element of inefficient ‘unjustified’ spend which can subsequently be eliminated over and above the challenging target set for CP3 by ORR’s ACR2003.

As we set out in detail in Part 2 of this document, we believe that by the end of CP3 in 2008/09, there will be no ‘unjustified’ expenditure left over from the post-Hatfield expenditure increases in Controllable Opex, Maintenance or Renewals. Consequently the CP4 targets should recognise that all current expenditure is justified, and, as such, achievable savings will be significantly lower than the levels of efficiency savings achieved in CP3 as there is no additional catch-up left. This is shown in Schematic 7 below.

In Schematic 7, we have sought to illustrate the long-run efficient level of expenditure, shown as the orange line. This line represents the notional efficient expenditure given the level of knowledge and technology that Network Rail / Railtrack had at the time.

7. Network Rail’s view of efficient long run expenditure



- The efficient level of expenditure (the orange line) is likely to have increased less than it actually did 2001/02-2004/05 as some of the increase is recognised to have been inefficiently spent
- Historically however expenditure on the network was below the sustainable long run trend, hence the orange line is above the red line in the early years of CP1
- After Hatfield, the level of efficient expenditure required increased as there were additional short term activities required to stabilise the network and improve operational performance. However this was significantly lower than the increase shown in the solid red line. Since Network Rail’s acquisition of Railtrack, it has worked actively and diligently to reduce expenditure and improve efficiency
- In 2008/09, when Network Rail has eliminated all unjustified expenditure from the cost base, the orange line and the red line coincide
- During CP4, the efficient level of expenditure is lower than the ORR low case (2%) reflecting the opportunities we have identified and our stretch targets (although we recognise that the lower ORR rate is likely to be appropriate in CP5)

Network Rail’s Refinements to the Analytical Framework

Introduction

We have set out above, how, based on the publicly available information available at the time of writing of the report, ORR’s consultants arrived at the efficiency range of 2-8% p.a. Network Rail believes that the consultants intended that a 2% p.a. improvement was as equally likely and plausible as 8% (without taking a view on the shape of the intervening distribution).

Our own projections assume savings above the lower bound. However, on the basis of internal Network Rail knowledge, in some cases supported by specific data which can be provided to ORR, the maximum value appears less plausible. We have used this internal information to refine and tighten the range, enabling it to provide a more useful triangulation for target-setting going forward. We have made a number of refinements that are listed below:

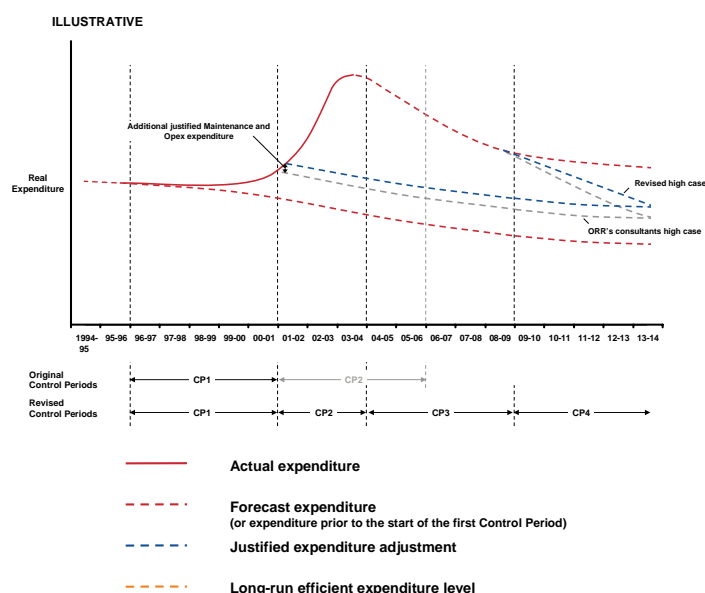
- Adjustment for improved understanding of the level of justified OMR expenditure increases
- Adjustment to the estimation of long-term efficiency trends seen in other industries

It is important to note that we have not made any adjustments for OMR expenditure increases that we believe to be important but for which we are unable to confidently quantify the impact and nor have we made any quantitative adjustments to reflect the increased cost resulting from the significant increase in network traffic. We therefore consider this to be a very conservative assumption.

Adjustment for improved understanding of the level of justified OMR expenditure

Drawing on internal research and analysis (set out part one of this document) Network Rail has refined the consultant's adjustment to reflect the level of justified OMR expenditure. The impact of the adjustments is illustrated in Schematic 8.

8. Adjustment to reflect the level of justified OMR expenditure



- Network Rail believes that all of the real increase in renewals expenditure allowed by ORR's consultants is justified.
- Internal analysis summarised in the Review of Historical Expenditure (part 2 of this document) shows that inefficiencies did occur in Track Renewals caused by the overriding imperative to stabilise the network and undertake whatever work was deemed necessary at the time but that these inefficiencies were driven out by 2003/04.
- However, internal research and analysis described in the Review of Historical Expenditure document has also identified that a significant part of the controllable opex and maintenance increases were justified, specifically
 - 37% of the real maintenance expenditure increase was justified
 - 55% of the real controllable opex expenditure increase was justified

Adjustment to the estimation of long-term efficiency trends seen in other industries

In determining the (high case) continued rate of efficiency improvement possible beyond the Hatfield-related catch-up, ORR's consultants attempted to draw parallels with efficiency improvements in other (regulated) industries. The suitability of such comparisons is therefore a very important consideration.

The rate of continued savings assumed was based on the arithmetic average improvement in Real Unit Operating Expenditure (“RUOE”) achieved historically in a number of network industries (water, sewerage, electricity (distribution and transmission) and telecoms). Although ORR’s consultants do not explicitly state the assumption used to derive the high case, we assume that it is 4.1%, which we note is consistent with 4.1% being the average of the range of overall efficiency improvements (2.5% - 5.7%) cited in the document.

We have identified a number of issues relating to ORR’s consultants’ use of efficiency improvements observed in other industries to underpin the 8% efficiency improvement. As already discussed, it is important to note that these efficiency improvements represent the combination of catch-up and frontier-shift observed in other industries with the ORR’s consultants implying an additional element of catch-up due to the apparent Hatfield effect.

We have considered the ORR’s consultants’ use of efficiency improvements and propose alternative treatments to improve the analysis and develop our own revised view. The key issues identified are:

- NGC’s efficiency gains are not an appropriate comparison to Network Rail
- Applicability of RUOE-based comparisons (which relate to opex) to our Renewals Expenditure (which is capex)

NGC’s efficiency gains are not an appropriate comparison to Network Rail

ORR’s consultants calculated that NGC had achieved efficiency improvements of 5.7% p.a. (in terms of RUOE) and 50.1% in total over 11 years. This is the second highest level of efficiency gains identified in the report.

The highest level of efficiency gains identified in the report is similar, and is that achieved by BT (based on call volumes) at 51.1%. However, ORR’s consultants explain that this is not a relevant measure of unit costs for the purposes of estimating savings targets for Network Rail. In the context of this analysis, we concur.

“... The large output growth experienced by BT during the timeframe (approximately 10% per annum in terms of call volume, but less than 1% per annum in terms of exchange lines) will bias the unadjusted RUOE figures upwards ...”

L.E.K. / Oxera, 2005

For similar reasons, Network Rail believes that the NGC figure is also not an appropriate comparator. NGC was included in ORR’s comparator set because it met the stated criteria:

- it was engaged in the ‘provision of network infrastructure services’ (which implies increasing returns to scale and density, and the long-term effects of past investment on current efficiency levels), and;
- ‘the industry [is] subject to incentive-based economic regulation’

NGC’s unit costs were calculated based on the volume of electricity transmitted which is analogous to calculating BT unit costs based on the volume of calls. Both networks are (predominantly) electrical, where increased ‘output volume’ (within capacity constraints) incurs negligible incremental costs in maintaining the network. This is in sharp contrast to the (very different) unit costs against which Network Rail’s targets are set, which are in relation to the volumes of actual engineering activity undertaken in maintaining and renewing our network. The nearest equivalent measure to NGC’s units

of outputs for our network would be passengers carried, which have increased (and hence our expenditure per passenger has decreased) significantly in recent years.

We note that although not explicitly stated by ORR's consultants, the distribution businesses (3.8% RUOE) partially use the same units as NGC (based on the approach taken by Europe Economics, 'Review of Railtrack Efficiency', 2000) and hence it could be argued that this comparator be also excluded or adjusted.

Network Rail also notes Arthur Andersen's 2000 report for OFGEM suggests that the level of demand growth was a material factor in the high levels of efficiency improvement

"... NGC has achieved 6.8% real unit operating expenditure (RUOE) per annum reduction since privatisation. More recently, in the period from 1997 to 2000, when slower system demand growth was experienced than in the early 1990s, in absolute terms NGC achieved a reduction of 5.2% p.a. ..."

Arthur Andersen, "Review of NGC Efficiency", 2000

Removing NGC from the analysis reduces the range of efficiency savings calculated by ORR's consultants from 2.5-5.7% (average 4.1%) to 2.5-3.8% (average 3.2%).

We note that ORR's consultants have made an adjustment to reflect the level of output quality improvements observed in the Water and Sewerage industries. However, no adjustment was made to the other industries. Network Rail believes that it has historically achieved higher improvements in output quality than the other industries. However, we have conservatively made no adjustment for this within the analysis presented here.

Applicability of RUOE-based comparisons to our Renewals Expenditure

RUOE, as described by the ORR's consultants, measures the level of operating expenditure excluding depreciation per unit of output (in real terms). Consequently capital expenditure (equivalent in Network Rail's case to Renewals) is not included in RUOE.

Over the period 1996/97 to 2003/04 only 57% of Network Rail's total OMR expenditure was attributable to Maintenance and Controllable Opex; the remaining 43% was capital Renewals expenditure, equivalent expenditure to which would not be included in RUOE.

Earlier regulatory reviews have acknowledged that lower efficiency improvements tend to be achieved within capital expenditure than in operating expenditure.

- In the CP2 review, a study by ORR's consultants found that:

"... Capital efficiencies, as reported, tend to be lower than operating efficiencies, as reported, this is due to the effect on relative operating and capital inputs resulting from capital substitution ..."

Europe Economics, Analysis of Responses to "Review of Railtrack Efficiency", 2000

- In CP3, ORR's determination differed for Operations, Maintenance and Renewals. The average annual efficiency targets for renewals were 6.8% which was

significantly lower than the average of the non-capitalised expenditure, for which the target was 7.5%

From this evidence, it is clear that any efficiency target applied to the whole of Network Rail's controllable expenditure (controllable operating expenditure and renewals) based solely on RUOE is likely to overstate the achievable gains.

Moreover, it is worth noting that the Europe Economics' inclusion of depreciation in their RUOE calculations as a rough proxy for capital expenditure reduced the comparator industries' RUOE average from 5.6 to 4.1%, a reduction of 1.5%.

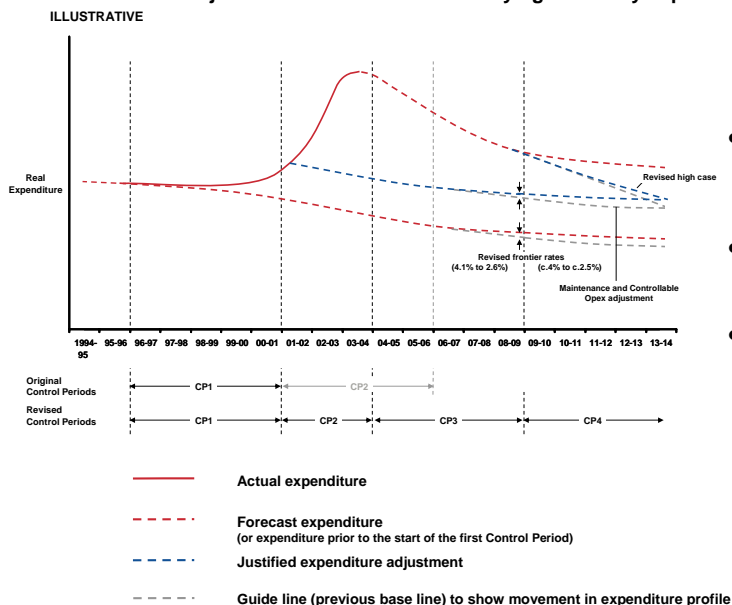
"... Although there may be a number of simple biases arising from the use of depreciation as a proxy for capital maintenance, this method suggests the capital substitution adjustment may be of the broad order of 1-2 per cent a year ..."

Europe Economics, Analysis of Responses to "Review of Railtrack Efficiency", 2000

Taking the midpoint of Europe Economics' 1-2% (1.5%) off 43% of a notional total expenditure lowers the 2.5-3.8% range (average 3.2%) to 1.9-3.2% (average 2.6%).

Based on these arguments, the underlying efficiency improvements have been revised accordingly. This reduces the level of efficiency gain assumed in the ORR high case, the results are illustrated in Schematic 9. below.

9. Adjustment for the level of underlying efficiency improvements



- The change in the underlying level of efficiency improvements is shown by the blue and red lines. The previous forecasts from Schematic 9 are shown by the grey lines
- Based on the analysis outlined above, we have reduced the level of annual efficiency gain by 1.5%
- This change only applies to the ORR high case

Conclusion

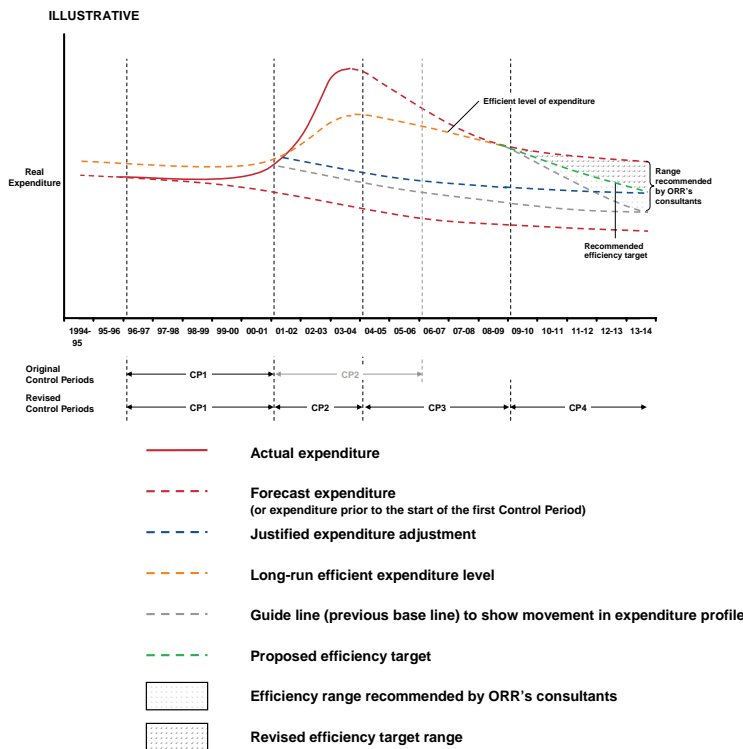
Collating the new information now available, Network Rail has built on the methodological foundation developed by the L.E.K. / Oxera report to refine the maximum plausible range of 2-8%, and believes that, in the light of this information, the reasonable and appropriate range for efficiency target-setting based on this top-down methodology is 2-3.2% per annum.

The top of this range (3.2%) is made up of 0.6% per annum, based on our analysis of historical expenditure and our conservative estimates of the size of necessary and justified increases, and 2.6% per annum, based on our revised estimation of long-term efficiency trends seen in other industries.

We have used a combination of bottom-up initiatives and the additions of stretch targets to derive our overall efficiency profile of 3.3 per cent per annum. Taking into account the effect of projected input price inflation this is around 2.4 per cent per annum. We believe that this triangulates well, within the noted limitations of top-down approaches, with the reasonable range reached by our revision of the ORR’s initial analysis.

Building on the previous schematics (Schematics 7-9), these conclusions are shown graphically in the schematic below.

10. Network Rail’s stretch efficiency target and revised range



- The orange line is the efficient level of expenditure as developed in Schematic 7
- The grey lines represent the ORR's consultants' original range of efficiency targets
- The red lines bound Network Rail's revised range of efficiency targets, the lower red line is hidden by the green line. This green line has the same trajectory as the orange line and represents Network Rail's stretch target for CP4

Part Two – Review of historic expenditure

Summary

The Pre-Hatfield expenditure trend is not an appropriate starting point for the development of efficiency targets for CP4

The pre-Hatfield level of expenditure was considerably too low to be used as any sort of comparison for future expenditure. There are four reasons for this:

- The volumes of renewals and maintenance activity prior to Hatfield were at an unsustainably low level and, therefore, a proportion of the increased volumes is required on an on-going basis to maintain a steady state level of asset condition.
- The same applies to expenditure in other areas such as training, engineering and information management.
- The growth in traffic during CP1 and CP2 implies that even the steady state level of renewals will be higher in 2003/04 than it was in 1999/00.
- Past renewals activity was not carried out at a steady level but instead peaked as a number of major renewals programmes were delivered. This left a legacy of assets all reaching the end of their economic life at approximately the same time. This happens largely in CP4.

Any expenditure that arose in the aftermath of Hatfield but which was not required on an ongoing basis is more than accounted for by the improvements in efficiency achieved during CP3

In each of the three main areas of cost (renewals, maintenance and controllable opex), there were significant increases in expenditure after 1999/00. However, in each of these areas there are several important reasons for increases in the level of expenditure required to deliver a sustainable railway. These reasons are principally the result of externally-driven factors or the need to redress the long period of underinvestment and other output-driven factors.

A comprehensive set of data which would enable a full and precise picture to be formed of these cost increases is not available and so each causal factor that we address in this document fits into one of two categories:

- Those that we believe contributed to the cost increase over this period, the reasons for which we can explain but not quantify fully, and
- Those that we believe contributed to the cost increase over this period, the reasons for which we can explain and are confident in quantifying.

The causal factors, whether we can quantify them and their impact are summarised in the table below.

Renewals

Causes of expenditure increase (99/00 - 03/04)	Able to Quantify?	Total (£m)
Track		
Trend in unit cost per composite mile	Yes	406
Volume: Improved understanding of asset behaviour	No	-
Volume: Requirement to improve asset condition	No	-
Volume: Long-run traffic growth	No	-
Unit Cost: Changes in safety procedures and installation practices	No	-
Unit Cost: Renewals worktypes	No	-
Unit Cost: Crime & security	No	-
Unit Cost: Input prices	No	-
Telecoms	Yes	204
Structures	Yes	197
Other	Yes	40
Total		847
Justified expenditure as a % of total expenditure increase		100%

Maintenance

Causes of expenditure increase (99/00 - 03/04)	Able to Quantify?	Total (£m)
Volume: Improved understanding of asset behaviour	No	-
Volume: Requirement to improve asset condition	No	-
Volume: Re-railing	No	-
New equipment	No	-
Re-railing activity	Yes	50
Volume: Rail Grinding	Yes	50
Volume: Traffic growth in the period	No	-
Volume: Changed contract structures	No	-
Volume: Inspection frequencies	Yes	60
Unit Cost: Improved understanding of asset behaviour	No	-
Unit Cost: Crime & security	No	-
Unit Cost: Input prices	Yes	90
Unit Cost: Less white space	No	-
Improved information collection: Activity Recording	No	-
Improved information collection: Asset condition	No	-
Total		250
Justified expenditure as a % of total expenditure increase		37%

Controllable opex

Causes of expenditure increase (99/00 - 03/04)	Able to Quantify?	Total (£m)
Number of staff: Engineering	No	-
Number of staff: IM	No	-
Number of staff: Safety & Compliance	No	-
Number of staff: HR	No	-
Number of staff: Other	No	-
Unit Cost: Signaller's Award	No	-
Unit Cost: Other Pay Inflation	No	-
Pensions	Yes	60
Input Prices	Yes	89
Non-Staff Insurance	Yes	90
Total		239
Justified expenditure as a % of total expenditure increase		55%

It is important to appreciate that our revised top-down range for efficiency target-setting of 2-3.2% is based only on factors that fall into the second of these categories. We therefore believe the upper-limit of 3.2% to be an absolute maximum as it is derived from only the factors that we are confident in quantifying, with no assumptions, estimates or adjustment for those factors that we believe to be important but which we are unable to quantify fully.

During CP3 Network Rail will have improved efficiency by 31%. Given that pre-Hatfield efficiency targets had been and were expected to be substantially lower than 31% over a control period (the CP2 target was 16.8%), it is clear that Network Rail has achieved considerable efficiency gains over and above the improvements which had been anticipated in those targets. Therefore, a significant proportion of the 31% must represent reversing out any additional expenditure caused by the rapid pace of change and need to stabilise the network after Hatfield. That proportion is sufficiently large to more than account for all such expenditure.

However, Network Rail accepts that there are significant efficiency opportunities going forward, which we have sought to identify and explain in this submission. Network Rail remains focused on the ultimate goal of achieving the maximum efficiency savings possible within the constraints of delivering a high quality railway to its customers and of maintaining a broad perspective on the objectives and efficiency of the railway as a whole.

Introduction

An understanding of the historical trend in infrastructure expenditure is an important input to the setting of efficiency targets for CP4

The focus of Network Rail's work in developing efficiency targets for future control periods is based on a detailed understanding of the current cost base, and a bottom-up assessment of the initiatives which can be undertaken to deliver future efficiency savings from the current base rather than a top-down estimate based on analogous industries and extrapolation of historical trends.

Whilst we believe that the approach we have taken is the most appropriate way to set such targets, we note that the recent trends in Network Rail's expenditure have been the subject of considerable debate, comment and analysis. In particular, we note that ORR's consultants, as discussed in more detail in Network Rail's response to the L.E.K. / Oxera, December 2005 document, have used analysis of historical expenditure for the period starting in 1996/7 as a basis for setting future cost efficiency savings targets.

In order to engage with this debate and incorporate its insights into our efficiency work going forward, we examine below the historical trends in cost.

There was a significant increase in total expenditure following 1999/00

As a starting point,

Figure 1 below shows the level of OMR expenditure from 1996/97 – 2006/07 in nominal terms.

Figure 1 : OMR expenditure (1996/97 – 2006/07) in nominal terms

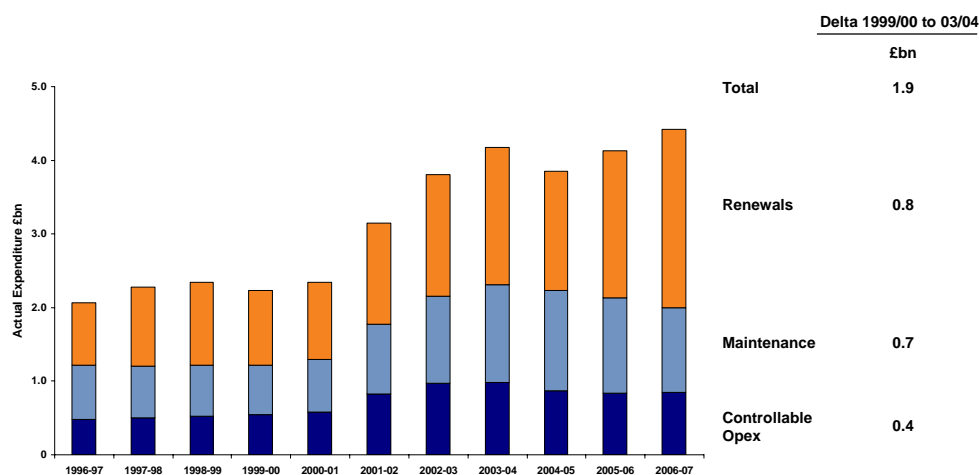


Figure 1 shows that OMR expenditure increased very significantly after 1999/00, by £1.9bn. Of the constituent areas of expenditure, Renewals increased the most, by £0.8bn, followed by Maintenance at £0.7bn and Controllable Opex at £0.4bn.

Figure 2, below, shows the changes in expenditure within Renewals over the time period 1996/97 – 2006/07. Figure 2 shows that a large proportion of the additional Renewals expenditure was in Track (43%). There were also significant increases in expenditure in Structures and Telecoms

This section examines the trends in historical OMR expenditure and identifies and explains the range of causal factors of the expenditure increase during this period.

A comprehensive set of data which would enable a full, precise picture to be formed of the causes of this cost increase is not available. However, Network Rail worked diligently during the early period after the administration of Railtrack to gain as full an understanding as possible of its cost base, and to reach the most appropriate conclusions about the sources of the expenditure increase. These conclusions were developed drawing on a wide constituency of experienced professionals within Network Rail.

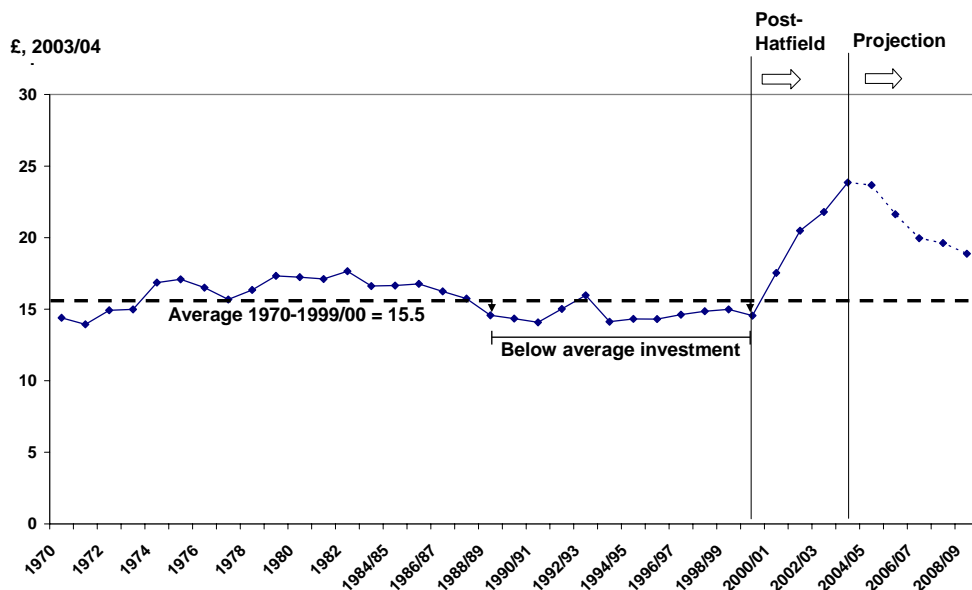
Figure 2 Renewals Expenditure (1999/00 – 2003/04)			
£ million	1999/00	2003/04	Delta 1999/00-2003/04
Track	271	677	406
Structures	141	338	197
Telecoms	29	233	204
Other	577	617	40
Total non-WCRM Renewals	1,018	1,865	847

Evidence of under-investment

We believe that the level of expenditure in 1999/00 was at an unsustainably low level

One of Railtrack's objectives after privatisation was to fund and deliver significant new infrastructure investment. After Hatfield, it became clear that the cost reductions achieved in the period following privatisation had continued the pre-privatisation levels of underinvestment, causing deteriorating asset quality.

Figure 3: Total Rail Industry Cash* costs per train kilometre



* Total Rail Industry Costs include British Rail, Railtrack/Network Rail, TOC/FOC, ROSCO & SRA costs

We have identified a range based on the average unit cost from 1970 – 1999/00 and the previous peak unit cost: we believe that expenditure within this range is the level of expenditure required to deliver a sustainable railway. Figure 3 shows that for the period between the mid-1970s and mid-1980s the actual cost was within the sustainable range. However, from 1988/89 onwards, expenditure per train kilometre was below the average level over the period (apart from in 1993/94) and was at an unsustainably low level.

We have investigated further the specific example of track, which is the area of expenditure with the largest increase over the period considered, in particular the activity of re-railing

Figure 4, below, shows the number of miles of rail that was replaced each year from 1955 to 2004/05 (This includes WCRM). The volumes are calculated based on the volumes purchased by NDS and free issued.

Figure 4: Miles of Re-railing per annum

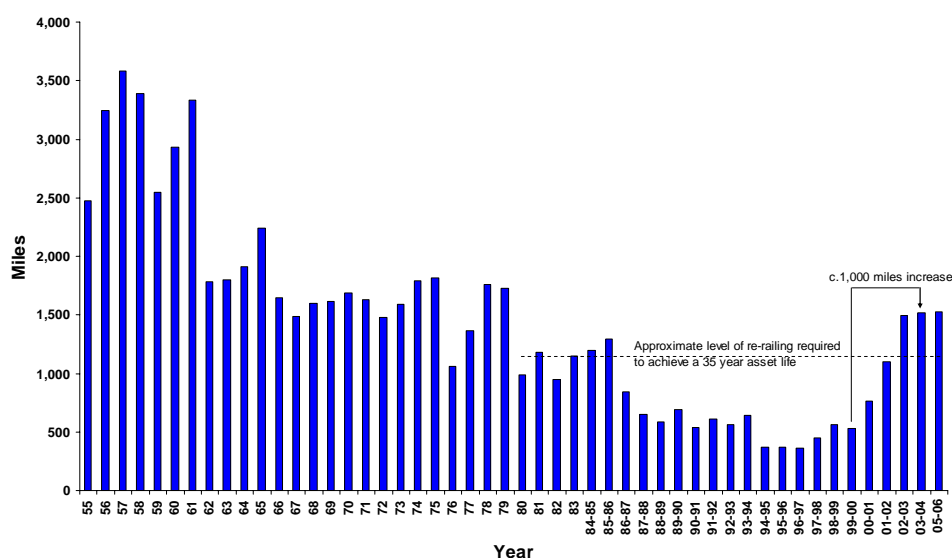


Figure 4 shows the volume of re-railing declined over the period 1955 to 1996/97. Significant steps downward occurred in 1962, 1980 and 1986/87, although the year-on-year pattern was somewhat variable. The level of re-railing during the 1990s was below a sustainable level. An approximate sustainable level based on 19,000 miles of track and 35 year average asset life is c.1,100 miles per year as marked on the chart. The increase in volume of re-railing that occurred between 1999/00 and 2003/04 is therefore required to maintain the asset in a sustainable way without compromising outputs.

Overview of causal factors

The increase in total expenditure from 1999/00 to 2003/04 is largely explained by external circumstances or additional expenditure necessary in order to deliver the outputs required of the railway infrastructure

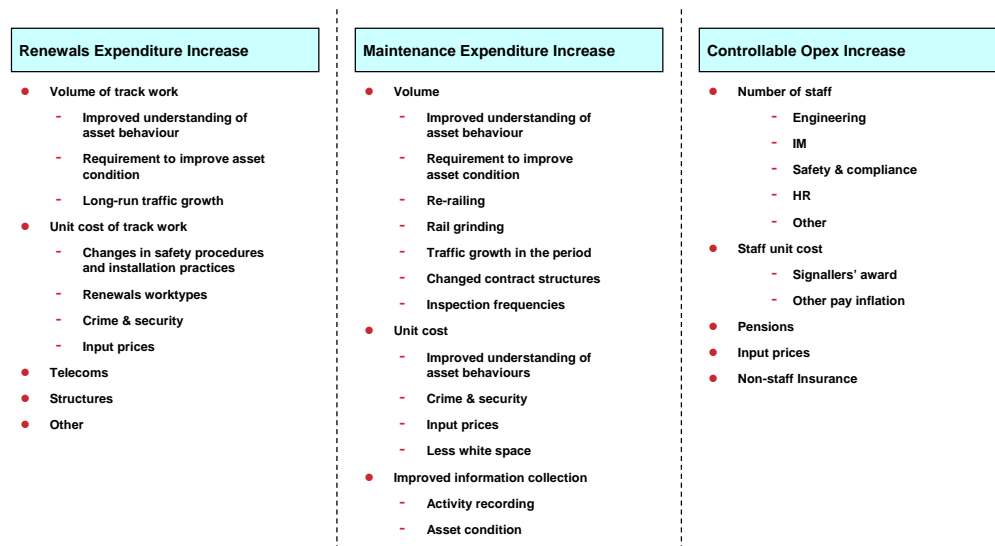
This increase mainly reflects the significant increase in the level of activity undertaken following Hatfield as part of the overall effort to improve asset condition. The improved understanding of asset behaviour had a material impact on the cost of undertaking

infrastructure work. Of the total increase, renewals makes up £0.8bn of that increase and reflects the significant increase in the volume of track renewals, in particular, the additional re-railing as part of efforts to stabilise the network. In addition, maintenance volumes increased substantially, with increased frequencies and the re-introduction of grinding.

However, despite these justified increases in expenditure, it is widely believed that some of the additional expenditure was caused by the pace of change, as the industry sought to stabilise the railway and cope with sudden increases in engineering activity in the aftermath of the Hatfield accident. In assessing future efficiency savings targets, the extent (if any) to which such expenditure will remain by the end of CP3 needs to be taken into account.

A list of causal factors identified so far for the expenditure increase during the period 1999/00 to 2003/04 is illustrated in Figure 5. However, it should be noted that there may be additional factors not yet identified.

Figure 5 : Causes of 1999/00-2003/04 expenditure increase



The diagram below shows all of the factors listed in Figure 5 above in a 'cause-and-effect' schematic on page 26. The box on the right of the main 'spine' describes the overall outcome. The main branches from this 'spine' represent the principal drivers of this outcome (i.e., the split of the expenditure increase into Controllable Opex, Maintenance and Renewals). Further sub-branches disaggregate these drivers into successively finer levels of detail.

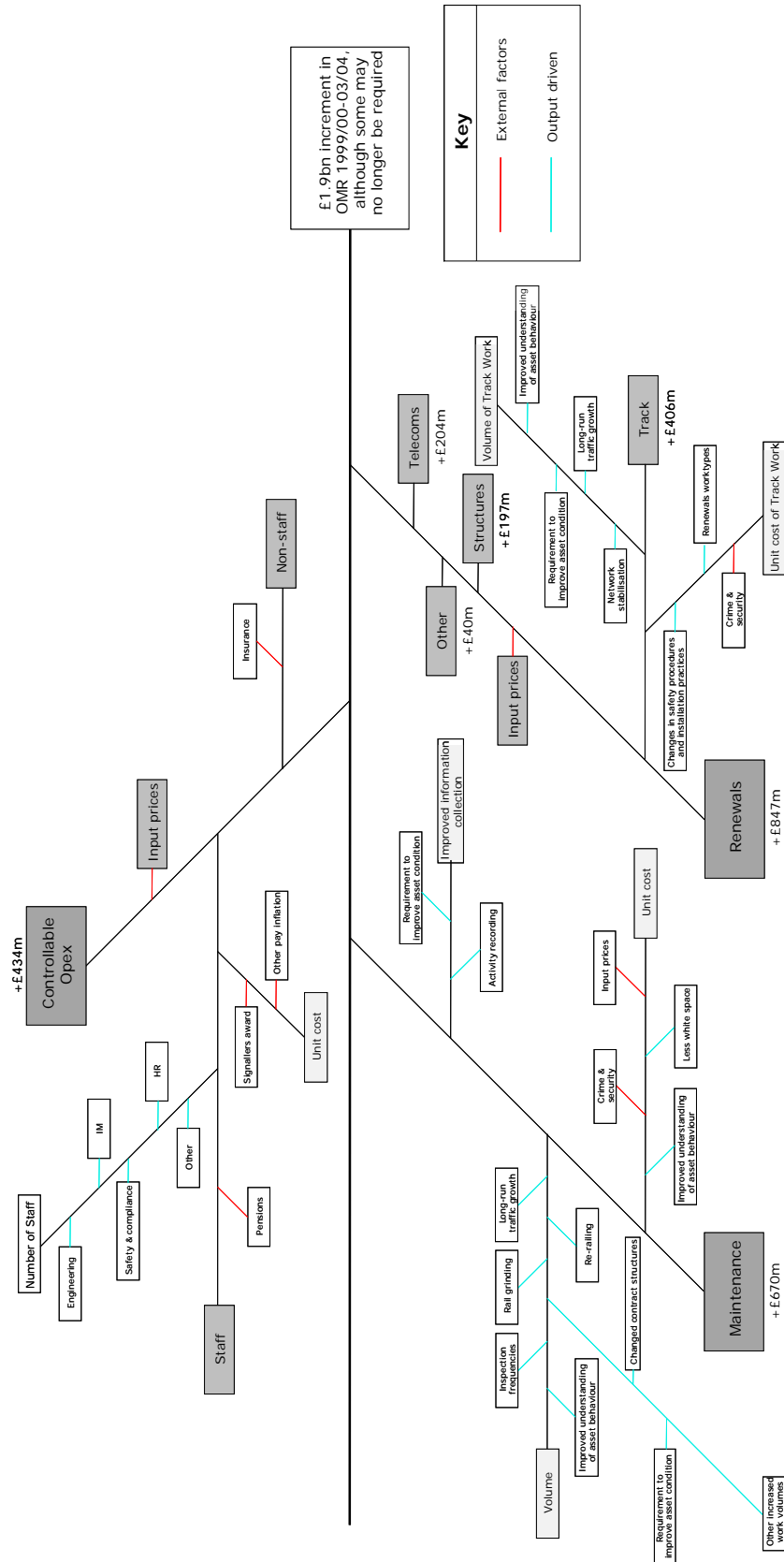
Each of the factors listed in Figure 5 and the 'cause-and-effect schematic' is described in detail in the separate following sections of this document for Renewals Expenditure Increase, Maintenance Expenditure Increase and Controllable Opex Increase.

We recognise that a proportion of the increase in expenditure immediately following 1999/00 was caused by the rapid pace of change during the aftermath of Hatfield and the need to stabilise the railway, and which was not required on an ongoing basis as the network returned to more normal operations and conditions.

However, our plan is based on required volumes and unit cost assumptions and there is little evidence to suggest that unit costs of given activities increased substantially as a result of this stabilisation. Moreover, during CP3 Network Rail will have improved efficiency by 31%. Given that pre-Hatfield efficiency targets had been and were

expected to be substantially lower than 31% over a control period (the CP2 target was 16.8%), it is clear that Network Rail has achieved considerable efficiency gains over and above the improvements which had been anticipated in those targets. Therefore, a significant proportion of the 31% must represent reversing out any additional expenditure caused by the rapid pace of change and need to stabilise the network after Hatfield. That proportion is sufficiently large to more than account for all such expenditure.

Causes of 1999/00 – 2003/04 expenditure increase



Note: * Factors resulting from changes in external circumstances

** Factors where additional expenditure was and remains necessary in order to derive the outputs required of the railway infrastructure

Causes of increased renewals expenditure

As shown in

Figure 1 above, the level of renewals costs increased significantly between 1999/00 and 2003/04. Of the total increase, renewals makes up £0.8bn of the increase.

There are three reasons why the pre-Hatfield level of renewals activity was considerably too low to be used as any sort of comparison for future expenditure.

- **Firstly, the volume of renewals prior to Hatfield was at an unsustainably low level and, therefore, a proportion of the increased volumes is required on an on-going basis to maintain a steady state level of asset condition;**
- **Secondly, the growth in traffic during CP1 and CP2 implies that even the steady state level of renewals will be higher in 2003/04 than it was in 1999/00; and**
- **Thirdly, the profile of past track renewal activity means that we have a significant amount of rail in the network which was installed before 1979 and will be reaching the end of its life in CP4.**

The increase in total expenditure from 1999/00 to 2003/04 is largely explained by additional expenditure necessary in order to sustain the required outputs of the railway infrastructure or by external circumstances.

Our work has identified a range of factors which have driven these expenditure increases. These are explained in the subsequent parts of this section.

Figure 6 below shows PLR unit costs per composite mile over the period 1996/97 to 2006/07.

Figure 6: Track renewals unit cost per composite mile

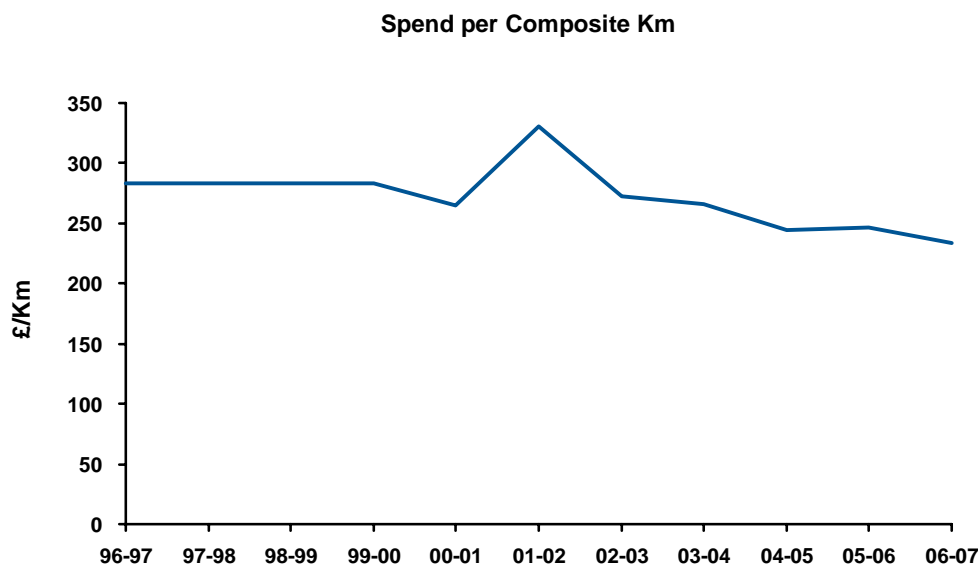
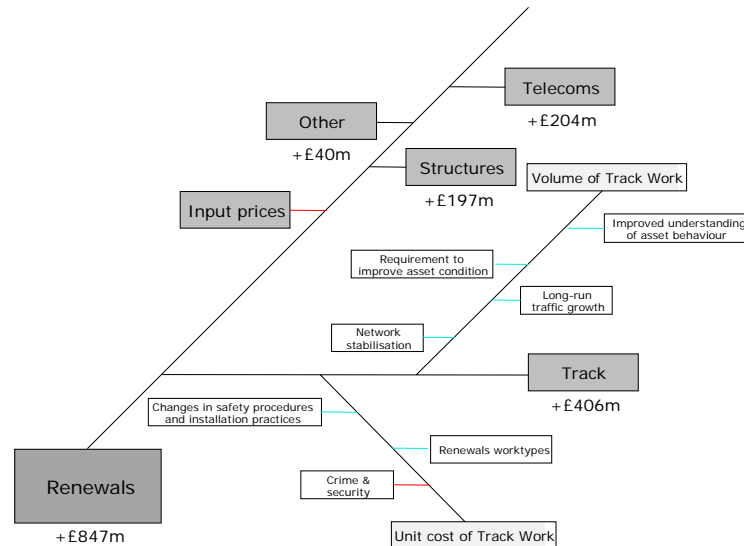


Figure 6 shows that, after an initial peak in unit costs post-Hatfield, unit costs for PLR fell significantly during this period. Indeed, by 2003/04, these costs were actually lower than in 1999/00.

As such, despite the significant increase in volumes required following Hatfield, Network Rail managed to deliver this work efficiently.

The range of factors identified causing increased renewals expenditure is illustrated in Figure 7 below.

Figure 7 : Range of factors causing increased renewals expenditure



Volume of Track Work: Improved understanding of asset behaviour

The work that followed on from Hatfield led to significant developments in the understanding of asset behaviour, which in turn led to changes in the way assets were managed. This resulted in increased volumes of activity

In the years preceding Hatfield, the UK rail network was considered to be in acceptable condition. Although Railtrack recognised that the network had undergone a long period of underinvestment, it was not expected that there would be significant safety issues in the near future.

In particular, prior to Hatfield, rolling contact fatigue (“RCF”) was not a well understood effect and it had not been investigated in detail, as it was not considered to be a significant risk.

However, extensive research and investigation was subsequently undertaken to understand RCF fully and this increased understanding led to changes to the approach to managing track renewals. This research included hiring industry experts, such as TTCI, that worked on this issue for several years. As a result Network Rail is now internationally recognised for its understanding of RCF and the technology used to identify it.

The revised approach effectively recognised RCF as a serious defect and led to a number of updates to track standards with the release of a series of Permanent Way Special Instructions (“PWSI”) which were amendments to the existing track engineering standards. PWSIs (1 to 4) were eventually integrated into the engineering standards in 2005, in the form of TRK001. The revised standards required additional activities to be carried out in order to maintain a sustainable railway, for example by increasing the use of lubrication and replacement of pads.

This improved understanding of how RCF developed and how best to manage it had wide-ranging implications for Network Rail, including its renewals expenditure, which are described in this section.

These changes were necessary in order to sustain appropriate asset condition and safety standards for users of the railway to a sustainable level.

The increased understanding in RCF also resulted in increased volumes of renewals activity

The greater awareness of RCF and its consequences caused a significant increase in the required volume of renewals, in particular in re-railing which increased from c.350 miles p.a. to over 1,500 miles p.a. Based on a typical re-railing cost of £200k per track mile, which is equivalent to £100k per rail mile, and an increase in annual rail miles between 1999/00 and 2003/04 of approximately 1,000 miles, the incremental cost impact of increasing re-railing activity to a sustainable level can be estimated at approximately £100m per year.

In the immediate aftermath, the need to carry out high levels of re-railing and other track renewals resulted in planned activities being delayed. These additional volumes were then inherited as a backlog by Network Rail.

The impact of our improved understanding of RCF and how it drives renewals is permanent and therefore the increase in volume associated with them is required on an ongoing basis, although Network Rail of course continues to work diligently to identify more efficient ways to manage RCF and its affects on the network.

It has become clear to Network Rail that the level of expenditure prior to Hatfield represents a period of long-term under-investment, i.e., low volumes of renewals prior to Hatfield were inappropriate and inefficient in the long-term and they lead to a deterioration of asset quality.

Volume of Track Work: Requirement to improve asset condition

In the years up to 1999/00, asset condition had declined to an unacceptably poor level, which Network Rail sought to address in the period up to 2003/04.

The incidence of broken rails, as just one measure, reached 917 in 1999/00. This was recognised as a major issue in ACR2000 (before Hatfield) and a mechanism was put in place to provide additional funding to reduce this measure below the level assumed in the review, if this was found to be appropriate. Consequently, during CP2, Network Rail sought to improve asset condition. Figure 8 below summarises the position in 1999/00 and 2003/04 in some key measures of asset condition for which comparable data is available.

Figure 8 : Summary comparison of asset condition measures 1999/00 versus 2003/04

Asset Condition	1999/00	2000/01	2003/04	Change (99-04)	
				%	Absolute
Percent of rail renewed annually	1.7%	3.4%	4.4%		2.7%
Number of Level 2 Exceedences (per track mile)	2.0	1.8	1.1	(45%)	(1)
Number of Broken Rails	919	706	334	(64%)	(585)

This table shows some considerable improvements in asset condition. By 2003/04, the number of broken rails had been reduced by 64% versus 1999/00 which represented a key measure of progress. Level 2 exceedences were also reduced by 45%. This

improvement resulted, in part, from increased renewals volumes and represents good asset stewardship.

Volume of Track Work: Long-run traffic growth

Network traffic grew significantly following privatisation, resulting in increased renewals expenditure

Following privatisation, the level of traffic on the network increased significantly, in response to the unexpectedly large increase in passenger volumes. This additional traffic caused damage to the underlying track assets each year. By the end of CP2, in 2003/04, the railway would have experienced traffic increases of 41% (as measured by Passenger Vehicle Kilometres) over the nine year period starting from 1995/96.

Consequently, over time, the higher level of traffic has reduced the average asset life, in turn requiring a higher ongoing volume of renewals activity. This is largely reflected in additional revenues through the variable charges but focussing just on expenditure levels ignores this.

Unit cost of Track Work: Changes in safety procedures and installation practices

Higher safety standards for engineering work have resulted in increased costs

As part of our drive to improve the safety of our workforce, we have continued to try to reduce the exposure to risk of our people, both directly employed and of our contractors.

One of the ways we have done this is to introduce new procedures that encourage work to be planned so that it can be carried out without exposing people to the risk of passing trains. This is known as “green zone” working. Although we have been successful in reducing the accident frequency rate of our workforce, this has meant the need to both employ additional people to operate the planning process and has sometime led to more expensive, although safer, solutions to carrying out work than would have been used in the past.

Unit cost of Track Work: Renewals worktypes

The mix of the renewals workbank changed adversely, in cost terms, following 1999/00

At ACR2000 assumptions were made as to the amount of work that could be carried out using the seven renewal specifications identified as being the most efficient. However, it has been found difficult to sensibly specify as much of the volume as was expected using these seven specifications. As an example one of the seven types was the use of steel sleepers for track renewal. Using this type only makes sense where the ballast depth is adequate to allow steel sleepers to be used without any reballasting. We have found that the volume of potential sites where this was the case wasn't as great as had been expected and as a result the actual mix of work delivered has used a lower percentage of the seven most efficient specifications than expected.

Unit cost of Track Work: Crime & security

Increases in the level of crime and concerns regarding security have led to material increases in expenditure on preventing crime and improving security. This relates to both the loss of valuable tools and materials and the costs required to protect them.

Input prices

Input prices have increased at above RPI, resulting in significant cost increases

As demonstrated in our recent detailed work undertaken on Input Prices, Network Rail's input prices have risen at approximately 1.0% above RPI on average historically and are likely to continue to do so throughout CP4. Whilst the study did not look back to CP2, it is reasonable for this purpose broadly to extrapolate the findings for CP3 and CP4 backwards and assess the impact of input price inflation of RPI+1% per year on the level of expenditure incurred. This effect accounts for c.£130m of expenditure increase between 1999/00 and 2003/04.

Telecoms

The introduction of the new FTN/GSM-R activity during the period resulted in a cost increase of c.£200m. This activity is, and for some years will continue to be, ongoing. As such this increased level of expenditure will still be required going forward.

Structures

As agreed between Network Rail and ORR at the ACR2003, the level of structures activity during the pre-Hatfield period was materially below that required to deliver a sustainable railway. The process of redressing this insufficient level of activity was instituted during this period, resulting in structures costs increasing by some £200m between 1999/00 and 2003/04.

Other expenditure

Other expenditure increased by c.£40m between 1999/00 and 2003/04 due to the introduction of other activities required to deliver a sustainable railway on an ongoing basis.

Causes of increased maintenance expenditure

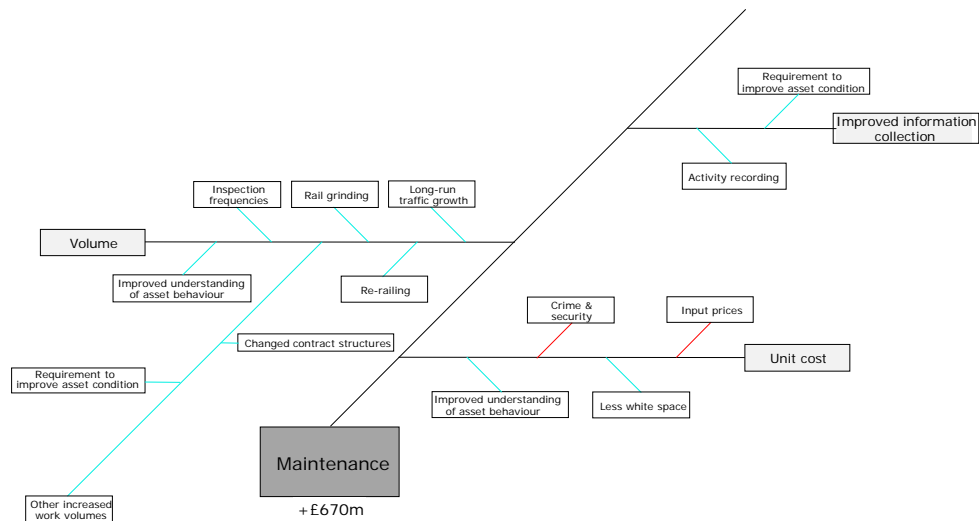
The increase in total expenditure from 1999/00 to 2003/04 is largely explained by external circumstances or additional expenditure which reflects our improved understanding of what is necessary to deliver the outputs required of the railway infrastructure

The level of maintenance expenditure increased significantly between 1999/00 and 2003/04. Our research in this area shows that the increase was the result of a range of factors as described in the following sections.

As per renewals expenditure, this increase mainly reflects the significant increase in the level of activity undertaken following Hatfield as part of the overall effort to improve asset condition. The analysis carried out after Hatfield identified a number of areas where changes were needed to our maintenance approach and these changes, together with increasing safety requirements, had a material impact on the cost of undertaking infrastructure work. Maintenance volumes increased substantially, with increased frequencies and the re-introduction of grinding.

The range of factors identified causing increased maintenance expenditure is illustrated in Figure 9 below.

Figure 9 : Range of factors causing increase maintenance expenditure



Volume: Improved understanding of asset behaviour

The Hatfield accident effectively resulted in RCF being understood and reclassified as a serious defect, leading to a higher volume of work

Prior to Hatfield, RCF was considered to be a relatively minor defect, e.g., it was not, of itself, considered sufficiently serious to generate urgent maintenance action. However, following the increased understanding developed by Network Rail after the Hatfield accident, the significance of this type of fault was fully appreciated, and our approach to its management was extensively revised, reflecting the understanding of RCF as a serious defect. This was achieved through a series of Permanent Way Special Instructions (“PWSI”) which were amendments to the track engineering standards. PWSIs (1 to 4) were integrated into the engineering standards in 2005, in the form of TRK001. Our new approach required additional activities to be carried out in order to maintain a sustainable railway, for example by increasing the use of lubrication and replacement of pads.

Volume: Required to improve asset condition

The need to significantly improve asset condition resulted in increased volumes of activity

The improved understanding of RCF required an improvement in the level of asset condition throughout the network, and therefore higher specification of the maintenance work required to achieve the desired levels of operational safety for the railways.

Volume: Re-railing

Rail replacement volumes needed to increase after Hatfield

The full appreciation of the seriousness of RCF led to an immediate need to replace very significant volumes of rail where RCF was identified, resulting in an immediate 'spike' in the volumes of work undertaken. However, after this initial rapid response to RCF, the ongoing volume of track maintenance work has remained higher than in recent history. This results from the ongoing need to replace rail affected by RCF much earlier than was the case prior to Hatfield now that it is known that these defects are present and potentially dangerous.

Immediately following Hatfield, the maintenance contractors delivered a significant percentage of the re-railing volumes required. This additional maintenance activity was required whilst the renewals organisation and infrastructure prepared to undertake the significantly increased volume of renewals activity. However, these temporary volumes returned to a significantly lower level prior to 2003/04.

In response to recommendations following Hatfield, new ultrasonic and patrolling equipment specially designed to detect RCF was purchased to replace old pedestrian equipment and this resulted in incremental capex and opex expenditure between 2001/02 and 2003/04.

The increased awareness of the risks associated with track defects led to us to remove them from the track earlier than had been the case in the past. By 2003/04 we were rectifying, under maintenance work, about 20,000 track defects a year by re-railing the affected section of track, with about two-of this maintenance re-railing being caused by wheel-rail interface damage. Rectifying each track defect costs between £2,000 and £5,000, meaning that the annual cost increase since Hatfield has been about £50m. However, the benefits of this approach have been seen not only in reduced risk but also in the lower number of broken rails.

Volume: Rail grinding

The new activity of rail grinding was introduced following 1999/00, resulting in increased maintenance costs

Rail grinding, which had been carried out by British Rail to rectify rail corrugation rather than to control the propagation of cracks caused by RCF, was reduced on the network during the mid 1990s and this contributed to the decline in asset condition during that period.

As part of the research work carried out following Hatfield, Railtrack reviewed international good practice in rail grinding and the role grinding could play in combating RCF. This work identified the need to significantly increase the volume of grinding to control the growth of defects and reduce the risk of broken rails. As a result in 2003/04 we spent around £50m on rail grinding against virtually no expenditure in 1999/00.

Volume: Traffic growth in the period

Network Traffic grew significantly during CP2, resulting in increased maintenance costs

As previously mentioned, passenger vehicle kms increased by 23% between 1999/00 and 2003/04, with a resulting increase in level of maintenance required to address the increased level of damage caused to the track assets.

Volume: Changed contract structures

During CP2, the structure of maintenance contracts was revised significantly, which also led to increases in maintenance costs

During 2000, Railtrack concluded that the original RT1/A maintenance contracts needed to be improved. The RT1/A contracts were closed book and provided limited transparency, making it difficult for Railtrack to understand and compare supplier performance in order to control costs.

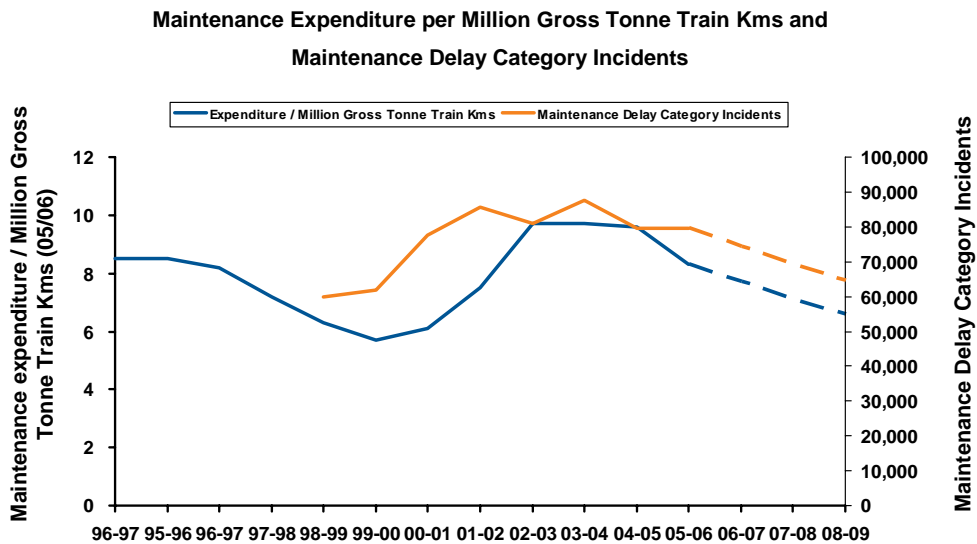
Railtrack started to introduce IMC2000 contracts which incentivised contractors to improve asset condition through higher levels of inspection and maintenance work, make better use of engineering access and increase Railtrack’s involvement in the planning and packaging of work. However, the new contracts typically led to increased maintenance costs. By June 2001, 74% of maintenance costs were delivered under IMC2000 contracts.

Figure 10 shows that there is a lagged relationship between maintenance expenditure and operational performance, i.e., from 1996/97 the level of maintenance expenditure declined, but the effect of this reduction in expenditure in terms of maintenance delay category incidents was felt most strongly from 2000/01 onwards.

Over the period prior to the introduction of the new contracts, the indexation arrangements in the initial contracts caused contractors to cut activities to unsustainable levels. This resulted in a requirement to increase activity levels back to a sustainable level, which was achieved by the introduction of the new contract structures.

These increased volumes and higher unit costs are required to deliver a sustainable network on an ongoing basis.

Figure 10 : Maintenance Expenditure and Maintenance Delay Category Incidents



Volume: Inspection frequencies

Inspection frequencies have increased following 1999/00, resulting in increased costs

Following Hatfield, the frequency of maintenance inspections in track and the range of methods used to perform inspection have also increased significantly.

The track inspection requirements at the time of Hatfield were set out in Railtrack Line Specification RT/CE/S/103, Issue 3. This set out mandatory inspection frequencies and defined the action required on discovery of track defects. Inspections (visual, ultrasonic and track geometry recording) were carried out at intervals relating to the speed of traffic and equivalent tonnage using the line.

Figure 11 below, illustrates the minimum inspection frequency requirements under this specification:

Figure 11 Frequency for visual and ultrasonic inspection of RCF sites, 1999/00			
Visual Track Inspections			
Track Category	Frequency of Inspection	Minimum interval between inspections (days)	Maximum interval between inspections (days)
Cat 1 & 2 Jointed	Twice per week	2	4
Cat 1 & 2 CWR Cat 3 & 4 Jointed	Weekly	4	8
Cat 3 & 4 CWR Cat 5 & 6 Jointed	Once per two weeks	9	17
Cat 5 & 6 CWR	Once per four weeks	23	31
Ultrasonic Rail Inspections			
Track Category	Nominal interval (months)	Minimum interval between inspections (months)	Maximum interval between inspections (months)
Cat 1*	3	-	3.5
Cat 1 & 2*	6	-	7
Cat 2, 3*, 4* & 5*	12	-	13
Cat 3, 4, 5, 6 & 6*	24	-	26
Track Recording Runs			
Track Category	Nominal interval (months)	Minimum interval between inspections (months)	Maximum interval between inspections (months)
Cat 1	3	-	4
Cat 2	6	-	8
Cat 3, 4, 5 & 6	12	-	14
* The shorter intervals for track categories apply to specific high risk types of track such as those in tunnels or S&C and adjustment switches.			

Following Hatfield, the full appreciation of the seriousness of RCF led to both an immediate need to undertake a comprehensive inspection of track over the whole network in order to identify any instances that had not been detected under the

previous methods and also the need to update our track inspection processes to better manage RCF in the future.

As a result, even after the initial rapid response was concluded, there was an ongoing additional volume of visual and ultrasonic inspection work. This necessary increase in inspection frequencies was described in the Permanent Way Special Instruction No. 4, Issue 1 (RT/CE/PWSI/004), released on 1st June 2001. In 2003/04, RT/CE/PWSI/004, Issue 3 (Revised) provided instruction on the management of rails to control RCF, GCC and HC.

Figure 12, below, taken from RT/CE/PWSI/004, Issue 3 (Revised), shows the frequency for visual and ultrasonic inspection of RCF sites.

These changes resulted in higher visual and ultrasonic inspection costs: whereas foot patrols had cost c.£30m in 1999/00, in 2003/04 the cost including visual and ultrasonic inspection was closer to £90m. This represents a necessary £60m increase in maintenance costs if the risks from RCF are to be adequately controlled.

Figure 12 Frequency for visual and ultrasonic inspection of RCF sites, 2003/04				
Line Category	Cat. 1A	Cat. 1 & 2	Cat. 3, 4 & 5	Cat. 6
Severity of RCF	Interval for Ultrasonic & Visual Inspection (months)			
Rerailed RCF Sites (Visual Only Until Cracking is Identified)	3	3	6	12
Ground RCF sites where cracks have been removed completely, (Visual and UT)	6	6	12	24
Light (Visual & UT)	6	6	12	24
Moderate (Visual & UT)	3	3	12	24
Heavy (Visual & UT)	2	2	6	9
Severe (Visual & UT)	1	1	3	6
Light, Moderate and Heavy RCF sites which have been ground to the specified profile and under a regular grinding regime (UT only until rail has worn smooth. Once the rail has worn smooth the site should be reclassified on the basis of the visible surface length of RCF)	U15 test at frequency for RCF severity prior to grinding	U15 test at frequency for RCF severity prior to grinding	U15 test at frequency for RCF severity prior to grinding	U15 test at frequency for RCF severity prior to grinding
Severe RCF sites which have been ground to the specified profile and under a regular grinding regime (UT only until rail has worn smooth. Once the rail has worn smooth the site should be reclassified on the basis of the visible surface length of RCF)	U15 Test 1	U15 Test 1	U15 Test 3	U15 Test 3

Although British Rail had used some train-based ultrasonic inspection, this was not re-introduced until 2001. In 2001 Railtrack and then Network Rail started to develop the capability to accurately and reliably identify defects developing from RCF using train based inspection. Working with Sperry, a leading US company, Network Rail continued this work and now aim to deliver an 8 weekly cycle of inspecting all category 1a, 1 and 2 track and about half category 3 track. Although there are obvious costs both in acquiring the necessary hardware and carrying out the inspections and processing the results, this work has helped to reduce the number of broken rails on the network to the current low levels and to control the risks associated with rail defects.

In addition to the increased frequency, the nature of RCF itself has resulted in the need for changes in the methods of inspection. The ultrasonics methods used to inspect rail prior to Hatfield are not able to identify and classify RCF sufficiently accurately, so these methods have been supplemented, where necessary by manual inspection and measurement, which is significantly more expensive. There is currently no automated method available which is capable of undertaking these inspections.

Network Rail is now considered one of the world leaders in the use of new train-borne and trackside technologies to measure and record asset condition. The introduction of the New Measurement Train (NMT) in June 2003 has significantly improved the frequency and level of data collection. Data is collected on the condition of the track, overhead power lines and signals using scanners, lasers and video cameras.

NMTs allow us to identify issues that were previously difficult to detect, and will do so increasingly in the future. In particular, gall measurement will enhance the analysis of information collected by zero degree ultrasonic probes. The first stage of this work is currently being piloted.

This increased frequency of maintenance inspection and the change in inspection methods have resulted in a significant, permanent increase in the level of maintenance expenditure required for a sustainable railway.

Unit cost: Improved understanding of asset behaviour

Lower tolerance of allowing defects to remain in the track requires more unplanned and reactive work, increasing unit cost

One of the changes introduced after Hatfield was reduced acceptance of allowing defects to remain in the track after they had been identified. A decision was made that if particular defects with a depth greater than 5mm are found then, to keep risk to an acceptable level, the rail must be replaced within 36 hours of the fault being identified. Because this work cannot be planned in advance, this results in an increase in costs as a result of the unplanned nature of such urgent work, despite improvements in asset condition .

As part of our drive to improve the safety of our workforce we have continued to try to reduce the exposure to risk of our people, both directly employed and of our contractors.

One of the ways we have done this is to introduce new procedures that encourage work to be planned so that it can be carried out without exposing people to the risk of passing trains. This is known as “green zone” working. Although we have been successful in reducing the accident frequency rate of our workforce, this has meant the need to both employ additional people to operate the planning process and has sometime led to more expensive, although safer, solutions to carrying out work than would have been used in the past.

Unit cost: Crime & security

Increases in the level of crime and concerns regarding security have led to material increases in expenditure on preventing crime and improving security. This relates to both the loss of valuable tools and materials and the investment required to protect them.

Unit cost: Input prices

Input prices have increased at above RPI, resulting in significant cost increases

As demonstrated in our recent detailed work undertaken by L.E.K. Consulting on Input Prices, Network Rail's input prices for maintenance have risen at approximately 0.9% above RPI on average in CP3 and are forecast to increase at 1.3% above RPI in CP4. Whilst the study did not look back to CP2, it is reasonable for this purpose broadly to extrapolate the findings for CP3 backwards and assess the impact of input price inflation of RPI+0.9% per year on the level of expenditure incurred. This effect accounts for c.£90m of expenditure increase between 1999/00 and 2003/04.

Unit cost: Less white space

Reduced levels of 'white space' between 2003/04 and 1999/00 have made efficient working practices more difficult to achieve

As passenger volumes increased from 1999/00 to 2003/04, the TOCs increased the frequency of the services provided to accommodate the increased demand. This caused the interval between services, or 'white space' to reduce, and in some cases longer operating days. As a consequence, there were fewer and shorter windows of opportunity to undertake maintenance activities.

As there are significant fixed time costs required at the beginning and end of maintenance activities, reductions in the length and frequency of periods of 'white space' have a significant impact on maintenance unit costs.

Improved information collection: Activity recording

Significantly improved activity recording has resulted in increased costs

It became clear late in CP1 that Railtrack had insufficient information regarding the maintenance activities that were being carried out on the network. In order to become an intelligent client for contractors, and to fulfil its asset stewardship commitments, Network Rail invested in MIMS, and required contractors (and, after in-housing, maintenance staff) to record activities in that system. Initially, between the period 1999/00 and 2003/04, this additional activity led to increased costs for the IMCs and for Network Rail's maintenance function.

Improved information collection: Asset condition

Significantly improved activity asset condition recording has also resulted in increased costs

During CP1, Railtrack was required by the Rail Regulator to develop and populate a comprehensive asset register. This project took a number of years to complete and the development continued until CP3, with associated costs. So although this information now enables us to manage our business better, the costs of developing the register between 1999/00 and 2003/04 are a justified incremental cost above the 1999/00 level.

Causes of increased controllable opex expenditure

The increase in total expenditure from 1999/00 to 2003/04 is largely explained by external circumstances or additional expenditure necessary in order to

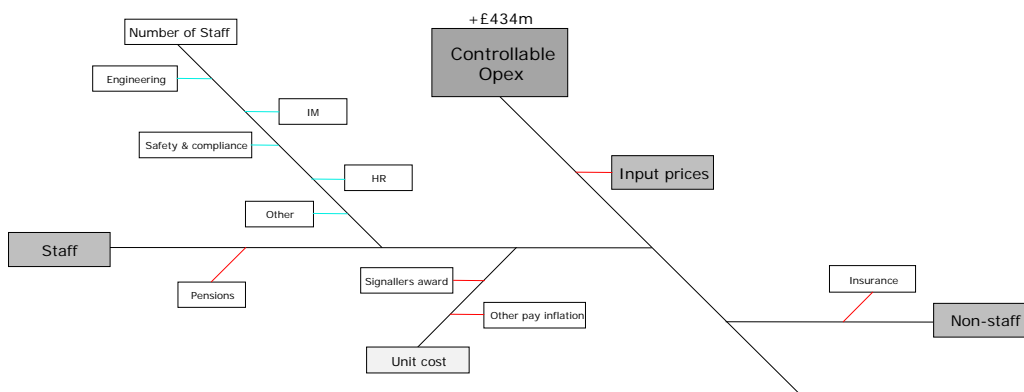
deliver the outputs required of the railway infrastructure and the associated activities required to support this work

The level of controllable opex increased significantly between 1999/00 and 2003/04. Our work identifies that the increase in controllable opex expenditure is the result of several factors described below:

This increase mainly reflects the significant increase in the level of activity undertaken following Hatfield as part of the overall effort to improve asset condition. As our understanding of asset condition and asset failure and degradation mechanisms have improved, so we have identified that some historic practices are no longer appropriate for managing risk at an acceptable level. We have reflected this in our activity levels, as well as the way in which our work is planned and carried out. There have also been a range of external factors which have impacted costs adversely.

The range of factors identified causing increased controllable opex is illustrated in Figure 13 below.

Figure 13 : Range of factors identified causing increase controllable opex



Number of staff: Engineering

Increased in-house engineering expertise and greater attention to development of future engineering resources resulted in additional costs

After Hatfield, it was identified that the business did not have a sufficient in-house engineering expertise to enable it to be an informed client and to properly manage its assets. It was also clear that if action was not taken there would be an increasing shortage of competent railway engineers available in Great Britain. This led to action to both strengthen the in-house engineering team but also to put in place arrangements to develop the next generation of railway engineers.

Some of the additional activities undertaken were new to the company or were significantly expanded to improve safety and the quality and efficiency of maintenance and renewal work. These include:

- the development and management of new techniques and regimes for track inspection and rail grinding, including research and development on the wheel/rail interface and the development of remote condition monitoring systems
- improvements to asset knowledge and asset reporting in line with the company's Asset Information Strategy

- the establishment of System Interface Committees to manage systems interfaces including wheel/rail and ERTMS
- the recruitment and training of additional engineering staff to address weaknesses in industry competence, including the development of conversion courses and sponsorship of students

Number of staff: IM

IM staff costs increased significantly following material improvements in information and data collection activities during the period

Number of staff: Safety & compliance

The Safety and Environment (S&E) Plan initiated in 2003 covers a wide range of activities which represent incremental costs to the business

This plan included about £150m of opex over the next three years. Some of the changes included in the S&E Plan schemes include:

- Vegetation management: increase of the flail strip depth from 3 to 5 metres in support of increased green zone working; development of pro-active maintenance schemes, and addressing previous backlog of work
- Railway crime: covering the “four Es”, education, enabling, enforcement and engineering measures to reduce railway crime
- Interoperability: managing compliance with EU Directives
- Level crossings safety: costs include the replacement of 137 miniature warning light crossings; the upgrade of 4,200 user worked crossings; the conversion of 130 automatic opening locally monitored crossings and the implementation of level crossing strategy
- SPAD mitigation schemes and associated activities aimed at reducing category A SPADs
- Visual impact: management of graffiti, pigeons and other visual intrusions

Number of staff: HR

HR staff costs increased significantly during the period as a result of the requirement to recruit more staff as Network Rail’s structure developed due to the improvements made to enable us to deliver a sustainable railway

Number of staff: Other

More generally, as noted in the previous section, Network Rail recruited significant numbers of new staff during the period to enable us to deliver a sustainable railway. The resulting higher headcount caused material increases in other staff costs

Unit cost: Signallers’ award

Significant revision of terms and conditions for signalling staff following negotiation with the RMT resulted in material increase in signalling staff costs

Unit cost: Other pay inflation

Pay inflation during the period was above RPI, resulting in increased real wage costs

Pensions

Pensions costs grew significantly during CP2 following the pension holiday and stock market declines

Pension costs of c. £60m p.a. from 2001/02 onwards compare to £1m in 2000/01 and £20m p.a. anticipated at the time of the CP2 determination. The increase was due to a shortfall in funding identified in the actuarial valuation of the Railway Pension Scheme at 31 December 2001. The Railway Pension Scheme is an industry scheme that is not under Network Rail's control. The shortfall resulted in a substantial increase in company and employee contributions which was beyond our control.

Pension fund deficits have been a serious issue for many companies in recent years and follows declines in the stock markets.

"The continuing slide in technology and telecom stocks on a global basis has left a trail of poor returns...WM Company, which tracks 1,600 pension funds in the UK, estimates that falling equity markets have reduced the value of pension funds by £31bn"

Pensions Age, May 2001

"Falling stock markets wiped almost £38bn from British pension fund assets in 2001, plunging them into their second successive year of negative growth"

Reuters News, March 2002

Input prices

Input prices have increased at above RPI, resulting in significant cost increases

As demonstrated in our recent detailed work undertaken by L.E.K. Consulting on Input Prices, Network Rail's input prices for opex have risen at approximately 1.5% above RPI on average in CP3. Whilst the study did not look back to CP2, it is reasonable for this purpose broadly to extrapolate the findings for CP3 backwards and assess the impact of input price inflation of RPI+1.5% per year on the level of expenditure incurred. This effect accounts for £89m of expenditure increase between 1999/00 and 2003/04.

Non-staff: Insurance

Insurance costs have risen as a result of market-wide increases in premium

The costs of insuring the business have increased substantially since the CP2 review was completed, with annual premiums increasing by almost five times from £25m in 2001/01 to £115m in 2003/04. From 1999 to 2002, Railtrack's premiums were based

on a three-year insurance contract agreement. A number of factors combined to drive up the premiums, the first of which is economy wide, including;

- the general state of the insurance market following September 11th
- the impact of claims arising from major accidents, notably Ladbroke Grove and Hatfield
- the increasing underlying trend in claims