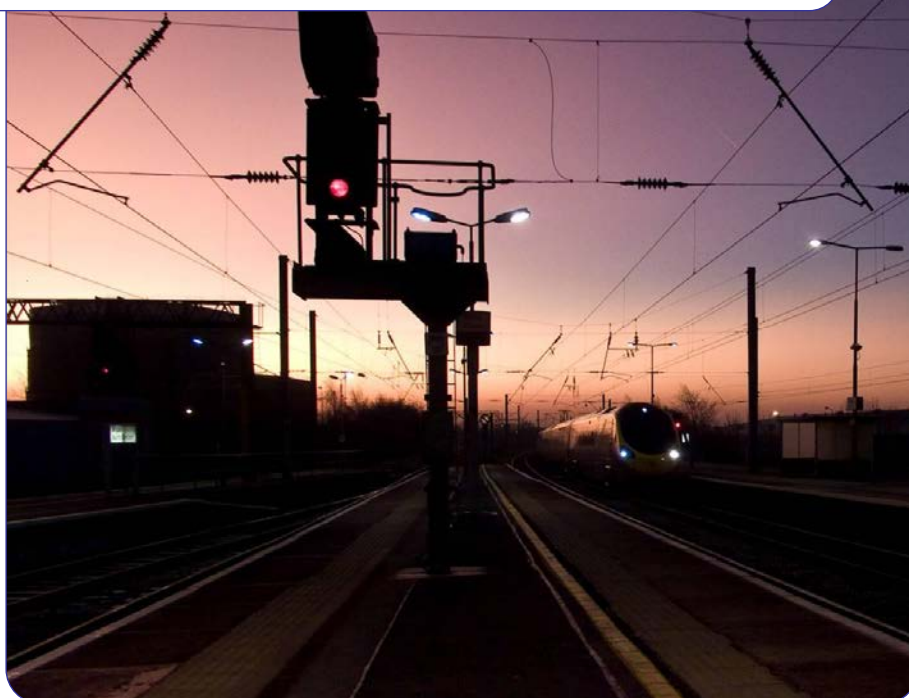


# Possession Management Review

For PR13

for Office of Rail Regulation

Final Report;  
16 July 2012




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## 1 Executive Summary

The objective of this study is to assess the relative efficiency of Network Rail in its performance in the management of Possessions, i.e. securing times to allow staff safe access to the UK Rail infrastructure for the purposes of inspection, maintenance or renewal activities. This has been achieved through original benchmarking work undertaken with a range of international Comparator organisations, and a review of existing benchmarking work and other studies undertaken in this area.

In particular, this study builds on the research undertaken in the 2006 ORR report “Possession Benchmarking Exercise”<sup>1</sup> and the more-recent studies culminating in the 2011 “Infrastructure Managers Efficiency benchmarking study”<sup>2</sup>. This study does not seek to replicate the research undertaken for these precursor studies, but to add to their conclusions in determining what efficiency gains are practical for Control Period 5 (CP5) and what would need to be done for Network Rail to become “best-in-class” in the area of Possession Management.

The results from the benchmarking work undertaken were found to be broadly in line with previous such studies, including those undertaken for the recent McNulty report, in that an apparent efficiency gap of around 30% between Network Rail and the average performance of Comparator organisations was identified in a number of key areas. Detailed interviews with Network Rail staff were then used to investigate the scope for improvements in these areas, and the issues that need to be addressed for Network Rail to achieve both average and best-in-class performance. A summary of the results of these investigations is set out below;

### 1.1 Asset Management / Workbank Planning

Whilst Network Rail was found to have a number of centres of excellence in individual Asset Management systems and processes, the overall impact of these was felt to be less than the sum of its parts due to inconsistencies in approach and differing timescales in planning processes. This has the effect that the workbanks emerging from the process do not currently take full opportunities for co-ordination of work, either geographically or between asset classes.

This area, however, is likely to be a key beneficiary of the Devolution of responsibility within Network Rail, with the introduction of Director of Route Asset Management (DRAM) posts in each of the devolved Route Management teams. This managerial change, combined with the investment in new systems and processes recommended by the ORR’s “Relative Infrastructure Managers Efficiency Evaluation of Gap Analysis factors” study will give Network Rail the opportunity to develop a best-in-class approach in this area for CP5.

Success in this area, however, will be dependent on the new DRAM posts developing appropriate relationships with the remaining Central functions, external service delivery organisations and Train Operators. The objective of any changes should be focussed on facilitating the creation of workbanks with both geographical and asset-class synergies to optimise the use of Engineering Access within each Route, and for the Routes to work together to spread best practice throughout the network.

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<sup>1</sup> Possession benchmarking exercise Report for Office Of Rail Regulation, Lloyds Register Rail Jan 2006

<sup>2</sup> Relative Infrastructure Managers’ Efficiency Evaluation of UIC LICB Approach; Summary Report, ORR 11 Aug 2010

## 1.2 Delivery of Maintenance and Renewal Work

The gap between Network Rail's unit costs for delivery of work and that of Comparators has been measured across a wide range of studies as being between 10 and 40%. A wide range of underlying reasons for the higher cost of work in UK Rail have been identified through the benchmarking work undertaken for this report. Key differentiators include lengthy and involved planning processes, low productivity from possessions (observed start-up and hand-back times can be many times higher than Comparators), a largely-casual labour force delivering low quality work and lack of investment in "maintainability" in the infrastructure.

These factors result in possessions in the UK that tend to be longer and more disruptive than in Comparator countries. This has the knock-on effect of reducing the revenue-earning capabilities of UK Rail while delivering higher infrastructure costs. Sections 1.2.1 to 1.2.5 below summarise the main causal factors identified, with the short and longer-term requirements for improvements

### 1.2.1 Timing of Engineering Work

The main difference noted between Network Rail's planning of possessions and that of Comparators is that the UK still relies largely on longer weekend possessions, with relatively little work being undertaken on midweek nights. This is driven by historical factors, and has become entrenched through the Schedule 5 access rights of TOCs and FOCs, which were set at privatisation in 1994 based on market and operational factors dating back decades in many instances.

The basis of most Comparators lower unit costs for engineering works is a balanced programme of repeatable maintenance and renewal work, optimised for midweek timeslots which are often lengthened far beyond those available to Network Rail by the use of worksites alongside running trains to allow core freight, passenger and empty-stock movements to continue during most engineering operations.

This major difference between UK Rail and Comparators was found to be a major factor underlying the differential costs observed in the benchmarking work. Network Rail is working hard to drive change in this area, including a change in emphasis from conventional renewals towards "enhanced maintenance" to enable more work to be done in shorter possessions, and ongoing engagement with Train Operators to secure the longer weeknight possessions needed to deliver efficient work-packages. Meaningful progress in this area will not be possible, however, without a fundamental change in the current rights of the majority of operators, with changes based on a re-appraisal of the costs and benefits of current early-morning and late-night access rights across the week. This process will need to both facilitate an increase in midweek Engineering Access time for Network Rail and give Train Operators more Access at times of pent-up demand; in particular on Sunday mornings for passenger operators and overnight diversions for freight operators.

### 1.2.2 Investment in Maintainability

UK Rail's congested tracks and rapidly-growing markets will, however, restrict the opportunities for delivering the types of efficiency outlined in section 1.2.1 above. More fundamental changes to the current regime will therefore be required if the efficiency-levels of Comparators are to be achieved without significantly restricting the commercial operations of Train Operators. It is therefore recommended that alongside the strategic re-balancing of Engineering Access outlined above, the case for re-engineering of the UK Rail infrastructure and processes to facilitate continuous improvement in engineering efficiency needs to be addressed. As noted above, the most-successful

Comparator organisations are those that have robust safety and operational processes for regular service-train operation alongside worksites on key routes. This is judged to be a vital component of a programme of continuing reduction in the net cost of engineering works on the UK's radial network, where limited opportunities for alternative routing of services put Engineering Access in direct opposition to commercial opportunities.

The key components of such a development are the creation of a core network capable of signalled bi-directional operation, with new signalling and more facing crossovers required to give this flexibility. Additional diversionary capability, with sufficient clearance for the higher-profile 9'6" containers on intermodal services, and with more capacity for berthing engineering trains near to worksites is required, with more flexible electrification systems, simpler isolation processes and better road access to main routes being an important part of the overall investment package.

A parallel workstream on the re-engineering of safety equipment and processes will also be required to allow Red Zone working for key renewal and maintenance tasks to be undertaken safely. In addition to reducing disruption to train services for Engineering Access, investment in creating a higher capacity and more-flexible rail network would also have significant performance benefits. It is vital that the daytime performance benefits and opportunities for revenue growth are also taken into consideration in making a business case for this strategy.

The timing of such investments is critical. The planned introduction of ETCS signalling systems towards end of CP5 gives a once-in-a-generation opportunity for this type of step-change in Engineering Access, and continuing improvement into CP6 will be dependant on an early decision on the infrastructure enhancements, in track as well as signalling, for the rollout of ETCS systems.

### 1.2.3 Contracting Policy

In addition to the strategic opportunities outlined in Section 1.2.2 above, the benchmarking work has identified a number of smaller changes possible with opportunities for quicker payback. One of these is the development of a partnership approach with Contractors; at present, the work delivery bodies, whether internal or external contractors, are involved by Network Rail at a relatively late stage in the process, with significantly more short-term "tendering" of work than in Comparator organisations, apparently in the interests of minimising unit rates. This has multiple negative outcomes, including:

- Endemic late re-working of plans, with contractors requesting changes as they come on board,
- Multiple interfaces requiring co-ordination and re-planning sometimes until a few hours before work starts,
- Loss of "learning" between jobs, as frequent changes of contract and employment of casual labour to minimise first cost loses continuity over time,
- Lack of quality from a largely casual workforce, often not working full-time on rail work due to current emphasis on weekend working, with low skill levels requiring additional staff and producing low-quality outcomes and more complex and prescriptive safety arrangements.

Most Comparators studies involve their contractors (or in-house work delivery units) at a much earlier stage in the process, working with a smaller number of specialist organisations to tackle the issues raised above and drive down overall costs of the process whilst improving quality. Network Rail has



already identified this as a key issue for CP5, and is basing planned improvements in track and S&C efficiency on this approach.

#### 1.2.4 Possession Booking / Timetabling

An important factor underlying the long and multi-party planning process in the UK is the current timetabling process. The “Bid and Offer” process in the UK requires the base Engineering Access for each timetable to be established at T-84; this is an order-of magnitude greater than most Comparators, who were found to work on an incremental timetabling process requiring shorter planning horizons. The effect of this difference in the UK is magnified by the operation of the Schedule 4 and Schedule 8 regimes, which incentive booking of possessions for Engineering Access up to 4-times earlier than alternative systems, long before detailed planning starts or contractors are engaged. This restricts possibilities for synergies to be explored and learning to be applied to optimise Engineering Access time required.

The resourcing of engineering work through engineering trains / tampers etc in the UK also tends to be a much later part of the planning process than in Comparator organisations; this seems likely to be a contributor to possession problems caused by non-availability of these resources. In particular, UK Rail is unusual in having engineering trains provided by third parties (i.e. freight operators rather than the infrastructure manager or engineering contractor) and unique in engineering trains not having timetabled paths to and from worksites, but relying on the skills of route controllers “on the day” to arrive and depart on time. It is not clear if this is a cause or an effect of the very high level of “last-minute” planning observed, but it is an area of significant difference from Comparators.

#### 1.2.5 Possession Management Processes

The final significant area of difference observed between UK and overseas practice for Engineering Access was the time taken to start-up and hand-back engineering possessions. The benchmarking work undertaken confirmed the findings of many previous studies in this area; although our findings suggested that the average difference in time taken might be lower than previously concluded, the variability in times recorded for taking and hand-back of possessions is much greater in the UK than for Comparators. This has a variety of causes, including relatively low historic investment in creating an easy-to-maintain network, multiple organisations on site and a large, casualised workforce lacking familiarity with the rail environment. This results in an elongated planning timescale, and start-up and handback processes which tend to take significantly longer and involve more people at all stages than equivalent processes overseas.

As with many of the other findings of this study, this does not come as a surprise, as there are a number of structural issues interacting to restrict the ability of Network Rail to address these issues. The sheer number of organisations involved in the Engineering Access process, the “one-way” incremental nature of changes to safety rules over time and the relative power of staff representatives in opposing changes, which reduce the number of staff needed, all combine to make significant changes in this area difficult, and militate against investment in progress in this area.

Network Rail’s current policy, under its Engineering Access Programme, of making small, evolutionary changes is therefore probably the best approach in the short term. It is, however, considered essential that the planned introduction of ETCS in CP5 is used as a one-off opportunity for a fundamental re-think of processes in this area, and the case for re-engineering of safety requirements must be an integral part of the case for investment in Maintainability outlined in Section 1.2.2 above.

## 1.2.6 Summary

Based on the review of external best practice and detailed discussions with Network Rail and UK Contractors and Train Operators, it is estimated that, in the long term, potential benefits of up to £150m per year can be achieved through improvements in the possession planning and delivery process. Equally importantly, these savings can be delivered alongside changes in track access for passenger and freight operators which could deliver at least a similar benefit to the industry in increased revenue and reduced operational costs.

As outlined above, these savings will be delivered through a wide variety of initiatives covering all aspects of the possession management and delivery processes. The short-term “quick-wins” in terms of improving possession productivity, simplifying planning processes and improving contracting policies and practice must take place alongside the longer-term issues of investing in “maintainable” infrastructure that both reduces long-term maintenance / renewal costs and is designed to reduce disruption to services whilst maintenance and renewal takes place. The key “deliverables” in CP5, many of which are currently being developed as part of the ongoing Access Management Programme, are;

- Improvements to the possession planning process, to reduce overall timescales and maximise the productive use of each opportunity for Engineering Access to the track, allow 7-day working and reduce need for contingency time allocations, are estimated to have the potential to deliver annual benefits in CP5 in the region of £30-60m
- Improvements to the possession protection / safety management regime to maximise the productive time available for work within possessions are estimated to have the potential to deliver an additional annual benefit in the region of £10-25m
- Improvements to the relationships with contractors, in particular those which would allow a smaller, specialist workforce to be recruited and trained based on a reduced reliance on weekend working is estimated to have the potential to deliver a further annual benefit in the region of £8-14m

The savings outlined above of between £50m and £100m per year are estimated to represent the range of likely achievable outcomes for CP5 in the area of possession management. In the longer term, however, significant further efficiencies are possible; the benchmarking work undertaken suggests that achieving best practice performance in this area could deliver annual savings of up to £150m compared to current performance (i.e including the CP5 savings outlined above). Achieving these additional savings is, however, dependant on significant changes to the network and contractual regimes;

- Investment in “Maintainable” infrastructure
- Optimising working practices and equipment around “balanced” 7-day Access
- Streamlining safety processes
- Relaxation of “social service” protection in Operator’s track access rights
- Changes to the timetabling and Contractual Enforcement Regime processes

In addition to the cost savings outlined above, significant operational cost and revenue benefits would come from the introduction of the 7-day railway, although this would reduce the overall savings possible from Engineering Access, as more possessions are likely to be needed to complete work in

the shorter timeslots available. The potential non-engineering benefits from this investment are detailed in section 7, and will include;

- Reduction in Engineering Access costs of up to £150m / year as outlined above
- Large net increase in revenue from additional Sunday shopping and leisure travel – the full extent of this will depend on the scope of timetable changes, but is estimated to be potentially significantly greater than the estimated potential saving on Engineering Access of £150m
- Big net improvement in passenger and freight performance through increased flexibility and resilience of network, giving further increase in revenue and reduction in performance regime payments
- Reduction in freight (non-staff) resource costs in region of 10-15% through 7-day utilisation of assets currently used “5½ days” per week, with potential for increase in revenue from customers requiring 7-day service, e.g. domestic intermodal.
- Further reduction in engineering costs through investment in lower-maintenance infrastructure

These benefits will, however, only be possible in CP6 and beyond if the issues outlined in the bullet-points above are tackled in CP5, and in particular, if the specification for ETCS resignalling and associated investment in infrastructure and track layout is for a continental-style “maintainable” 7-day railway. It is therefore recommended that the business-case for accelerated investment in the creation of a “7-day” railway be prioritised whilst plans for ETCS introduction from the end of CP5 are being finalised.

## 2 Introduction

### 2.1 Background

The Office of Rail Regulation (ORR) asked Lloyd's Register Rail (LRR) to conduct a review of management of possessions by the UK's Infrastructure Manager, Network Rail, providing the ORR with an update on its processes and procedures, planning and management practices. This work will ultimately contribute to the overall body of knowledge in support of the Periodic Review of rail industry costs, (PR13).

This study therefore seeks to provide a focus on achieving the right balance between the short-term interests of the railway users in terms of network availability and the long-term objectives including 7-day railway, balancing the opportunities to increase capacity alongside the needs for greater efficiency, improved performance and long-term sustainability of the maintenance and renewal activities on the rail network. In so doing, the study draws on extensive discussions with Network Rail staff and a review of best practice from Comparator rail businesses in Europe and from around the world, in order to understand what lessons can be learned and applied in the UK to improve efficiency without compromising safety in the process.

The study also draws on a number of previous reports in this area in assessing the extent to which the current possessions strategy is fit for purpose and able to deliver business outputs both in terms of current and future demands. A key element of this assessment is a view on the potential impact of the various changes happening in the rail industry at present, including the implications from a possessions viewpoint of the process of devolution of responsibility from the central functions in Network Rail to the geographically based Route Director organisations.

### 2.2 Approach

The starting point for this work is the LRR Possession Review report of September 2006 produced for the ORR<sup>3</sup>. This looked in detail at the delivery of specific types of maintenance and renewals work and compared these with a number of European Comparator organisations, and the previous benchmarking studies for ORR drawing on the historic International Railway Union (UIC) cost comparison benchmarking datasets. In addition, Network Rail has commissioned and undertaken a number of more-detailed benchmarking studies, including work by the Civils Benchmarking Alliance and the Track Asset Management International Benchmarking work. These subsequent studies confirm that none of the organisations benchmarked in the 2006 study have fundamentally changed their approach, so this new study does not seek to replicate, but to build on, the earlier work, both in widening the geographical scope of the benchmarking and in looking at a wider set of cost-causation factors.

The focus of this study is therefore primarily on the process, rather than the delivery, of the efficient delivery of Engineering Access to the UK rail network. It should be noted that, due to the wide number of variables involved, and the significant differences between processes and measurements in each of the Comparator organisations, the efficiency-gaps identified are necessarily indicative rather than definitive at this stage. One of the key findings of the study is that the quality and quantity of data being collected by infrastructure-managers in this area is at best patchy, for both Network Rail

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<sup>3</sup> Possession benchmarking exercise Report for Office Of Rail Regulation, Lloyds Register Rail Jan 2006

and the Comparators. This inevitably affects both the availability and quality of data for benchmarking, and much of the data secured is therefore based on estimates from a relatively small sample.

There are four key areas which determine the overall cost to the UK Rail industry of taking possession of the infrastructure to allow access for engineering activities, both maintenance and renewals. These are:

- The efficiency of the planning process
- The efficiency of physically taking possession of the tracks
- The efficiency with which the engineering work is undertaken
- The impact of the process on the commercial activities of the railway

These factors are inextricably inter-related, and it is likely that the optimum outcome will combine elements of all four areas. For clarity of presentation, however, this document initially considers each element in isolation to identify how outcomes could be optimised before looking at the “blockers” restricting progress in each of the areas identified and the “enablers” which need to be in place to facilitate optimal outcomes.

Lloyd’s Register would like to take this opportunity to record our appreciation of the co-operation and support we have received from Network Rail and the Comparator organisations throughout this process.

### 3 International Comparisons 1; Process Benchmarking

To assess the efficiency with which Network Rail undertakes its Engineering Access to the rail network, two approaches have been deployed. Initially, a “first-principle” view was taken on the processes used, and the results achieved, by Network Rail through detailed face-to-face meetings with individuals at each stage of the process, through planning and set-up to delivery and handover, from both Network Rail and other stakeholder organisations. The results and conclusions from this work are detailed in Sections 5 to 8 below.

The findings from these initial discussions were then used to identify a number of key stages in the process where scope for further efficiency in the way Network Rail planned and delivered its various Engineering Access activities was identified. This work was used to create a questionnaire to facilitate international comparison of Network Rail’s processes and performance. This questionnaire was then used to support a series of one-to-one, own-language interviews with selected rail administrations across three continents, with the objective of widening the range of Comparator organisations beyond those already engaged in benchmarking by ORR / Network Rail, and establishing links that could form the basis of more-detailed follow-up work in the future. The organisations taking part in this work were;

- Korail (KNRA), South Korea (Infrastructure Manager)
- Canadian Pacific, Canada (Integrated Rail Operator)
- Banedanmark, Denmark (Infrastructure Manager)
- MTR, Hong Kong (Integrated Metro Operator)
- ProRail, Netherlands (Infrastructure Manager)
- RailCorp, Australia (Infrastructure Manager)

The use of Lloyd’s Register’s local staff in each of the administrations questioned allowed time saving from a “parallel” process and greater access into the organisation than a process restricted to English-speakers, while the ease of understanding allowed more areas to be addressed in the limited time available. The downside was that each interview took place “from first principles”, with the interviewer having no knowledge of the background and responses from the other interviews – this means it is harder to assess the degree of comparability of the responses from the various organisations.

The benchmark data used in Sections below is anonymised, in accordance with the wishes of the respondents. To allow regional comparisons to be explored, however, this has been done geographically, with the “Eastern” Comparators (Australia, Korea and Hong Kong) designated E and the “Western” Comparators designated W in the tables and graphs below.

In line with the scope of work for this study, the detailed benchmarking work undertaken focused mainly on the process areas identified – accurate and meaningful benchmarking of generalised and / or normalised costs across different organisation structures, national contractual and legal frameworks and commercial cultures was not a feasible objective given the constraints of timescale and resources available. However, Network Rail is currently undertaking a considerable amount of UK and European benchmarking, looking in detail at the underlying drivers of cost-differentiation between different rail and non-rail engineering Comparators; this data has been made available to the study, and is used to provide additional quantitative assessment of Network Rail’s performance where appropriate.

### 3.1 Possession Productivity

The number of possessions needed to undertake all the tasks in a given workbank is dependant on both the total number of hours available for each possession, and the productivity with which these hours are used. Much data exists on the comparison between the UK and overseas administrations in this respect, including the most-recent study for ORR<sup>4</sup>, the Relative Infrastructure Managers Efficiency evaluation of Gap Analysis factors. This found that, typically, a UK possession has 3.5 hours productive work per 8-hour possession (around 45%), whilst in Switzerland, 6.5 hours out of 8 (around 80%) are reported to be available to work-teams for productive use, as shown in Figure 1 below;

**TYPICAL 8-HOUR SCENARIOS**

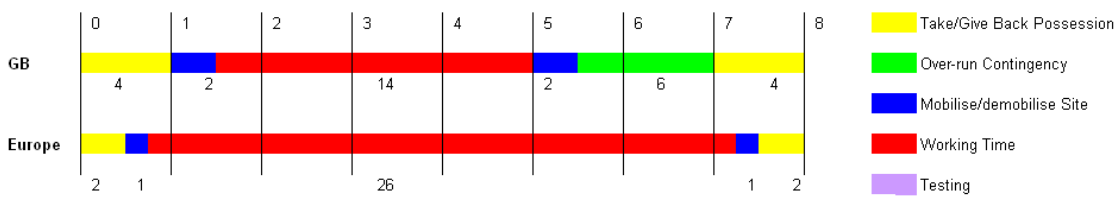


Figure 1; Comparison between UK and Swiss possession productivity (ORR study)

As outlined above, the principle objective of the benchmarking undertaken for this study is to identify data that gives an insight into the causal factors underlying these observed differences in performance, rather than repeat the measurements of the results as undertaken by previous exercises. It was, however, important to check these findings against the Comparators used for this study, both to benchmark the actual gap in productivity, and to secure some indicative results from the Eastern Comparators, as these have not featured in previous studies.

As with all such benchmarking, the lack of centrally held and independently verifiable data, both by Network Rail and by all the Comparators means that the results of this benchmarking, as detailed in Section 3.1.1 below, are indicative, rather than statistically significant.

#### 3.1.1 Time taken for possession start-up and hand-back

The time taken from arrival on site to start of work is a critical component of Engineering Access efficiency. The benchmarking undertaken for this study in this area gives results that are consistent with the larger studies quoted above; Comparators who were able to give data in this area both for electrified and non-electrified lines reported times significantly lower than the Network Rail figures. This data is, however, subject to a more-than-usual level of uncertainty – the wide variety of parameters being measured, including location, type of work, size of job, signalling systems etc, and the lack of systematic data collection mean that the “average” values quoted have little statistical significance.

<sup>4</sup> Relative Infrastructure Managers’ Efficiency Evaluation of UIC LICB Approach; Summary Report, ORR 11 Aug 2010

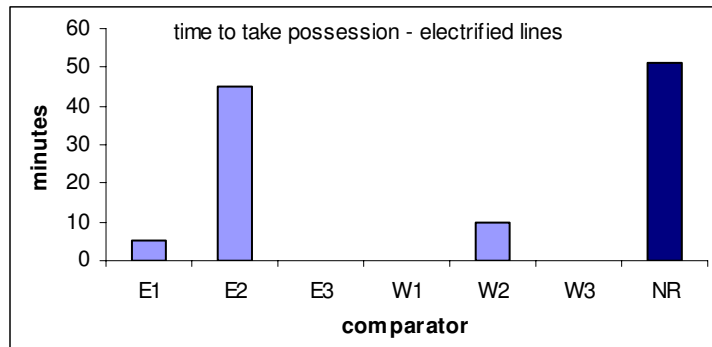


Figure 2; time taken from passage of last train to start of work – AC electrified routes

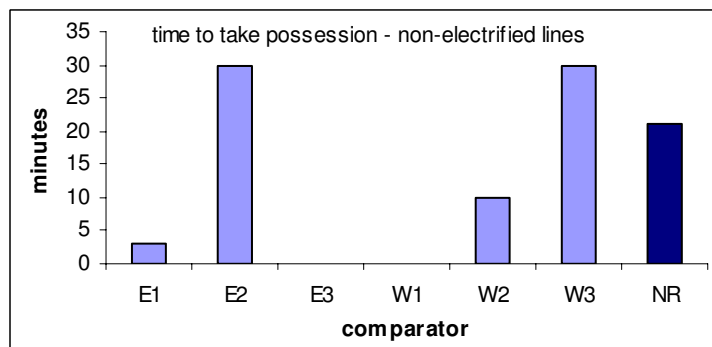


Figure 3; time taken from passage of last train to start of work – non-electrified routes

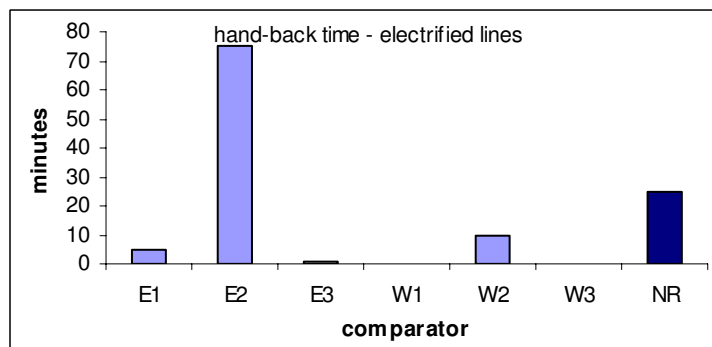


Figure 4; time taken from end of work to first train – AC electrified routes

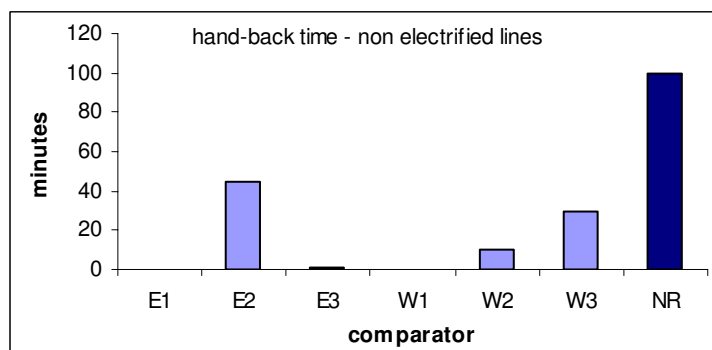


Figure 5; time taken from end of work to first train – non-electrified routes

Although there are "outliers" in each dataset caused by local factors (including a "standard allowance" for one of the Eastern Comparators, which in each case is longer than needed but is



designed to ensure that work can start and finish on time), the trend in the data shows Network Rail to be amongst the worst performers in each of the scenarios measured.

Notwithstanding the issues around the validity of comparability of these data, these findings are in line with the findings of previous studies in this area and the wealth of anecdotal evidence available. The use of average Network Rail data (collected manually from the records of over 1000 possessions in each case) does, however, give results with significantly less variance between Network Rail and Comparators than previous studies, which have tended to look in more detail at a much smaller sample of possessions. This indicates that the overall scale of the difference may be lower than currently thought, potentially reducing the overall scope for efficiency savings. In this area, however, it is clear that there is scope for such savings; the quantification of the potential benefits for CP5, based on the process benchmarking of the identified causal factors, is addressed in Sections 5 and 6 below.

### 3.2 Planning Process

The first area of process benchmarking undertaken looked at the planning of Engineering Access. Discussions with Network Rail revealed a lengthy, multi-stakeholder approach that is a potential driver of inefficiency both in terms of the cost of the process and the likelihood of sub-optimal outputs, so the benchmarking work undertaken sought to test both of these hypotheses. All the questions in this section refer to processes for booking plain-line track renewals requiring a disruptive possession, selected as a typical engineering possession for railways worldwide.

#### 3.2.1 Booking of Possessions

The first issue studied during the benchmark exercise was concerned with the lead-time for the booking of disruptive possessions in each of the Comparator networks. As with many of the issues, it proved difficult to identify a “typical” occurrence to benchmark; the values quoted are for relatively minor disruptions to timetabled service, typically of up to 1 day in duration. The overseas values given for this varied from T-26 (weeks) down to T-3; this compares to Network Rail’s practice of beginning the booking of such possessions at T-84 under the Engineering Access Statement (EAS) process;

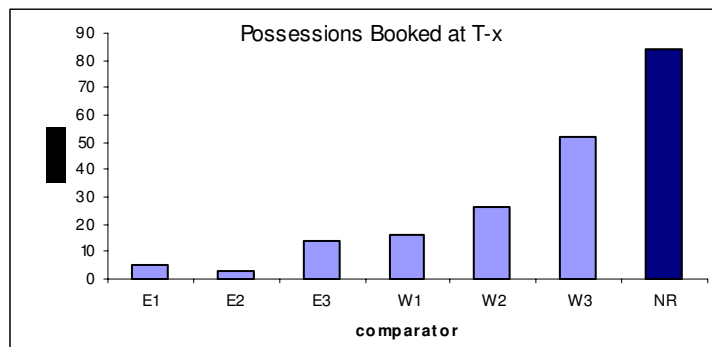


Figure 6; *Booking of Possessions*

This is mainly due to the contractual framework in the UK, which incentivises the booking of disruptive possessions at an early stage in the process. To reduce access payments under Schedule 4, the process starts at T-84 so that restricted Access can be incorporated in the base timetable.

As with most of the quantitative benchmarking work undertaken, it is not possible to “normalise” these values to adjust for differences in timetabling processes, physical layout of network or methods

or engineering approach used; the value of the exercise lies in identifying Network Rail’s current position vis-à-vis the Comparator organisations and the likely reasons for the differences identified.

In this first case, it is clear that the reason for Network Rail’s overall planning horizon being significantly longer than that of the nearest Comparator is driven primarily by the contractual framework. The existence of such a long-term plan can clearly be a positive benefit, although the disconnect between the booking of the worksites and the actual engineering plans, which are finalised in the Confirmed Period Possession Plans (CPPPs) at a more-typical T-26, can clearly be a source of inefficiency.

There is a distinct split in the values from the overseas Comparators, with Eastern companies booking the possessions for such work at very short notice; as short as three weeks in two cases, whilst Western Comparators allow between 14 and 26 weeks. In both cases, this is primarily a function of the engineering methods used and the flexibility of the rail network and timetable to accommodate routine renewals work – the use of alternative routes, Single Line Working (SLW) or alternative transport means that the actual work is less disruptive than it would be in the UK, and therefore requires less planning lead-time.

### 3.2.2 Engaging of Contractors

All of the benchmark Comparators used contractors to undertake small-scale renewals work, giving a useful comparison. All have long-term agreements with renewals contractors, and most have exclusive agreements, usually geographical, to give economies of scale. The engaging of contractors in the process was defined as the point at which a workbank item was “handed over” to a specific contractor – the values again varied widely from 3 to 40 weeks, with Network Rail’s value being around the average, but significantly lower than the Western Comparators who were able to respond.

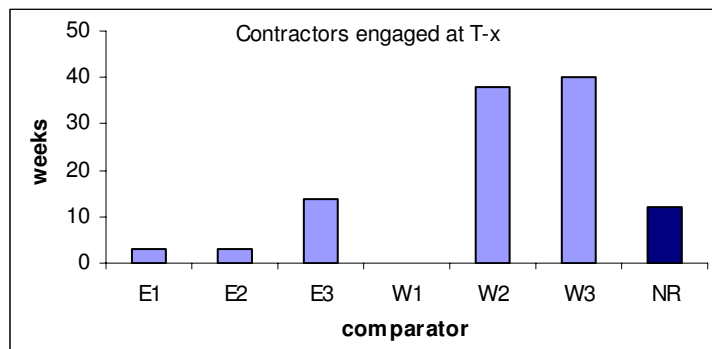


Figure 7; *Engaging of Contractors*

Once again, the Eastern Comparators had the shortest planning timetables, with work being allocated only a few weeks before delivery, although this is generally in the context of long-term relationships between contractors and infra-managers. The Western Comparators engaged the contractors at an early stage as an integral part of the planning process; the generally later involvement of contractors in the detailed Network Rail planning process was felt to be a potential source of inefficiency. Responses from our industry discussions indicate that plans frequently have to be re-worked once the engineering and logistics contractors became involved.

### 3.2.3 Booking of Timetable Paths for Engineering Trains

The booking of timetable paths for engineering trains to get materials to remote sites is a crucial part of the Engineering Access process; the biggest proportion (33%) of possession overruns in the UK are related to problems with engineering trains (see section 3.4.2 for breakdown). As ever, the wide variety of methods used worldwide to resource and book trains makes direct comparison difficult, but the range of values given of 1 to 12 weeks shows that the Network Rail process of using “Short Term Planning” processes to path engineering trains is significantly out of line with practice elsewhere.

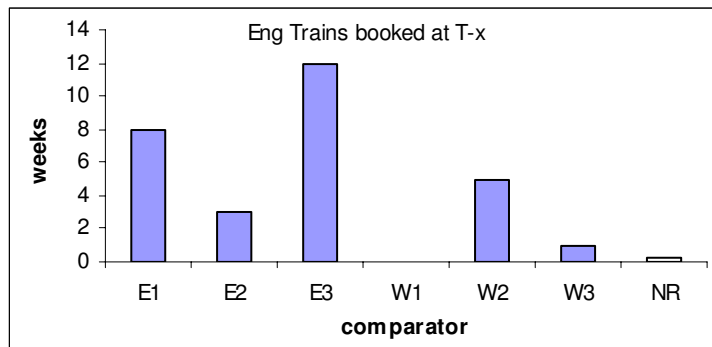


Figure 8; *Booking of Engineering Trains*

The key issue emerging for the booking of engineering trains is not so much the planning lead-time therefore, as the process used to ensure that there is a timetable path available for the train. Although the professionalism of the planners involved means that the vast majority of Network Rail’s engineering trains run on schedule, the Short Term Planning (STP) process used is felt to be a significant contributor to the amount of late re-planning of engineering work, tying-up planning resource and resulting in above-average losses of productive possession time.

Additional benchmarking was undertaken on the issue of the operation of engineering trains. Whilst in the UK, these are contracted-in at relatively short notice from a pool of qualified suppliers, the majority of Comparators either mostly operate engineering trains themselves, or their long-term engineering contractors do so as part of the overall contract for providing engineering services, with only occasional use of external train operators to provide additional capacity. Qualitative responses in this area suggests that this has a significant effect in managing the risk to Engineering Access from non-availability or poor performance of engineering trains, with no Comparator reporting this as a significant issue.

### 3.2.4 Planning of Passenger / Freight Timetables

A key part of the Engineering Access process is the planning of public timetables, preventing disruption to travellers’ plans due to uncertainty. Once again, there are many steps in this process, and it is not possible to be certain that a standard point is being measured, but the responses received from Comparators show a range of values from 2 to 16 weeks, with Network Rail being an extreme outlier.

The basis of this observed difference is the cycle of annual “first principle” bidding for timetable paths introduced in 1994 in the UK. All Comparator organisations employ an “incremental change” approach to timetabling which is likely to require less planning overhead, and to allow the timescale for planning of the public timetable to be more closely linked to the Engineering Access planning timescale. It is felt that this also has an impact on the amount of late re-planning of work required in the UK’s process, with a consequent reduction in the efficiency of the planning process and increase in risk of delivery problems.

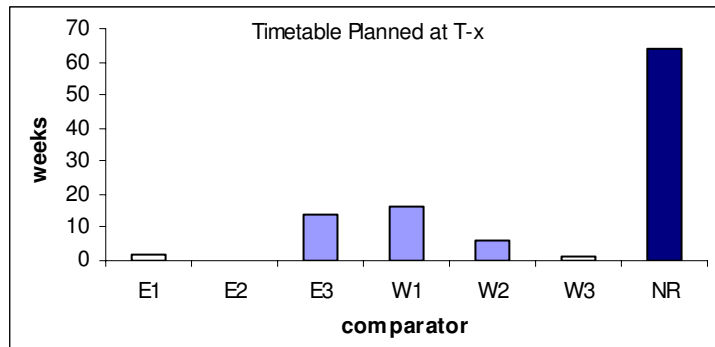


Figure 9; *Planning of Alternative Timetable*

### 3.2.5 Last Change to Public Timetable

The finalisation of the public timetable is a key milestone in the planning process, providing the travelling public with certainty of travel times and thus underpinning customers’ confidence in the rail transport system. Most Comparator organisations take a similar view on this, with the majority “locking-down” train time 12-14 weeks out, with Network Rail at the lower end of this timescale.

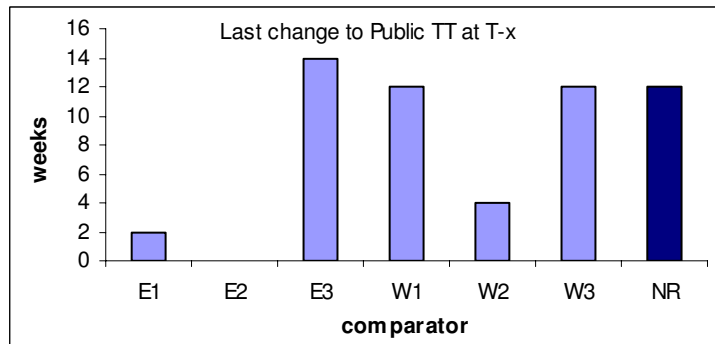


Figure 10; *Last Change to Public Timetable*

Network Rail’s 12-week target is driven by “Informed Traveller” deadlines, and is not linked to the Engineering Access process, with the result that many decisions on planning and resourcing work in possessions are taken when it is too late to change advertised train times. We found that overseas Comparators tend to have a more integrated process, with, for instance, contractors and engineering trains also locked-down at the same time as the public timetable. In addition, it should be noted that this issue is less significant for the Comparator organisations, where timetabled passenger and freight trains are either diverted onto alternative routes or can work past the work-sites using Single Line Working (SLW).

### 3.3 Planning Systems

The use of information technology to provide information and decision-support is common to all benchmarking Comparators. Only one, however, was able to demonstrate an integrated system, linking the key elements of the process into a joined-up planning and data-provision tool, with Enterprise Asset Management (EAMS) and Inspection Registration Systems linked to an Engineering Work and Traffic Information System providing pan-organisational scheduling and KPI data. The Comparator using these systems also reported the lowest unit costs for the cost benchmarking work reported in Section 4 below, and although it has not been possible to statistically verify this, it is in line with expectations that the best planning systems should result in lower-cost delivery.

This “best-practice” exemplar was, however, one of the smaller Comparator organisations, and larger companies, particularly in the West, mirror Network Rail’s approach in having sophisticated systems covering key aspects of the process, but with limited formal integration of outputs or operation, potentially causing inefficiency through transaction costs at the system interfaces, and loss of synergies and learning / feedback opportunities.

The systems quoted as being used at each stage of the process are outlined in section 3.3.1 and 3.3.2 below;

### **3.3.1 Asset Management systems**

The process for Engineering Access begins with the creation of a manageable quantity of maintenance and renewal work required to maintain the network in an appropriate state for the traffic demands; this is known as the “workbank”. All the Comparators seen use IT systems for Asset Management / workbank creation purposes, with a mix of proprietary and in-house systems being deployed. Proprietary systems were represented by use of Maximo and AM Planner, whilst in-house systems quoted included EAMS and Bron2. Best-practice in this area is judged to be the use of the EAMS system, covering all asset types in a single system and producing output that is designed to be integrated into the work-planning and delivery processes.

The investigation of Network Rail’s Asset Management systems did not seek to judge the quality of the output, simply their “fit” with the Engineering Access process. In contrast with the best-practice Comparator, it was observed that the process and timescale for creation of workbanks using the Ellipse system varies between asset types, potentially giving an inconsistency of input to the Engineering Access process. An indication of this discontinuity was that front-line planning staff referred at one point to the workbank content as being “thrown over the wall”. It should be noted, however, that this process is likely to change with Devolution; the new DRAM posts will have the opportunity to tackle this issue at Route level in future.

### **3.3.2 Access Planning Systems**

Once the workbank is determined, the next step is to programme the work to maximise the efficiency of the engineering processes and minimise the disruption to train operations. These are conflicting requirements, and there is clearly scope to use IT systems to optimise this critical planning area, but, in common with Network Rail, most of the Comparators use combinations of Programme Management tools (mainly Primavera) and their train planning systems (RailSys, ITPS etc) to manage this interface. Best-practice in this specific area was displayed by a Western Comparator, using the MultiRail planning tool to take possession durations and work-types from Primavera into the Train Management System and iterating to optimise the combination of Engineering Access and train operation. It is believed that Network Rail could benefit from work in this area – Devolution again provides an opportunity to explore the options available. One such opportunity is the use of the Engineering Access module in the ITPS software used by Network Rail to integrate access for engineering and normal operations. It is understood that this is contingent on other changes being made to the UK timetable planning process.

### 3.4 Data Collection

The systematic collection, analysis and dissemination of data on outcomes is an essential part of any continual improvement process, and an open question was asked to all Comparators as to whether KPIs relating to possession productivity was held centrally. 67% (four of the six) responded positively, mostly concerning data on availability of track for traffic, in line with the Network Rail data available centrally. The information available from the four Comparators collecting such data is shown in Sections 3.4.1 to 3.4.5 below, along with estimates of Network Rail’s performance in the areas measured.

The best-practice Comparator was again Western, holding central data on start and finish times of all Engineering Access works together with the actual engineering time spent “on the track” and value of engineering outputs delivered within the possession. This information is used in the form of KPIs to drive improvements in the network-wide efficiency of Engineering Access.

The data used by the best-practice Comparator is all collected by Network Rail, but is held locally, often in paper form, at many different locations around the network, and is reported to be difficult to access even by the Network Rail project team responsible for improvements in this area. As with Section 3.3 above, the recent Devolution of responsibility to Route management teams gives a clear opportunity to develop a best-practice approach in this area, enabling the development of KPIs to identify problem areas and measure ongoing improvements in output.

#### 3.4.1 Possessions booked but not used

As outlined above, most Comparators do not hold data centrally on detailed aspects of the delivery of Engineering Access, such as the number of possessions booked but not used. All were happy to make an estimate, however, based on their knowledge of the process, and as in previous categories, a clear East / West split emerged, with Eastern Comparators reporting very low levels of wastage, with significantly higher levels in the West.

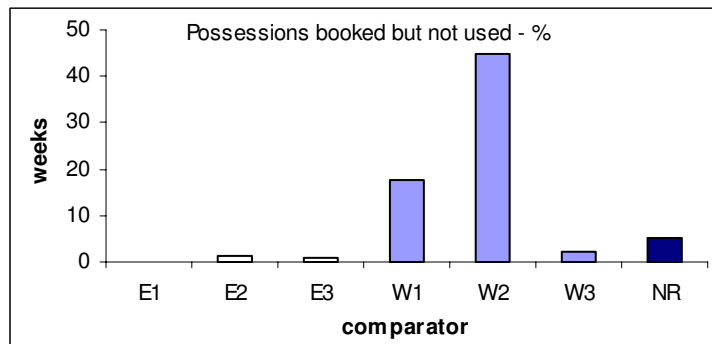


Figure 11; Possessions booked but not used - %

This data reflects the higher prevalence of advance “just in case” booking of possessions in the Western Comparators – in Network Rail’s case this is partly driven by the need to secure “track time” in advance of the work to avoid paying Contractual Enforcement Regime penalties to operators. The relatively low figure for non-used possessions disguises the fact that many respondents reported that the use actually made of possessions is often very different from that originally intended, with the implication that a significant percentage of disruptive possessions are actually used for work which could have been done in normal white periods for the route. It was not possible, however, to put a value on the extent of this problem, as no comparative data was available on actual possession use against the planned purpose.

### 3.4.2 Possessions over-running and disrupting train services

As with 3.4.1 above, little hard overseas data is available for the number of possessions which over-run and delay service trains. In the UK, however, the allocation of delay minutes to possession overrun through TRUST means that a very detailed record is available broken down geographically and with full details of the consequences. The comparative data shows, perhaps unsurprisingly, that the estimates of possession overruns by the Comparators are significantly lower than the TRUST-recorded values from Network Rail, with Eastern Comparators reporting very low values of below 1% in each case, whilst Western Comparators average around 4% - this makes Network Rail's value of 4.9% seem a little high in comparison.

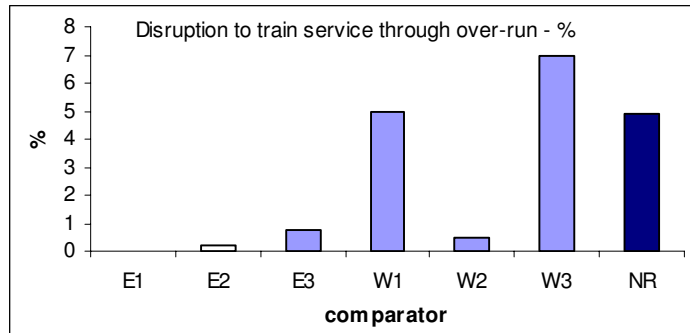


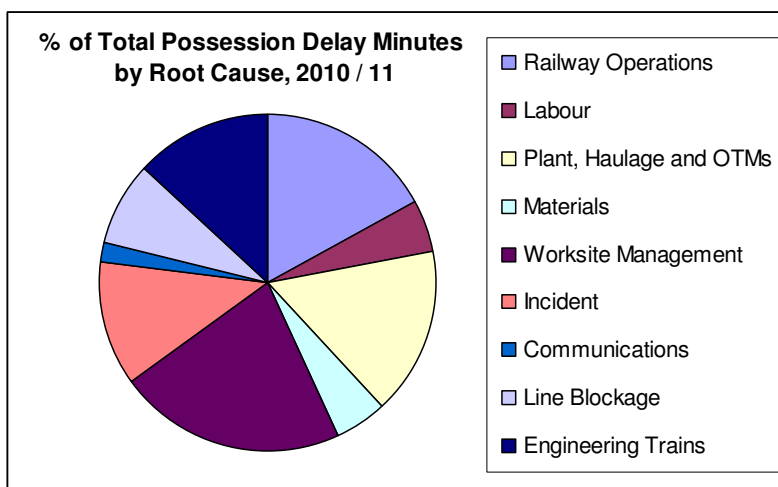
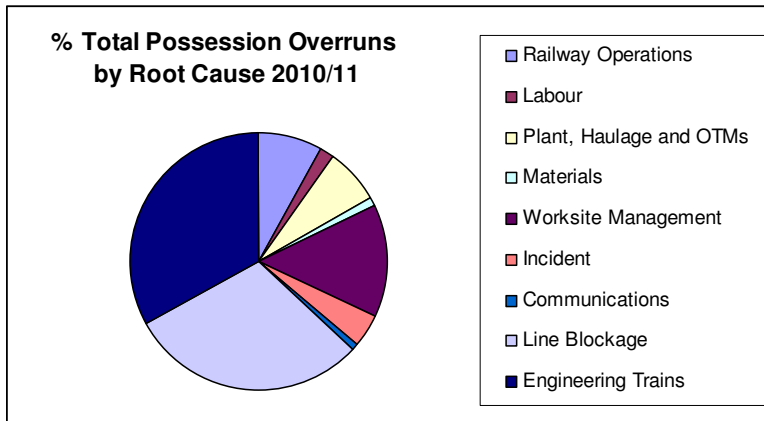
Figure 12; *Disruption to train service through over-run - %*

Although it is likely that there is an element of under-reporting of disruption to train services where there is no financial implication to infra-manager or operator, it still seems counter-intuitive that where these constraints exist, there are still a large number of such overruns occurring. This suggests that, although significant contingencies are included in the planning process, Network Rail's possession plans are more ambitious in scope than the Comparators. It could be hypothesised that this is related to longer set-up and hand-back processes in the UK, meaning that more discrete activities have to be encompassed in the time available and that the work requirements have to be met in a shorter "window". This is likely to increase the need to maximise the use of each such window, with additional work being programmed-in, and to increase the dependencies on the on-time delivery of individual elements of the plan.

It should be noted, however, that the ability to interrogate the TRUST data to identify patterns and compare management approaches between the Routes gives Network Rail a "best-in-class" advantage in this area, and provides a strong argument for the routine collection of more such data. This formed the basis of the work of Network Rail's Access Management Programme in allocating root-causes to each of the over-runs recorded in 2010/11 in the Possession Overrun Cause and Effect Analysis (POCEA) workstream. The conclusions drawn from this exercise included the fact that the four biggest impacts on delay minutes in 2010/11 were caused by:

- Poor worksite management
- Problems with Engineering Trains
- Plant failures
- Operations Delivery Failure

The breakdown of these data shows, however, that issues such as Engineering Train delays and Line Blockages (which between them are responsible for nearly two-thirds of all overruns) do not cause the most delay minutes – Worksite Management issues alone are responsible for more delay minutes than these two categories combined;



Network Rail has used this analysis to focus on these issues in future improvement plans in a traditional Plan-Do-Check-Act continual improvement process. The fact that the “root-causes” had to be added manually to the TRUST data, however, means that the “check” function cannot be easily achieved with the data available, again requiring a one-off exercise in retrieving data manually from devolved records. This suggests a need for a national system for collecting and analysing KPIs, including process measures, linked to the TRUST data on possession performance.

### 3.4.3 Possessions where work is not completed in allocated time

Another key measure of the effectiveness of the overall possession planning and delivery process is the ability of the engineering teams to complete the work in the time allocated. This is another dataset where there is a clear East / West split, with Eastern Comparators reporting no problems in this area, whilst all the Western Comparators have problems in completing planned workloads. The Network Rail data available only referred to actual over-runs of the possession, as measured by the TRUST data. Discussions with Contractors and Operators suggests that the total number of Network Rail possessions where work has to be deferred or curtailed to avoid over-running and delay to train services is much higher, possibly in the region of 15-20%, equal to the worst-performing comparator; there is, however, no official confirmation of this.



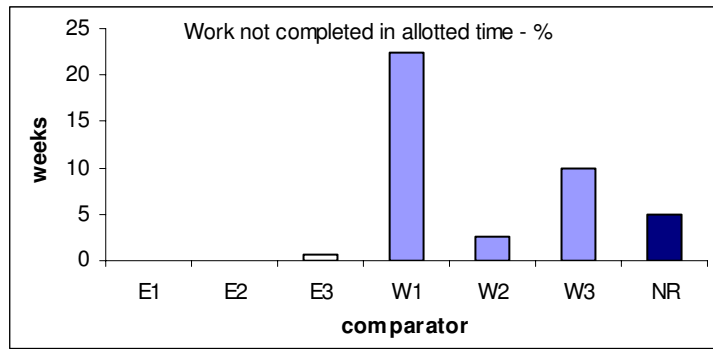


Figure 13; Possessions where work is not completed in the allocated time - %

The key issue here is the number of times each organisation has to go back to worksites to complete unfinished work – this clearly has the double disadvantage of increasing the costs of the actual work, and diverting resources from other planned work. As with many of the issues in this section, the long-term contractual relationships and 7-day approach adopted by the Eastern Comparators in particular seems to minimise the likelihood of work not being completed; this again suggests that Network Rail’s plans to move towards this type of relationship and way of working are soundly based.

### 3.4.4 Possessions where work finishes early

Another source of inefficiency in Access Management is possessions that are taken, but in which the work finishes early, i.e. more could be achieved in the timeslot. If this is an endemic issue, it would suggest that fewer, more efficient possessions could be taken, saving both time and money. The benchmarking scores show that only one Comparator organisation has a significant problem in this area.

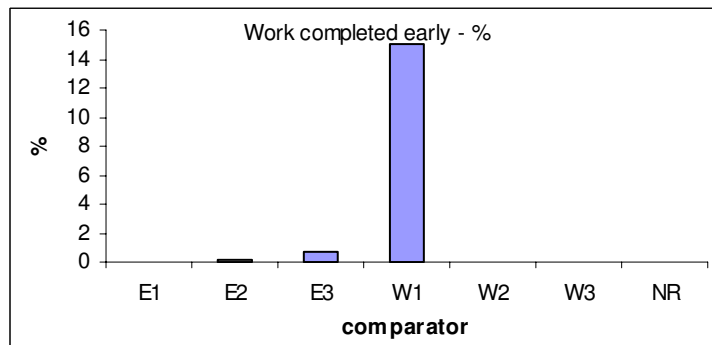


Figure 14; Work completed early - %

Network Rail was unable to provide an official value, but analysis of performance data provided suggests that on average, the work undertaken in UK possessions is completed around 90 minutes earlier than booked in the Weekly Operating Notice. This is consistent with the estimated average value of contingency time in each 8-hour possession, and could therefore be indicative of a well-managed possessions regime. The wide range of values making up this average, from 434 minutes early to 112 minutes late, indicate, however, that there are significant differences between planned and actual performance, unlike the best performing Comparators where plans are reported to be rigorously delivered within fixed time-windows.

It must be stressed that the values used in the above analysis are based on estimates from a very small sample of representative possessions, but these suggest that Engineering Access time in the UK is not utilised as efficiently as in overseas Comparators. The benchmarking responses indicated that in best-practice organisations, the planning process is based on achievable standard times for the tasks to be undertaken. The best-performing Comparators also routinely identify additional tasks that can be undertaken at each site should the main workload finish early, allowing staff to use any spare time productively. This is clearly linked to multi-skilling of work-teams, and is an area that Network Rail could usefully consider in its review of processes following Devolution.

### **3.4.5 Late-running service trains**

Although the main source of disruption noted is the delay to trains from over-running possessions, there is a corollary to this in the occasional disruption of carefully planned Engineering Access by the start being delayed, sometimes significantly, by a late running service train. The policy in the UK is to allow such trains to complete their journey before the possession can be taken, even though this can result in significant waste of resources and occasionally cause the cancellation of planned work that can no longer be completed in the time available.

The Comparators were asked what, if any, policies they had in this respect. All reported that such cases tend to be judged on the day, but an East / West split was noted, in that the tendency of Eastern Comparators was to enforce the possession, and make alternative arrangements for passengers, whilst Western Comparators reported that normally the train would be allowed to complete its journey. It is acknowledged that these responses may have more to do with the culture in the different countries than a hard-nosed drive for efficiency of engineering operations.

## **3.5 Cost / Time of Safety Processes**

The safety of track workers and rail travellers and staff is the first priority at every stage of the Engineering Access process, and there are a large number of processes and procedures in place in the UK to ensure that this is not compromised by economic or time constraints on work teams. The net result of this process, however, is that UK possessions appear to require more start-up and handback time than comparative work undertaken on overseas networks. Benchmarking work suggests that this is partly due to a different approach to safety processes in the UK, and partly due to investment in "maintainability" in overseas networks; this latter issue is dealt with in Section 3.6 below.

The potential scope of efficiency savings in this area is high. Previous research<sup>5</sup> indicates that for Network Rail, as little as 2 hours from each eight-hour possession is available to work teams to actually put "spade into ballast", whilst best-practice countries such as Switzerland can achieve 80% + efficiency. This would indicate that a significant reduction in the number of possessions needed is possible if efficiency of taking and hand-back of possessions can be increased.

These issues have, however, been the subject of a number of previous studies and initiatives, and are currently receiving the attention of Network Rail's Access Management Programme team, but the UK performance remains worse than that of international Comparators. The benchmarking work undertaken, therefore, looked at the key components of setting-up and handing back possessions, to

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<sup>5</sup> Relative Infrastructure Managers' Efficiency Evaluation of UIC LICB Approach; Summary Report, ORR 11 Aug 2010

see if any conclusions could be drawn about the root-causes of underperformance in the UK. The results from this are detailed in sections 3.5.1 to 3.5.5 below;

### 3.5.1 Number of staff required

Strong circumstantial evidence suggests that the structure of the UK railway drives the need for more staff to be required “on the ground” at possessions to deal with the safety processes required and manage the interfaces between the different organisations involved. Recent detailed benchmarking work by Network Rail on the relative efficiency of Network Rail against European comparators for S & C renewal work<sup>6</sup> (not the same comparators as those in this Report). concluded that the actual financial efficiency was similar, but that the number of staff required by the UK process was nearly twice that of the nearest comparator, as in Figure 15 below;

	<i>UK</i>	<i>EU1</i>	<i>EU2</i>	<i>EU3</i>
<i>No of permanent way operatives (includes all machine/OTM operators)</i>	<i>33</i>	<i>17</i>	<i>16</i>	<i>19</i>
<i>Total no of men including safety related staff (excluding possession management related resources)</i>	<i>41</i>	<i>18</i>	<i>16</i>	<i>21</i>

Figure 15; *Comparison of staffing for delivery of single turnout (source Network Rail)*

This relative inefficiency is being hidden at present by the very low labour rates achievable in the UK; Network Rail’s benchmarking into Structures costs<sup>7</sup> show that labour rates for UK rail are up to 50% lower than continental European comparators. This “efficiency”, however, is achieved at the cost of a largely casual workforce, and may actually be a root-cause of the overall higher costs of UK rail – the use of a large number of non-specialist staff on work teams increases safety, management and logistical difficulties, and is likely to result in lower-quality output, requiring re-work. These issues are difficult to measure, but all Comparator interviews revealed a different approach, with small, dedicated teams working full-time on key tasks. This suggests that Network Rail’s current drive to “professionalise” its approach through closer relationships with contractors and a better spread of work throughout the week is likely to result in lower overall costs in the longer term, despite increasing unit wage costs through employment of higher-skilled staff.

The number of variables involved in the taking of a “typical” possession means that it is difficult to identify the efficiency with which the process is undertaken. The benchmarking work in this area, therefore, looks at the number of staff responsible for managing a step in the process of taking a possession, and the number employed solely to undertake safety “look-out duties”

The responses as set out in Figure 16 and Figure 17 below show that, of the organisations who responded, there is a relatively small variation in the numbers involved, suggesting that this is an area where traditional methods are still widely-used. Best-practice Comparators report the adoption of IT-

<sup>6</sup> Track Asset Management: CP5 benchmarking & delivery efficiency review, Network Rail 16 Nov 2011

<sup>7</sup> Civils Benchmarking Alliance (Network Rail); Benchmarking UK Rail Civil Engineering Projects to Europe, Jan 2011

based solutions such as video inspections and iPad communications, both of which are currently being trialled by Network Rail. Rail Unions in the UK continue to strongly oppose the replacement of staff roles by technology in this way.

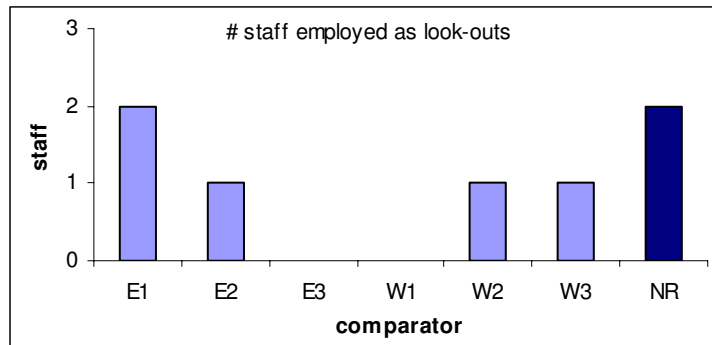


Figure 16; Staff responsible for lookout duties

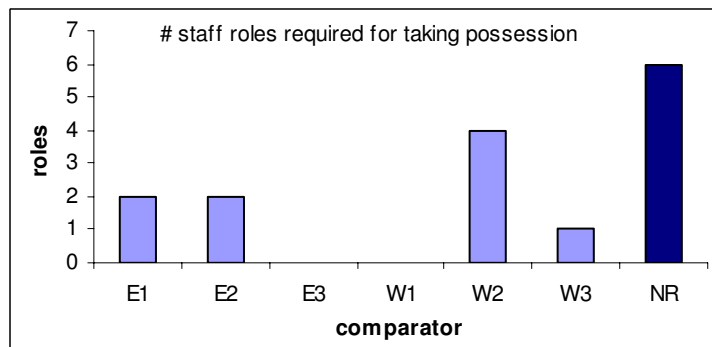


Figure 17; Roles required for taking possession

Network Rail has above average numbers involved in both cases, demonstrating the results of the Industrial Relations barriers to achieving best-in-class delivery of management and safety processes in the UK Rail environment. An example of this is the Network Rail practice of staff walking the extent of the possession to place warning boards and detonators, with start of work delayed until confirmation of the physical blockade has been received. Best-practice reported in this area includes the protection of worksites by signals, with a single member of staff responsible for look-out duties backed-up by access to train movement systems, and preparations for work (and in some cases, the work itself) commencing whilst these measures are being established. For many worksites, a reduction in this physical set-up time would be the biggest single improvement in efficiency, due to the long distances required to be covered at walking speed at present.

### 3.5.2 Working alongside running trains

Another key differentiator between Network Rail’s practices and those of Comparators is the extent to which work can take place alongside running trains. For most overseas administrations, the key to running a 7-day rail service is the ability to maintain limited train movements past the site of normal engineering work, in particular the bread and butter of routine track maintenance and enhanced maintenance activities. Whilst not all Comparators were able to provide a figure for the minimum separation distance, all confirmed that their normal processes included methods of managing safety during train movements past work sites, and none reported a reduction in such movements over the past few years. Closer to home, the site visit to Network Rail’s HS1 operation confirmed that the wider

separation of tracks on the Channel Tunnel Rail Link is used to allow train movements past “live” worksites at up to 160 kph, with no adverse safety outcomes to date.

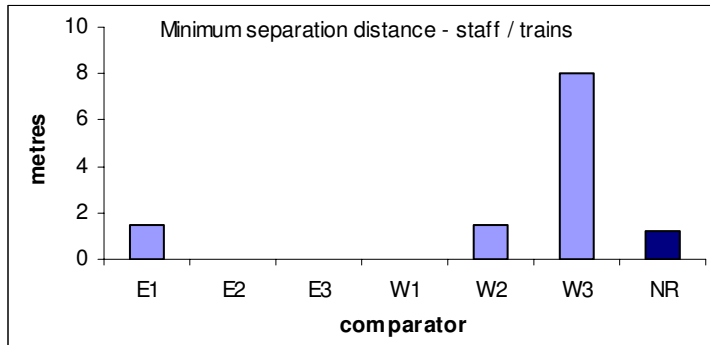


Figure 18; *Minimum separation distance (m) between track workers and moving trains*

The restricted loading gauge on the Network Rail infrastructure is often quoted as a reason why Single Line working is not a normal work-practice in the UK. The results of the benchmarking show, however, that provided proper precautions are taken it is feasible to consider more use of this in a UK context; Network Rail’s minimum safe distance, dependant on train speed and with appropriate safety preparations and equipment, is actually smaller than any of the Comparators in this area. This is an important conclusion - the issue of delivering “normal” track maintenance and upgrade work alongside running trains is a key element in the ability of overseas administrations to deliver 7-day rail services on key routes. Even European administrations with a number of alternative routes between main centres, such as the Netherlands and Switzerland, tend to keep overnight passenger services operating on normal lines at reduced frequencies and speed whenever possible, to avoid bussing intermediate passengers. Freight services will be diverted whenever possible, but the possibility of continuing to provide a service past single-line possessions provides an important commercial benefit to rail freight, as outlined in Section 7.4 below.

### 3.5.3 Time of day for Engineering Access

Another area identified where work can be undertaken at significantly lower cost than at present is the use of daytime possessions for maintenance work. At present, this is restricted to the least-busy routes in the UK. In the recent past, however, many four-track routes had mid-day “weaves” from fast lines onto the slow or relief lines timetabled-in for all trains, to allow Engineering Access to take place during the day. This is significantly cheaper than overnight working, as no lighting is needed and staff unit rates during the daytime will not attract “unsocial hours” premiums.

Five Comparators responded to this question, but two of the Eastern companies reported no daytime maintenance, due to the intensive nature of the service operated over their main-line network. Of the three Comparators reporting some daytime maintenance work, these tended to be confined to secondary routes, with main arteries being maintained overnight, as the practice in the UK.

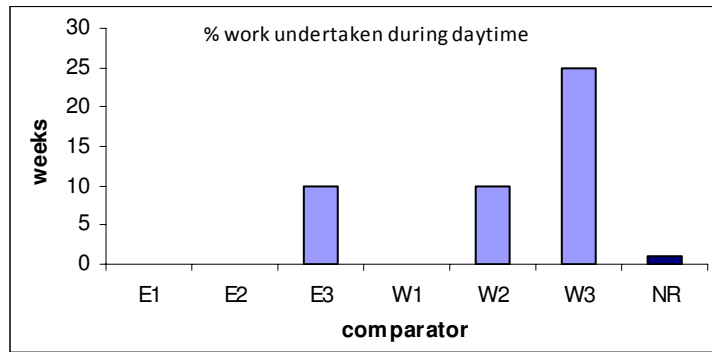


Figure 19; work undertaken in daytime - %

The intensive use currently made of Network Rail’s four-track routes, and the future increase in traffic forecast would seem to preclude a reversion to any significant level of daytime maintenance activity, in line with most administrations worldwide. The fairly widespread use of limited daytime maintenance by Western Comparators suggests, however, that this may be an option for lightly-trafficked routes, possibly in conjunction with developments in working alongside service trains in line with findings in 3.5.2 above.

Data was also sought on the extent to which track renewal work was undertaken during normal White Period possessions on weekday nights, as opposed to disruptive overnight or weekend possessions. A clear East / West split emerged here, with both Eastern Comparators reporting that most of their renewal workload is handled in this way, whilst Western Comparators reported between 30 and 40% undertaken on weekday nights.

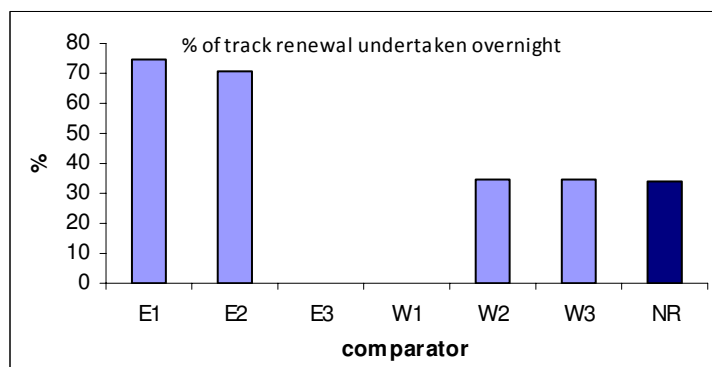


Figure 20; track renewals undertaken overnight - %

Although Network Rail’s value for the percentage of work done is similar to Western Comparators, it is significantly lower than for the “best-practice” Eastern Comparators. It is also of note that the Network Rail value is almost entirely composed of “High Output” renewals, with most conventional renewals being undertaken in the longer “window” available at weekends. Discussions with Western Comparators suggest renewals outwith midweek nights are mostly undertaken in blockades, either covering whole weekends or for longer periods; one of the Comparators has a programme of whole-route closures covering weekdays as well as weekends in the holiday season, with through rail traffic diverted and use of buses for local journeys. The demand characteristics and contractual relationships for UK Rail mean that this is not a feasible option for Network Rail, restricting the overall efficiency gains possible in this area.

### 3.5.4 Isolation times for AC electrification

Network Rail’s Access Management Programme team have identified the time taken in the UK to achieve a safe electrical isolation as a key area for development work, with no fewer than five separate projects currently underway looking at the various types of electrification systems and the processes needed to secure a safe isolation. The benchmarking results in this area suggest that this is not a major problem for Comparators – the maximum time reported for safe isolation was 30 minutes, and an Eastern Comparator allows just 5 minutes, suggesting that significant improvements can be made.

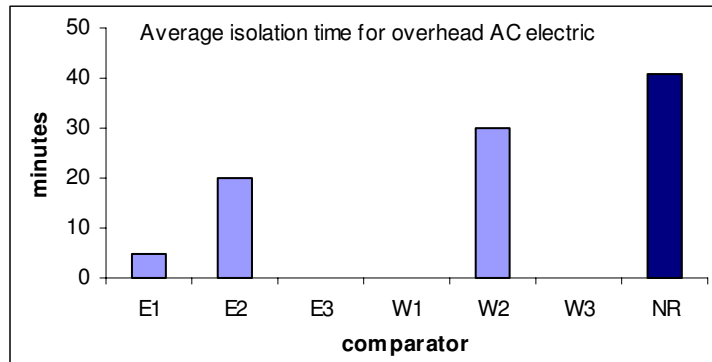


Figure 21; *Isolation times for AC electrification*

Improvements in this area, however, are critically-dependant on the nature of the infrastructure - the site-visit made to HS1 also observed isolation procedures of around 15 minutes, suggesting that the best-practice figures can be replicated on purpose-built UK infrastructure in a UK safety environment.

A key issue for Network Rail is a reduction in the significant variability in the observed times taken for isolations at present – the variability of the isolation set-up values reported was between 3 and 186 minutes for a sample of 325 possessions. This is partly an issue of investment in infrastructure upgrades over time, as explored in section 3.6 below, but is also a training and competence issue, with potential benefits from the “professionalising” of work teams through adoption of 7-day working and closer relationships with Contractors.

### 3.5.5 Process Steps for isolation of AC electrification

To test the hypothesis that the reason for differences in performance in the area of electrical isolation is driven by the complexity of the process, the Comparators working with AC overhead electrification were asked how many steps their process had, and how many people were required to manage this process. As can be seen from Figure 22 below, there is, however, no obvious correlation between the complexity of the process as measured by the number of steps and the number of roles needed and the time taken to achieve a safe isolation.

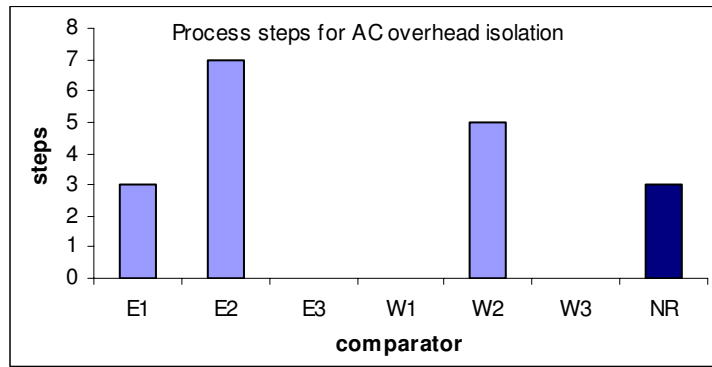


Figure 22; Process steps needed for isolation of AC electrification systems

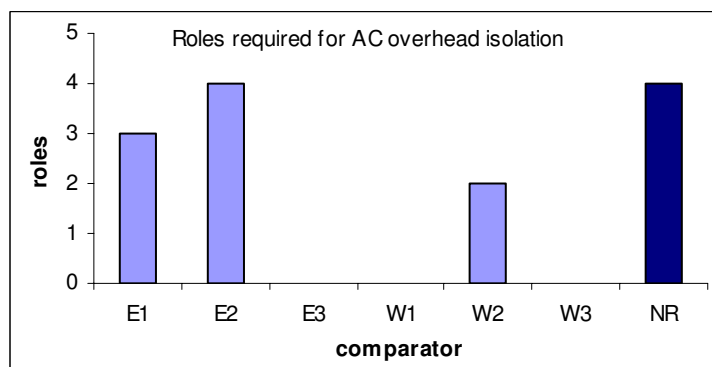


Figure 23; Roles required for isolation of AC electrification systems

Network Rail’s process emerges from this comparison as amongst the best in terms of the number of steps needed, despite their relatively poor performance in terms of time taken and number of roles needed. This supports the conclusions in section 3.5.4 that investment in infrastructure and staff training are the key issues driving efficiency in this area, rather than further work on process improvement.

### 3.6 Investment in Maintainability of Network

The extent to which the infrastructure is designed for ease of maintenance is a key driver of the overall efficiency of the Engineering Access process. Much of the “heritage” UK infrastructure has been built on the basis of lowest first-cost, and as such is likely to be inherently more expensive to maintain than networks built around a whole-life-cycle cost model. There are a wide variety of parameters which determine the maintainability of rail networks; the benchmarking undertaken identified the five areas outlined below as significant in terms of the aspirations in the UK to improve efficiency both in the short and longer-term.

#### 3.6.1 Engineering Access Points

Getting staff and their transport to worksites quickly and effectively, and minimising the walking required is a key requirement for effective Engineering Access. This is clearly driven partly by geographical issues; there is little point in providing access to the rail infrastructure where there is no



road access. The reported data on this issue shows one clear outlier, with an Eastern Comparator having a number of access points that is an order of magnitude bigger than all other organisations; taking away this outlier leaves Network Rail above the average level for the other Comparators.

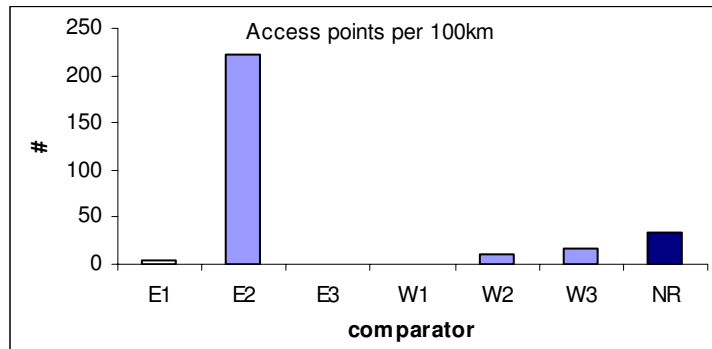


Figure 24; # of access points per 100 route-km

The results of this benchmarking indicate that Network Rail is not significantly out of line with Comparator organisations for number of access points to the network for Engineering Access, suggesting that this issue is not a priority area for efficiency investments.

### 3.6.2 Isolation points for electrified network

The provision of sections of electrified route that can easily be isolated for Engineering Access without restricting the use of other parts of the network is another key enabler of efficient Engineering Access. Benchmarking in this area proved unexpectedly difficult, both because of differences in standards of AC overhead electrification systems and definitions of isolation points, and results are therefore far from conclusive. It is clear, however, that the high-performing Eastern Comparator with the lowest declared unit costs has capabilities in this area which are significantly more-flexible than Network Rail.

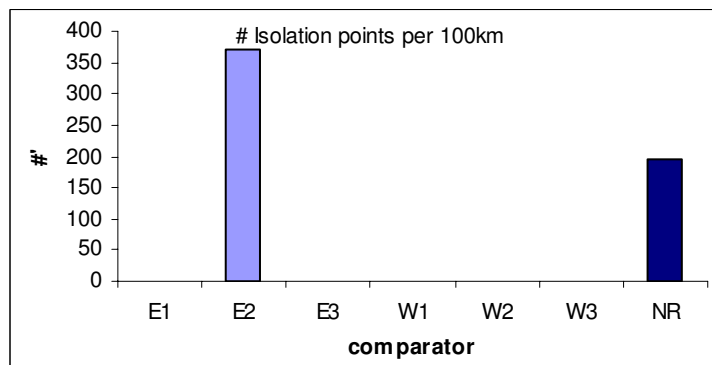


Figure 25; # of isolation points per 100 electrified route-km

This is consistent with the findings of previous studies, which identify the lack of flexibility of isolation in UK electrification, e.g. inability to isolate single lines on multiple track routes and isolations near junctions effectively closing all routes rather than just the one being worked on, as key issues in reducing the efficiency of Engineering Access for UK Rail.

### 3.6.3 Engineering sidings

The ability of engineering trains to reach the worksite at the correct time and in the correct sequence emerged as a significant issue amongst UK respondents during the study, with many citing the difficulty of timetabling and pathing trains from often-remote material sources along busy routes to be available at worksites. Major jobs can result in all available loops and sidings being successively occupied from early morning on the day before the work, with potential consequences for service performance and creating difficulties of resourcing for the engineering trains and the work itself, with materials being held tens or even hundreds of kilometres away from the worksite.

The Western Comparators had no readily available data on the number of sidings and loops available for engineering trains but observation in the administrations concerned suggest that significantly more spare capacity is available in most European administrations than on Network Rail. All the Eastern Comparators were able to give figures, with, once again, the lowest-cost administration reporting an order-of-magnitude higher availability of spare capacity.

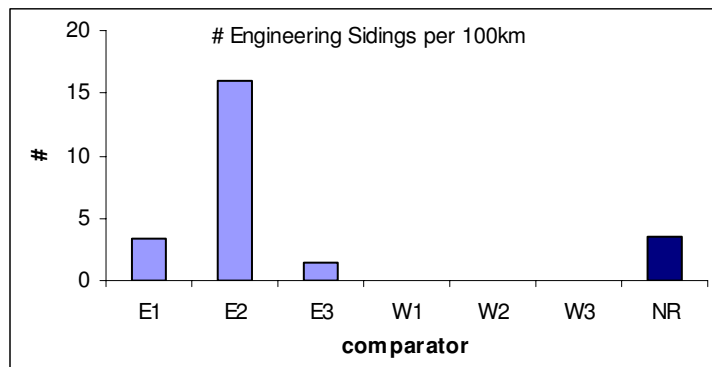


Figure 26; # of engineering sidings per 100 route-km

Network Rail’s value of four sidings per 100 route-km is around average for the Comparators responding if the “outlier” is taken out, although these figures have not been adjusted to reflect the activity on the network. The hypothesised lower value than Western comparators is not necessarily a bad thing; one of the consequences of having significantly fewer signals and switches is a reduced need for maintenance and fewer potential points of failure. The combination, however, of a relative lack of spare capacity in the network with the problems in the planning process outlined in Section 3.1 means that resourcing worksites by engineering trains has been identified as one of the top-four causes of delay and cancellation to possessions. The strategy of storing materials at “virtual quarries” strategically located across the network helps to ensure that resources are available, but it is important that this is backed-up by the capability to hold trains “on the day” close to worksites on all strategic routes.

### 3.6.4 Bi-directional signalling

To maintain a timetable using single line working (SLW) at a reasonable cost and service frequency during certain types of engineering possession, as outlined in Section 3.5 above, the ability to signal trains through single-line sections is essential. This has traditionally been undertaken using bi-directional signalling on key routes, and the percentage of the network thus equipped is a useful measure of the extent to which this is a feasible way of extending effective overnight engineering windows without reducing early morning or late night train services. The benchmarking shows that

most Comparators have this capability on more than 50% of their network, covering all key routes; by contrast, Network Rail has less than 10% of the total multiple-track network covered.

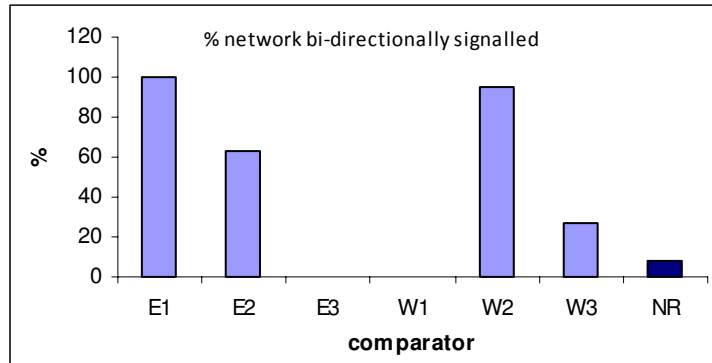


Figure 27; % of multiple-track network with bi-directional signalling

The low percentage of bi-directional signalling in the UK, and the lack of plans to significantly increase this with planned conventional resignalling, means that it is not currently possible to adopt a strategy of planned train movements past worksites even if safety regulations and systems of work are improved to facilitate this. It should further be noted that the major cost in moving to bi-directional signalling is not the signals or interlockings themselves, which can be relatively low-cost (e.g. SIMplified Bi Directional Signalling (SIMBiDS) on the East Coast Main Line north of Northallerton), but the associated trackworks, with additional facing crossovers at suitable distances to allow reduced timetable operations over temporarily-signalled track.

The benchmarking exercise also asked Comparators what the typical distance was on their double or multiple track networks between crossovers allowing facing main-main movements. As can be seen from Figure 28 below, Network Rail’s provision of this type of infrastructure is around the average of the Comparators. Cross-referencing this result with Figure 27, however, it is clear that the results from this exercise did not correlate particularly closely with the provision of bi-directional signalling,

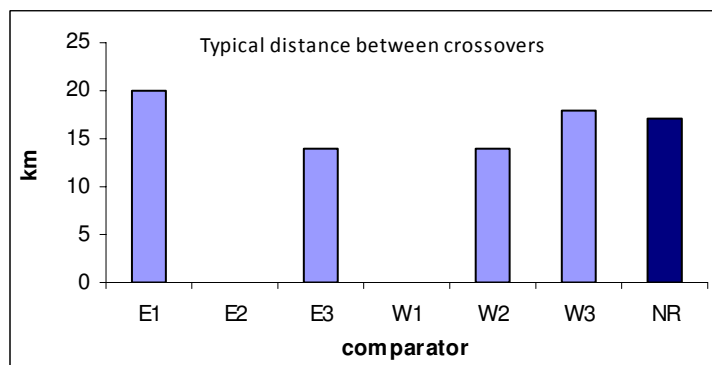


Figure 28; average distance between facing crossovers

suggesting that some administrations use such infrastructure for out-of-course rather than signalled / timetabled operations. This is clearly true for Network Rail, meaning that use of the facing crossovers for single-line working to reduce the disruption caused by Engineering Access will usually require special operational arrangements requiring additional staff, such as pilotman working; this will often not be a cost-effective solution for small engineering works.

### 3.6.5 Availability and duration of White Periods

As outlined above, a key driver of the unit costs of engineering work undertaken is the amount of actual track-time available to the work-team; this comprises of the overall time window available less time taken to start-up and hand-back the possession. In the UK, almost all engineering work is undertaken in full possessions of the route, either during overnight timetabled White Periods or during extended possessions that disrupt timetabled services.

The contractual basis of UK rail means that the White Periods available for Engineering Access on the vast majority of routes is based on the times of the first and last trains run in 1992, as this timetable formed the basis for the Schedule 5 access rights for the TOCs at privatisation in 1994. This timetable, in turn, was based on an historic timetable, in many cases dating back to the days of steam, at times fixed when customer demand was very different, and engineering processes bore little resemblance to today's mechanised high-output approach. In addition, the 1992 timetable included a number of Empty Coaching Stock (ECS) movements to and from depots which no longer exist, or which were put in by British Rail as a "low-cost" way of balancing rolling-stock allocations.

The common denominator of these issues is the reduction of the time available for Engineering Access to allow for the running of trains with little or no customer demand, protected by firm contractual rights. For routes with significant freight potential and no diversionary capability, this is not a significant issue, as there is a strong market demand for these, but for all other routes, the net effect of these rights is to restrict the Engineering Access, thereby driving up the overall cost with little net benefit. There is clearly a strong argument for challenging this "1992" settlement as part of the CP5 planning process – the range of potential benefits from this are outlined in Section 7 below.

The benchmarking questionnaire asked Comparators for details of their approach to allocating train-free periods on their main routes. A relatively low number of responses were received in this area, reflecting the difficulties in definition for networks with a more-flexible approach to timetabling and a greater reliance on SLW alongside worksites. No clear pattern emerges from the responses received, with the percentage of routes with train-free periods varying from all to none, although it is potentially significant that the only network reporting 100% closure for Engineering Access for a fixed period of time 7 days a week also reports the lowest unit costs.

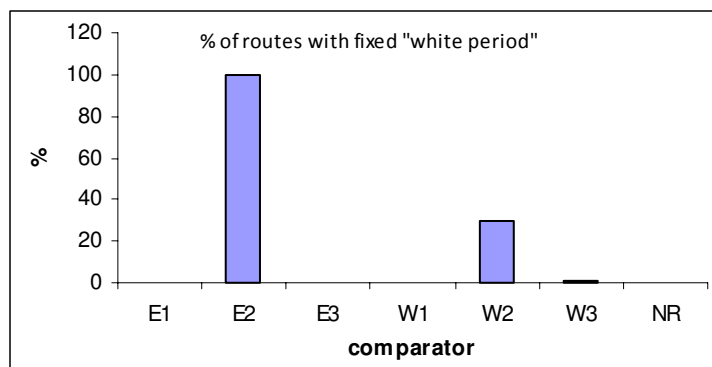


Figure 29; % of inter-urban routes with no-train White Periods

The wide variety of historical factors affecting the distribution and duration of White Periods across Network Rail's routes means that UK Rail effectively has no standards in this area, making direct comparisons difficult. It is clear, however, that, where they are enforced, the overnight White Periods on 7-day railways are relatively short (4-5.5 hours), and, like Network Rail, most Comparators only have fixed White Periods on a limited number of routes.

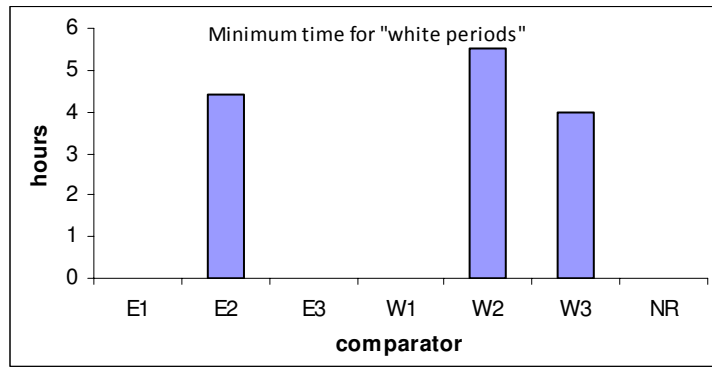


Figure 30; *Minimum time for White Periods*

Set against these tentative conclusions however, is the fact that the lowest-cost Comparator reports a strict application of a 4.5 hour White Period on all routes. Given the similarity of the engineering tasks being undertaken, these results support the hypothesis that a standardised approach, with access times tailored to fit an optimised engineering process on a railway with high investment in “maintainability” will result in lower long-term unit costs for Engineering Access. It should also be noted that most Western Comparators are able to extend effective engineering time significantly by using SLW to run trains past the worksite either throughout the engineering work, or both before and after the formal White Period if needed.

### 3.7 Management of Interfaces

It is often advanced as a truism that the complexity of the contractual and organisational environment in UK rail is a key driver of differential costs, with the management of multiple interfaces in a “fragmented” industry requiring significant resource. This is, however, a difficult area to quantify in terms of wasted cost, particularly in the context of trying to identify potential efficiency savings within the current industry framework. To try to assess the relative complexity of Network Rail’s internal and external interactions, a “tick-list” of all the interfaces managed at some point by staff involved in Engineering Access was created, and the Comparators were asked to identify which interfaces were common to their own experience. The results of this exercise are shown in Figure 31 overleaf.

Perhaps surprisingly, most of the Comparators ticked most of the boxes, leading to the conclusion that railways, as presently managed worldwide, are inherently complicated entities. Areas where significant differences were reported included direct contact with government bodies, with only two other organisations reporting this, and dealings with staffing agencies and contractors – more than half the Comparators provide in-house resources for Engineering Access activities.

The qualitative responses in this area gave an impression that the quantity of individual interactions is greater in the case of Network Rail than for the Comparators, but no useable data could be identified to confirm this. Other issues raised included two Comparators expressing surprise that a specialist area like rail engineering should draw on resources from staffing agencies rather than using specialist contractors or dedicated in-house teams. The question was also asked as to whether any other interfaces are managed on a regular basis. The main response was to add neighbouring infrastructure managers and in-country private rail administrations to the list; this is clearly not a significant issue for UK rail.

Department / Organisation	yes (%)
Engineering Delivery Access Planning team	100
Engineering Delivery Resource Planning team	100
Maintenance Planning team	100
Maintenance Work Delivery team	100
Passenger / Freight Timetable Planning team	100
Contractors	50
Staffing agencies	35
Asset Renewals organisation - Track	100
Asset Renewals organisation - Structures	100
Asset Renewals organisations - Signalling	100
Major Projects planning team	100
Passenger Train Operating Companies	100
Freight Train Operating Companies	100
Government bodies eg Regulation / Safety	35
Information Management / Data collection	100
Engineering Train planning team	85

Figure 31; % of Comparators reporting contact with each type of stakeholder

### 3.8 Contractual Enforcement Regimes

Qualitative benchmarking was undertaken on the issue of the existence and effectiveness of Contractual Enforcement Regimes amongst the Comparators. A clear East / West split was noted on this issue; none of the Eastern Comparators is subject to such a regime. (It is, however, a matter of record that the Chief Executive of MTR has to account in person each day to the Minister of Transport for any train that runs more than ten minutes late – this is not judged to be transferable best practice...).

The Western Comparators all reported themselves as either subject to some kind of incentive regime or preparing for one. None is either as formal or as far-reaching as the Schedule 4 / Schedule 8 regimes covering Network Rail; one is based on the monthly reporting of a small number of possession KPIs, with financial penalties for failing to meet agreed targets. The other reported scheme requires the company responsible for the infrastructure to give a discounted access charge to other operators if annual targets for avoiding disruption are not met.

Both schemes reported have the advantage of simplicity compared to the UK Rail regimes, and the “annual target” scheme is felt by both infra-manager and operator to give a good, proportionate incentive for compliance without adding to cost or complexity of operation. The KPI-based scheme, which is closer to the UK’s in structure and operation, however, is felt by its users to be ineffective, with insufficient penalties being applied to influence behaviour and no effective mechanism for attributing fault when targets are missed.

Discussions with Network Rail and UK TOCs revealed that, on balance, the regimes are felt to be effective in providing Network Rail’s customers with compensation if their contractual entitlements are not delivered, although passenger operators are generally happier than freight customers with the

level of payments made. An issue raised by a number of the UK respondents to the benchmarking work however, is the underlying cost to the industry of providing the data that allows these schemes to work, including resource-hungry delay attribution and dispute resolution procedures. There is clearly a danger that, after 15 years of contractual access, these costs have been “internalised” into the system without questioning the overall value-for-money of maintaining the regimes they support. This issue is, however, outwith the scope of this study.

### **3.9 Data Collection / Continuous Improvement**

The benchmarking data collated in this Section, both from the Comparator organisations questioned and from existing benchmarking from other sources, provides a useful “snapshot” of the situation at present and a guide to areas where Network Rail could focus to further improve its Engineering Access efficiency. There is, however, a further dimension to this work; as explored in section 3.4 above, the ability to achieve sustained improvement in this area is at least partly dependant on the collection of data on Key Performance Indicators, and its regular use in systematically reviewing process and delivery efficiency as part of a process of continuous improvement.

All Comparator organisations were therefore asked “open” questions about their performance and policy in this area. All reported an ongoing programme of innovation in engineering techniques, with tests underway in the use of “jump frogs” to provide temporary switches, site protection through fixed warning lights and improvements to site access through increased use of road-rail vehicles, but only two organisations, both Western Comparators, reported a systematic programme of process improvements. Initiatives reported in this area included a policy of “swarming”, with route segments sequentially targeted for work from across all the engineering disciplines to reduce overall disruption across the network, and a programme of systematically moving work from weekend blockades to weekday nights, with improved alternative transport for travellers affected. Only two Comparators reported current benchmarking activity, although another is still using the historic UIC dataset dating back to the 1990s which also forms the basis of the 2010 ORR Report “Relative Infrastructure Managers Efficiency”.

Network Rail is currently undertaking a systematic process-improvement under the Engineering Access Programme, including constructing a central database of possession KPIs, and has an active programme of international benchmarking covering both track and structures. Coupled with the delay causation data held for use with the Contractual Enforcement Regimes, this is judged to represent current international “best-practice” in this area.

## **4 International Comparisons 2; Indicative Track and S&C Renewal Costs Benchmarking**

### **4.1 Engineering cost benchmarking data**

The core purpose of this study is to assess the efficiency of Network Rail's Access Management processes, using international comparisons and detailed investigation into its current activity. The effective use of benchmarking data, particularly studies comparing results from different continents, is limited that the comparison is by the fact that the organisations providing the data are structured differently, operate in different legal and economic frameworks and use different processes to achieve the same outputs.

These limitations on this process mean that even for detailed, long-term studies like the cost-benchmarking currently being undertaken by Network Rail, the results can only give indications of where differences occur rather than a definitive quantitative value for the scale of the differences. Sections 5 and 6 below therefore look in more detail at what the conclusions of the benchmarking work detailed in Section 3 might mean in terms of Network Rail's cost-base going into CP5, whilst section 7 considers what the impact of planned and possible changes might mean for UK Rail's commercial revenue.

Although this study focuses on the efficiencies possible from improvements in Access Management, however, it is clear that the bulk of the cost savings achievable will be delivered through reductions in the engineering costs, for which improvements in Access Management is merely the "enabler". This Section therefore undertakes an evaluation of the potential scope for such savings, both through new benchmarking results and by drawing on existing work undertaken in this area. As this is not the core area of study, it must be stressed that the benchmarking in sections 4.2 to 4.4 below uses nominal rather than normalised values, using the standard costing systems of the Comparators, and is therefore intended to be indicative of potential areas for improvement rather than providing an absolute value for the scale of improvement possible. It should also be noted that comparisons undertaken in this area are limited to the main cost headings of track and structures, rather than trying to cover all areas of engineering expenditure.

#### **4.1.1 Other benchmarking data**

A number of detailed benchmarking studies have been undertaken during CP4 with a view to establishing realistic efficiency targets for Network Rail based on data from comparative organisations, both within the rail industry and (for structures), the wider infrastructure-management community. Due to the difficulties of baselining and normalisation between different organisations and countries, none of these claim to provide definitive results, but the outcomes are broadly in line with our research as outlined above. These are referred to, where appropriate, in Section 3 above; Sections 4.2 to 4.4 below draw on these studies in addition to the results from our own benchmarking to draw conclusions on the potential for efficiency savings in CP5.



## 4.2 Scope for cost efficiencies – Track

A major area for potential savings in CP5 is in the track renewal budget. Discussions with Network Rail indicate that investment approval has now been secured for a major project to evaluate the feasibility of switching the emphasis in this area from full track renewals to an Enhanced Maintenance regime, in which the life-cycle cost of each component is optimised through selective replacement of rail, sleepers and ballast as required. This will have the twin benefits of avoiding the replacement of assets that are not at the end of their economic life through the normal renewal process, and facilitating the use of shorter possessions as part of the move to a 7-day railway approach.

The downside of this proposed change, however, is that more of these shorter possessions will be required per track km over time, as each renewal possession will potentially be replaced by up to three possessions for enhanced-maintenance of the track components. The scoping work for this is at an extremely early stage, but it seems likely that the result of the changes will see the number of possessions required for work on track, for maintenance, enhanced maintenance and renewals, increase in CP5 compared to the CP4 outturn. The reduction in engineering costs achieved will therefore be accompanied by a corresponding increase in the costs of Access Management, although it is anticipated that there will still be a net benefit, particularly if improvements to the Access Management process are introduced alongside the engineering changes.

### 4.2.1 Benchmarking results - track

As outlined above, the benchmarking work undertaken for this study asked the Comparators if they record costs for plain line track renewal. The responses are shown in Figure 32 below;

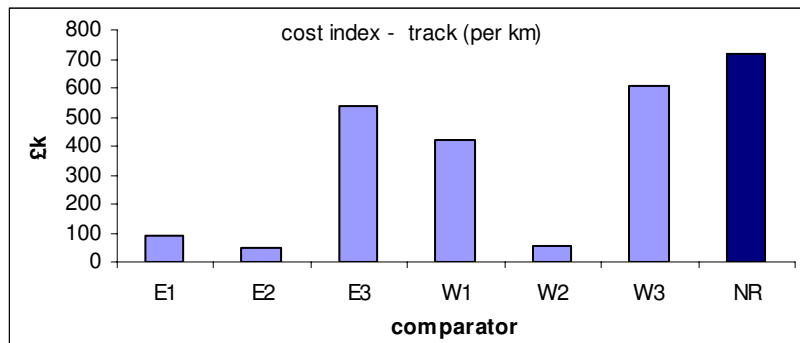


Figure 32; *Unit rate comparison for track renewal (not normalised)*

As can be seen, some Comparators only record a limited range of direct costs, meaning that the data provided cannot be used for comparisons. The Comparators able to provide data on a job-cost basis all showed costs lower than the current Network Rail High Output rates of £716k / km; these are mostly in the range of the target unit cost rate for CP5 of £584k, suggesting that the targets set are realistic. Network Rail’s CP5 benchmarking & delivery efficiency presentation to ORR<sup>8</sup> included a similar comparison, based on more-detailed benchmarking analysis – this is reproduced in Figure 34 below;

<sup>8</sup> Track Asset Management: CP5 benchmarking & delivery efficiency review, Network Rail 16 Nov 2011

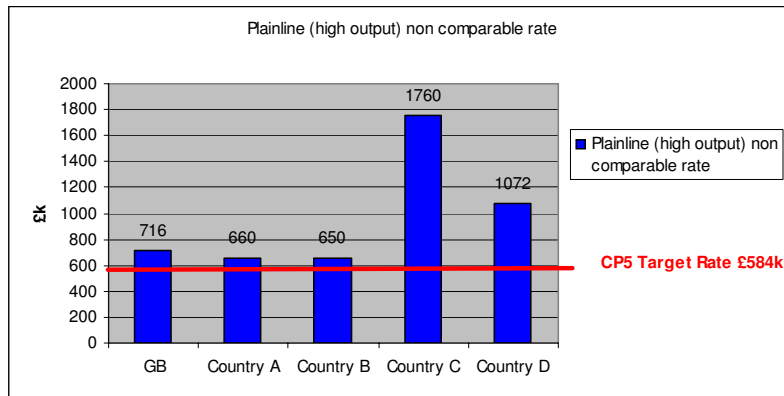


Figure 33; Unit rate comparison for track renewal (source – Network Rail)

The potential shortcomings of direct comparison of these data are illustrated by the results of the benchmarking question asked on the line-speed following track renewals and the nominal asset life for renewed for each of the comparators. The results shown in Figure 34 and Figure 35 below show significant variations in both parameters, suggesting wide variations in the quality of the work undertaken and / or differing specifications for the renewal of assets.

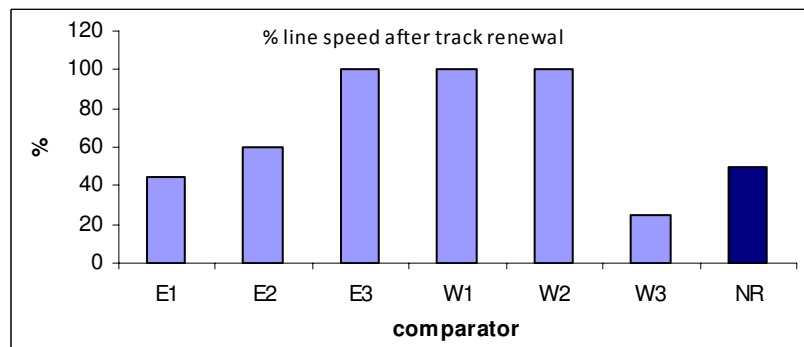


Figure 34; % line speed after track renewal

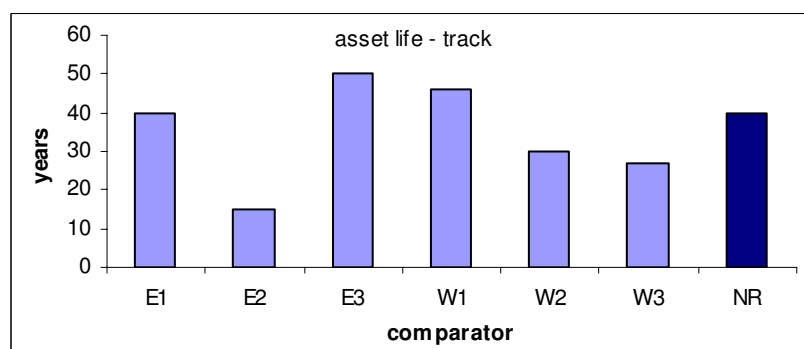


Figure 35; asset life - track

#### 4.2.2 Implications for CP5 - Track

In addition to the benchmarking and Network Rail data detailed above, a number of other studies have been made into Network Rail's efficiency in the area of Track Renewals. The data in the ORR's

Initial Industry Plan Review<sup>9</sup> shows CP4 expenditure on Conventional Track Renewals forecast at £1,565m. This Review forecasts a reduction in the net spend in this area to £1,071m in CP5 – a reduction of 31.6%. By comparison, the annual expenditures in Network Rail’s “pre-efficient” forecast sum to £1,165m, a reduction of 25.6%.

This is consistent with the findings of the ORR study into “Relative Infrastructure Manager’s Efficiency” of August<sup>10</sup> and the ORR report “International cost efficiency benchmarking of Network Rail” of September<sup>11</sup> 2010. These studies conclude that Network Rail’s efficiency of renewal delivery is “significantly” lower than that of the Comparators investigated. The report quotes values of apparent differences in unit rates quoted in the range of 25 – 50%, with a “credible range” estimated in the region of 34 – 40% difference between Network Rail’s unit costs and the observed “frontier of efficiency”. The difference between Network Rail’s performance and the upper-quartile performance of Comparators is estimated at 27 – 35%.

The other recent benchmarking work in this area has been undertaken by Network Rail, as summarised in the “CP5 benchmarking & delivery efficiency” presentation. This confirms, *inter alia*, that Network Rail believe a high-output unit-cost target of £584k per track km for CP5 is achievable. The findings of the benchmark studies quoted above suggest that a small further improvement could be targeted for CP5.

The externally-derived figures above are consistent with this study’s (not statistically significant) findings of a 30-40% gap between Network Rail’s current performance and international best practice. This suggests that the lower total expenditure for renewals from the Initial Industry Plan Review, as set out below, could be achievable as a stretch target;

<b>Network Rail - Pre-efficient</b>	<b>14/15</b>	<b>15/16</b>	<b>16/17</b>	<b>17/18</b>	<b>18/19</b>	<b>CP5</b>
Plain Line Renewals	233	233	233	233	233	1165
High Output Renewals	119	119	119	119	119	595
<b>Total "pre-efficient"</b>	<b>352</b>	<b>352</b>	<b>352</b>	<b>352</b>	<b>352</b>	<b>1760</b>
<b>Benchmark-based target</b>	<b>14/15</b>	<b>15/16</b>	<b>16/17</b>	<b>17/18</b>	<b>18/19</b>	<b>CP5</b>
Plain Line Renewals	214	214	214	214	214	1071
High Output Renewals	109	109	109	109	109	546
<b>Suggested Targets</b>	<b>323</b>	<b>323</b>	<b>323</b>	<b>323</b>	<b>323</b>	<b>1617</b>

### 4.3 Scope for cost efficiencies - Switches & Crossings;

Benchmarking of S&C costs is not as easy as that for track renewals, as the volumes of activity are lower and there is considerably higher variability of output. Not least of these is the asset life – the results from the benchmarking shown in Figure 36 below show a range in target-life for S&C assets of between 7 and 50 years; this clearly has a considerable impact on the first-cost of the asset. There is a similar variety of line-speeds quoted following renewals of S&C, although unlike track, these are broadly in line with the data for asset life, with only the two shortest-life assets needing a reduced line speed following renewal.

<sup>9</sup> Part A Reporter Mandate AO/017: Initial Industry Plan (IIP) 2011 Review, ORR 16 Dec 2011

<sup>10</sup> Relative Infrastructure Managers’ Efficiency Evaluation of UIC LICB Approach; Summary Report, ORR 11 Aug 2010

<sup>11</sup> International cost efficiency benchmarking of Network Rail, ORR September 2010

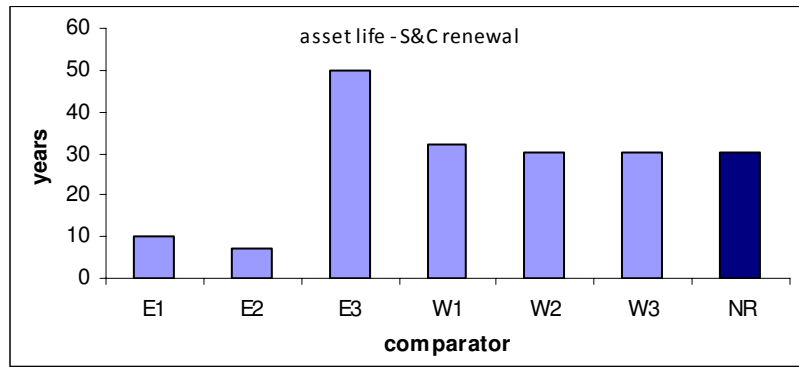


Figure 36; *asset life – S&C*

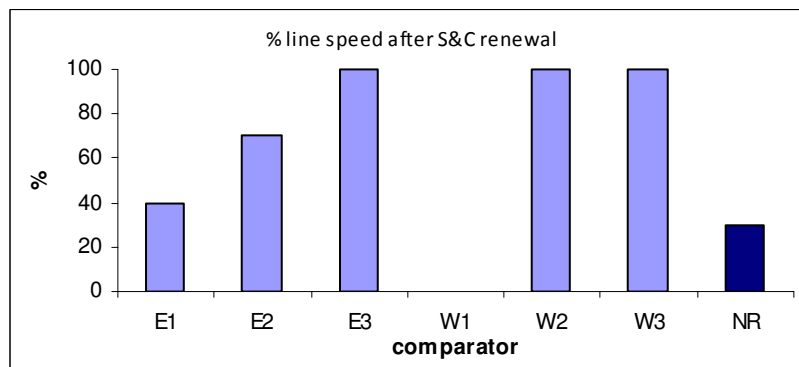


Figure 37; *% line speed following S&C renewal*

### 4.3.1 Implications for CP5 – Switches & Crossings

The treatment of overhead costs for S&C renewals also seems to vary more widely for S&C than for track renewals. Despite clear guidelines on “includable” costs, the data provided by Comparators in this area did not provide a sound basis for “like for like” comparison, with only one available dataset providing useful data. This was from a Western Comparator, and showed Network Rail costs to be around 20% higher, based on the renewal costs for a main-main crossover in an urban environment.

There has, however, been other work undertaken in this area, most recently by Network Rail as reported in their CP5 benchmarking and delivery efficiency review of Nov 2011. The results from this work are shown in Figure 38 below; these show a similar 20% efficiency gap between Network Rail’s current cost and best practice, although their costs are around 25% lower than the least efficient of the four Comparators studied.

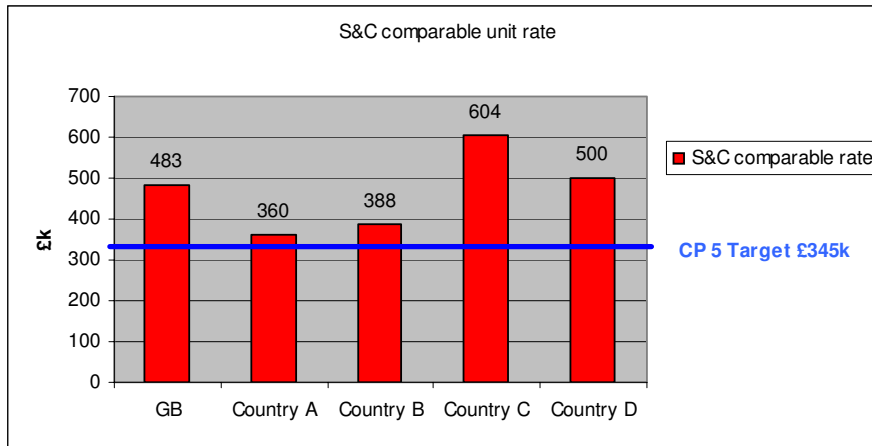


Figure 38; Cost Index for S&C renewals (source – Network Rail)

As with track renewal, where volume will drop as part of the switch to Enhanced Maintenance, the forecast volumes of S&C renewals for CP5 are significantly lower than for CP4, with a near four-fold increase in refurbishment meaning that the total volume of activity is broadly similar between the two control periods. This makes the potential for benefits from efficiency savings harder to estimate, as it is not clear if there is equivalence between the outputs over the control periods. It is, however, difficult to see savings emerging towards the high end of the efficiency range identified by the generic “Infrastructure Managers Efficiency Review” in the range of up to 40%. The current figure of 12.2% represented by the figures in Network Rail’s “pre-efficient” forecast is, however, significantly lower than the potential efficiency-savings values in excess of 20% identified by Network Rail in their 16<sup>th</sup> Nov presentation to ORR.

This would therefore suggest that, as in the case of track renewal, the efficiencies of around 20% represented by the data in the Industry Initial Plan Review, representing a reduction in costs of around £12m per year, or around 8% compared to the “pre-efficient” figures, represents an achievable target based on the data available.

Network Rail - pre-efficient	14/15	15/16	16/17	17/18	18/19	CP5
S&C	147	147	147	147	147	735
<b>Benchmark-based target</b>	<b>14/15</b>	<b>15/16</b>	<b>16/17</b>	<b>17/18</b>	<b>18/19</b>	<b>CP5</b>
S&C	135	135	135	135	135	673

#### 4.4 Scope for cost efficiencies - Structures

As with the S&C benchmarking data above, the response received from our Comparators for cost benchmarking data for structures produced only one response which appears to be costed on a comparable basis to Network Rail. This suggests that UK rail costs are around 15% higher than those of Comparators – the very small sample size available and uncertainty as to the components of these costs, however, means that little reliance can be placed on this conclusion.

A more-comprehensive study of comparative costs is provided by Network Rail's "Civils Benchmarking Alliance" benchmarking report on Structures<sup>12</sup>. This research uses "first-principles" costing, asking contractors in overseas rail administrations and non-rail UK contractors to cost-up a range of civil engineering work. This study concluded that total scheme costs are around 34% higher in the rail environment than the equivalent UK costs for non-rail schemes. The nominal UK costs are 7 – 25% higher than in equivalent European schemes, although bringing UK-style Schedule 4 costs into the equation made both overseas Comparators more expensive than the UK rail costs, making it difficult to draw firm conclusions on the extent to which UK rail costs can be reduced.

This issue highlights a significant difference between UK and overseas practice, in terms of the length of and scope of possessions taken for major work, such as bridge renewals. As noted earlier, many European rail administrations use route closures, often during summer holiday periods, to undertake "route modernisation", with signalling, track, earthworks and structures being renewed / maintained during the day in a no-train environment. This approach has occasionally been adopted in the UK, most-recently with track renewals on the Settle and Carlisle and Middlesbrough – Whitby routes, but the costs of the Schedule 4 regime effectively preclude a wider-scale use on economic grounds.

It seems, therefore, that the additional costs of undertaking major works in shorter time-windows than Comparators contributes to the higher unit costs in the UK, with the additional complexity and contingency needed undertake the work in multiple short possessions rather than one of the "right" length for efficient working. This conclusion is supported by the results of the Civils Benchmarking Alliance, where low-cost structure renewals actually became higher-cost than the UK equivalent once the notional Schedule 4 costs were included. Progress could be made in this area in CP5 through Alliancing between Network Rail and TOCs, allowing flexible rather than contractual balancing of the costs and benefits of longer blockades for Engineering Access.

Overall, the 35% premium paid by Network Rail over UK non-rail projects identified by the Civils Benchmarking Alliance clearly indicates the opportunity to improve efficiency significantly, but it is not easy to determine what proportion of the additional costs are "fixed" due to the contracts, structure and standards of UK rail. As outlined above, little additional clarity can be added in this area at present, either through other ORR reports or through the benchmarking work undertaken for this study.

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<sup>12</sup> Benchmarking UK Rail Civil Engineering Projects to Europe; (Network Rail) Civils Benchmarking Alliance, Feb 2011

## 5 Efficiency of Access Planning Process

### 5.1 Background

A focussed and “lean” planning process is a key determinant of the overall efficiency of the process for taking Engineering possessions. This section looks at the stages of Network Rail’s current process, drawing on the benchmarking work undertaken, results from other studies in this area and interviews with Network Rail staff to assess the opportunities for efficiency at each stage of the process. These are used to estimate possible efficiency savings for CP5, and which part of Network Rail’s costs are affected, with potential for “double-counting” with other initiatives highlighted.

### 5.2 Timing of Engineering Work / Interface with Train Service

A key conclusion of the benchmarking work undertaken, both for this and previous studies, is that Network Rail’s practice of undertaking much of its major engineering work during lengthy White Periods on Saturday Night / Sunday morning is increasingly out of line with international best-practice in this area. This practice is built-into the current structure of UK Rail; the effective “freezing” of track access times during the creation of TOCs “Schedule 5” access rights has meant that an Engineering Access pattern introduced at a time when there was very little demand for passenger or freight traffic on Sundays has survived more or less intact into the 21<sup>st</sup> Century. The consequences of this for UK Rail include:

- Engineering Contractors have to rely on “casual” labour; an effective maximum of 15 hours work for most “renewal” staff each week means that it is not economically viable for them to develop a trained and committed full-time workforce (see section 5.7 below),
- Passenger Operators are unable to offer a consistent year-round service until after 1200 on Sundays, meaning that many day-out and shopping trips are not feasible by rail, on a day on which leisure travel is now approaching Saturday levels (see Section 7.3) below,
- Freight Operators, many of whose customers operate 24 / 7, are faced with a “five and a half day” railway, leading to under-utilisation of assets of 10-15% and restricting access to flow-critical traffic, especially domestic intermodal for supermarkets and just-in-time manufacturing (see Section 7.4 below).

The benchmarking work shows that, although most rail systems start later on a Sunday morning than weekdays and Saturdays, none of the Comparators use Saturday night / Sunday morning possessions to anything like the extent that Network Rail do. The Comparators studied all utilise an equally-timed 7-day overnight Engineering Access period to undertake both renewals and maintenance work, developing suitable techniques for efficient taking and handing-back of possession, and for undertaking engineering activities efficiently in shorter timeframes than is usual on Network Rail. In most cases, the amount of time available for Engineering Access is enhanced by the use of SLW to allow passage of the small number of freight trains running overnight, and the occasional early and late passenger train, without having to give up the possession. This capability is, however, based on the ability to use either line in a double-track railway flexibly; this is not currently the case on the vast majority of Network Rail’s routes.

Network Rail's current definition of a short possession is 13 hours, and recent data<sup>13</sup> shows the number of possessions delivered in this timeframe increasing by 6% in CP4 compared to CP3. The real challenge however, is to deliver a significantly higher percentage of the work in the 8-hour or less White Period available midweek on most routes. Network Rail's plans for CP5 show this as a key target, with a dramatic increase in the number of midweek possessions at the expense of a significant reduction in the number of 30-hour + weekend blockades. This is forecast to have the net effect of reducing the total number of possession hours by 35% in CP5.

### 5.2.1 Implications for CP5

The valuation of the "opportunity costs" to Operators of the ability to provide a 7-day service to customers is outwith the scope of this study, but interviews with Passenger and Freight Operators indicate that there is the potential for both significant increases in revenue for passenger operators and savings of cost for freight operators. These are evaluated in more detail in Section 7 below. The potential benefits from the professionalisation of the workforce are looked at in Section 5.7 below, whilst the costs and benefits of developing a rail network that can support 7-day operation are considered in the following Section 5.3.

It should be noted that, in line with the approach taken in Comparator countries, the economic justification for equipping routes with bi-directional signalling do not only come from the maintenance benefits realised – there are significant performance benefits as well, with the ability to maintain a reduced service alongside most types of infrastructure or rolling-stock failures. As noted above, the proposed phased replacement of conventional signalling with ETCS systems, starting from the end of CP5, provides a "once-in-a-generation" opportunity to move to a European-style railway in this respect. It is therefore strongly recommended that a detailed analysis of the costs and benefits of this, both operationally and in terms of "maintainability" is undertaken before the CP5 targets are finalised.

## 5.3 Investment in Maintainability

The benchmarking work undertaken looked at a wide range of issues around the maintainability of the Network, covering investments in access to the track for staff, capacity for engineering trains, the ease of making electrical isolations etc, in addition to the extent to which the network is equipped for bi-directional operation. The responses received tend to support a prevailing view in the industry that decades of cash-limits during the British Rail period meant that a "lowest first cost" approach was often taken. It can be argued that this lack of up-front investment has led to a network that has less spare capacity and is less flexible operationally than the Comparators; the end-result of this is a network that has systemically-embedded higher maintenance costs than the Comparators. These are most noticeable as longer set-up and hand-back times for possession, and significantly less ability to run trains past engineering worksites cost-effectively and/or in a reasonable transit time.

The comparisons of renewal rates, where Network Rail's planned asset life is significantly longer than the average, particularly for S&C assets, suggests that these systemically higher underlying costs for Engineering Access noted are currently partly compensated for by minimising the number of possessions needed. It is therefore of concern that the current proposals to change the emphasis from

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<sup>13</sup> Delivering Access Efficiencies in CP4, April 2012 – Network Rail



conventional renewals to an Enhanced Maintenance approach for track assets is likely to require a higher number of possessions in future. Given that there is a significant efficiency gap in this area, increasing the number of possessions to take advantage of lower lifecycle costs for engineering work is unlikely to deliver major cost benefits unless the underlying inefficiencies in process and “maintainability” are dealt with at the same time.

There have been a number of initiatives in the area of maintainability, the most recent of which was Chiltern Railway’s “Evergreen 1” double-tracking, where heavy “set and forget” rail was used and the whole route bi-directionally signalled to create a European-style “maintainable” railway. It is noted, however, that this approach has not been followed in the most-recent “Evergreen 3” upgrade. This creation of a “partly-maintainable” network even in a small, self-contained route such as Chiltern, is a good example of the lack of a clear policy in this area, and it is recommended that this issue is addressed before the ETCS resignalling programme commences, as outlined in Section 5.2 above.

### 5.3.1 Implications for CP5

There is clearly a great deal more that Network Rail could do, both in terms of investments in upgrades to the existing network and, in the longer term, develop new specifications for renewals of track and especially signalling / layouts to reduce the long-term costs of maintenance of the network. As outlined above, the key issues to address include;

- Specification of track components, including ballast-bed, for optimum life-spans,
- Invest in better (road) access to the network,
- Improve flexibility of electrical isolations,
- Eliminate cross-track cables supplying signalling or power to both lines,
- Moving equipment and cabinets into Green Zone locations,
- Increase the number of sidings / loops capable of holding engineering trains,
- Increase clearances between tracks where possible,
- Gauge-clearance of alternative routes to enable freight diversions during engineering work,
- Invest in bi-directional layouts and working,
- Re-opening of potential diversionary routes, (e.g. Lewes – Uckfield, Leeds New Line etc).

The difficulty with this issue is that all of these investments will continue to give performance and cost benefits long after the end of CP5, but will have to be paid for “up-front” from a limited investment budget, which also has to deal with the issues of increased traffic squeezing the capacity and resilience of the network. It is therefore recommended that the top five bullets above, representing relatively low first-cost initiatives, be considered for introduction from the start of CP5 on a zero or small net-cost basis, whilst the case for the efficiency and performance improvements associated with additional sidings / loops and bi-directional signalling should be an integral part of the investment case for ETCS. It should be noted that the scope for continuing efficiency improvements beyond CP5 is judged to be critically-dependent on an early decision (i.e. within CP4) to prioritise investment in Maintainability in future resignalling / remodelling schemes – failure to do this would mean that the embedded efficiency gap between Network Rail and overseas comparators would remain. This will allow the Engineering Access efficiency benefits to be progressively introduced, as the new signalling is phased-in across the network.

The estimated financial effects of investments in “maintainability” as part of a move to a high-performing railway are outlined in Section 8.1.3 below.

## **5.4 Asset Management process / Creation of Workbanks**

The longest lead-time item identified is the process of building-up the workbanks. Network Rail’s Asset Management programme feeds into a workbank of jobs requiring to be undertaken on their various assets, by class, with a maximum planning timescale of up to five years. The workbanks emerging from this process form the basis for long-term planning for possessions. This is currently based on a two-year time horizon, with possessions first-booked at T-84 as part of the process to ensure that out-payments to operators under the possession regimes are minimised. The result of this is that possessions are first-booked a long time before the detailed planning process starts, potentially introducing a perverse incentive to overbook disruptive possessions at this stage to avoid the significantly higher costs of Contractual Enforcement Regime payments for securing additional track time after timetable base is established. Compared to best practice Comparators, Network Rail’s process is more remote from the delivery organisations, both in time and organisationally, and has a less-systematic approach to identifying geographical synergies between asset classes at the planning stage.

There are a number of initiatives ongoing in this area, of which probably the most significant is the Devolution of responsibility to the new DRAM roles in each of the Route Management Teams. This new role provides the opportunity to address a number of the issues raised by the benchmarking comparisons in this area, in particular the apparent lack of a common planning process between the asset types / engineering disciplines; co-ordination by route will potentially give the opportunity to create a co-ordinated workbank to form the basis of the Engineering Access strategy.

This will be supported by Network Rail’s central strategy initiatives for asset information, including Offering Rail Better Information Services (ORBIS), and the progressive implementation of the “Intelligent Infrastructure” move to condition-based maintenance based on proactive condition-monitoring systems and processes such as the “Gotcha” Wheel Impact / Load Detection system.

The other significant change in this area in CP5 will be the adoption of an Enhanced Maintenance regime for track and S&C assets. As noted above, this is likely to have the effect of increasing the number of possessions, but is forecast to deliver lower first-cost and life-cycle costs for these assets. The critical issue for workbank planning is that the reduced scope of activity should enable more of the work to be done in shorter possessions, supporting a move from long weekend possessions to a 7-day railway pattern of regular midweek possessions. This outcome should see the disbenefits of shorter overall time-windows balanced-out by the adoption of improved work-practices which will facilitate improved productivity; this is, however, unlikely to be the case unless improved possession-management processes to maximise productive time within possessions are also implemented in line with the issues raised in Section 6 below.

### **5.4.1 Implications for CP5**

The workbank planning process is a critical “enabler” for Network Rail’s Engineering Access strategy in terms of delivering work packages that are capable of optimisation for the engineering time-windows available. The issue of co-ordination of workbanks clearly has an impact on the ability of Network Rail to time engineering possessions on specific sections of line to gain synergies of Access. If this approach were to be prioritised above the “natural” cycle of refurbishment and renewal,

however, this could result in increased life-cycle costs for some assets, so this issue needs to be considered in the context of an improved costing model, as outlined in Section 5.5 below.

Improvements in this area will make a significant contribution to the engineering cost savings outlined as possible in section 4 above. The ORR “Relative Infrastructure Manager’s Efficiency” report<sup>14</sup> gives a value for the potential savings in this area of between £30m - £50m per annum, split down as follows;

- Automated Data Collection; £20 – £27m
- Adoption of automated Data Entry; £5 – £10m
- Wide use of automated inspections; £3 – £8m
- System Failure Trends; £1 - £2m

This work concentrates on the issues of input into the Asset Management process, and as such is largely outwith the scope of this study. The benchmarking work undertaken, however, confirms that Network Rail’s current processes in this area fall short of international best practice. The scale of savings identified in the ORR report is judged to be proportionate to the potential for savings in this area, and the results of the ongoing initiatives, as outlined above, are judged to be sufficient to allow Network Rail to address the problems identified in the area of workbank planning affecting the efficiency of Possession Management if they are followed-through in CP5.

## 5.5 Better access planning through improved systems and processes

Once the workbanks are determined, the next Access Management challenge is the allocation of packages of work to specific worksites and time periods. As noted in Section 5.4 above, this is first undertaken by Network Rail at a strategic level at T-84, much earlier than any of the Comparators questioned. The best-practice noted in this area is the pattern adopted by most of the Comparators of starting a continuous dialogue between the workbank planning and the work delivery departments / contractors around a year before the work starts, with detailed plans being finalised and signed-off at around T-26. This process includes a systematic review of needs covering maintenance and refurbishment activities across all asset classes at each location, to ensure that all work required within 12 months of a given possession is taken into consideration when planning Engineering Access. One of the Western Comparators has developed this further, with pro-active “swarms” of engineering work planned for each route to minimise the overall disruption to revenue-earning traffic.

This is in line with Network Rail’s laid-down process, which has a Confirmed Period Possession Plan (CPPP) at T-26. For UK Rail, however, the much-earlier starting point for booking the possession locations and the later engagement with the contractors who will actually deliver the work and the operators who will resource the engineering trains effectively means that the process is significantly more granular than that observed at the Comparators. These additional steps all require additional planning resource, both within Network Rail and in the supply chain, both increasing the cost and also the risk that mis-communication or double-booking of centrally-controlled resources such as engineering wagons or tampers will put the effective delivery of planned Engineering Access at risk. As outlined in Section 3.2.3 above, problems with the resourcing of engineering trains and (to a lesser extent) tampers to work in possessions has been identified by Network Rail as the single biggest cause of “on-the-day” failure of possessions. A range of apparent causes for this were observed during the

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<sup>14</sup>Relative Infrastructure Managers’ Efficiency Evaluation of UIC LICB Approach; Summary Report, ORR 11 Aug 2010

study, including the movement of engineering trains under “control orders” instead of in timetabled paths, the over-booking of central resources by separate planning teams, difficulties in finding stabling points close enough to worksites and late changes to plans meaning trains having to disrupt established worksites.

Discussions with Network Rail staff also confirmed that the trend at present is to book “specialist” possessions, i.e. all but the largest worksites are restricted to a single activity to reduce the complexity of the planning task and help to ensure ease of delivery. Best-practice from Comparators suggests that for some routine tasks this can be the most efficient way to ensure productivity, but that the optimum outcome is to maximise the benefits of “bundling work” into existing possessions whenever possible. The example of Austrian railways in scheduling 89 separate activities into a single possession is an oft-quoted, if extreme, example of this type of optimisation. Other Comparators report that they maintain a “shadow” workbank of less-urgent tasks which work teams move on to once they have finished their primary task at a particular site. Given the fact that UK possessions take, on average, significantly longer to set up and hand-back than those of overseas Comparators, this suggests that any activity which improves the productivity of the possession should be included in the plan, even if the risk of late handback is thereby slightly increased.

The benchmark comparisons also show that Network Rail tends to book engineering trains later than Comparators, and are in a small minority in not applying the normal timetabling process to these services. This is a key area where improvements can be made, and estimated savings include a reduction in the number of delay minutes attributed to over-running possessions, a reduction in the number of wasted possessions and better value-for money from the booking process.

### 5.5.1 Implications for CP5

In developing comparisons with overseas organisations, it has to be acknowledged that Network Rail faces a significantly bigger challenge than most, both through the historic size and complexity of the UK Rail network and the relative complexity of the industry structure. Both these factors are structural, and both are likely to contribute towards an embedded efficiency gap against the best-performing Comparators in this area. As noted in Section 5.4 above, however, Network Rail has taken a pro-active step to mitigate these factors in the introduction of the new DRAM post in each of its new Route Management organisations.

This initiative gives UK Rail the opportunity to develop a planning process more in line with the best practice observed in this area, as the smaller scale of operation should allow planning staff to develop closer relationships with a smaller number of key players. The success of this will, however, largely be dependent on wider changes to the process, including changes in the contracting strategy and the relationships with the timetabling and Contractual Enforcement Regime processes detailed below. The long-term success of the strategy will also critically-rely on the establishment of a process for the systematic feedback of best practice around the network, and the provision of funding for local initiatives aimed at maximising the benefits from the Devolved approach. The “smarter” use of scarce resources, both in terms of engineering input and Engineering Access time is a critical enabler in improving efficiency.

The recent creation of the DRAM post at each of the Route Manager’s organisations, and the dependencies of achieving overall savings on changes in the relationship with contractors and an improved process for workbank planning, means that it is difficult to determine what the cost-base for CP5 will be in the area of access planning. The recent ORR “Relative Infrastructure Managers

Efficiency” report gives a range of annual savings of £30m – £60m in this area in CP5, split down as follows;

- Improved Planning; 5m to £11m
- Planned Preventative Maintenance; £4m - £8m
- Pro-active intervention; £18m - £37m
- Centralised Planning; £1m - £2m
- Better data quality; £1m - £2m

The bulk of these savings will be in the area of reduced volume of work and lower engineering costs, rather than in efficiency savings from possession management; for instance, the improved planning referred to in the first bullet relates to asset degradation rates rather than the possession planning process. The fourth bullet does refer specifically to the planning of possessions, but the recommendation that planning should be centralised to save money has already been overtaken by events, with the Devolution process meaning that the savings targeted will now come from the ongoing decentralisation of the planning process.

The scale of savings predicted, however, is consistent with the findings of our discussions with Network Rail and the supply chain. Although the proposed new central delivery organisation will retain some involvement, the potential benefits from removing duplication of activity between centre and routes, and from earlier involvement of contractors with consequential reduction in re-working is estimated at a minimum of 2-4 posts per Route. Costing these at £50k / post, and taking into account the corresponding savings in counterparties staffing, this would give a reduction in cost in the region of £2m - £4m p.a., with Network Rail’s savings at 50% of the total.

## 5.6 Integration with the Timetabling Process

The UK rail process of “bid and offer” for timetable creation, based on the concept of starting with a “white space” as the start-point for each year’s timetable, was found to be unique amongst the Comparators, all of whom take an evolutionary approach to developing each year’s timetable. At the extreme, for instance, one Western Comparator claims to have only had one white-space iteration of their basic timetable since the 1970’s. Although the technical issues are complex, it is understood that the current process used means that the Engineering Access module for the ITPS planning tool used by Network Rail cannot be utilised in the UK at present, although use of this module is quoted by a number of Comparators as an integral part of their Engineering Access planning process.

The reliance in the UK process of a T-84 base-date for each new timetable is, however, the driver of the need to book disruptive possessions much earlier in the UK than in any other administration, with the inevitable result that the booking of these is separated from the work-planning and resourcing process. At the other end of the timescale, the T-12 “informed traveller” deadline for locking-down the public timetable also does not coincide with the Engineering Access process, which officially continues until T-8 and in practice can involved planning and re-planning work until a few hours before the possession is due to start.

The key issue for Engineering Access is to ensure that the engineering and possession planning process is “joined-up” with the timetable planning process, to reduce the number of iterations of the planning cycle for each possession. This is most critical at the start of the process – unless the initial booking of disruptive possessions is based on resourced plans for delivering the agreed workbank,

subsequent stages of the process will inevitably be based on “what there is” rather than what is needed, with a loss of efficiency as a result. It is difficult to see how this can be made to work with the current timetable process and Contractual Enforcement Regimes, but mitigations could include;

- Much earlier involvement of contractors in the planning process for major work (see Section 5.7),
- Changes to Schedule 4 to allow Network Rail to book the Engineering Access time it needs at a more-appropriate point in the process (see Section 7.2),
- Changes to the Schedule 5 access rights of Operators to give longer midweek access periods, with reductions in / bus substitutions of early and late train services (see Section 5.2).

As noted above, these issues are all covered in more detail elsewhere in this report.

### **5.6.1 Implications for CP5**

The changes needed within the UK Rail industry and its contractual framework to support the adoption of an evolutionary approach to timetable planning are very wide-ranging, and mainly fall outside the scope of this study. International comparisons, however, suggest that the number of people involved in planning and development of timetables and Engineering Access are significantly higher than overseas, yet the overall process is, in many cases, demonstrably less efficient than that of the Comparators.

It is acknowledged, however, that these changes go to the heart of the contractual framework underpinning UK Rail, and could therefore be seen as restraining the effectiveness of the competitive-tendering model underlying overall cost-control for both rail and engineering services in the industry as currently regulated. As such, no estimates are included for efficiency savings in the area of possession management costs for CP5.

## **5.7 Resourcing / Contracting Policy**

Research undertaken with Network Rail’s front-line contractors for maintenance and renewal work reveals that the current pattern of mainly weekend working means that it is not economically-viable for them to employ a full-time work-force for deployment on their rail activities, relying instead on staffing agencies and smaller specialist sub-contractors to staff up their work. This “casualisation” of the workforce has a number of negative outcomes that actively reduce the efficiency of the Engineering Access process;

- There is little opportunity for “learning” from previous activities, with new staff, and often different contractors, employed on each job,
- The Safety Management process is made more complex, and therefore slower and more expensive, by the need to assume that many staff on each job will not be familiar with basic processes, requiring more-prescriptive controls and processes,
- Frequent re-tendering for work reduces the incentive for contractors to invest in staff training or improved systems and processes,

- Quality of and speed of delivery output suffers though staff’s unfamiliarity with the processes and tools,
- Investment in training and equipment is difficult to justify.

As an example of the problems this can cause, Network Rail’s data for the time taken to take-up and hand-back possessions shows that, for many types of possession, UK Rail can equal or even beat the best-in-class performance from overseas Comparators. They also show, however, that there is an extreme variability in performance in this area; with a high proportion of Schedule 8 costs for train delay coming from problems in this area. It can be argued that UK Rail’s combination of having the highest proportion of planned Engineering Access time reserved for contingencies and yet also showing the amount of delays from over-running work stem from the variability in quality from a largely casualised labour force.

The “casualised” workforce is often justified on grounds of efficiency, with UK unit costs for labour and materials consistently being the lowest in benchmarking studies. These low input costs are, however, in both cases associated with the highest aggregate costs for delivery of the work, suggesting that there is no net benefit to UK Rail from the current contracting regime’s focus on driving down unit costs, and supporting the moves outlined above towards a more partnership-focused approach in line with the best-practice Comparators. The current structural bias towards weekend working as outlined in Section 5.2 above, however, means that it is unlikely that significant improvements can be made in this area except as part of a wider-ranging process of change.

Another likely cause of poor delivery is from mis-matches between the time planned for each job and the time needed. As noted in Section 5.6 above, the booking of possessions up to two years in advance means that many jobs are undertaken in the time available rather than the optimal (lowest-cost?) time for each job being calculated and possession booked accordingly. This problem is compounded by the difficulties of modelling the Schedule 4 costs of increased Engineering Access time in specific cases, meaning that it is difficult to test assumptions made about the trade-off between the costs of longer possessions against higher engineering costs.

This inefficiency is further exacerbated by the fact that the contractors who actually do the job are not involved until much later in the process, giving little opportunity to contribute their learning from previous jobs to the process. In addition, much more work in the UK is also put out to tender from “framework” suppliers than in equivalent overseas Comparators – this is a further disincentive to suppliers to invest in building quality systems and processes, as they do not have a committed workload to give them a return on their investment.

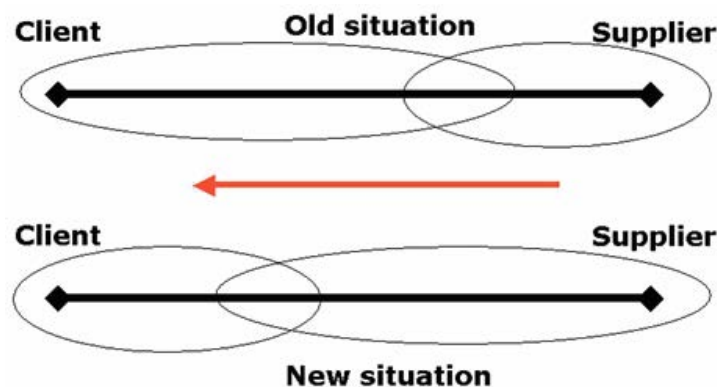


Figure 39; Proposed changes in split of responsibility (source Network Rail)

Network Rail has recognised this issue, and Figure 39 above shows how it plans to give the supply chain a greater role in the planning and delivery process to start to address this weakness. This clearly helps to address the issues around contractor involvement. If taken in conjunction with the reductions in the planning timescales recommended in Section 5.5 above, with a later start and earlier finish to the detailed planning process to coincide with “informed traveller” deadlines and reduce the last-minute re-planning of work, significant improvements to the overall efficiency of the process should be possible.

### 5.7.1 Implications for CP5

From the evidence of the benchmarking work undertaken, the objective of changes in the process for resourcing of engineering work should be to create a professionalised supply chain, with contractors providing full time teams of staff specialised in specific work areas. These teams should have the full range of skills to manage the safety interfaces, complete associated tasks and deal with emerging issues whilst on site. As noted, full benefits from this approach are dependent on the creation of a repeatable 7-day workload rather than the current “once a week” pattern; for routes and asset classes that this can be achieved on, the benefits should include;

- Significant reductions in planning costs from direct early involvement of delivery contractors,
- Reductions in allowances for start-up, hand-back and contingencies through improved teamwork and familiarity with processes,
- Improved productivity and quality from a “professional” workforce,
- Continuous improvement through feedback of “learning” and investment in training and support.

Most of these benefits will accrue in the longer-term as a reduction in the overall cost of renewal and maintenance activities, mainly through higher productivity within possessions reducing the overall number of possessions needed, fewer safety and supervisory staff being needed and improved output quality reducing the need for rework. In estimating a value for the possible scale of efficiency savings possible, it should be noted that changes to the contracting regime is the mechanism, rather than driver for cost savings. The actual savings achievable are therefore shown in Section 6 below by component.

The use of long-term “partnership” contracts to help to achieve these efficiencies will, of course, raise the risk that part of the benefit from more-rapid than expected reductions in cost could be taken by the contractors in the form of higher profits and remuneration to senior staff. It is therefore recommended that some form of profit sharing is included in the proposed new long-term contracts, to ensure that innovation and efficiency are incentivised but that Network Rail gets a “fair” share of benefit from improvements made.

## 5.8 Summary of Planning Issues

A common thread running through the examples of relative inefficiency in this Section is the number of planning and communication interfaces which have to be managed to ensure that Engineering



Access to the network is effectively managed, and matched to the requirements of maintaining and renewing the Assets. The complexity of Network Rail's process in this respect at present is, at least in part, a result of the complexity of the UK Rail structure including, but not limited to, the wide range of "inherited" work-practices and related Industrial Relations problems. It is therefore difficult to see major improvements in this area in the short term.

A major issue identified, however, is that the extent of re-working of plans, often until a very late point in the planning process, is significantly higher than best-practice Comparators. This is largely independent of the complexity of the planning environment, and the recommendations made in this, and previous, reports of;

- improvements to asset management processes,
- better local planning based on the Route Management structure,
- closer alignment of Engineering Access with the timetabling process, and
- earlier / more comprehensive involvement of contractors in the process.

should ensure that the savings currently being forecast for CP5 can be delivered. Beyond this, further savings will be contingent on the issues of investment in "maintainability" and moves to a 7-day railway.

Section 6 below looks in more detail at the key areas of the efficiency savings possible in CP5; a summary of the overall financial implications is included in Section 8.

## 6 Efficiency of Taking Possessions

### 6.1 Background

Once a possession is established, there is a finite amount of time available to undertake the maintenance or renewal work planned. The efficiency with which this is done, and therefore the amount of work completed in each possession, is a key determinant of the overall cost of the process – the more work that can be completed in each possession, the fewer possessions will be needed.

Much work has been undertaken to develop an objective measure of Network Rail's efficiency in this area against Comparator organisations – this has included extensive internal benchmarking by Network Rail including comparison against similar UK businesses (e.g. National Grid), and a systematic look at European Comparators by both Network Rail and other organisations, mainly on behalf of ORR. The conclusions drawn from this work, alongside the new benchmarking work undertaken for this study, are that there is scope for further improvement in Network Rail's planning and delivery of maintenance and renewal work. The issues emerging as areas where further efficiencies could be achieved are outlined below.

### 6.2 Safety-Management and Communications Processes

Safety Management processes on Britain's railways are the product of 150 years of evolution, with each major incident prompting a review of the rules governing the issue and additional controls being added to ensure there was no repetition. Although a lot of good work has been undertaken recently on "risk-based" reviews of current rules, there has been little change in the protection arrangements for possessions, with manual positioning of boards and markers and traditional ways of recording possessions taken.

The benchmarking work undertaken for this and other studies suggests that this is an area with significant potential for improvement in terms of efficient use of both time and resources. The Rail Safety and Standards Board are currently working on a 'New Approach', redrafting the Rule Book modules to "enable major business benefits by creating opportunities for the industry to improve the way it operates the railway", including:

- Enabling the rules changes to support the Network Availability Programme (originally known as the 7 day railway); a radical change of Network Rail practices for maintenance and renewal of its assets will provide greater access to the network to run revenue earning train services,
- Streamlining the process of setting up safe systems of work including engineering possessions, and provides for the use of On Track Machines outside of possessions,
- Use of modern technology to manage-out risks, such as the use of "mobile green zone" enclosed trains at worksites
- Supporting the work of the Network Rail Access Programme in their re-design of engineering processes leading to more useful work time and so to fewer possessions and less disruption to train services lowering costs for the industry as a whole. By thus improving the access to the infrastructure, Network Rail will be able to introduce maintenance regimes that drive down the rate of asset failure leading to a more reliable network.

The New Approach includes a systematic assessment technique that will help the industry to challenge the existing model for operating the railway, enabling innovation in operating practices. The industry has already identified a number of areas in which it wants to make this kind of challenge, including the rules relating to possession management.

Over and above this initiative, the benchmarking work undertaken with a European administration that is currently preparing to switch all of its routes from conventional signalling to ETCS level 2 (replacing all lineside signals with in-cab signalling linked to the train's control / braking systems) revealed that this change is being accompanied by a first-principles re-writing of all rules. The old rule book is being discarded in its entirety and a set of completely new rules are being written based on the risks of modern railway operation, written around in-cab signalling and modern communications technology. The system created to store this new rulebook was created to hold 10,000 entries, but to the surprise of the team undertaking the work, the total number of rules deemed necessary for the safe operation of the entire network is around 100. Further innovative use has been made of the new technology available to reduce the impact of Engineering Access, such as a hand-held "cab-signalling" kit to allow shunters and engineering staff on the track to be protected as if they were a train in the system.

There is clearly significant potential for this type of application to be implemented in the UK as part of the rollout of ERTMS, but it is likely to be many years before a network-wide adoption of such an approach will be available.

### **6.2.1 Implications for CP5**

The benchmarking work undertaken clearly shows the management of safety as a key difference between UK and Comparator practice, with UK Rail both taking more time to complete safety processes and apparently requiring higher staffing levels too, with UK jobs requiring up to double the number of staff for equivalent overseas work.

There are, however, a large number of vested interests in this area, and progress will not be easy. Initiatives such as the multi-skilling of staff, re-introducing the (recently shelved) reviews of protection arrangements and the introduction of a "responsible person" approach can, however, even under the present safety management regime, allow significant savings to be made. The "New Approach" outlined above is planned for completion in 2013, so the full benefit will be realised in CP5. Although these will be inter-dependant on other initiatives for full implementation, it is estimated that efficiencies in possession management through of improvements in Safety Management means that a progressive reduction in costs over CP5 to a total reduction of between £4.5m and £13m per year compared to the CP4 outturn should be achievable. This relatively wide range takes into account the likelihood of strong internal and external opposition in this area, and therefore relatively slow progress in agreeing changes

## **6.3 Electrical Isolations**

Network Rail has identified a number of initiatives which if successful would improve efficiencies in providing electrical isolations to either shorten possession times or make more productive time available in possessions, these include:-

- Increases to the spacing of temporary earth connections in AC traction areas. This would reduce the number of earths required and therefore the time required to establish the work site,
- Changed processes to reduce the time taken to block lines to electric traction,
- Changes to DC line instructions to allow a reduction in the number of short circuit straps required when protecting isolations in DC traction areas,
- Provision of some motorised earthing devices to facilitate remote operation in AC traction areas and reduce the time and labour resource required,
- Provision of motorised isolation switches to facilitate remote operation in AC traction areas and reduce the time and labour resource required,
- Provision of motorised hook switches to facilitate remote operation in DC traction areas and reduce the time and labour resource required.

In addition, there are further initiatives to provide greater flexibility to reduce the impact of isolation, as follows:

- Re-sectioning of the OLE to increase the availability of diversions,
- Provision of alternate feeds to maintenance depots to allow isolations to be taken without forcing unnecessary disruption to depot working.

### **6.3.1 Implications for CP5**

Based on the benchmarking work undertaken, it is believed that a significant improvement is possible in this area to match the performance of other peers. Whilst improvement to best-practice level will be dependent on further investment in “maintainable” infrastructure, the work being undertaken by the Engineering Access Programme to reduce the variability of outcome for existing processes will give benefits in the shorter term. Based on Network Rail’s current programme, and taking account of the fact that only 56% of possessions involve an isolation, it is estimated that efficiency savings in the region of £2.5m per year can be achieved from the start of CP5. If the programme continues, with some investment in improved equipment, annual savings of up to £5.5m per year would represent a stretch target for year 5.

## **6.4 Multi-skilling / Professionalisation of workforce**

Traditionally, individual staff on the ground have been used to carry out the different tasks involved in establishing a possession, i.e. placing possession limit boards/detonators, placing work site marker boards, and making earthing arrangements in electric traction areas. In some situations e.g. placing earthing straps at the limit of a DC isolation, the earthing can be undertaken by a competent individual who is also responsible for setting up the work site. Each of these tasks is of short duration in general, and it is not clear to what extent the people involved are or can be better-utilised during the rest of the possession and what work has been done to see if rationalisation of the specialists involved has been attempted. A move towards greater multi-skilling would provide a more efficient and flexible work force, however, the barriers to achieving this are coupled with the fact that much work is currently done at weekends and many staff have to have other roles/jobs for the rest of the week. In addition, contractors lack of involvement in the planning processes and their short-term

contracts are likely to impact on their interest in specialist staff training, and reduce the potential benefits available from economies of scale in this area.

Our perception is that some of the benchmark countries e.g. Switzerland, achieve significant efficiencies through development of specialist teams for key activities, developing a “pit-stop” approach to undertaking routine possession management and engineering work to give economies of scale.

#### **6.4.1 Implications for CP5**

The benefits from the creation of multi-skilled specialist teams to deliver key elements of the maintenance and renewal output on the costs of possession management are estimated at between £8.5 and £14m per annum. This represents the likely increase in productive working time in each possession, but does not, of course, include the further benefits from the improvements in the unit cost of output from more-productive use of the engineering time.

### **6.5 “Red Zone” Working**

In the last fifteen years, the use of “Red Zone” working during the normal timetabled operation of trains has been discouraged by both Network Rail and the Safety Regulator because of the wish to reduce the risk of on-track staff being struck by trains. Sections of the network have been designated Red Zone Prohibited which means that no work can be undertaken in that area without a possession. This separation of service trains and workers has led, in general, to a reduction in worker accidents but has come at a cost in terms of lack of flexibility to carry out minor activities without requiring a possession. However, the impact of this reduction has been at least partially offset, it appears, by the increase in accidents within a possession when trains and on-track plant are still moving and the protection arrangements used may be less robust than during red zone working. This has been compounded by the increasing use of on-track mobile plant.

Given this experience, it would appear to be timely to review the application of Red Zone working to see if further relaxation in its use would be possible without having a detrimental effect on the overall safety record. Network Rail has indicated as part of its Network Implementation Availability Plan that it is prepared to consider the widescale introduction of working under Adjacent Line Open (ALO) using fixed/mobile warning systems or SLW, as appropriate. They also have initiatives underway to reduce the number and extent of red zone prohibitions.

Traditionally single line working was used to deal with incidents, or to provide for continuation of a basic level of train service, often during the night or on Sundays. It is unrealistic, without the provision of proper or even basic bidirectional signalling and associated point work (facing crossovers) to provide anywhere near the same capacity as normal, so train operations aspirations need to be carefully managed. Nevertheless, provision of single line working may provide opportunities to enable key trains that cannot be diverted to pass, and streamlining the operating rules and facilities available to maximise capacity could provide worthwhile benefits. It is not clear to us whether this has been done *per se*, although Network Rail is looking to make more use of SIMBiDS, where it exists on the network, together with reductions in the need to provide additional staff on-train for out-of-course working.

The use of innovative technology (for the main line railways) such as mobile traffic light signals remotely controlled and some form of simple dispatcher working as used on some preserved railways,

might offer a solution, but there are issues with level crossings, station working and signing of speed restrictions that need to be considered also.

### **6.5.1 Implications for CP5**

The use of Adjacent Line Open (ALO) working gives the opportunity for a relatively low-cost extension of time-windows for engineering work, improving efficiency by allowing more work to be completed under each possession. Its applicability in CP5 is, however, likely to be restricted by both safety considerations and the lack of suitable signalling and infrastructure. The likely benefits for improved efficiency are therefore estimated to be in the region of £3.5m - £7m; the ORR "Evaluation of Gap Analysis Factors" report estimates savings of up to £11m – this can be regarded as a "stretch" target, but is likely to require significant investment in infrastructure and process improvements

## **6.6 Investment in Innovation**

As is evident from our earlier comments, Network Rail has been reviewing in great depth its approach to possessions and it would be reasonable to assume that it has looked at a wide range of possible ways to make possession management more efficient. The issues outlined below cover a number of potential improvements that could be brought about by a more cohesive and universal access to data; work has started in this area. The following issues therefore are intended as an overview of the areas where improvements are possible for CP5.

Each sub-section below takes an overview of an area where an opportunity for efficiency savings has been identified by the benchmarking work undertaken or interviews with Network Rail staff, and looks at the realistic scope for savings given the environmental constraints in UK rail. This is used to generate an estimate for savings possible in CP5. Where a constraint is felt to be challengeable, an indication of the potential savings is given. The issues covered in this section are all currently being dealt with in some form by Network Rail, mainly as improvement projects contributing to the Access Management Programme.

### **6.6.1 Provision of ERTMS / ETCS**

Although it will take many years before it is fully implemented on a wide scale, ETCS signalling systems can inherently provide for bidirectional signalling at significantly lower cost providing line-side signals are not required. The benchmarking work done confirms that this should also enable a more-economic provision of worksite protection, single line working and provision of permanent and temporary speed restriction information using the features of in-cab signalling

### **6.6.2 Provision of Traffic Management/Control Systems**

In some other countries, the management of and protection of possessions is done using the signalling and traffic management systems using features that are built into the software. Network Rail is embarking on a large project to replace all its traffic management systems giving the opportunity to invest in better facilities for the efficient management of possessions.

### **6.6.3 Other Possibilities**

The following list is a non-exhaustive selection of other innovations that could contribute to more efficient use of possessions; a number of these are already in the process of being developed by Network Rail:

- Plain line pattern recognition – using an array of vehicle mounted cameras and image analysis software to identify defects in sleepers, fastenings, rails, switches, clamps etc, and identify the absence of components,
- Track Circuit Operating Devices (TCODs) – A portable device that allows the user to activate the track circuit and turn the relevant signals to danger thereby protecting the work site in a simplified manner,
- Mobile “Green Zone” – a covered train that allows work to be undertaken safely on a single line within a multi-line environment reducing reliance on possessions,
- Fixed warning systems – permanent staff protection systems fitted at the busiest locations to reduce set-up / handback times for possessions, increasing available work-time
- Curve Assisted Laser (CAL) – system fitted to tampers to return the track to predetermined alignment reducing possession durations and number,
- Modular Signalling – standardised and simplified signal structures which require less installation and hence possession time,
- Kit redesign – the ongoing adoption of new equipment and processes that are optimised for the time available for engineering works, rather than using lowest-cost techniques that lock-in the longer weekend possessions, or require new disruptive possessions. A recent example of this is the development of lightweight stressing kit which is easier to deploy and faster in use,
- Learning – although the benchmarking shows that Network Rail has more data readily available than most Comparators, the study found that much of the data collected on possession performance is stored inaccessibly, and therefore of no use for management or continuous improvements purposes. The Engineering Access Programme proposal for better use of Information Technology to link worksites, operations centres and HQ, and to create and use databases of KPIs is a vital component of efficiency improvements in possession management. A recent example of this is the trial use of iPads for on-site communication and data collection purposes.

#### 6.6.4 Implications for CP5

The adoption of innovations in practice and process is a key component of improvements in efficiency, and the issues raised above are only a small percentage of the many possible efficiency improvements over the seven years to the end of CP5. Each will have to be subject to cost-benefit appraisal, and it is therefore difficult to estimate the total savings possible, but it is considered that a “stretch-target in this area for further savings could see a progressive adoption of new representing savings of up to an additional £20m per year by the end of CP5.

### 6.7 Summary

The range of potential efficiency savings for possession management costs in CP5 identified in this Section 6 is in the region of £25m - £50m per annum, broken down as below;

- Safety Management; £4.5m - £13m,
- Electrical Isolations; £2.5 – £5.5m

- Multi-skilling / Professionalisation; £8.5m - £14m
- Adjacent Line Open working; £3.5m - £7m
- Innovation; £6m – £11m



## 7 Commercial Issues

### 7.1 Background

Sections 5 and 6 above have been concerned with the physical and process issues affecting the efficiency of delivery of Engineering Access. The other key influences on the overall net cost / benefit to UK Rail are the commercial incentives on the stakeholders in the process. These fall into two main areas – the revenue foregone by the rail industry while the tracks are unavailable for passenger and freight trains, or by artificially extended journey times, and the actions of the incentive regimes which are, in principle, designed to compensate the Operators for the opportunity cost of this lost revenue.

The inclusion of these issues in the consideration of the net costs of Engineering Access adds considerable complexity, but is unavoidable in the context of optimising the outcome. At its simplest, the lowest-cost engineering solutions are achieved when no trains are running at all, whilst revenue is maximised when there are no restrictions on train operations. Neither of these paradigms is, of course, achievable in the context of a busy, mixed-traffic railway; to optimise the regime for Engineering Access it is therefore necessary to identify the conditions where the difference between the overall network revenue and the engineering costs of maintaining and renewing the Assets is greatest. Sections 7.2 - 7.4 below, therefore, look at the issues affecting train operator's revenue-earning potential, as an important input into the issue of how the net cost of Engineering Access to UK Rail can be minimised.

### 7.2 Contractual Enforcement Regimes

The UK's contractual "rewards and penalties" incentive regimes are unique in the rail world, both in terms of the breadth of their scope and in the amount of money involved. Their main impact on the Engineering Access process comes through the operation of the Schedule 4 and Schedule 8 of the Track Access Agreements. These seek to incentivise Network Rail to respectively minimise change to the Engineering Access time required once the process of building a timetable has started, and manage possessions "on the day" so as to avoid unplanned disruption to timetabled services before and after taking possession of the tracks.

The benchmarking work undertaken shows that, despite the strength of the financial incentive on Network Rail to finish possessions on time, their performance in this respect is amongst the worst of the Comparators studied. The long-term trend of an improvement in performance in this area has "levelled-off" recently, as shown in Figure 40 below, with current delay minutes per £10k investment currently above the corresponding values from the previous 3 years.

Despite this apparent lack of actual incentive, discussions with Train Operators revealed strong support for the Contractual Enforcement Regimes relating to Engineering Access. This is on the basis that unless Network Rail has an incentive to avoid disruption to services, they would be tempted to prioritise the booking and / or completion of engineering works above the running of service trains to the agreed timetable.

Informal discussions were also held with the Comparators about the operation of the regimes, to elicit an "independent" infrastructure manager's view of their efficacy. The consensus view was that, whilst payment to operators of compensation for delaying a train due to over-running engineering works was generally seen as a good incentive, the payment of guaranteed levels of compensation for the

agreed cancellation of marginal train services could encourage operators to agree to more such cancellations than might be justified by taking a “market” view.

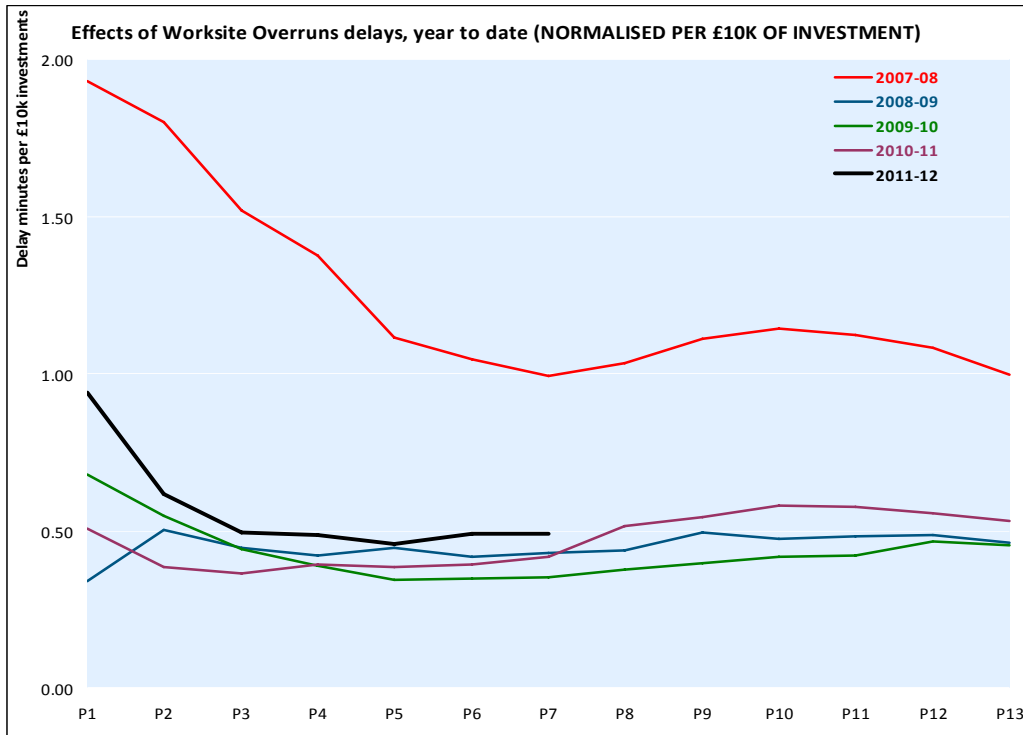


Figure 40; Delay minutes from worksite overruns 2007/8 - present (source ORR)

This is exacerbated at present where operators have a “cap and collar” arrangement whereby the marginal revenue risk is held by the DfT. Under this regime, Schedule 8 payments are not counted as passenger revenue, giving operators a strong incentive to agree to service cancellations as they keep all the “revenue” from these, rather than just a percentage of actual passenger revenue.

The UK respondents to the benchmarking also raised the issue of the apparent incentive on Network Rail to overbook additional possession time at the start of each timetable period, minimising Contractual Enforcement Regime costs for Engineering Access compared to booking slots at a later stage of the process. There is apparent evidence for this in the estimates made of up to 5% of possessions booked not being used at all, with a larger percentage of booked possessions not being used for the purpose for which they were originally booked. There is no data available to assess the full extent of this issue, but discussions with Network Rail staff suggest that this may be the case for up to 20% of all possessions.

The other main perverse incentive arising from the Contractual Enforcement Regimes raised by UK respondents is the inclusion of generous contingencies into on-the-day schedules to ensure right-time finishes, and abandoning work early to save the possibility of possessions over-running and thereby avoiding Schedule 8 costs. Discussions with Comparators confirmed that very little “contingency” time is included in planning for routine work in possessions – despite this, as noted above, their performance in finishing work on time was in most cases significantly better than Network Rail.

### 7.2.1 Implications for CP5

It is difficult to estimate the effect of the adoption of efficiency improvements in possession management on the Schedule 4 Regime. Improvements in the planning will naturally tend to reduce the costs to Network Rail, but the proposed increase in the number and length of midweek possessions will raise the cost of compensation to Operators through this mechanism. It will not be possible to provide an estimate of the net result until the effect on volume and timing of the Enhanced Maintenance proposals are known; a “best-guess” at present would be that holding costs at the current levels would require a significant improvement in the planning process, and would therefore represent a “stretch target” for CP5

Improved management of possessions should, however, result in a reduction in the payments to operators through the Schedule 8 Regime, although efficiencies through reduction in contingencies are likely to have the effect of increasing these payments, as the benefits of completing engineering work using fewer possessions will be balanced by the increased likelihood of the work over-running. This reduction would not, however, be material, being forecast at less than £0.5m per year based on a reduction pro-rata to the efficiencies outlined in Sections 5 and 6.

## 7.3 Passenger Revenue

The issue of the effect on Network Rail’s costs on the timing of Engineering Access to the rail network is considered in Section 5.2 above. To determine the net impact on the financial performance of the railway industry, however, it is necessary to consider the impact on revenue. The lowest-cost time for engineering work is weekday daytimes, but the direct impact this has on preventing the railway meeting its core purpose of moving goods and people means that this is restricted to very occasional major blockades, not only in the UK but in all other Comparator countries.

The only partial exception to this is found in mainland Europe (e.g. France and the Netherlands), where the timetable on urban routes is eased in the August holiday period. This gives a corresponding increase in opportunities for maintenance between trains, with whole-route blockades, sometimes for a week or more, applying during this period with intermediate stations served by bus and diversion of through trains. This enables significant reductions in unit costs for renewals of track and structures, but is only feasible for the UK in the context of wider changes, as the difference in demand during holiday periods is less pronounced and the additional Contractual Enforcement Regime costs would be many times the savings generated.

This leaves the main opportunities for engineering work as the traditional weekend extended White Periods and bank holidays, or the shorter White Periods on midweek nights. Sections 7.3.1 to 7.3.3 below look at the issues around each of these from an industry revenue point of view, to complement the engineering cost views in Section 5.2. Three main issues emerged from the discussions on the effect of Engineering Access on passenger revenue – in order of magnitude, these were the impact on earnings from the “traditional” Saturday night / Sunday morning white period, the potential loss of income from longer midweek white periods and the effect of overrunning engineering works on customers.

### 7.3.1 Effect on Sunday Revenue

The market for travel on Sundays has changed significantly over the past thirty years, and it is understood that recent research work undertaken in this area suggests that there is a significant and growing demand for leisure travel which is being suppressed by the reduced timetable and uncertain

performance caused by Sunday morning White Periods and blockades for engineering works. A specific issue emerging from recent work is that the “inconvenience factor” of extended journey times and particularly bus-substitutions on Sundays is having an increasingly negative effect on people’s decision to travel by rail. This combination of a rapidly growing market and increased reluctance to accept disruption means that the impact on passenger revenue of traditional Sunday extended blockades is both large and growing.

### **7.3.2 Effect on Weekday revenue**

Whilst also growing, the demand for overnight travel (say 2330 – 0530) is an order of magnitude lower than for Sunday morning, and there is little doubt that the effect of increasing engineering activity in this time period and reducing the impact on Sunday mornings would have a material impact on overall rail passenger revenue. This is supported by consideration of the demand characteristics of the respective periods; early morning and especially late evening rail travel is often a forced “distress purchase” as there are no other cost-effective alternatives for people needing to travel by public transport at this time, so the demand tends to be very inelastic. By contrast, Sunday morning travel is mainly a leisure or shopping trip, with a plethora of transport or other leisure activity alternatives – this means that demand is very elastic, with customers easily put-off rail travel by actual or even perceived unreliability.

### **7.3.3 Revenue effect of over-running possessions**

The key negative issues in relation to an increase in midweek overnight work are the possibility of impact on daytime revenue from passengers unable to make a return journey due to earlier route closure and, more seriously, the potential for impact on core revenue of over-running work disrupting peak-time services, as outlined below.

Research shows that regular over-runs to due poorly managed or over-ambitious possessions can have a disproportionate impact on passengers’ perception of service reliability, and therefore their propensity to travel. Should the 7-day railway philosophy be adopted and the bulk of engineering possessions be undertaken on weekday nights, regular disruption could significantly affect peak revenue over time. Due to the sums involved, this could quickly negate the benefits of increased Sunday revenue.

### **7.3.4 Implications for CP5**

The objective of moving to a 7-day railway for passenger services is fully supported by the evidence outlined above, with the respective demand profiles suggesting that there would be a significant increase in Sunday revenue, greatly outweighing the likely loss of revenue from reduced / diverted / bus-substituted late evening and early morning services.

This is, however, heavily dependant on the additional Engineering Access time created on midweek nights to fully-meet Network Rail’s asset management needs. The increased potential for over-running works to disrupt morning peak services puts the network’s core revenue at risk; even a small number of major incidents, or regular minor problems, would be likely to negate the potential revenue benefits of the switch.

It is therefore essential that a new 7-day regime is robust, allowing ample time, including contingencies, for all the work required to maintain and renew the Assets. This is required both to reduce the short-term pressure on individual works to over-run to meet over-ambitious workload scheduling, but also to prevent the build-up of a maintenance backlog in the longer term which

would result in performance problems due both to asset degradation and increased numbers of additional possessions needed to address the backlog.

## **7.4 Freight Revenue**

The main user for overnight train paths on the rail network are the FOCs. These services are therefore, by definition, those most likely to be disrupted by Engineering Access, and there is considerable evidence of a mature and ongoing dialogue between the operators and Network Rail on managing the effects of this on the commercial revenue. Unlike the passenger network, it is an unavoidable fact that key revenue streams will be impacted. The priority issue for Freight Operators in respect of overnight engineering Access, therefore, is the maintenance of train paths through worksites and/or the provision of alternative routes with similar infrastructure characteristics to the usual route, i.e. loading gauge, electrification, capacity etc. Freight traffic is not as time-critical as passenger, and provided a reliable maximum end-to-end journey time can be guaranteed, customers will happily accept longer transit times.

### **7.4.1 Implications for CP5**

The current pattern of Engineering Access means that effectively freight operators are faced with a 5½-day railway, with very few opportunities to run trains reliably 52 weeks / year between Saturday lunchtime and Monday morning. This has two negative outcomes; firstly, as with passenger services, there is an element of revenue suppression in the freight market from FOCs inability to secure a 7-day service, particularly in the key growth market of domestic intermodal traffic. There is believed to be scope for growth in traffic for just-in-time manufacturers such as automotive and supply of supermarkets, where the ability to provide uninterrupted and reliable daily deliveries is crucial to the needs of a growing market that is seeking alternatives to reliance on increasingly congested roads.

The second key issue for freight operators concerns resource utilisation. Although the “weekend break is currently used for maintenance of wagons and locos, there is considerable scope for using existing resources for running more trains if there were reliable paths available. For bulk commodities such as coal and for international intermodal traffic, where the demand for traffic is 7-day, this would allow the traffic on offer to rail to be carried with 10% - 15% less resource in terms of locomotives and wagons. This major saving made possible by 7-day access could reduce costs sufficiently to attract new traffic to rail, generating both additional margin and a net increase in revenue for UK Rail.

Whilst it may not be practical to provide this guaranteed 7-day access to all freight routes, its implementation on a small number of key routes has the potential to both reduce costs and increase revenue. As with the potential passenger benefits, it is important that these benefits are fully quantified and taken into consideration in the decision-making on future Engineering Access strategies.

## 8 Interdependencies and External Constraints

### 8.1 Interdependencies

The analysis in Sections 5 - 7 above includes estimates for the financial benefits of the areas of potential efficiency improvements indicated by the benchmarking work and previous studies. The actual impact of changes in any of these areas in CP5 is, however, difficult to estimate due to the interdependencies between the various elements; these are considered below in terms of their ease of implantation, and therefore their likelihood of actual implementation.

#### 8.1.1 Core assumptions for CP5

Network Rail's asset management strategy for their key asset classes of track / S&C, is to significantly lower life-cycle cost by moving towards an "enhanced maintenance" regime, reducing the need for renewals and therefore enabling more work to be undertaken in shorter midweek possessions. This strategy will require significantly more possessions for Engineering Access, potentially driving costs up in this area.

We conclude, however, that there is sufficient opportunity for improved efficiency in the process to enable the planned increase in activity to be achieved at no net increase in Engineering Access costs in CP5 provided the change is phased-in effectively, through the processes outlined in Sections 5 and 6 above. It is considered feasible that the investments needed for this could largely be covered through changes in the contracting strategy, with longer-term involvement of contractors enabling them to make their own investments in training and new technology to help to meet the targeted reduction in unit costs for CP5. The key elements of this process are;

- Improvements in Asset Management processes (Section 5.4);
- Better planning processes (Section 5.5);
- Improved alignment to timetabling processes (Section 5.6);
- Improvements in Resourcing / Contracting strategy (Section 5.7);
- Incremental improvements to safety processes (Section 6.2);
- Multiskilling and professionalisation of the workforce (Section 6.4);
- Incremental improvements in processes and equipment (Section 6.6).

Improvements in all of these areas are included in Network Rail's current plans for CP5, and taken together should ensure that the full benefit of reductions in unit cost of engineering work, as outlined in Section 4 above, to be realised.

The overall savings possible from possession management productivity being improved to "best-in-class" level is significant; taking a "top-down" view, the apparent efficiency gap of around 30% on an estimated resourcing budget of around £500m per annum suggests that savings of up to £150m per year could be possible. The benchmarking shows, however, that many of the costs are already at "efficient" levels, e.g. wages levels, restricting the overall savings possible. In addition, there are a large number of physical, process and contractual constraints to efficiency within the UK rail environment, and without investment to tackle these, it is suggested that only around 15-30% of the theoretical total potential efficiencies, or around £25m - £50m per annum, are feasible for CP5.

### 8.1.2 Move to 7-day Railway

The current pattern of work being undertaken in lengthy Saturday night / Sunday morning white periods is both a source of resource inefficiency and a significant constraint on both passenger and freight revenue. To achieve further net improvements in the annual costs in the context of a move to a 7-day railway within CP5 and beyond, therefore, it will be necessary to move towards a continental-style railway both in terms of the infrastructure provision and in terms of the maintenance and renewal processes. This will require, inter alia, significant investments in infrastructure and safety processes to allow train operation alongside engineering work, either on alternative routes or through signalled single-line working alongside safe worksites. An early start will need to be made on creating an investment case for the changes needed to ensure that cost-reductions and revenue growth can continue into CP6.

The key components of this change will include;

- Negotiated reductions in early and late train movements, with diversion and bus substitution where necessary, to create increased opportunities to undertake midweek possessions (Section 5.2),
- Re-engineering of processes and investment in equipment to improve productivity from standard midweek Engineering Access time-windows to facilitate processes (Section 6),
- Further professionalisation of workforce to create dedicated multi-skilled teams (Section 6.4),
- 7-day access to the Network will allow freight operators to reduce their operating costs, and allow both freight and passenger operators the opportunity to develop new markets (Section 7).

The main benefits from the changes outlined above will come in increased revenue / reduced costs from the 7-day railway; the effect of progressively switching to the shorter time-windows offered by midweek nights will inevitably increase the number of worksites required. It is estimated that the investment in processes, equipment and training will be sufficient to ensure no net increase in unit costs, meaning that the revenue and operational costs benefits from 7-day operation will be fully realisable.

### 8.1.3 High-performing 7-day railway

The long-term objective for Engineering Access in the UK rail industry must be to achieve “best-in-class” performance. The benchmarking work undertaken suggests that this is currently represented by both the best-performing Eastern comparators and European infrastructure managers such as Swiss Railways. These can both apparently achieve around 80% efficiency in terms of “track-time” from possessions. This level of improvement will, however, require a sustained programme of investment in “maintainability” in addition to the systematic adoption of best-practice processes for asset management, planning and contracting, and is therefore only likely to be fully realised over an entire investment life-cycle given the current starting point for UK Rail.

There is, however, a “once-in-a-generation” opportunity to introduce the changes needed to create a “maintainable” network in the introduction of ETCS signalling systems, currently planned to start towards the end of CP5. The key elements of this will include;

- The widescale adoption of bi-directional signalling / SIMBiDS on all key routes, accompanied by comprehensive investment in maintainability (including gauge-widening if practicable), to facilitate train operation alongside “High Output” maintenance and renewal works;
- A comprehensive re-writing of the safety rules to take full advantage of the new technology and improved methods of work, based on new risk assessments and best-practice from high-performing Comparators;
- Continued development of alternative routes to allow identified key services to run 24/7 – this is likely to include selective re-openings (e.g. Lewes – Uckfield, Leeds New Line etc.)

It is very difficult to estimate the effect on cost-efficiency of the move to a “high-performing” 7-day railway, due to the large number of variables involved. The benchmarking work done, however, suggests that the net result of the investments in infrastructure, equipment and training outlined above should be that the efficiency of possession management improves from Network Rail’s current estimated value of between 40 and 50% of productive time per possession to a value close to the “best-in-class” Comparators at around 80% (see section 3.1 above).

This change will, of course, mainly apply to staff costs only – there are only limited corresponding benefits in material or logistics costs from improvements in this area. On this basis, it is estimated that additional annual efficiency savings, above Network Rail’s current “efficient” expenditure forecast of around £150m could be available, or around £750m per Control Period from changes in possession management alone, i.e. not including improvements in engineering efficiency. It should be noted that savings of this scale would only be possible following the rollout of high levels of “maintainability” across the whole network, in addition to significant corresponding investments in planning processes, staff training and equipment.

It should be noted, however, that the benefits from the changes proposed will also include a significant increase in passenger and freight revenue from the 7-day railway, and improvements in service performance from more-flexible track and signalling systems. Given the costs of the enhancements required, it is likely to be critical that these factors are taken into account in making the case for the investment needed to create the “maintainable” railway.



## 8.2 Force Field analysis

The Force Field diagram in Figure 41 below provides an overview of the issues around improvements in Engineering Access for UK rail identified during the study, as summarised in Section 8.1 above, with a summary of the key “enablers” identified which are supporting the necessary efficiency improvements, and the potential remaining obstacles to positive change in this area;

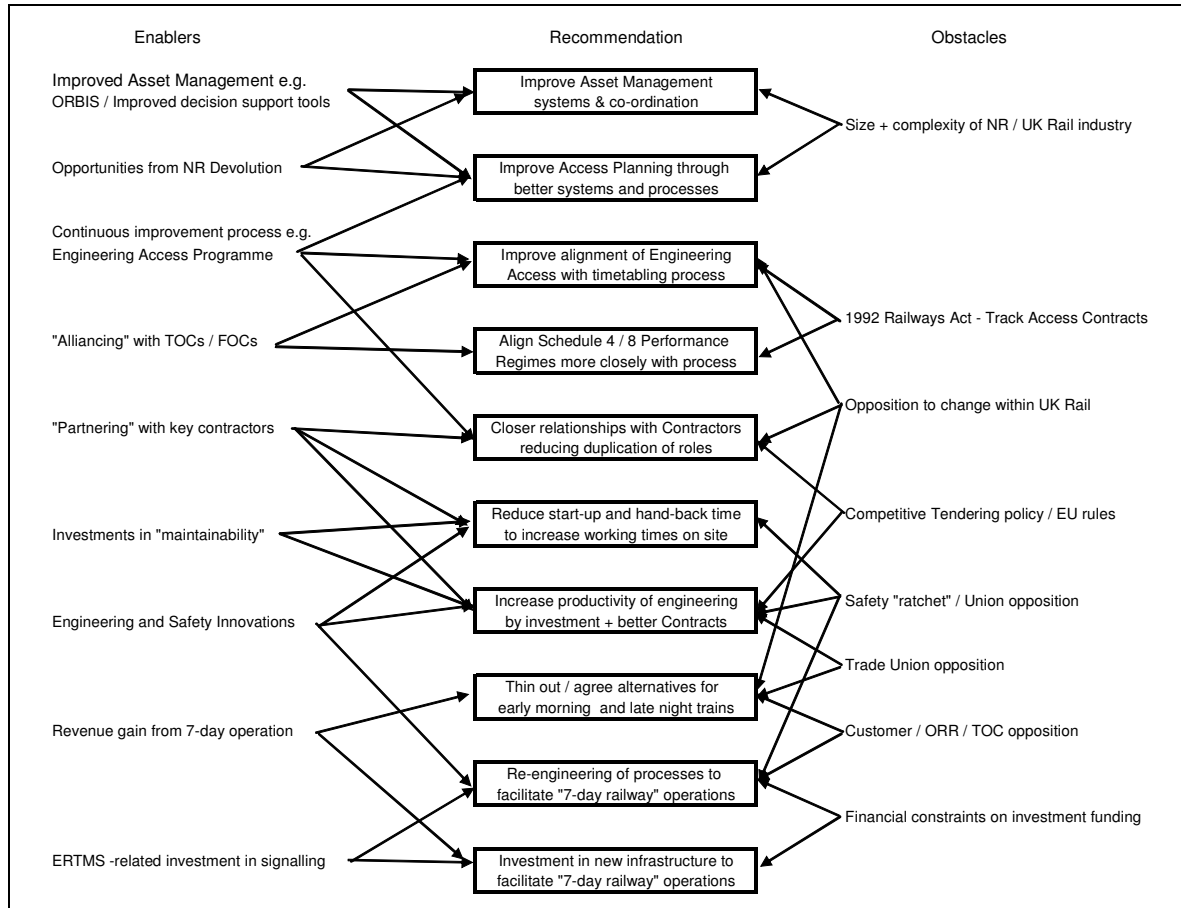


Figure 41; Force Field diagram showing key enablers and obstacles to change

## 8.3 Conclusions

Based on the review of external best practice and detailed discussions with Network Rail and UK Contractors and Train Operators, it is estimated that the potential benefits from increased efficiency of Possession Management / Engineering Access in CP5 are in the range of £48m - £99m, with the following breakdown;

- Changes to the possession planning process through Devolution £30-60m
- Changes to the possession protection / safety management regime £10-25m
- Changes to the relationships with contractors £8-14m

In the longer term, further efficiencies are possible, with potential overall savings on the current cost-base for possession planning and management of up to £150m per annum (NB - this figure includes the £48m - £99m outlined above). Achieving these additional savings is, however, dependant on significant changes to the network and the contractual regimes, including;

- Investment in “Maintainable” infrastructure
- Relaxation of “social service” protection in Operator’s track access rights
- Changes to the timetabling and Contractual Enforcement Regime processes

The biggest potential benefits identified, however, would come from the introduction of the 7-day railway, with Engineering Access spread equally throughout the week rather than concentrated on weekends as now. Paradoxically, this would reduce the overall savings possible from Engineering Access, as more possessions are likely to be needed to complete work in the shorter timeslots available. This would, however, be greatly outweighed by cost savings and additional revenue available to Train Operators from full 7-day operation on all core routes.

## 9 Glossary of Terms

**7-day (railway)** – A change away from lengthy Saturday night – Sunday Morning White Periods to an equalised amount throughout the week, allowing a normal (weekend) passenger timetable to be operated on a Sunday – now referred to in the industry as the “Network Availability Programme”

**(Engineering) Access Management Programme** – Network Rail initiative to identify root causes of inefficiency in Access Management and introduce improvement projects to deal with key issues

**ALO / Adjacent Line Open** – The practice of undertaking renewal and / or maintenance work on one track of a two or more track railway whilst service trains continue to operate (usually at reduced speed) on one or more of the other tracks

**Alliancing** – A process of close co-operation between Network Rail and individual TOCs to try to re-create the benefits of an integrated railway company. Wessex is an example of a deep alliance, e.g. a shared management team. Simpler Alliancing is currently being pursued with Abellio Greater Anglia, C2C, ScotRail, Northern and Southeastern amongst others

**(Fixed) Assets** – all the physical assets required by Network Rail to provide support train operations, e.g. track, signalling, electrification, structures, plant etc

**Comparators** – collective term for the six overseas railway organisations used for benchmarking purposes for this study (see section 3); also used for organisations which were the subject of benchmarking in other studies quoted.

**Contractual Enforcement Regime(s)** – A generic term used to cover both the Schedule 4 process for agreeing changes to access rights and the Schedule 8 “rewards and penalties” regime in Train Operators track access contracts.

**Devolution** – The recently completed process of devolving increased managerial responsibility to ten out-based Route Management teams within Network Rail.

**DRAM** – Director of Route Asset Management post / department introduced into each Route Management team as part of the Devolution process

**Engineering Access** – The restriction of commercial use of the railway for the purposes of maintenance, refurbishment or renewal of Network Rail’s fixed assets

**Enhanced Maintenance** – A philosophy of using “selective renewal” of track and S&C components (track, ballast-bed, sleepers etc) rather than full renewal of the entire asset, to maximise the useful life of each element of the asset.

**ETCS / ERTMS** – European Train Control System / European Rail Traffic Management System; new European standard signalling systems, based on wireless shore-train communication with and Automatic Train Protection systems which stop the train automatically before each “red signal”

**FOC** – Freight (Train) Operating Company

**IIP** – The Initial Industry Plan

**Maintainable / Maintainability** – Railway infrastructure that is designed for ease of maintenance, with initial higher investment reducing overall life cycle costs

**(Train) Operators** – Companies operating passenger, freight and infrastructure train services on the UK rail network

**Possession** – the creation of a safe zone for to allow workers access to rail lines for the purposes of maintenance, refurbishment or renewal of Network Rail’s fixed assets

**Red Zone / Green Zone** – Worksites where there is deemed to be a risk to staff from moving rail vehicles (Red Zone) or no such risk exists (Green Zone).

**Route(s)** – Network Rail’s devolved local management areas

**S&C** – Switches and Crossings

**Schedule 4 / 8** – See “Contractual Enforcement Regimes” above

**SLW (Single Line Working)** – Running passenger or freight trains in both directions over the adjacent line of a two-track railway, allowing maintenance or renewal work to be undertaken on the other line.

**SIMBiDS** – Simplified bi-directional signalling, a low-cost type of bi-directional signalling developed for use on the UK Rail network

**T-x** – Both in interviews with staff and official documentation found examples of timescales in the T-x format with the units (x) referring variously to years, weeks and days. All timescales in the T-x format in this study refer to the number of weeks in advance of the deadline (T) referred to.

**TOC** – (Passenger) Train Operating Company

**UIC - International** Railway Union (*Union Internationale de Chemins de Fer*)

**UK Rail** – The whole UK rail industry, including all cost- and revenue-generating activities.

**White Period** – times when there are no trains timetabled on a particular section of line to allow pre-planned Engineering Access.

# Appendices

## Appendix A Benchmarking Questionnaire

## A.1 Possession Productivity

### 1. Possession productivity for track renewal work

*NB. This question relates to a "typical" track renewal job on a two-track railway of 150-180 km/hour. Assume the site has no access problems.*

- a. For a normal plain-line renewal of 500m of main-line track, what would the approximate cost be?  
Please break the figures down by category area if possible (e.g. staff, materials, contractors, compensation paid to operators etc.).

Item	Unit	Value	Comments
Staff costs	Local currency		
Material costs	Local currency		
Contractor costs	Local currency		
Compensation paid to operators	Local currency		
Other costs	Local currency		
<b>Total cost</b>	Local currency	<b>0</b>	

- b. How long would your staff / contractors have to have possession of the track to complete this work, including your normal preparation and site clearing activities?

Item	Unit	Value	Comments
Possession time	Hours		

- c. What % of normal speed would the route be restored to the operator at, and when would the operator expect normal line speed to be restored?

Item	Unit	Value	Comments
Restored speed	% of normal		
When restored	Hours		

- d. What is your target asset life for this type of asset before its next scheduled renewal?

Item	Unit	Value	Comments
Target asset life	Years		

- e. Do you have a dedicated team for renewal of S+C assets, or is this work done by the team who also do track renewals?

Item	Unit	Value	Comments
Dedicated team for S+C renewals?	yes/no		

**2. Possession productivity for S+C renewal work**

*NB. This question relates to a "typical" Switch and Crossing renewal job on a two track main line similar to that in question 1*

- a. For a normal renewal of a main-main crossover with speeds around 180kmh main / 25kmh diversionary on main-line track, what would the approximate cost be? Please break the figures down by category area if possible (e.g. staff, materials, contractors, compensation paid to operators etc.).

Item	Unit	Value	Comments
Staff costs	Local currency		
Material costs	Local currency		
Contractor costs	Local currency		
Compensation paid to operators	Local currency		
Other costs	Local currency		
<b>Total cost</b>	Local currency	<b>0</b>	

- b. How long would your staff / contractors have to have possession of the track to complete this work, including your normal preparation and site clearing activities?

Item	Unit	Value	Comments
Possession time	Hours		

- c. What % of normal speed would the route be restored to the operator at, and when would the operator expect normal line speed to be restored?

Item	Unit	Value	Comments
Restored speed	% of normal		
When restored	Hours		

- d. What is your target asset life for this type of asset before its next scheduled renewal?

Item	Unit	Value	Comments
Target asset life	Years		



**3. Possession productivity for bridge work**

*NB. This question relates to a "typical" renewal of a concrete-construction road underbridge on a two track main line similar to that in question 1*

- a. For a normal renewal of an underbridge with a span of around 7m, what would the approximate cost be?  
Please break figures down by category area if possible (e.g. staff, materials, contractors, compensation paid to operators etc.).

Item	Unit	Value	Comments
Staff costs	Local currency		
Material costs	Local currency		
Contractor costs	Local currency		
Compensation paid to operators	Local currency		
Other costs	Local currency		
<b>Total cost</b>	Local currency	<b>0</b>	

- b. How long would your staff / contractors have to have possession of the track to complete this work, including your normal preparation and site clearing activities?

Item	Unit	Value	Comments
Possession time	Hours		

- c. What % of normal speed would the route be restored to the operator at, and when would the operator expect normal line speed to be restored?

Item	Unit	Value	Comments
Restored speed	% of normal		
When restored	Hours		

## A.2 General

### 4. Planning processes

- a. How many weeks in advance of work actually commencing on site for a job such as the Plain Line Renewal in question (1) do you:

Item	Unit	Value	Comments
Book the possession of the track section concerned	Weeks		
Engage the contractors / book the staff to undertake the work	Weeks		
Plan the timetable for revised train service operation during the work	Weeks		
Book the engineering trains to bring materials to the site	Weeks		
Finalise and publicise the public train timetable	Weeks		
What is the latest time before work starts that you are allowed to change the timetable for passenger trains to take account of changes to the plan?	Weeks		
Are these times typical for other types of renewal, e.g. signalling, structures etc?	Yes/No		

- b. i) Do you use any Engineering Process Planning / Costing IT systems to support decisions on how and when to undertake maintenance and renewal work, and / or how to optimise time? If so, which ones?

Item	Unit	Value	Comments (identify systems)
Do you use such systems?	Yes/No		

- ii) Do you use any Timetable / Access Planning / Costing IT systems to support decisions on how and when to undertake maintenance and renewal work? If so, which ones?

Item	Unit	Value	Comments (identify systems)
Do you use such systems?	Yes/No		

iii) If both types of systems are used, are they linked to provide a comprehensive access planning tool?

Item	Unit	Value	Comments
Are the systems linked?	Yes/No		

- c. Appendix A has a list of possible organisations / departments who may need to be involved in planning possessions for engineering work. Please tick all those which would normally be involved in planning a possession on your railway, and / or add any which you deal with but are not on the list.

## 5. Data collection

- a. What data do you collect on the cost / results of engineering possessions?

Item	Unit	Value	Comments (identify types of data collected)
Data collected on cost / results	N/A	N/A	

- b. Do you regularly measure and use Key Performance Indicators in this area? Could you give either hard data or an estimate for the following KPIs:

Item	Unit	Value	Comments (estimate / hard data)
% of possessions booked but then not used because resources are not available	%		
% of possession which over-run and disrupt the train service	%		
% of possessions where work is not completed in the allocated time	%		
% of possessions where work finishes early (i.e where more work could be done in time available)	%		
% of possessions which are booked but are not actually needed for planned engineering work	%		

**6. Cost / Time of safety processes**

- a. When staff are working on the track, what (if any) additional protection measures do you take (in addition to ensuring signalman is aware of worksite) before work can begin? If staff are employed (solely) on look-out duties, how many such staff are needed per worksite

Item	Unit	Value	Comments (identify measures)
Are there additional protection measures?	Yes/No		
How many staff are employed on look-out duties	Number		

- b. How many people are involved in the process of taking a possession of a normal worksite on a two-track main line? (not including staff working on the track, just those responsible for making sure the worksite is ready)

Item	Unit	Value	Comments
Number of people	Number		

- c. Who has overall responsibility for assuring the safety of staff working on the site? Do you have staff whose only role during a possession is to ensure the safety of staff working on the site?

Item	Unit	Value	Comments
Person with overall responsibility	Job title		
Are there dedicated safety staff?	Yes/No		

- d. What IT / communication systems are used to set up and ensure the safety of a normal worksite in a possession?

Item	Unit	Value	Comments (identify systems)
IT / communication systems	N/A	N/A	

- e. i) Do you allow staff to work on a track alongside passing trains on an adjacent track (under either bi-direction signalling or Single Line Working on a 2-track line, or normal working on a 3/4 track route)?

Item	Unit	Value	Comments
Staff allowed?	Yes/No		

- ii) If so, what is the minimum separation distance allowed between staff working on the track and passing service trains (passenger or freight, not engineering trains)?

Item	Unit	Value	Comments
Minimum separation distance	Metres		

iii) What (if any) special working arrangements or protection has to be put in place to allow staff to work alongside passing trains?

Item	Unit	Value	Comments (identify working arrangements)
Are there special working arrangements?	Yes/No		

f. What is the approximate percentage of track maintenance work (by value) undertaken during the operational day, i.e. whilst service trains are running – either between trains or with single track possessions?

Item	Unit	Value	Comments
Track maintenance work during day	% by value		

g. If staff are working on plain-line track with an overhead electric system, how many minutes does it take from their arrival on site to the safe isolation of the power supply and permission to start work being granted (state AC / DC)?

Item	Unit	Value	Comments (state AC / DC)
Safe isolation time	Minutes		

h. How many steps / people are involved in the process of securing an isolation of the overhead electric supply on the day of the possession?

Item	Unit	Value	Comments
Number of process steps	Number		
Number of people involved	Number		

**7. Investment in “maintainability” of network**

a. For a typical main line linking cities, what investments have you made in the maintainability of your network (per 100 route-km)?

Item	Unit	Value	Comments
Approximate number of vehicle and pedestrian access-points for maintenance staff	Number per 100 route-km		
Number of local electrical switching boxes for taking isolations on electrified lines	Number per 100 route-km		
Number of sidings available for Engineering Trains	Number per 100 route-km		
What percentage of the network is equipped with bi-directional signalling?	% of network		
What is the typical distance between crossovers on inter-urban main line routes?	Metres		

**8. Possession productivity**

a. What is the average time between the last train leaving the area within the possession limits and work starting on a normal track renewal job as in question (1), on electrified and non-electrified lines?

Item	Unit	Value	Comments
Average time - electrified lines	Minutes		
Average time - non-electrified lines	Minutes		

b. What is the average time between the work finishing and the first train entering the section on a normal track renewal job as in question (1), on electrified and non-electrified lines?

Item	Unit	Value	Comments
Average time - electrified lines	Minutes		
Average time - non-electrified lines	Minutes		

- c. What percentage of your routes have “white periods” overnight where no timetabled trains run to allow access to track for maintenance and renewal?

Item	Unit	Value	Comments
“White period” percentage	% of routes		

- d. What is the minimum time allowed for such a “white period” on main line routes between cities?

Item	Unit	Value	Comments
“White period” minimum time	Hours		

- E What percentage of track renewal work is undertaken at Weekends, during Weekdays or on Weekday Nights? (please estimate if no exact data available)

Item	Unit	Value	Comments
Weekends	%		
Weekday daytime	%		
Weekday nights	%		

## 9. Relationship with stakeholders

- a. What is your organisation’s relationship with key industry stakeholders? (e.g contractual, part of same group, partnership, other)

Item	Unit	Value	Comments
National Government	N/A	N/A	
Passenger Train operating companies	N/A	N/A	
Freight Train operating companies	N/A	N/A	
Infrastructure Renewal organisations	N/A	N/A	
Other	N/A	N/A	

**10. Incentive regimes**

- a. Do you have any reward / penalty regimes in place to compensate train operators for disruption to their services caused by engineering work? (Please attach detailed description of any such schemes to response if available)

Item	Unit	Value	Comments
Are there reward / penalty schemes?	Yes/No		
What is the basis for these payments?	N/A	N/A	
How effective would you assess them to be in reducing costs / improving services to rail customers (passenger and freight)?	N/A	N/A	

**11. Engineering trains**

- a. Are engineering trains planned using the normal timetabling process?

Item	Unit	Value	Comments
Are engineering trains planned?	Yes/No		

- b. Are engineering trains operated by the infra-manager or brought-in from train operators?

Item	Unit	Value	Comments
Engineering train operation by	Infra Manager / Train Operator		



**12. Late-running service trains**

- a. If the last passenger train on a route is running late and would cause a possession to be delayed or cancelled if it ran through the worksite, is your policy to run the train and delay the engineering work or cancel the train and move passengers by bus?

Item	Unit	Value	Comments
Late-running policy	allow to disrupt possession / cancel train		

**13. Possession improvement programmes**

- a. Do you have any projects running at present to lower the cost of engineering access to the network and / or unit costs of maintenance and renewals?

Item	Unit	Value	Comments (identify improvement projects)
Are there improvement projects running?	Yes/No		

**14. Benchmarking data**

- a. Do you have any benchmark data from other rail networks in any of these areas you could share with us to further increase the value of this exercise?

Item	Unit	Value	Comments (identify data)
Can you share any benchmark data from other rail networks?	Yes/No		

### A.3 Planning Interfaces

#### Appendix A

#### Departments or Organisations dealt with in planning track possessions

please enter yes or no for each example below, and add any others at the bottom

Department / Organisation	Unit	Value	Comments
Engineering Delivery Access Planning team	Yes/No		
Engineering Delivery Resource Planning team	Yes/No		
Maintenance Planning team	Yes/No		
Maintenance Work Delivery team	Yes/No		
Passenger / Freight Timetable Planning team	Yes/No		
Contractors / staffing agencies	Yes/No		
staffing agencies	Yes/No		
Asset Renewals organisation – Track	Yes/No		
Asset Renewals organisation – Structures	Yes/No		
Asset Renewals organisations – Signalling	Yes/No		
Major Projects planning team	Yes/No		
Passenger Train Operating Companies	Yes/No		
Freight Train Operating Companies	Yes/No		
Government bodies eg Regulation / Safety	Yes/No		
Information Management / Data collection	Yes/No		
Engineering Train planning team	Yes/No		

## Appendix B Meetings / discussions held

Many thanks to the following individuals who gave generously of their time and knowledge in contributing to this study. \* Especial thanks go to Network Rail’s Access Management Programme team and Benchmarking staff, who provided excellent support throughout the work.

Adam Doy, Network Rail	Kelly Phillips, Canadian Pacific
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