

Response to LECG and Horton 4 Consulting's review of Oxera's 2008 report to the ORR

**Prepared for
Office of Rail Regulation**

October 27th 2008



Oxera Consulting Ltd is registered in England No. 2589629 and in Belgium No. 0883.432.547. Registered offices at Park Central, 40/41 Park End Street, Oxford, OX1 1JD, UK, and Stephanie Square Centre, Avenue Louise 65, Box 11, 1050 Brussels, Belgium. Although every effort has been made to ensure the accuracy of the material and the integrity of the analysis presented herein, the Company accepts no liability for any actions taken on the basis of its contents.

Oxera Consulting Ltd is not licensed in the conduct of investment business as defined in the Financial Services and Markets Act 2000. Anyone considering a specific investment should consult their own broker or other investment adviser. The Company accepts no liability for any specific investment decision, which must be at the investor's own risk.

© Oxera, 2008. All rights reserved. Except for the quotation of short passages for the purposes of criticism or review, no part may be used or reproduced without permission.

Contents

| | | |
|-----------|--|-----------|
| 1 | Introduction | 1 |
| 2 | The RUOE analysis—issues raised | 3 |
| 2.1 | Comparator selection | 3 |
| 2.2 | Identification of central range | 5 |
| 2.3 | Reset hypothesis | 9 |
| 3 | The TFP analysis—issues raised | 11 |
| 4 | Horton 4 Consulting response | 13 |
| 4.1 | TFP analysis | 13 |
| 4.2 | RUOE analysis | 14 |
| A1 | Comparator selection | 15 |
| A1.1 | Inclusion of BAA | 15 |
| A2 | Deriving the central range | 16 |
| A2.1 | Distribution analysis | 16 |
| A2.2 | Trend analysis | 16 |
| A2.3 | Approach to measuring the average | 17 |
| A2.4 | Additional discussion regarding the exclusion of the gas distribution networks and Scottish Water from the central range | 17 |
| A3 | The reset hypothesis | 19 |
| A4 | TFP analysis | 21 |
| A4.1 | Analysis is over-simplistic | 22 |
| A4.2 | Analysis is sensitive to a range of assumptions | 23 |
| A4.3 | ‘Nature of work’ comparators are not appropriate | 23 |
| A4.4 | Weightings used are incorrect | 25 |
| A4.5 | Assumptions used to derive frontier shift are inappropriate | 26 |

List of tables

| | | |
|------------|--|----|
| Table 2.1 | Result of unit costs analysis (average % per year) (reproducing Table 4.7) | 5 |
| Table 2.2 | Sensitivity check, choice of output measure for BT | 7 |
| Table 2.3 | Scottish Water RUOE reductions, sensitivity check | 8 |
| Table 2.4 | Revised Oxera methodologies, (%) | 9 |
| Table A2.1 | Results of the trend analysis, statistical table | 17 |
| Table A4.1 | Sensitivity analysis for the TFP growth benchmarks (% per year) | 23 |
| Table A4.2 | Activity mapping for OM&R | 24 |
| Table A4.3 | Sensitivity analysis for the maintenance composite benchmark | 25 |

1 Introduction

Following the draft of Oxera's report for the Office of Rail Regulation (ORR) on the scope for efficiency gains for CP4,¹ LECG was asked by Network Rail to provide a review of the approach employed.²

Oxera's response to LECG's review is set out in this report. A number of the points had already been raised by LECG in its Network Rail-commissioned response to the 2005 LEK/Oxera study.³ These have been addressed and clarified in section 3 of the final version of Oxera's 2008 study.

In addition, several issues were raised by Horton 4 Consulting in its report, 'International Efficiency Benchmarking in the Network Rail 2008 Periodic Review', which are also addressed in this report.⁴

The purpose of the Oxera study is to provide an assessment of the efficiency gains achievable by Network Rail in Operating, Maintenance & Renewals (O,M&R) expenditure, which is intended to inform the 2008 periodic review. In undertaking the study, Oxera has endeavoured to ensure that the analysis is as relevant to Network Rail as possible, while making the best use of the available data on indirect comparators in other regulated utilities and competitive markets.

The evidence presented is based on indirect measures of productivity growth, which are less precise than more direct measures of efficiency, such as top-down or bottom-up benchmarking. The use of more direct measures of efficiency, such as the international benchmarking work undertaken by the ORR and the Institute of Transport Studies (ITS), could help to increase the level of confidence in any possible cost reduction target.

Summary of the approach

Oxera's report uses evidence from other regulated companies (real unit operating expenditure (RUOE) reduction analysis) and from competitive sectors of the economy (total factor productivity (TFP) growth analysis) to provide a benchmark range of possible future cost reductions for Network Rail.

Three basic criteria were used in selecting the companies to be included in the RUOE reduction analysis to ensure comparability with Network Rail:

- the comparators should own, maintain and renew network infrastructure;
- the comparators should be part of an industry operating under economic regulation;
- robust data, preferably from regulatory accounts, must be available.

Given the diversity in the performance of other regulated companies, the report divided the range of possible efficiencies for Network Rail—measured as percentage real unit operating expenditure (RUOE) reductions—into those for more efficient firms (up to 4% per year), firms

¹ Oxera (2008), 'Network Rail's scope for efficiency gains in CP4', April.

² LECG (2008), 'A review of Oxera's draft report for the ORR', a report for Network Rail, May 9th.

³ LEK and Oxera (2005), 'Assessing Network Rail's Scope for Efficiency Gains over CP4 and Beyond: A Preliminary Study', December 12th.

⁴ Horton 4 Consulting Ltd (2008), 'International Efficiency benchmarking in the Network Rail 2008 Periodic Review', July.

of average efficiency (4–6.2% per year) and relatively inefficient firms (5–7% per year). However, no judgement was made as to where in the range Network Rail's efficiency might lie as Oxera has not undertaken any direct cost efficiency assessment.

There is more than one way in which cost reduction trends can be summarised. Therefore, to provide a balanced assessment and preclude undue influence on the potential range for CP4 efficiencies, several approaches were examined to ensure consistency. Table 4.7, in Oxera's 2008 report, shows that for industries of average efficiency growth potential, the central range of estimates from the industry average RUOE reductions (4–6.2% per year) is corroborated by the data summarised in several different ways.

In addition, the Oxera study examines the reset hypothesis, according to which the sharp increase in costs that followed the Hatfield derailment and the period of administration are hypothesised to have reset the industry to a position typically observed around privatisation. The range of 5–7% per year overlaps with the range resulting from the RUOE analysis (4–6.2% per year).

The TFP growth analysis is based on the assumption that the productivity performance of a particular industry can be represented by a weighted average of the performance of a number of other industries. The industries that make up the composite benchmark were selected because of the similarities between their activities and those undertaken by Network Rail in each asset category. Since the productivity growth estimates come from firms operating in competitive markets over long time horizons, it could be suggested that their performance represents that of an efficient firm, and therefore that any increases in productivity are due to frontier shift. In reality, there may be transition costs and structural inefficiencies, which could have affect the productivity performance of the assessed sectors. Oxera therefore adopted an assumption, based on academic evidence, that approximately 75% of economy-wide productivity gains arise from pure frontier shift.

Summary and structure of Oxera's response

LECG provides comments in the areas of comparator selection, the identification of the central range, the relevance of the use of the reset hypothesis and the TFP analysis. The majority of LECG's comments are either minor and have little impact on the results of the analysis, or are not valid. The main body of this report goes through each of LECG's major comments, but focuses mainly on those areas where Oxera feels that LECG's comments are valid or could have an impact. Additional discussion of the issues raised by LECG is provided in the appendices to this report.

The issues raised by Horton 4 Consulting are discussed in section 4.

2 The RUOE analysis—issues raised

Throughout its review, LECG expresses some concern about the data underlying the analysis. Using data over a long time horizon can give rise to consistency concerns. For this reason, as for the 2005 Oxera report, considerable thought and care were given to ensuring that the data is as consistent as possible. In addition, as part of Oxera's standard quality assurance processes, comprehensive audits and data verification were undertaken.

Some changes to the data used in the 2008 study compared with the 2005 study relate to adjustments to ensure that the data was as consistent as possible over time. In addition, whenever possible, the most up-to-date version of the data available was used, as regulators and companies revise their historical data from time to time to ensure accuracy and consistency.⁵ Moreover, the additional years of data since 2005 have been added to the data series used in the analysis. Appendix 2 of Oxera's 2008 report provides a detailed discussion of the data used and the adjustments undertaken. For example, it explains that uncontrollable costs, where publicly available, have been adjusted for.

The longer times series, updates to the data and additional adjustments for consistency also explain the differences in the RUOE and reset hypothesis analysis set out in LECG's tables 13 to 16.

2.1 Comparator selection

The criteria used by Oxera to select the comparator industries were as follows: they are price-regulated industries and companies that own, maintain and renew network infrastructure, and they have robust data available. Initially, all network industries in the UK were considered for inclusion in the analysis.

LECG suggests that BT data should be excluded from the analysis, but that data from Royal Mail and BAA should be included. In addition, it suggests that Scottish Water should be included with the water and sewerage companies of England and Wales (E&W)—ie, not treated as a separate industry.

The arguments for and against including particular companies in the analysis are discussed in the following sections.

2.1.1 Including BT as a comparator

BT was included as a comparator because it meets the criteria referred to above. LECG has put forward three arguments for removing it from the comparator set.

- The impact of quality: LECG presents evidence (Table 13) which suggests that the only company in Oxera's comparator set with declining quality performance is BT. However, the quality measure used by LECG relates to the retail arm of the business, which is not included as a comparator in Oxera's analysis. To undertake comparisons between BT and National Rail's network on a similar basis, the RUOE calculation was based on BT's wholesale business. The more relevant quality measure for the wholesale business could be faults per line, an area in which BT has shown *improved* performance, while making one of the largest cost savings in the Oxera comparator set.

⁵ The financial accounts published by companies are subject to revision in later periods.

- The rate of technological change: LECG also states that technology-intensive industries, such as telecoms, may be able to reduce their unit costs more quickly than other, less technology-reliant utility industries. While this may be the case, Oxera considers that no company in the comparator set can match exactly the rate of technological improvement of a rail infrastructure company—indeed, some comparator companies may have less potential for efficiency savings owing to slower rates of technological progress. Given that there is no single indicator that adequately captures the effects of technological growth on productivity growth, such that these effects could be controlled for in the analysis, Oxera proposes that the most equitable approach would be to consider a wide range of comparators for the RUOE analysis. It should be acknowledged that there are differences in the technologies used, with sensitivities to removing the upper and lower industries subsequently considered where the rate of technological change may be particularly high or low.
- Estimation errors in calculating BT's RUOE: LECG argues that since the two BT-specific estimates of RUOE reductions differ, which are based on two different outputs, at least one of them must be wrong. In fact, different RUOE measures for network companies are the norm, especially when one output measures the extent of the network (in the BT case, the number of exchange lines) and the other measures the traffic in that network (the volume of call minutes). It is this fundamental relationship that leads to 'increasing returns to scale and density', which LECG notes is its preferred evaluation criterion for comparator selection.

In LECG's previous analysis for Postcomm on Royal Mail's efficiency position, BT was included in the comparator set.⁶

Oxera considers that BT is a suitable comparator because the telecoms company owns, maintains and renews network infrastructure, has reliable data and is price-regulated.

2.1.2 Not including Royal Mail in the comparator set

LECG argues that Royal Mail should be included in the analysis because it operates a significant UK-based transport infrastructure network and is subject to incentive regulation. In addition, LECG suggests that comparability of ownership structure is important when considering the scope for efficiency improvements, and given that Royal Mail is not privately owned, suggests that it should be included in the comparator set.

Royal Mail did not meet the criteria for inclusion in the comparator set for several reasons, the primary one being that it does not own, maintain or renew a network. In addition, it may not be an appropriate comparator for Network Rail as it has a different cost structure, being a much more labour-intensive business. Around 60–70% of Royal Mail's costs relate to labour,⁷ compared with 40–45% in the case of Network Rail.⁸

Lastly, according to LECG, the closest sectoral comparator to Royal Mail in the wider economy is the distributive trades industry, which was given a higher weight than 70% in LECG's TFP comparator analysis of Royal Mail for Postcomm.⁹ LECG's comments on Oxera's TFP analysis do not refer to this industry as a possible comparator for Network Rail, which suggests that the nature of activities undertaken by Royal Mail is markedly different from that of Network Rail.

⁶ LECG (2005), 'Future Efficient Costs of Royal Mail's Regulated Mail Activities', August 2nd, Table 244.

⁷ Royal Mail Group Limited (2007), 'Regulatory Financial Statements 2006–2007'.

⁸ Network Rail Limited (2007), 'Annual Report and Accounts 2007', June 18th. Labour costs are calculated as employee costs over operating costs. (See Note 5 of the accounts.)

⁹ LECG (2005), 'Future Efficient Costs of Royal Mail's Regulated Mail Activities', August 2nd, Table 256.

2.1.3 Not including BAA in the comparator set

In addition to Royal Mail, LECG suggests the inclusion of BAA as a comparator. BAA was not included in the Oxera analysis for several reasons, the primary one being that BAA does not own, operate and maintain a network.

In addition, there were concerns relating to data quality; in particular, the data to delineate depreciation and security costs from the total operating expenditure (OPEX) is not readily available. Moreover, given the significant increases in security costs starting in the first regulatory period,¹⁰ using unadjusted data would lead to comparisons that are not like-for-like and may bias the results.

The data concerns surrounding BAA's cost information suggest that it is not suitable for inclusion in the analysis. However, the additional comments raised by LECG are addressed in Appendix 1 to this report.

2.1.4 Conclusions on comparator selection

On the basis of the arguments discussed above, Oxera does not consider that any changes in the comparator set are necessary.

2.2 Identification of central range

In arriving at a range of RUOE trends, there is more than one way in which trends in cost reduction can be summarised. To ensure a balanced assessment and preclude undue influence on the potential range as a result of choosing a particular summary measure, several approaches were examined:

- RUOE trends over all periods for which data is available;
- RUOE distribution analysis at company and industry levels; and
- trend analysis.

As shown in Table 4.7 of Oxera's 2008 report, reproduced below, all four approaches produce broadly consistent estimates, although the range provided by the distribution analyses is wide. This was due to the inclusion of all companies and industries in computing the range, whereas the other measures excluded certain industries (see further discussion below).

Table 2.1 Result of unit costs analysis (average % per year) (reproducing Table 4.7)

| | Range of estimates |
|---|--------------------|
| Industry average annual RUOE (central range) | 4.0–6.2 |
| Reset hypothesis | |
| By control period | 6.8 |
| By years since privatisation | 5.2 |
| Distribution | |
| At a company level | –2.6 to 7.0 |
| At a industry level | –0.5 to 8.1 |
| Trend analysis | 4.2 to 8.1 |

Source: Oxera analysis.

¹⁰ In its study, LECG excludes the period after 2001 due to the significant increase in security costs. However, according to the CAA, due to stricter government standards and regulations introduced in 1986, security costs increased very significantly during BAA's first price control period (CAA, 'Economic regulation of BAA south east airports 1992-1997', November 1991, p. 31.)

Paragraphs 3.20–64 of LECG’s review of Oxera’s approach to determining the central efficiency range suggest an alternative range. LECG’s main arguments relate to:

- the use of both BT-specific RUOE reduction measures in the analysis;
- not accounting for approximately £30m of efficiency savings projected to be achieved by Scottish Water, after the merger of the three Scottish water authorities;
- using Scottish Water as a separate comparator in the analysis and not including it as part of the E&W water and sewerage industry;
- the removal of industries that displayed either low or high RUOE reductions, in order to derive the proposed central range.

LECG also provides some additional comments on the implementation of the distribution and trend analysis, and the use of alternative averaging approaches, which do not affect the ranges derived from the Oxera analysis. As such, these comments are considered to be of secondary importance and are treated separately in appendix 2.

2.2.1 Using both of BT’s RUOE reduction measures (potential double-counting of BT)

As with any multiple-product business, it is difficult to assess efficiency savings without detailed costing information for each type of output produced. As a network business, two of BT’s most important outputs relate to the size of its physical network (represented by the number of exchange lines) and the volume of traffic on the network (represented by the volume of call minutes). Since it is not possible to aggregate these two output measures robustly into a composite, BT-specific output without using arbitrary assumptions or going outside the bounds of RUOE analysis, Oxera calculated and included both RUOE reduction measures in the analysis.

This use of both measures is not without precedent—NERA, in its 2005 report for Ofcom, used these two measures to assess BT’s efficiency.¹¹ Europe Economics also used both measures of efficiency in its analysis.¹²

The reason why the use of both measures is important in the case of BT but not for the other network companies included in the analysis is that BT has seen significant growth in traffic levels in recent years, mainly due to the ICT revolution. By contrast, the demand for new exchange lines has been more modest—in fact, Oxera analysis shows that the total number of BT exchange lines has been *decreasing* over the past five years, by, on average, 1.1% per year,¹³ mainly due to the increased competition in the provision of telecoms services. From the above, it becomes apparent that BT’s performance under an RUOE reduction measure would be biased if only one output measure were used in the analysis.

For most of the other network industries considered, the demand for new connections and their levels of traffic have remained relatively stable. As such, there was no need to examine both network- and traffic-level measures. In the cases of the E&W water and sewerage companies, network measures were used as the main output for maintenance expenditure and business activities. Similarly, for Scottish Water, a network measure was the chosen output for sewerage costs. In the case of BT, multiple measures of RUOE reductions were used because cost information was available in greater detail for these industries. A similar approach would have been adopted for the energy companies and BT if robust cost data at this more disaggregate level had been available.

¹¹ NERA (2005), ‘The Comparative Efficiency of BT in 2003’, a report for Ofcom, March 11th.

¹² Europe Economics (2000) and (2003), ‘Analysis of Responses of ‘Railtrack Efficiency’.

¹³ Based on Oxera’s analysis of BT accounts and statistics published on Ofcom’s website: Telecoms Data Updates (<http://www.ofcom.org.uk/research/cm/tables/>)

To address LECG's concerns on this issue, Oxera has checked the impact of excluding one of the two measures of reductions in RUOE for BT from the central range as a sensitivity. The results are presented in Table 2.2 below.

Table 2.2 Sensitivity check, choice of output measure for BT

| | Central range (% per year) |
|---|----------------------------|
| Oxera 2008 report | 4.0–6.2 |
| BT, exchange lines excluded | 4.0–6.2 |
| BT, call minutes excluded | 4.0–4.9 |
| BT, assuming midpoint of two RUOE reduction measures | 4.0–5.5 |

Source: Oxera.

As discussed above, both output measures give an indication of BT's performance. Depending on which output measure is used, the top end of the central range is between 4.9% and 6.2% per year. As it is not clear how to combine these measures robustly into a single output measure, the use of the midpoint of the two RUOE reduction measures (5.5% per year) could be considered a reasonable assumption to use if it is considered not desirable to include both measures.

2.2.2 Scottish Water

Separate comparator

Scottish Water was not used in the analysis in 2005 but has been included in the comparator set in the 2008 report as more data was available. However, Oxera chose to exclude Scottish Water from the calculation of the central range. Scottish Water is at a relatively early stage in the regulatory cycle, which may have implications for consistency in cost reporting and the potential for achieving significant cost reductions due to catch-up. The merger of the three separate Scottish water authorities serves to compound these issues.

The benchmarking exercises undertaken by the Water Industry Commission for Scotland (WIC) suggest that Scottish Water has the potential to achieve significant catch-up efficiencies (suggesting that an additional cost reduction of approximately 25% is required for Scottish Water to reach the efficiency frontier, which is considerably more than the evidence presented in Oxera's 2008 report for the England & Wales companies).

Moreover, Scottish Water is regulated by WIC, which is independent of Ofwat. The company also has different incentives to the E&W water and sewerage companies regulated by Ofwat and is subject to a considerably shorter regulatory period than the E&W water sector.

A more detailed discussion of these issues can be found in Appendix 2.

For the reasons given above, Oxera chose to include Scottish Water in the wider comparator set as a separate comparator. Even if Scottish Water were to be included in the E&W water and sewerage industry, there would be no change in the central range, since the E&W water and sewerage industry is also not part of the central range.

Merger savings

The second issue raised by LECG is the possible efficiency savings that were achieved by Scottish Water after the merger of the three water authorities, which, according to LECG, amount to £30m.¹⁴ LECG argues that since these savings are not available to Network Rail,

¹⁴ LECG (2008), 'A review of Oxera's draft report for the ORR', a report for Network Rail, May 9th.

they should be treated as uncontrollable costs and therefore be excluded when calculating Scottish Water’s RUOE reductions.

The figure quoted by LECG appears to be the *target* efficiency savings set by WIC (£29.3m¹⁵ merger saving from both operating and capital maintenance expenditure in both water and sewerage services) and not what Scottish Water actually achieved from the merger. Oxera has found no evidence to indicate whether or not the merger target identified by WIC was actually achieved by Scottish Water by 2005–06.

As a sensitivity analysis, Oxera examined the effects of Scottish Water achieving the targeted merger savings on its estimated RUOE reductions, with these savings pro-rated across the water and sewerage services and operating and capital maintenance expenditure. Since it is unclear when such savings could have been achieved, two scenarios were considered:

- the total merger savings were achieved in the first year (2002–03); and
- total merger savings were achieved cumulatively by the third year (2004–05).¹⁶

Table 2.3 presents the results of the sensitivity analysis.

Table 2.3 Scottish Water RUOE reductions, sensitivity check

| | RUOE reduction (%) |
|--|--------------------|
| Without merger savings | 8.8 |
| Total merger savings achieved in 2002–03 | 8.1 |
| Total merger savings achieved by 2004–05 | 7.1 |

Source: WIC, Oxera calculations.

Table 2.3 suggests that, had the merger savings suggested by the regulator been achieved, Scottish Water would still have been at the upper end of the range of possible RUOE reductions. On the basis of the arguments discussed in this section, Oxera does not consider that any changes in the way Scottish Water is treated are necessary.

2.2.3 Deriving the central range

The way Oxera has arrived to the central range is explained in section 4.2.2 of the 2008 report submitted to ORR. LECG argues that ten times more data points were excluded from the lower range of Oxera’s central range. This is not correct since the analysis presented in Table 4.1 of Oxera’s 2008 report was undertaken at the industry level rather than the company level, to eliminate any biases associated with unequal weights assigned to industries with a large number of firms. When the results of the distribution analysis at the company level are compared against those at the industry level, a significant difference in means is observed. This is driven purely by the number of companies in industries such as water and sewerage. LECG also appears to support the use of industry-level comparators:

In our view, the most useful result from this analysis is the mean (or the median) for the industry—as the company data seems to provide spuriously low results. (LECG (2008), p. 56, para 3.66)

At the industry level, only three comparators were excluded: the E&W water and sewerage companies, which displayed the lowest RUOE reductions; Scottish Water, which displayed

¹⁵ WIC (2001), ‘Strategic Review of Charges 2002-06’, November, p. 221.

¹⁶ According to WIC, Scottish Water should be able to realise any merger savings within three years—ie, by 2004–05. See WIC (2001), ‘Strategic Review of Charges 2002–06’, November, p. 221.

the highest; and the gas distribution networks (GDNs), for which the available data was based on forecasts and was therefore unlikely to be comparable to the other industries.

2.2.4 Conclusion on the central range

Table 2.4 below summarises the results of the analysis described above.

Table 2.4 Revised Oxera methodologies, (%)

| | Range of estimates (% per year) |
|---|--|
| Central range, Oxera report | 4.0–6.2 |
| Central range, BT, exchange lines excluded | 4.0–6.2 |
| Central range, BT, call minutes excluded | 4.0–4.9 |
| BT, assuming midpoint of two RUOE reduction measures | 4.0–5.5 |

Note: OPEX from the comparator industries refers to operating costs plus those maintenance costs that are not capitalised.

Source: Oxera analysis.

Oxera has addressed LECG's comments by examining some additional sensitivities (see above and Appendix 2), and, in the case of the trend analysis, has provided extra statistical information.

LECG also provides some additional comments on the implementation of the distribution and trend analysis, and the use of alternative averaging approaches, which do not affect the ranges derived from the analysis. As such, these comments are considered to be of secondary importance and are treated separately in Appendix 2.

The central range identified is of a similar magnitude, over a five-year period, as that of a number of studies discussing Network Rail's efficiency, which suggest that there is a substantial gap between Network Rail and international comparators, as well as best practice. For example, a UIC study shows an efficiency gap of 36% for maintenance and 30% for total costs.¹⁷ In addition, the joint ORR and Institute for Transport Studies study using the LICB (Lasting Infrastructure Cost Benchmarking) dataset and international regional data suggest that there is a significant efficiency gap to European best practice of around 37–44%.¹⁸

2.3 Reset hypothesis

Oxera used several approaches to infer the central range estimate for Network's Rail potential scope for cost reductions, one of which was the reset hypothesis, as suggested in the 2005 LEK/Oxera study. The reset hypothesis examines the data from a different perspective, by introducing dependence between control period and efficiency gains. The hypothesis suggests that, due to the Hatfield derailment, Network Rail's costs and efficiency were set back, or 'reset', to those similar to the pre-privatisation level.

LECG has made a number of comments on the reset hypothesis:

- there is no conclusive proof that the expenditure increases after Hatfield were due to inefficiency;
- Oxera does not heavily caveat the hypothesis;

¹⁷ ORR (2008), 'Update on the Framework for Setting Outputs and Access Charges and Strategic Business Plan Assessment', February, p. 113.

¹⁸ Smith, A., Wheat, P. and Nixon, H. (2008), 'International benchmarking of Network Rail's maintenance and renewals costs', June.

- drivers for larger efficiency savings in the second control period in comparator industries are missing in the case of Network Rail;
- the short timeframe used could bias the results;
- the reset hypothesis has no regulatory precedent.

Most of LECG's comments are valid, but fail to acknowledge that the reset hypothesis is only a hypothesis, which Oxera did not aim to prove or disprove. It is simply another way to consider making the data more comparable to Network Rail's situation. However, the trade-off is that it uses fewer data points and hence the uncertainty surrounding the estimate is greater. Therefore, all the caveats that were applied to the hypothesis in the 2005 report are still applicable. It is up to the ORR to decide whether the hypothesis is valid and relevant for Network Rail. A more detailed examination of LECG's comments and Oxera's response can be found in Appendix 3.

3 The TFP analysis—issues raised

In paragraph 5.4 LECG summarises its criticisms of Oxera's TFP analysis, as follows:

- the analysis may be over-simplistic,
- it is sensitive to a range of assumptions,
- it may contain errors,
- 'nature of work' comparators selected are not the most appropriate set,
- weightings used are incorrect, and
- the assumption used to derive frontier shift is inappropriate.

On the first issue, LECG argues that a number of factors are not considered by the analysis, such as the effects of fixed factors over the short run, the impact of the regulatory/competitive environment, the rate of TFP gains in the general economy, and differences in economies of scale among the comparator industries. The first two points are implicitly dealt with in the analysis by selecting comparators that are similar in their characteristics to Network Rail. The last two points are explicitly dealt with in the analysis, which also provides extensive sensitivity analysis to test the impact of using different assumptions. Oxera therefore considers that additional adjustments are not necessary. These points are addressed in detail in section A4.1.

On the second issue, LECG argues that the assumptions used regarding the adjustments for economies of scale and capital substitution are not 'well supported' and 'the results are clearly sensitive to these assumptions.' In addition to the discussion with reference to academic papers and reports by regulators on capital substitution and economies of scale provided in the 2008 Oxera report, Oxera provided extensive sensitivity analysis that tests for the effects, among others, of using alternative assumptions on the elasticity of scale and extent of capital substitution. The analysis revealed that adopting these alternative assumptions led to a relatively narrow range for the TFP benchmark of 1.5–1.9% per year. These points are addressed in detail in section A4.2.

The third issue seems to focus exclusively on the labelling of a table. In paragraph 5.24, LECG correctly highlights that 'Potentially, there could be a labelling issue—and the figure could relate to TFP growth above total industry TFP.' This is correct. The title of Figure 5.2 should read 'Average annual TFP growth **outperformance** in the selected sectors'. This is a labelling mistake and has no effect on the results of the analysis.

The comparator set for Oxera's TFP analysis was selected based on the similarities between the industries' activities and those undertaken by Network Rail in each asset category. The weightings used to create the composite benchmark were based on Network Rail's CP4 cost information, which was sourced from the company's strategic business plan and supporting data.

Both of these issues were discussed with the ORR, which also provided final sign-off on the selection of comparators. Nevertheless, given the overall uncertainty, Oxera undertook extensive sensitivity analysis to test, among other factors, the effects of using different mappings and weightings. The results showed that the range of the TFP estimates under different assumptions is quite small (1.5–1.9% per year). Oxera has also expanded the sensitivity analysis to address the concerns expressed by Network Rail and LECG about the comparator set (see Table A4.3 in Appendix 4). The results from this expanded sensitivity analysis support the assertion that the composite productivity benchmark is not overly sensitive to the comparator selection suggested by LECG. In addition, analysis undertaken by LECG on the use of alternative weightings found that when the suggested alternative

weights are used in the construction of the composite benchmark, the overall effect is marginal (approximately 0.1%).

With respect to LECG's final point, the assumption used by Oxera to derive the frontier-shift estimate is based on academic evidence.¹⁹ LECG states that it does not believe that the academic evidence is sufficient and argues that the majority of the industries in the comparator set are regulated utilities which achieved significant post privatisation efficiency improvements (ie, catch-up gains) over the timeframe of the analysis. However, the contribution of the sectors that include some regulated companies is not large enough to dominate the composite benchmark, and their overall performance not unique among the comparator set. The additional discussion provided in Appendix A4.5 would suggest that it would not be appropriate to change the frontier shift assumption on the basis of the arguments put forward by LECG.

In conclusion, Oxera made a conscious decision to keep the analysis simple, instead of producing a long list of add-on effects and then 'guesstimating' their impact. This approach could not only give a false impression of increased accuracy, but would ultimately further complicate an already difficult issue and introduce intractable bias into the results. Instead of adopting this approach, Oxera chose to focus on issues that had previously been examined in the regulatory and academic debate, and whose effects could be controlled for using evidence from robust analysis. In addition, Oxera provided an extensive sensitivity analysis to test the impact of the various assumptions on the results of the analysis, and has provided additional analysis in this report to examine some of the issues raised by LECG and Network Rail. Oxera is confident that the results of the sensitivity analysis and the points raised by LECG demonstrate that no change in the range provided by the TFP analysis is necessary or justified.

¹⁹ Färe, R., Grosskopf, S., Norris, M. and Zhang, Z. (1994), 'Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries', *The American Economic Review*, **84**:1, March, 66–83.

4 Horton 4 Consulting response

Horton 4 Consulting has reviewed the ORR's approach to assessing the level of expenditure on maintenance, renewals and operating costs in its draft determinations of access charges. In doing so, the Horton 4 Consulting report raises several issues relating to Oxera's analysis of TFP and reductions in RUOE in other UK utilities.

The Horton 4 Consulting report claims that the 35% efficiency gap is not supported by Oxera's analysis. In its draft determinations for CP4, the ORR has used efficiency targets of 3.5% per year for operating costs and 5% per year for maintenance and renewals. Both of these are below the top of the range suggested, of 4–6.5% per year. Even if the observation defining the top of this range—BT—were removed from the sample, the targets would still be within a reduced range of 4–5.5% per year.

The report states that it is hard to justify the use of frontier benchmarking when a company at the frontier might be expected to earn supernormal profits rather than the cost of capital. In competitive markets, profit incentives should mean that firms are on, or near, the efficient frontier, yet earn a normal cost of capital. Frontier benchmarking (or yardstick competition) has been used as a way of proxying the incentives provided by competitive markets to be efficient and to remove the x-inefficiency associated with natural monopolies. Economic regulators have a duty to incentivise firms to be efficient, while ensuring that they can still finance their functions.

4.1 TFP analysis

The Horton 4 Consulting report suggests that the results found in the TFP section of Oxera's 2008 study are influenced by the comparators enjoying abnormally large post-privatisation productivity growth in the UK. The report goes on to suggest that looking at the whole of Europe rather than the UK, and examining a shorter time period (1980–95) leads to lower estimates of frontier growth. Three main issues are raised.

- *Use of UK rather than European data*—with regard to using UK or European data, the purpose of the exercise is to replicate as closely as possible what frontier shift in competitive markets similar to Network Rail might look like. UK data over this period was considered to provide a more relevant comparator for Network Rail's situation than pan-European data, as it considers the performance of firms operating under conditions similar to those of Network Rail.
- *Period of analysis*—Oxera reports sensitivities to expanding and contracting the period over which the TFP growth is estimated, which were used to derive the range of TFP growth benchmarks of 1.5–1.9% per year for O,M&R. Figure 5.1 of Oxera's 2008 report shows that, if using the 1980 to 1995 period, the analysis would not fully capture two business cycles, which may bias the results and not include the most recent information on how the comparators are performing. The 1981 to 2004 period was considered to be most useful because it includes the more recent data on firm performance, as well as two full business cycles to avoid cyclical effects.
- *Comparator set*—a significant proportion (at least 35%) of the comparators come from markets that are not price-regulated, ensuring that there is a good mix of firms operating in competitive markets. It is not possible to be exact, as it depends on how much of the transport and storage sector is made up of price-regulated goods, compared with those operating in non-price-regulated markets.

4.2 RUOE analysis

Horton 4 Consulting identifies some of the issues surrounding RUOE growth in comparator industries and suggests that these can lead to a wide variety of results. The Oxera analysis in the 2008 study attempted to correct for these issues as best as possible (by adjusting for economies of scale and adjusting both the input and output data to ensure comparability). However, there is always an element of uncertainty when undertaking such indirect benchmarking. This is why it should be corroborated with other evidence from direct benchmarking studies of rail infrastructure managers' performance.

The report says that it is not clear how Oxera derived the central range of '4–6%'. Section 4.2.2 of Oxera's 2008 report (under the heading 'Deriving the central range') explains the rationale for excluding industries to form the central range of 4–6.2% per year. These were as follows:

- gas distribution—the data available was forecast rather than achieved;
- England & Wales water and sewerage—historically slow technological progress and low rates of productivity growth; and
- Scottish Water—a short period of regulation and the introduction of PFIs led to concerns over the consistency of the data.

This is only one way to examine the data and arrive at a useable range; hence, several other approaches were used, including distribution analysis, trend analysis and the reset hypothesis. Each approach is a different way of cutting the data and leads to different results. These approaches are summarised in Table 4.7 of Oxera's 2008 report, and are used to arrive at the recommended range of 4–6.5% per year.

With regard to the reset hypothesis, the central range is not 'raised', as suggested by Horton 4 Consulting; rather, it is an alternative way to examine the data. Instead of removing outlying companies, the data is summarised by the number of control periods and time since privatisation. It does not rely on the central range itself. As acknowledged above, there is a trade-off between having data relevant to Network Rail's current situation and the number of observations.

The Horton 4 Consulting report notes that the mean RUOE is much lower than the recommended range. This is because the analysis of RUOE reductions is undertaken at the industry, rather than the company, level. The mean of the company-level observations is lower due to the large number of companies in the England and Wales water and sewerage sector compared with the other industries. To avoid biasing the results by some industries having many more companies than others, the analysis was done at the industry level. The mean average annual rate of RUOE reduction was 5.4% per year for all the industries examined, and 5% per year for those in the central range.

The report suggests that the performance of BT, NGC and electricity distribution could have been boosted by cost reallocations, merger savings and rapid technological change (for BT). Where possible, the data was adjusted to control for such factors; however, indirect benchmarking is not a precise science and there may be unexplained variation in the results, both positive (as identified by Horton 4 Consulting) and negative (such as how quickly new technologies become available, different incentives for innovation, and cost allocations which could be negative as well as positive). As identified in the Oxera (2008) study, the results of indirect benchmarking should not be used in isolation, but supported by direct benchmarking evidence of Network Rail's relative efficiency, such as that undertaken by the ORR and ITS.

A1 Comparator selection

A1.1 Inclusion of BAA

LECG suggests the inclusion of BAA in the comparator set. There are several reasons why BAA was not included in the analysis. The primary reason was the primary one being that BAA does not own, operate and maintain a network.

In addition there were concerns relating to data quality; in particular, the data to delineate depreciation and security costs from the total OPEX is not readily available. Moreover, given the significant increases in security costs starting in the first regulatory period,²⁰ using unadjusted data would lead to comparisons that are not like-for-like and may bias the results.

LECG argues, however, that the data is available and that it has carried out similar (unpublished) efficiency analysis for CAA. Oxera has no access to this data and therefore cannot comment on its usefulness for this study.

In work undertaken for Postcomm, LECG used a very specific measure of productivity (staff costs per passenger).²¹ While such a measure could be used as secondary evidence on BAA's performance, it is not directly comparable to the other broader-based operating, maintenance and renewals cost measures used in the 2008 Oxera report. Moreover, LECG's use of BAA unadjusted staff costs could be problematic, given the significant increases in security costs starting in the first regulatory period.

LECG argues that BAA should have been used in the analysis due to its infrastructure being interconnected with that of Network Rail. The fact that it is possible to travel to several BAA airports by train does not make BAA a good comparator. In most cases (except Heathrow Express and Connect), rail links to BAA airports are not run by BAA, but by separate unregulated franchises within the BAA Group. Moreover, BAA sub-contracts maintenance work to Network Rail for its stations at Heathrow and Stansted.

It is also not clear whether BAA's activities are a close match to the work undertaken by Network Rail; both companies have a substantial civil engineering programme, but such activities are usually classified by BAA as capital expenditure (CAPEX) and the cost measure used to derive the RUOE relates to OPEX.

²⁰ In its study, LECG excludes the period after 2001 due to the significant increase in security costs. However, according to the CAA, due to stricter government standards and regulations introduced in 1986, security costs increased very significantly during BAA's first price control period (CAA, 'Economic regulation of BAA south east airports 1992-1997', November 1991, p. 31.)

²¹ LECG (2005), 'Future Efficient Costs of Royal Mail's Regulated Mail Activities', August 2nd, Table 244.

A2 Deriving the central range

A2.1 Distribution analysis

For the distribution analysis, Oxera presents the mean, the median and the inter-quartile range. However, LECG questions whether the calculation of the average in the distribution analysis is correct. LECG argues that the mean value derived from the company-level distribution analysis is wrong, given the difference between the mean estimated at the company level and the mean estimated at the industry level. The difference in the results is explained by the different weights applied to industries in the case of company-level and industry-level analysis (due to differing numbers of companies in each industry).

In addition, LECG expresses confusion regarding the normal distribution line fitted onto the data in Figures 4.1 and 4.2 presented in the distribution analysis section of Oxera report. The normal distribution line was added to the charts for presentational purposes only, to indicate that the cost savings appear to be broadly normally distributed, in accordance with the law of large numbers.

From the charts and tables in the distribution section of the Oxera report, it can be inferred that the data is skewed. This is supported by a significant difference between the mean and the median of the results in the case of distribution by company. In the case of the distribution by industry, the mean and the median are only marginally different, implying that skewness is much less.

The mean of the distribution is more sensitive to extreme values than the median, especially when the sample size is small. The general practice is to use both measures when presenting the results of the analysis. Furthermore, it is worth noting Oxera did not rely on a particular estimate, but presented the whole range. Oxera presented the results of the distribution analysis in its report giving the mean, the median and inter-quartile range—this approach to presenting the data is often used in such cases (eg, by Ofgem).²² Furthermore, the analysis does not suggest a point estimate of the efficiency gains that can be achieved by Network Rail in the next price control. Rather, it provides a potential range which shows where the majority of savings have been achieved by the selected comparators on an annual basis.

A2.2 Trend analysis

Oxera used the analysis of RUOE reduction trends as an alternative way of assessing the data. LECG argues that the results of the trend analysis suggest a poor fit of the model and that Oxera removed from the analysis only lower average RUOE reduction industries.

The comparators that were removed from the analysis, referred to as the 'outlier industries', also included Scottish Water, and are thus broadly consistent with Oxera's central range comparators. The exclusion of BT from the sample has a negligible effect on the trend, as Table A2.1 demonstrates.

In section 4.2.5 of Oxera's report, Oxera comments only on the relatively low explanatory power of one of the models used. However, the results presented below, as well as in the

²² See Ofgem (2004), 'Electricity Distribution Price Control Review: Final Proposals', November.

2008 Oxera report, suggest that when the non-central range industries were excluded, the fit of the model in terms of explanatory power significantly increases.

Table A2.1 presents the model parameters estimated by the trend analysis.

Table A2.1 Results of the trend analysis, statistical table

| | Constant | Trend | R-squared |
|--|-----------------|-------------------|-----------|
| All industries | 0.040 (1.82) | -0.042 (16.97) | 0.273 |
| Central range industries (excluding E&W water and sewerage, Scottish Water and GDNs) | 0.185 (5.22) | -0.080 (21.36) | 0.636 |
| Excluding outlier industries, but including BT | 0.177 (6.03) | -0.079 (24.27) | 0.675 |
| Excluding outlier industries | 0.190 (6.28) | -0.081 (24.42) | 0.688 |

Note: t-statistics is presented in parenthesis.
Source: Oxera analysis.

A2.3 Approach to measuring the average

To get around the sensitivity of the results to specific start and end points, and to avoid undue biases from atypical performance in any one year, Oxera calculated RUOE reductions using the average of annual changes approach.

A2.4 Additional discussion regarding the exclusion of the gas distribution networks and Scottish Water from the central range

GDN RUOE reductions were an addition to the analysis undertaken for the LEK/Oxera 2005 report. The inclusion of GDNs became possible after the publication of operation and financial characteristics for the networks during the recent price control determination (GDPCR 2007–13). However, the data that is available at present represents *forecast* costs and volumes. Furthermore, this forecast data includes Ofgem's assumptions about future levels of expenditure. As such, the actual performance of the GDNs is unclear; they may not achieve these targets or may outperform them. Although the GDNs' forecast RUOE reductions present an interesting comparison—given that Oxera's analysis is based on the level of *achieved* efficiency—their inclusion in the central range would introduce internal inconsistency.

Scottish Water is at a relatively early stage in its regulatory cycle, which, as noted in section 2.2.2 above, may have implications for its ability to achieve significant cost reductions due to catch-up.

With regard to cost data, Oxera's understanding is that the PFI contracts are long-term contracts and their cost estimates may distort the data. Given their long-term nature and that Scottish Water has little control over their costs, the PFI costs would ideally be excluded from the efficiency analysis. However, the reporting requirements have changed over time making consistent data on PFI contracts unavailable.

The benchmarking exercises undertaken by WIC suggest that Scottish Water has the potential to achieve significant catch-up efficiencies (implying that additional cost reductions of around 25% are required for Scottish Water to reach the efficiency frontier). In addition,

the recent cost reduction performance of Scottish Water, as reported by WIC, has been significant, with operating costs decreased from around £400m in 2001 to £250m in 2006. It should be noted that such cost reductions were achieved alongside an increase in the quality of service provided, as evidenced by the improvements in Scottish Water's Overall Performance Assessment (OPA) score.²³

For these reasons, and the fact that Scottish Water operates under a different regulatory regime overseen by a different regulator (WIC), Oxera chose to include Scottish Water as a separate comparator, but to exclude its RUOE reductions from the calculation of the central range. Even if Scottish Water were to be included in the E&W water and sewerage industry, there would be no change in the central range, since the E&W water and sewerage industry is also not part of the central range.

²³ WIC (2005), 'The Strategic Review of Charges 2006-10: The final determination', November 30th.

A3 The reset hypothesis

As noted in section 2.2, Oxera used a number of approaches to infer the central range estimate, one of which was the reset hypothesis, as suggested in the 2005 LEK/Oxera report. The reset hypothesis examines the data from a different perspective in that it introduces a dependence between control periods and efficiency gains. The essence of the hypothesis is that, due to the Hatfield derailment, Network Rail's costs and efficiency were set back, or reset, to those similar to the pre-privatisation level.

Oxera did not aim to prove or disprove the hypothesis. It is simply another way to consider making the data more comparable to Network Rail's situation. Therefore, all the caveats that were applied to the hypothesis in the 2005 report are still applicable. As such, the results should be treated carefully owing to the existence of a trade-off between the use of data covering a longer time period and the relevance of the analysis. Given the nature of the analysis, it is reasonable to assume that the data over the longer time period would provide more robust estimates. However, Oxera also aims to make the analysis as relevant to Network Rail's situation as possible.

The nature of the incentive regulation means that it is in a company's interest to achieve as much efficiency saving as possible within a given price control period. Therefore, estimates of RUOE reductions may be sensitive to the number of regulatory periods. Intuitively, firms may go for the easiest and largest savings in the early control periods, while in the later control periods the efficiency savings may be harder to achieve and smaller in value.

In addition, contrary to the compound growth rate—which takes into account only the start and end points—the reset hypothesis uses all the data available within a five-year window. Therefore, by applying a consistent approach to calculating average RUOE reduction, Oxera has used as much of the data as possible while examining data within the control period.

The reset hypothesis was initially introduced in the LEK/Oxera 2005 report. None of the UK regulators has examined RUOE data in a similar way. LECG argues that there are other similar experiences to the Hatfield precedence in terms of cost increase in the regulatory history in the UK. One such example on which LECG bases its argument is the cost increase for BAA after 9/11.

In the case of BAA, security costs have been increasing since its first price control review.²⁴ The regulator has always recognised the increasing security costs and has appropriately reflected such increases in the price determinations. These cost increases have been driven by tighter government standards and external factors outside BAA's control. The costs associated with the implementation of tightening security standards are explicitly accounted for in the price-setting mechanism. Furthermore, security costs represent only a proportion of BAA's cost base and the cost efficiency of security at airports is examined separately in the price control review.

LECG argues in section 4 of its report that the hypothesis was not applied consistently: 'the draft 2008 Oxera study quotes an example of significant expenditure increases for BT, but does not argue that BT should be 'reset' and appears to have 'reset' the GDNs without arguing that there was an associated expenditure increase.'

²⁴ In its study, LECG excludes the period after 2001 due to the significant increase in security costs. However, according to the CAA, due to stricter government standards and regulations introduced in 1986, security costs increased very significantly during BAA's first price control period (CAA, 'Economic regulation of BAA south east airports 1992-1997', November 1991, p. 31.)

In BT's case, the significant cost increases were introduced by management events such as the introduction of new accounting standard and changes in the regulatory regime.²⁵

In the GDNs' case, all the networks were part of National Grid Gas until 2005, when a structural separation took place resulting in a new market structure. However, as it was not possible to obtain robust and consistent data for each GDN prior to the recent price control determination, the 2008–13 price control period for GDNs was assumed to be the first. At the same time, when RUOE reductions are looked at from the years since privatisation perspective, it was assumed that GDNs were privatised more than 15 years ago as part of National Grid Group. As the gas industry has been regulated since privatisation, it is reasonable to consider GDNs to be in the category of 15+ years since privatisation. However, given the significant change in the market structure, the period before 2005 might not be considered comparable. In addition, given the new market structure, the GDNs may realise further efficiency gains, and were therefore allocated to the first price control period group. Whether GDNs are considered to be in their first or sixth price control review does not affect the conclusions for Network Rail (CP4 will be the second price control review since Hatfield) based on the reset hypothesis.

Evidence from other network industries suggests that the second price control period is when the largest efficiency savings are made (see Table 4.2 of Oxera's 2008 report). Network Rail's achievement of large efficiency savings in the first control period does not necessarily preclude efficiency savings of a similar magnitude being made again. The main driver of potential efficiency savings is the starting level of the firm's relative inefficiency. The Oxera report makes no assumption about Network Rail's efficiency relative to best practice, but sets out a range of possible efficiency improvements. The exact scope for future efficiency savings will depend on Network Rail's efficiency relative to best practice.

²⁵ See, for example, BT (2005), 'Financial Statements', p.165, note 2a: 'Wholesale access services are now charged at third party tariff to Service Providers (SP's) and BT Retail on an equivalent basis. For year ended 31 March 2004 the charge was at cost to the Retail System Business which was then charged on at third party tariff to SP's and the BT Retail Businesses and Activities. In order to implement this change for 2005 costing methodologies have been amended resulting in certain costs previously recognised in Activities within the Retail Systems Business now being attributed directly to Wholesale Services (see note 3(c))'

A4 TFP analysis

In two places in its report (paragraphs 2.37 and 5.2), LECG expresses concern about adding frontier-shift and catch-up estimates to derive targets, arguing that this practice leads to double-counting 'since a bottom-up analysis will already identify initiatives to deliver frontier shift'.

This issue can be clarified by providing a clear definition of frontier shift. According to the ORR's ITT, Oxera interpreted frontier shift to represent 'improvements likely to be achieved in the future by adopting technology or working practices yet to be developed' (p. 23). Therefore, a bottom-up analysis that assesses performance to existing best practice cannot reveal 'frontier-shift' efficiencies; rather, all efficiency improvements identified relate to catching up to best practice.

LECG is also concerned about the transition from TFP to unit costs: paragraph 5.3 states that 'the draft 2008 Oxera study calculates a frontier-shift (ie not a total efficiency target) in terms of TFP growth, rather than in terms of a RUOE target.' The first part of this statement is not correct, as section 5.5 of Oxera's report is devoted exclusively to a discussion of how the TFP growth estimate, which represents total productivity growth, can be decomposed into a frontier-shift and catch-up components. The final report, produced before the ORR provided Oxera with the LECG review, states this explicitly:

The benchmarks derived from a TFP growth analysis include the effects of both components [catch-up and frontier shift], and thus represent a measure of the scope of total productivity improvement.' (p. 23)

The second part of LECG's statement is correct. Oxera provides productivity growth estimates and does not attempt to translate these into cost reduction targets. The final report states:

The productivity growth benchmarks established in this report are only one element of the analysis to establish a long-term cost reduction target for Network Rail. The other major component required is an estimate for the likely input price growth in the rail infrastructure sector. Under the RPI – X framework, revenue allowances can then be set by calculating the two major components of X, namely:

- the differential in input price growth between the general economy and the rail infrastructure sector;
- the differential in the scope for productivity growth between the general economy and the rail infrastructure sector. (p. 30)

These adjustments need to be made before applying the productivity target in the report.

In paragraph 5.4, LECG summarises its criticisms of Oxera's TFP analysis:

- the analysis may be over-simplistic,
- it is sensitive to a range of assumptions,
- it may contain errors,
- nature of work comparators selected are not the most appropriate set,
- weightings used are incorrect, and
- the assumption used to derive frontier shift is inappropriate.

The following sections deal with each issue in turn.

A4.1 Analysis is over-simplistic

LECG argues that 'Oxera's analysis is presented at a much higher level than industry best practice—and in many places does not draw on the most recent debate, estimates and identified issues' (paragraph 5.12) '...and in particular a number of factors are not considered'. These arguments are discussed below.

- *The effects of fixed factors over the short run.* This relates to the business environment and the production process that each industry faces. These are implicitly considered in the analysis via the construction of the composite benchmark, which is informed by the similarities of the activities of the comparator industries to those undertaken by Network Rail. The majority of the industries used in the construction of the composite benchmark have similar capital structure constraints to Network Rail, such as long project lead times, extensive capital input requirements and long asset lives. As such, the comparators are likely to face similar conditions to Network Rail regarding the impact of fixed factors over the short run.
- *The regulatory/competitive environment.* This is also implicitly considered in the selection of comparator industries. The majority of these industries are under some form of economic regulation, similar to Network Rail. The construction and transport and storage sectors are the exceptions, but the results from the sensitivity analysis and the alternative composite benchmark (which was constructed solely using TFP estimates from the construction and business activities sectors, excluding all other sectors) suggest that any additional impact of the regulatory/competitive environment not already captured by the comparators is marginal.
- *The rate of TFP gains in the general economy.* This is explicitly considered in Oxera's analysis—see Table 5.2 of Oxera 2008. Most importantly, all industries considered are UK-based and therefore all function within the same general economic environment.
- *Economies of scale.* This is also explicitly considered—see section 5.3 of Oxera 2008 for an extensive discussion on the elasticity of scale estimate adopted for the analysis. Sensitivity analysis is also provided for the alternative elasticity estimate of 0.9 that was used in the 2005 Oxera/LEK report.²⁶

Indirect methods of assessing productivity growth require a number of assumptions in order to simplify the complex interactions that take place in the modern economy. In most cases, such interactions are hidden, and even where they are visible, they can be difficult to describe and their effects difficult to estimate. Oxera made a conscious decision to keep the analysis simple, instead of producing a long list of add-on effects and then 'guesstimating' their impact. This approach could not only give the false impression of increased accuracy but would ultimately further complicate an already difficult issue and introduce intractable bias in the results.

Instead of adopting this approach, Oxera chose to focus on issues that had previously been examined in the regulatory and academic debate, and whose effects could be controlled for using evidence from robust analysis. In addition, Oxera provided an extensive sensitivity analysis to test the impact of the various assumptions on the results of the analysis. Given the overall uncertainty surrounding the issue, the results of the sensitivity analysis are given the same weight as the results from Oxera's primary analysis in creating the final suggested range of estimated productivity growth.

²⁶ LEK and Oxera (2005), 'Assessing Network Rail's Scope for Efficiency Gains over CP4 and Beyond: A Preliminary Study', December 12th.

A4.2 Analysis is sensitive to a range of assumptions

In paragraph 5.12 LECG discusses the assumptions used regarding the adjustments for economies of scale and capital substitution, arguing that ‘neither of the assumptions is well supported’ and ‘the results are clearly sensitive to these assumptions.’

Sections 5.1 and 5.3 of Oxera 2008 provide discussion with reference to academic papers and reports by regulators on capital substitution and economies of scale, which support the assumptions used in the analysis. However, because the nature of work approach is indirect and owing to the uncertainties surrounding the complicated issues that need to be addressed, Oxera also provided sensitivity analysis, the results of which are presented in Table 5.3 of the Oxera 2008 report. The sensitivity analysis made use of an alternative elasticity of scale estimate (0.9) and alternative methods for calculating the capital substitution effects. The range of results from adopting these alternative assumptions is relatively narrow: 1.5–1.9% per year (Table 5.3 of Oxera’s 2008 report). The table is reproduced below.

Table A4.1 Sensitivity analysis for the TFP growth benchmarks (% per year)

| | OPEX | Maintenance | Renewals | OM&R |
|--|----------------|----------------|----------------|----------------|
| Base-case results | 1.0 | 2.1 | 2.1 | 1.9 |
| Expanding the period (1970–2004) | 0.8 | 2.2 | 1.9 | 1.8 |
| Reducing the period (1990–2004) | 1.3 | 1.6 | 1.7 | 1.6 |
| Capital substitution based on Europe Economics ¹ | 1.5 | n/a | n/a | 1.7 |
| Labour productivity | 0.9 | n/a | n/a | 1.6 |
| Removing transportation and storage | n/a | 1.9 | 1.9 | 1.7 |
| Comparators comprising only construction and business activities | n/a | 1.8 | 1.8 | 1.7 |
| Assuming 0.9 elasticity of scale | 0.5 | 1.8 | 1.8 | 1.5 |
| Range | 0.5–1.3 | 1.6–2.2 | 1.7–2.1 | 1.5–1.9 |

Notes: ¹ Based on the method used in Europe Economics (2003), ‘Scope for Efficiency Improvement in the Water and Sewerage Industries: Appendices’, Appendix 2, p. 26.
Source: Oxera analysis.

A4.3 ‘Nature of work’ comparators are not appropriate

The selection of the comparator set is discussed in paragraphs 5.27 and 5.28 of LECG’s report, in which it notes:

Our concerns are three-fold. First, the selection criteria are unexplained. Second, in places the choices appear illogical. We are unsure why, for example, ‘electricity, gas and water supply’ was chosen as proxy for ‘plant and machinery’ with respect to renewals, rather than, for example, ‘machinery’ or ‘renting of machinery and equipment and other business activities’. Third, NR believes alternative comparators might be appropriate. For example, for maintenance it is easy to argue that Construction should be added as a relevant benchmark. Similar adjustments could be made to opex and renewals. In the time available, we have been unable to perform a more detailed analysis on this aspect. However, the above is sufficient to show how the estimates change with respect to small changes in the comparator group.

The industries that make up the composite benchmark were selected because of the similarities between their activities and those undertaken by Network Rail in each asset category. For transparency reasons, section 5.2.2 of the 2008 report details the activities of

the industries that were deemed comparable to Network Rail and the criteria for selection. Both of these issues were discussed with the ORR, which also provided final sign-off on the selection of comparators. For ease of reference, Table A4.2 provides a replication of Table 5.1 from Oxera's 2008 report listing the industries used in the construction of the composite benchmark.

Table A4.2 Activity mapping for OM&R

| Weights for OPEX | % | Possible comparators |
|---|----------|---|
| Total operations and customer services | 43 | Electricity, gas and water supply; Rental of machinery and equipment and other business activities |
| Total other functions | 19 | Electricity, gas and water supply; Rental of machinery and equipment and other business activities |
| Total corporate services | 15 | Rental of machinery and equipment and other business activities |
| Total group activities (insurance and pensions) | 23 | Financial intermediation |
| Weights for maintenance | % | Possible comparators |
| Track | 36 | Transport and storage; Electricity, gas and water supply |
| Signals | 11 | Transport and storage; Electricity, gas and water supply |
| E&P | 5 | Transport and storage; Electricity, gas and water supply |
| Telecoms | 6 | Post and telecommunications |
| Maintenance—other | 5 | Transport and storage; Electricity, gas and water supply |
| Overheads | 23 | Transport and storage; Electricity, gas and water supply |
| Engineering | 6 | Rental of machinery and equipment and other business activities |
| NDS | 5 | Transport and storage |
| Other | 4 | Transport and storage; Electricity, gas and water supply; Rental of machinery and equipment and other business activities |
| Weights for renewals | % | Possible comparators |
| Track | 29.9 | Transport and storage; Electricity, gas and water supply |
| Signalling | 20.8 | Transport and storage; Electricity, gas and water supply |
| Civils | 17.0 | Construction |
| Operational property | 12.6 | Construction |
| Telecoms | 7.4 | Post and telecommunications |
| Electrification | 4.0 | Transport and storage; Electricity, gas and water supply |
| Plant and machinery | 3.1 | Electricity, gas and water supply |
| IT and other | 5.1 | Rental of machinery and equipment and other business activities |

Note: The weights used to develop the model are based on total Network Rail projected CP4 costs. Numbers may not sum to 100% due to rounding.

Sources: *Maintenance cost data*: Network Rail (2007), 'Strategic Business Plan—Supporting document, Maintenance Efficiency Model', October. *Operating cost data*: Network Rail (2007), 'Strategic Business Plan—Supporting Document, Opex Efficiency', October. *Renewals cost data*: Network Rail (2007), 'Strategic Business Plan—Control Period 4', October.

With regard to the use of the 'electricity, gas and water supply' sector as the sole comparator for the 'plant and machinery' asset category of the renewals expenditure, of the industries included for consideration Network Rail's expenditure on plant and equipment for its renewals activities correspond more closely to those in other infrastructure industries that undertake similarly large-scale, capital-intensive projects. Another possible comparator could be the construction industry. Oxera's sensitivity analysis (see Table 5.3 of the draft report, the results of which are replicated in Table A4.1 of this report) examines in more detail the

impact of substituting the construction sector for the ‘electricity, gas and water supply’ sector. It shows that the composite benchmark is still within the range recommended by Oxera. On the other hand, LECG’s suggestions could be viewed as unsuitable for this kind of analysis:

- the ‘machinery’ sector (Oxera has interpreted this as meaning the ‘manufacturing of machinery’ sector) is a sub-sector of manufacturing that deals with the fabrication and not the use of ‘plant and machinery’ assets. The activities undertaken by this industry are likely to be very different from those undertaken by Network Rail and its contactors with regard to this asset category;
- the ‘renting of machinery and equipment and other business activities’ sector has two components. The first, ‘renting of machinery and equipment’, includes all activities relating to the ‘renting and operational leasing of machinery and equipment’—ie, the granting of usage rights to a second party under a term of contract. Network Rail and its contactors are the lessees or renters of said equipment. It is highly likely that the activities of firms that *provide leasing services* of machinery and equipment (ie, specialist finance firms and banks) are not similar to those undertaken by Network Rail.

With regard to the inclusion of the construction sector in the maintenance benchmarks, an element of judgement is necessary to assign industry productivity benchmarks to asset categories. That is why the comparator selection was discussed with the ORR, with the regulator providing sign-off for the final selection. Nevertheless, given the overall uncertainty, Oxera undertook extensive sensitivity analysis, the results of which can be found in Table 5.3 of the draft report (replicated in Table A4.1 of this report). The results showed that the range of TFP estimates under different assumptions is relatively narrow (1.5–1.9% per year), and seem to support the opposite of what LECG claims, since they reveal that the composite productivity benchmark is not overly sensitive to the comparator selection.

Nevertheless, in the interest of clarity, Oxera has extended the sensitivity analysis to include the construction sector benchmark to maintenance expenditure, as per table 26 in LECG’s report. The results of this extended analysis are presented in Table A4.3.

Table A4.3 Sensitivity analysis for the maintenance composite benchmark

| | Original results | Including the construction sector benchmarks |
|----------------------------------|------------------|--|
| Base case results | 2.1 | 2.1 |
| Expanding the period (1970–2004) | 2.2 | 2.0 |
| Reducing the period (1990–2004) | 1.6 | 1.7 |
| Range | 1.6–2.2 | 1.7–2.1 |

Note: As per Network Rail’s suggestion in Table 26 of the LECG report.
Source: Oxera analysis.

The results of the extended sensitivity analysis reinforce the report’s conclusion on the relative robustness of the TFP estimates, and demonstrate that LECG’s argument is not supported by evidence.

A4.4 Weightings used are incorrect

LECG states that ‘The study does not explain how the relative weightings are derived’ (paragraph 5.30). The sources of the data can be found in Table 5.1 of the Oxera 2008 report, which is replicated as Table A4.1 in this report. The notes of the table explain that the relative weights are based on Network Rail’s CP4 cost information, which was sourced from Network Rail’s strategic business plan and supporting data. Network Rail has suggested that it considers that the weightings might not be correct (paragraph 5.31) and has suggested

alternative weightings. Oxera acknowledges that CP4 cost projections are likely to change throughout the review process, and thus the calculated weights might be slightly out of date if Network Rail decides to update its data submission. However, when the alternative weights are used in the construction of the composite benchmark, the overall effect is marginal (approximately 0.1%), as was reported by LECG.

This additional sensitivity test provides further evidence of the overall robustness of the estimated productivity growth range.

A4.5 Assumptions used to derive frontier shift are inappropriate

In paragraph 5.34 LECG argues that the 75% assumption of how much of the productivity growth rate is attributable to frontier shift is inconsistent with the 2005 preliminary study for the ORR in 2005 by LEK/Oxera.

The 2005 preliminary study reported sensitivities to both 50% and 75% assumptions (see Tables 5.7 and 5.8). The Oxera 2008 study references the work by Färe et al. in the *American Economic Review*, which provides a basis for choosing between the 50% and 75% assumptions used in the preliminary analysis. Färe et al. found that, on average, 75% of the economy-wide TFP growth is due to frontier shift.²⁷ In addition, this estimate could be considered a lower bound because it includes the contribution from non-market sectors, which are less competitive than the market sectors forming the composite benchmark.

LECG states that it does not believe that the academic evidence is sufficient to warrant a change in the assumptions, adding that:

the majority of the comparators to which the draft 2008 Oxera study now compares NR to in the nature of work analysis are regulated utilities (eg post, gas, electricity and water supply) which achieved significant post privatisation efficiency improvements (ie catch-up gains). In general, the time series over which the TFP analysis is constructed for these regulated companies will have included greater scope for catch-up (and, therefore a smaller proportion of their TFP improvements would be related to frontier-shift) than average

The 'electricity, gas and water supply' sector, which also includes unregulated activities such as electricity generation, represents approximately 33% of the composite benchmark for all OM&R activities (the range in individual cost elements is between 27% and 40%). The 'post and telecommunications' sector has an approximate weight of 5.6%, and the vast majority of the activities included in this classification are open to competition. As such, the contribution of these sectors, although significant, is not large enough to dominate the composite benchmark.

More importantly, the EU KLEMS data shows that the overall high TFP growth of the 'electricity, gas and water supply' sector is not unique among the comparator set. The construction sector, which Network Rail states is an appropriate comparator to some of its activities (see section A4.3), also displayed high TFP growth. According to the sensitivity analysis, the estimated composite benchmark when using only the construction sector and business activities sector is very similar to that from the base case (see Table A4.1).

²⁷ Färe, R., Grosskopf, S., Norris, M. and Zhang, Z. (1994), 'Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries', *The American Economic Review*, **84**:1, March, 66–83.

The above discussion makes clear that it would not be appropriate to change the frontier-shift assumption on the basis of the arguments put forward by LECG.

Park Central
40/41 Park End Street
Oxford OX1 1JD
United Kingdom
Tel: +44 (0) 1865 253 000
Fax: +44 (0) 1865 251 172

Stephanie Square Centre
Avenue Louise 65, Box 11
1050 Brussels
Belgium
Tel: +32 (0) 2 535 7878
Fax: +32 (0) 2 535 7770

Thavies Inn House
7th Floor
3/4 Holborn Circus
London EC1N 2HA
United Kingdom
Tel: +44 (0) 20 7822 2650
Fax: +44 (0) 20 7822 2651