NETWORK AVAILABILITY KPI

Final Summary Report

November 2007

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1. INTRODUCTION

Background and study objectives

1.1 The Office of Rail Regulation (ORR) requires a measure of the impact on railway users of possessions causing disruption to rail services. While Network Rail already produces possessions-related statistics on a four-weekly basis, these do not reflect their impact from the point of view of either rail operators or final customers. Steer Davies Gleave has been commissioned by the ORR, in partnership with Network Rail, to define a Key Performance Indicator (KPI) or group of KPIs that gives proper weight to the different characteristics of possessions, in particular:

- The location and length of the route affected, recognising that any given possession will typically affect a much larger section of the network than that actually subject to the engineering works; and

- Their timing, taking account of the fact that possessions during peak times will cause greater disruption to passenger services than at other times, while those at night are likely to affect freight services disproportionately.

1.2 To some degree, Schedule 4 of the Track Access Agreements between Network Rail and passenger operators already provides for the calculation of a weighted measure of possessions, expressed in terms of revenue compensation for the disruption caused. However, there is no clear consensus on whether the weightings and other parameter values applied in the calculation are appropriate in all circumstances. The Schedule 4 algorithm is subject to a parallel assessment to determine whether it can be improved as part of a wider rationalisation of the regulatory and contractual provisions governing both Network Change and possessions compensation.

1.3 The aim of this assignment is therefore to supplement the information on possessions compensation, which is confidential to the operators concerned, with one or more transparent Network Availability KPI(s) that provide all industry stakeholders with an understanding of how possessions are affecting the network as a whole. The need for such a measure arises as a result of:

- Concern among Train Operating Companies (TOCs) and Freight Operating Companies (FOCs), together with government, over a perceived increase in the extent of disruption to the rail network due to closures related to engineering works;

- A lack of appropriate metrics for measuring and monitoring the extent of disruption, inhibiting rational discussion of the issue;

- Network Rail's published ambition of moving to a '7-day a week' railway; and

- ORR's need for a mechanism to compare the value of alternative availability scenarios for regulatory purposes.

1.4 Whilst there is a desire for a single Network Availability measure covering both passenger and freight, it is recognised that it may also be appropriate to have separate

measures to capture the different requirements of user groups (e.g. passenger and freight) and additional measures to monitor against any potentially perverse incentives.

1.5 This paper forms a concluding summary report, outlining the metrics proposed to provide an industry measure of Network Availability, and summarises the work undertaken to derive these. This paper builds and summarises the conclusions of the work carried out as part of this commission and documented separately:

- 'Interim Report – Development of Metric Options', July 2007
- 'Assessment of Options Report – September 2007'
- 'Industry Stakeholder Workshop' presentation, 5th October 2007
- 'Network Availability Reporting Suite (NARS) - Outline Technical Specification, November 2007

1.6 The latter document describes in detail the definition and calculation of the proposed network availability metrics and provides a description of the system structure required for their measurement. Reference to this document is recommended for further details of the proposed metrics outlined in this report.

Structure of this report

1.7 The subsequent sections of this report are organised as follows:

- Section 2 outlines our methodology and approach;
- Section 3 examines the key issues considered in developing the proposed suite of metrics;
- Section 4 describes, respectively, a suite of proposed primary and secondary metrics to be developed and adopted to enable the ORR and the industry to monitor Network Availability;
- Section 5 provides a summary of our main conclusions; and
- Section 6 sets out an outline plan for implementation.

1.8 We also provide the following appendices to this report:

- Appendix A provides a glossary of industry abbreviations used.

2. METHODOLOGY

Approach

2.1 Our approach to the specification of a Network Availability KPI was based on three main work streams:

- Identification of KPI options;
- Assessment of KPI options; and
- System specification.

Identification of KPI options

2.2 The first stage of this study involved developing a 'long list' of possible metrics that could be used to reflect Network Availability. We gave consideration to a range of stakeholder objectives and aspirations for the measure and to the availability of potential data sources to facilitate calculation. Key steps involved:

- Preparatory work to review previous relevant work and consideration of synergies with other related projects (e.g. data collection), including the review of the Schedule 4 revenue compensation for possessions, which has been conducted in parallel to this study;
- Internal workshops with industry experts involving brainstorming and then challenging metric concepts;
- Interviews with a representative selection of industry stakeholders, including TOCs, FOCs, ATOC, DfT Rail, Passenger Focus and Transport Scotland., seeking comments concerning the impact of possessions on Network Availability (a summary of the key points arising from these interviews is provided in Appendix C): and
- Drafting a long list of possible metrics and an initial assessment against criteria reflecting the desired characteristics for a Network Availability KPI (a summary of the potential metrics considered and our initial assessment is provided in Appendix B).

Option assessment

2.3 A 'short list' of metrics was drawn up from those measures included in the 'long list' that showed the most promising potential against the initial assessment criteria. These were grouped as either:

- 'Primary' metrics, where they scored particularly well against most of the criteria; or
- 'Secondary' metrics that were considered to have merit as supplementary measures that could be monitored as a check against potentially perverse behaviours that might arise from one or more of the primary metrics.

2.4 We then subjected the 'short list' of metrics to testing and feasibility analysis. This included the following activities:

a) Detailed metric definition;

a) Graphical projection of metrics and statistical testing with potential parameter weightings in order to examine historical trends;

b) A feasibility assessment involving examination of the practical issues involved in capturing the relevant data and developing routine reporting systems for the variable parameters;

c) Further consideration of how far the KPIs, as defined, meet the objectives of the monitoring and targeting process and the extent to which they result in perverse incentives; and

d) Verification of functional specification and determination of the appropriate calibration of fixed input parameter weightings.

Evaluation criteria

2.5 We adopted a two stage evaluation framework to facilitate the selection of the preferred KPIs.

2.6 The first stage involved assessing each of the metrics on our 'long list' against four criteria designed around the objectives of the ORR. These stage one criteria are described below.

Stage 1 Criteria

(i) Ease of understanding and calculation

2.7 Any metric must be relatively easy to calculate such that the calculation process can be subject to automation and the result published on a regular basis. Moreover, industry stakeholders must understand and "buy-in" to the metric(s), and be able to draw clear conclusions from trends over time as to whether the impact of possessions is improving or deteriorating.

(ii) Alignment with rail network user requirements

2.8 The need for simplicity implied by the above criterion must be balanced against the need to ensure that the metric(s) adequately reflects the range of impacts on network users, according to the different characteristics of possessions. For example, as far as possible it should reflect the availability of diversionary routes and alternative/substitute modes as well as recognising different user characteristics (passenger and freight).

(iii) Use of existing data/systems

2.9 Any metric should make the best use of existing industry data sources and systems. Development of new systems can be time consuming and costly, and require additional resources to monitor and maintain.

(iv) Potential for disaggregation

2.10 Rail users will be more concerned with the performance/availability of those parts of the network that are relevant to their usual journey/service and less concerned with overall network performance, and therefore the ability to present a metric at an appropriate level of disaggregation is important.

Stage 2 Criteria

2.11 The second stage of the evaluation framework involved examining each of our preferred metrics on our 'short list' against a wider range of criteria, including those outlined above and the following additional considerations:

(v) Sensitivity of the KPI to changes in parameter values.

2.12 'External' factors which could influence the KPI (e.g. change in number of trains operated) need to be taken into account. It is important that such factors do not lead to significant deterioration in the KPI notwithstanding the beneficial impact of changes to the number, location or timing of possessions. Where necessary, effects of this kind can be addressed through appropriate normalisation of the chosen metric.

(v) Ability to update the KPI to take account of changes in rail strategy and policy

2.13 A number of changes in the broader regulatory framework are possible, not least changes to the Schedule 4 compensation mechanism following the current review. The chosen KPI(s) must be readily adaptable to reflect such changes.

(v) Robustness against potential for introducing perverse incentives on Network Rail

2.14 There is a risk that any one measure may incentivise Network Rail to adopt strategies that are counter to the objective of reducing the disruptive effects of possessions on operators and network users, or to broader objectives such as making the best possible use of existing rail capacity. For example, in principle a metric that deteriorated simply because of an increase in the number of trains operated, regardless of the underlying pattern of possessions, could discourage Network Rail from accepting additional services. Again, such incentives may need to be addressed through appropriate normalisation techniques as well as through companion measures reflecting the company's other objectives.

2.15 Details of our metric option sifting and option assessment are documented respectively in the following reports:

- 'Interim Report – Development of Metric Options', July 2007
- 'Assessment of Options Report – September 2007'

Industry consultation

2.16 A draft proposal for Network Availability KPIs was sent to a cross section of industry stakeholder representatives who were then invited to a seminar on 3rd October 2007 at which the metrics were presented and comments invited.

2.17 In addition, ORR, as part of its wider industry consultation on Network Rail's Outputs for the Periodic Review 2008, published our Option Assessment Report[1] and invited views on the specific proposals in chapters 4 and 5.

2.18 In developing the proposed suite of Network Availability KPIs we have taken account of comments received from this industry consultation and as a result some changes have been made.

System specification

2.19 Key considerations in developing the Network Availability KPIs were the availability of existing data sources and systems and the ability to implement the metrics within a relatively short time frame and without the need to undertake extensive system development and modification. An assessment of the industry data systems was undertaken including, in particular, Network Rail's Possession Planning System (PPS) and the Schedule 4 Compensation System (S4CS).

2.20 Following detailed consideration of how the appropriate data can be drawn from existing industry sources and how they should be formatted for the purpose of calculation and presentation of results, a high level functional specification for a Network Availability KPI Reporting Suite (NARS) has been prepared. This is

[1] http://www.rail-reg.gov.uk/upload/pdf/pr08_sdg_ntwkav-sep07.pdf

documented separately[2] and provides:

- an overview of the proposed Network Availability KPI's as set out in this paper;
- a description of the required calculations;
- an outline specification of data required for these calculations;
- an initial view on structure of data tables that may be required to develop a NARS database; and
- an overview of the external process required to derive input parameters and interfaces with legacy Industry Systems.

[2] 'Network Availability Reporting Suite (NARS) - Outline Technical Specification, November 2007

3. CONSIDERATIONS AND KEY ISSUES

3.1 Given the study objective of defining a KPI or suite of KPIs that give proper weight to the different characteristics of possessions and their impact on users of the network, we identified a number of potential ways of measuring Network Availability:

- Infrastructure availability;
- Train operator impact;
- Timetable impact – impact on train journey time;
- Passenger impact; and
- Level of predictability and reliability.

3.2 In this section we explain the key issues associated with each of these types of measure and also consider other factors influencing the practicality their measurement.

Infrastructure availability

3.3 This approach builds on the KPI metric already developed by Network Rail, which records overall Network Availability at a national level. This KPI is based on a sum of all track-kilometres that are unavailable for service. This is subtracted from total track-kilometres to provide a measure of the network available for service, expressed as a percentage per period.

3.4 A limitation of this Network Rail KPI is that it does not reflect the value of that availability to passenger or freight operators or users of the network. There is no distinction between lost availability of track during a time when few or no trains are scheduled and the loss of a critical junction or intensively used section of track such as on a busy commuter route.

3.5 We have proposed two approaches that weight the track-km available, firstly by the level of usage and secondly by the relative value of that usage.

3.6 The first approach is to weight available track-km by the number of trains operated. This would still have the shortcomings in terms of not reflecting the direct impact on operators, but it could offer a relatively straightforward improvement to Network Rail's current availability KPI and we have proposed this approach to establish a measure weighted by the number of freight trains operated.

3.7 The second approach is to weight by apportioned revenue. This would reflect the relative importance to the operator and by using revenue as a 'common currency' it would be possible to create a combined passenger and freight metric.

3.8 However, there are commercial sensitivities which inhibit the accessibility of revenue data by operator and we believe that it is highly unlikely that freight operators would be prepared to release such information. To get around this issue we have proposed to use an average revenue per train-km value and apply this to the number of train-km by traffic type. This would allow some differentiation between passenger operators where

revenue per train-km can potentially be obtained by Service Group, whilst an average revenue per freight train-km could be derived by summing revenues from published FOC accounts and dividing by total freight train-km.

3.9 This second approach would then weight available track-km by actual train-km multiplied by the relevant average revenue/train-km. This would be a fairly coarse and simplistic measure and would still have the shortcoming of not reflecting the direct impact on operators, but does provide a practical basis for a combined freight and passenger metric.

3.10 In order to apply these weightings it is necessary to divide the network geographically. Having given consideration to this, we concluded that the most appropriate level of geographic disaggregation is by Engineers' Line Reference (ELR). Actual rail traffic data by operator is recorded for each ELR in the ACTRAFF database and planned scheduled traffic is recorded similarly in the NETRAFF database. This issue is discussed further below under 'Other relevant key issues'.

Train operator impact

3.11 The impact of possessions on operators manifests itself in a number of ways:

- **Loss of revenue due to interruption to passenger demand.** This can be an immediate effect and also a longer term impact, particularly where services are frequently interrupted (e.g. by weekend closures) or subject to change at short notice where passengers perceive the service to be unreliable. This can be particularly acute for late evening and weekend markets. In the case of freight operators, an inability to offer a reliable and predictable service can lead to lost accounts with freight shippers simply switching modes.

- **Additional costs of operation.** These are associated with additional train mileage (including track access charges), revised fleet maintenance schedules and training and resources to maintain a capability to operate over diversionary routes.

- **Additional costs of providing rail replacement bus and taxi services.** These vary considerably by operator, but can be very significant where, for example, diversionary routes are not available.

- **Costs of business disruption.** These include resources engaged in train planning, scheduling temporary timetables, publicity and the general level of management distraction from delivery of the original planned service.

3.12 Schedule 4 is already designed to compensate passenger operators for the loss in revenue for planned possessions. Whilst the effectiveness and efficiency of this mechanism has been the subject of review as part of a parallel study, in principle, the Schedule 4 compensation mechanisms can be adapted to inform a metric to reflect the revenue impact on passenger train operators.

3.13 With the exception of possessions associated with enhancements ('Network Change') or where 'Significant Restrictions of Use' apply (where there are currently bespoke arrangements for compensation for additional costs incurred, agreed by negotiation),

there is no similar compensation mechanism for freight operators affected by planned possessions (although we understand that at the time of writing, an extension of the terms for compensation payable to freight operators under Schedule 4 is being considered). In the absence of a systematic compensation regime for freight operators, there are no appropriate data systems on which to directly relate possessions and the impact they have on freight operators.

3.14 With the exceptions referred to in the paragraph above, there are no existing mechanisms for compensating TOCs or FOCs for the costs incurred as a result of possessions. We considered estimating operating cost as a function of train distance in order to provide a metric that reflected the relative impact of possession on TOC/FOC costs. However, the problem with such a metric is that any increase in train-km (and thus costs), caused by diversions for example, can be offset by a reduction in train-km due to cancelled or curtailed services, thus making the underlying effect difficult to determine. Furthermore, in respect of freight, there are difficulties in capturing the change in train-km arising from possessions due to the complexity of freight schedules. This point is discussed further below under 'Timetable Impact'.

3.15 As noted above, the cost of rail replacement bus services is more significant for some operators than others. Where there are alternative tracks (e.g. fast lines and slow lines) or diversionary routes available, the extent to which rail rail rail replacement bus services are required when possessions take place may be quite limited (e.g. South West Trains), but where they are not prevalent, the level of rail replacement bus services can be considerable (e.g. ONE). Also, the nature of the market served and the relative yield per train-km varies considerably, such that for a given possession the cost of rail replacement buses may be relatively small compared to the value of revenue lost (for which compensation is paid through Schedule 4) for an Inter-city operator (e.g. Virgin West Coast), whereas the bus replacement costs are likely to make up a much larger component of a regional operator's costs (e.g. Scotrail).

3.16 The inconvenience to passengers of having to transfer between trains and rail replacement bus services, the poor quality of some of the buses provided and the increase in the resulting journey times were highlighted by some of the stakeholders interviewed. Furthermore, some stakeholder respondents commented that they had a concern that Network Rail was reluctant to exercise single line working and thus proliferate need for rail replacement bus services. The issue of single line working is discussed further below under 'Other relevant key issues'.

3.17 We believe that a metric that reflects the extent to which rail replacement bus services are necessitated by possessions would serve as a useful check on this component of operator costs and passenger disruption. We considered a metric based on rail replacement bus hours and have proposed that such a measure would be useful as a secondary KPI to supplement the primary Network Availability KPI(s). The issue of rail replacement bus services is discussed further below under 'Other relevant key issues'.

3.18 Whilst a metric that reflects the net financial impact would be desirable, there are difficulties of practicality. We considered the concept of such a measure, but the absence of data sources to reflect the true costs to operators prevents the net financial effect from being determined. The recently commissioned study to identify

improvements to the current compensation regime for costs incurred by TOCs as a result of possessions is being undertaken in parallel to this study. In the event that the outcome of that study results in a mechanism, such as an extension of the Schedule 4 regime to incorporate a cost compensation component, we would recommend that our suggested metrics drawing on the S4CS should be reviewed to see if a cost component could be incorporated.

Timetable impact – impact on train journey time

3.19 In principle, the timetable impact on passenger train journey time is already captured quite comprehensively within the Schedule 4 regime. The process involves a manual comparison between the planned timetable (defined as the First Working Timetable) and the revised timetable for operation at the time of a relevant possession (defined as the Applicable Timetable). For each possession a manual judgement is made on whether the difference between these timetables is due solely to the possession or partly due to the possession and partly for other reasons (e.g. TOC request due to special event). The difference between the two timetables is determined from the Train Service Database system and a percentage attributed reflecting the extent to which the possession is considered responsible for the difference.

3.20 The timetable differences are measured in terms of a number of attributes including journey time, journey distance and calling points and the relevant percentage applied. These differences inform the NREJT and WACM values as applied in the Schedule 4 compensation regime.

3.21 It should be noted that a comparison is also made between the Applicable Timetable and the Corresponding Day Timetable. Where the First Working Timetable has been adjusted to make allowance for possessions a Corresponding Day Timetable is used to reflect the typical timetable that would have been operated had the possession not been planned. The compensation payments derived from S4CS are based on a blend of comparisons of the Applicable Timetable with the First Working Timetable and the Corresponding Day Timetable.

3.22 Whilst there is an element of manual intervention, this system seems reasonably robust for capturing the actual impact of possessions on passenger train journey time and the stopping points affected. We have considered options using this measure, applying an average revenue weighting in order to provide a measure that captures the impact on passengers, at least to some degree.

3.23 The measure is somewhat more problematic for freight trains. At present, freight trains are not included in the timetable comparison for S4CS purposes. However, since such trains have a similar coding structure it would be theoretically possible to include them and, by creating ‘dummy’ service groups and monitoring point weightings, operator specific or traffic specific flows could be reflected. The main difficulty arises from the lack of a stable freight timetable due to the variable nature of freight train operations. In particular:

- The relatively short planning horizon for freight operators means that there are a considerable number of additions, subtractions and alterations between the drafting

of the 'First Working Timetable' (FWTT) and the period of currency of that 'base' timetable;

- The utilisation of timetabled paths varies considerably, where for some commodities (e.g. Coal) the actual utilisation of scheduled paths is less than 50%, while for others (e.g. Intermodal) it can be as high as 95%; and

- Many freight services are scheduled and operated at short notice (entered into the timetable by the 'spot bidding' process), where they may be scheduled even after a possession with a short notice period has been planned.

3.24 Freight access rights take one of three forms. Level 1 rights, Level 2 rights and Spot Bid rights. Level 1 rights give access to timed train slots at both the origin and destination of the traffic and are often route specific. Level 2 rights give access to a quantum of train slots between an origin and destination; these train slots can use any available route at a time which is determined when the relevant timetable is created. Spot Bid rights are available at shorter notice and allow the operator to gain access to spare capacity that is available on the network at short notice. Given that Level 1 rights are most likely to appear as route specific paths in the FWTT they could be more easily incorporated into a timetable based metric. Thus the metric could be developed to reflect availability for Level 1 freight paths. However, such a measure would exclude a very significant proportion of freight traffic. Most freight trains operated by the more recently established FOCs and freight train movements associated with newly acquired contracts are scheduled in paths acquired under Spot Bid arrangements.

3.25 Thus, if a similar approach to that used in Schedule 4 for passenger services were adopted for freight services, there would be considerable difficulty in determining timetable changes due to the variability of the 'base' timetable. In addition, differentiating timetable changes due to a possession from those induced by the operator, particularly in view of the sheer volume of operator-generated changes. Whilst we note that there has been a trend towards increasing timetable stability in some freight flows we do not believe this could be developed as a practical metric in time to meet the CP4 time scale.

3.26 Other freight issues are discussed below under 'Other relevant key issues'.

Passenger impact

3.27 Given the desire to reflect the impact of possessions on the user, a measure that reflects the direct effect on the passenger is particularly important in meeting the ORR's and Network Rail's objectives for the KPI.

3.28 Again, the availability of data from S4CS means that the effect on passenger journeys can be sourced from the same factors that are used to derive the impact on passenger revenue. A reasonable representation of the impact on passenger-experienced journey time can be achieved by applying the average number of passengers per train by relevant Service Group to the 'NREJT + WACM' values derived from S4CS. In principle, such a measure could be further refined to take account of the 'value' of notification given (as captured by S4CS), the relevant "Busyness Factor" for the

period and the values of time of relevant users (e.g. according to the profile of Business, Commuter and Leisure passengers for each Service Group).

3.29 A coarser measure could be based on a count of passenger journeys affected by possessions, without reference to the magnitude of the impact or the relative value of that impact to the passengers affected. Whilst this would certainly be simpler to calculate, given the data readily available from S4CS, there seems little merit in such a measure compared to one which took account of different impacts across different types of service and groups of passengers.

Level of predictability and reliability

3.30 A key issue for many of the stakeholders interviewed was the level and consistency of notice given for possessions. For long distance passenger operators, many customers book on line and require reservations. The ability to do this is constrained by the timing of uploads of timetable changes to the Train Service Database (TSDB). Currently, the cut-off period for this is 12 weeks in order for service changes to appear in the 'Informed Traveller Timetable' that is made available to passengers. Whilst only a relatively small proportion of customers require bookings and reservations further in advance than this, the current system nonetheless compromises potential revenues, particularly on some high value routes where there is strong competition from air and on which airlines are able to offer reservations up to a year ahead.

3.31 For other operators, where advance reservations are less significant, the 12 week cut-off period is less important for sales, but having sufficient notice to be able to plan and organise resources and to ensure that publicity of the timetable change is properly provided remains important.

3.32 For freight operators, the predictability and level of notice given regarding possessions was also cited as a key issue by those stakeholders interviewed. There was also a perception that many possessions are notified and then amended or cancelled, thus exacerbating the planning workload.

3.33 The Notification Factor within the Schedule 4 regime provides a mechanism for reflecting the value of notice to the passenger and the effect this has on revenue. Whilst we see some merit in retaining this component in a Network Availability metric in that it provides some incentive to NR to plan possessions earlier and given that it is already captured in the S4CS data system. However, we note that this element is being subject to review as part of the parallel exercise to consider modifications to the revenue compensation mechanism in Schedule 4. In addition, inclusion of the Notification Factor will also complicate the metric and make it more difficult to interpret. For example, an improvement in the metric could simply reflect that notifications were taking place earlier without any material reduction in their actual impact. We examined the effects of including and excluding the Notification Factor and found that it had only a small effect on the results. However, we given the importance of the issue to stakeholders, we have retained this element by proposing it as a separate secondary metric.

3.34 We also considered having other secondary metrics which would enable the reliability and predictability of possessions to be monitored. These included:

- The percentage of possessions uploaded to the National Timetable database on or before the 12 week threshold;
- The average notification period for possessions
- The percentage of possessions exercised; and
- The percentage of possessions amended or cancelled.

3.35 On further investigation it emerged that there are significant practical difficulties associated with recording the notification of possessions to operators and the tracking of possession amendments and cancellations. In respect of notification, the process of actual notification to operators is routinely iterative and involves meetings and, potentially, negotiations between Network Rail and the parties involved. These arrangements are not formally recorded on a systematic basis. The possessions are published in the Rules of the Route which are frequently updated during the timetable development process. Whilst the notification discount factors as applied in S4CS are derived from the possessions as they appear in the Rules of the Route, they are subject to a further audit process before being entered into S4CS and compensation payments determined. Possessions that only affect freight operators are by definition not subject to this process. We understand that frequently the version of the Rules of Route for any given possession recorded in PPS may be later than the first published version in which it appeared and therefore would not be a reliable source of possession notification date. For these reasons we have proposed to limit monitoring of possession notification to measures that can be reliably and routinely derived from the S4CS discount factors.

3.36 Possession amendments and cancellations are also difficult to track from PPS. Possessions which are amended may be cancelled and then reinserted as new possessions. Other possessions may be amended even where they do not have a material effect on operators. Depending on the timing of such changes they may or may not appear within PPS. Whilst we see some value in monitoring amendments and cancellations, the current systems do not lend themselves to capturing this information routinely in a meaningful way. However, we have proposed a secondary metric to monitor late possession cancellations. This would capture those possessions that are cancelled after the issue of the Weekly Operating Notice and therefore are likely to result in abortive costs as operators will have planned resources to accommodate such possessions and there may be little time left to notify their customers.

3.37 Another factor of concern to operators and their customers is the impact of possessions that overrun their planned duration. There is a risk that a regulated target for Network Availability could lead to behaviours which have perverse consequences. For example, if more work is concentrated within possession periods, in order increase the time that the network is available, the risk of possession overruns could also increase. This could be particularly undesirable where such overruns disrupted morning peak services on busy commuter routes. We believe therefore that a measure of possession overruns would also be desirable. This would be relatively easy to draw out as a measure, since “possession overrun” is already a cause code used in recording delays incurred by operator and by location.

Other relevant key issues

3.38 Other key issues that have emerged during the course of this study are discussed below.

Disaggregation of Network Geography

3.39 There is a requirement to be able to report KPIs by network geography to assist in analysis of performance of NR maintenance regions and allow comparison of the relative impacts of possessions on different operators. Also it will be required to report the KPIs by region, not least an ability to identify Scotland separately from England and Wales.

3.40 The ability to disaggregate possessions data derived from the S4CS geographically, and to assign certain parameters such as train-km, is dependent on mapping possession locations to a common geographic locator.

3.41 During the KPI development phase, the use of Strategic Route Sections was originally proposed as the basis of geographic disaggregation. This geography is used within the NR Infrastructure Cost Model (ICM), the Industry Network Modelling Framework (NMF) and within Route Utilisation Strategy/Strategic Business Plan publications. During development it became apparent that NR engineering systems do not capture data by this geography (and in particular the PPS) and it proved difficult to find a consistent and usable mapping system. On further investigation, it became apparent that actual rail traffic data by operator is recorded for each ELR in the ACTRAFF database and planned scheduled traffic is recorded similarly in the NETRAFF database. Further more, ELRs are also recorded in the possession information captured within PPS.

3.42 We have proposed that ELRs are used as the basic reference of network geography, and that data is captured at this level. This will enable some flexibility in the choice of geographic areas for the metrics as the required areas can simply be reported by aggregating by the appropriate selection of ELRs.

3.43 For each possession recorded in PPS, the ELR's affected are recorded, albeit not in a convenient form for automatic referencing. We have identified the need for some modifications to the PPS and the data feed to S4CS to enable an automated association between possession references and the ELRs affected.

Freight

3.44 During the interviews conducted with stakeholders, a number of respondents identified the importance to freight operators of the availability of a route between origin and destination. For many freight traffic flows, there are alternative routes available and thus a possession on one route can be mitigated by using a diversionary route. On the other hand, for some freight flows, especially containerised inter-modal traffic requiring the larger W10 loading gauge, the availability of diversionary routes can be very limited. It was suggested that there could be merit in a measure of route availability between key freight traffic nodes. As a general measure for all freight traffic, this would be problematic given the sheer number and complexity of origin

and destination pairings. But for a core network of W10 cleared routes between key terminals, there could be some merit in such a measure, although it would only be of interest to the stakeholders in such inter-modal traffic. We have not recommended taking this further at this stage as it is unlikely that such a measure could be developed within the CP4 programme time scales.

3.45 Another key issue is that with no equivalent possession compensation regime for freight, there is a lack of existing data sources from which to derive the possession impacts on freight trains. The problems of discerning the impacts of timetable changes may not be insurmountable, but as discussed above need further investigation.

3.46 It appears that each freight operator employs their own bespoke systems to monitor possessions to furnish themselves with sufficient information to support claims and monitor trends. This will not aid automation of data collection and makes analysis of historical trends difficult if not impossible. However, having discussed this with some of the freight operators, we conclude that it may be more practical to develop a metric that is informed by data collated and submitted by the FOC, than for NR to design a new data monitoring system to fulfil this role.

3.47 There is also a lack visibility of freight revenues. Tariffs are negotiated between operators and customers on a confidential basis. We have derived some generic values for freight in general based on the declared revenues in the published accounts of the major operators, but this does not give any indication of the relative values by commodity.

Rail replacement bus services

3.48 Some consultees have suggested monitoring the number of train services that are subject to replacement by buses due to possessions or even to monitor the number of rail replacement bus services operated.

3.49 The difficulty with the former suggestion is that rail replacement bus services do not necessarily mirror the train service that they replace. For example a rail replacement bus service may be instituted to serve a single station stop that has been omitted, while the train still operates virtually as scheduled. Other scenarios can be quite complex with where bus services may be provided to offer links to alternative routes or multiple bus services are provided to serve different stations omitted by a single train service.

3.50 Another difficulty with monitoring the number of train services that are subject to replacement by buses is that the Train Service Database that contains details of each service does not readily enable identification of such trains.

3.51 Whilst the Train Service Database does allow the number of rail replacement bus services to be identified, we consider a measure of bus-hours derived from the same source as more valuable. The former would not distinguish between a bus service that only involved a short journey, such as to an omitted station stop, from those involving very long journeys where a whole line of route is closed (e.g. Edinburgh to Newcastle).

Single line working

3.52 Some industry consultees expressed an interest in seeing greater use of Single Line Working (SLW) where this were a viable option to enable through train services to be retained rather than their replacement by bus services. For a measure that could be routinely applied across the network it would be difficult to differentiate line closures where SLW (i.e. loss of one track of a two track railway) is instituted from situations where a single line closure occur in more complex sections where there are more than two tracks available or where there are complex layouts or junctions are involved. To get round this problem, we have proposed a secondary metric that monitors the proportion of possessions that result in a whole route blockage.

Suppressed demand

3.53 An issue raised in the consultation process was that of suppressed demand. It was suggested that the frequent or routine loss of availability at certain times (e.g. weekends) has resulted in suppressed demand (passenger and freight). Therefore by weighting metrics by existing levels of usage or demand would result in the value of network availability during such periods being artificially suppressed.

3.54 Whilst we acknowledge this issue, at this stage there does not appear to be sufficient evidence of the scale of demand suppression and therefore no basis for determining a weighting adjustment. However, the design of the metrics are such that in the event of such information becoming available in future, the weightings could be adjusted accordingly.

Effective use of possessions

3.55 This study has been concerned with measures of the availability of the network to operators and with secondary measures designed to address potential perverse incentives that could result from the proposed primary metrics. While we have proposed some metrics that address the effects of the way possessions are exercised (e.g. extent of cancelled possessions, notification period and possession overruns), the scope of this study does not extend to the efficiency or effectiveness of the work undertaken during possessions.

3.56 We nevertheless note that the National Audit Office, in their review of the modernisation of the West Coast Main Line, recommended that a KPI should be developed to reflect the extent of work undertaken during possessions. 3 Such a measure would need to take account of the wide ranging nature of the engineering activities undertaken during possessions and the inherent measurement complexities that follow from this. In addition, we suggest that there will anyway be incentives on Network Rail to exercise possessions efficiently, not least the need to improve performance in line with the HLOS and the performance compensation arrangements within Schedule 8. We also note that the Network Rail Monitor already has a number of KPIs which monitor engineering activity levels, and these will complement the

[3] The Modernisation of the West Coast Main Line, National Audit Office, 22 November 2006.

availability metrics proposed in this report.

Rationale for metrics proposed

Unified Metric

3.57 A key challenge for establishing a single unified measure of Network Availability that reflects the relative values of both passenger and freight users is in finding a unit of value common to both modes. The only logical unit would seem to be an economic one. We considered the concept of combining the economic value of possession impacts on passengers, as described above, with an equivalent economic value of the impact on freight. Unfortunately this approach was constrained by:

- The lack of data sources relating the effect of possessions on the actual operation of freight and services; and
- The absence of established economic values of time for rail freight commodities.

3.58 As a compromise, we considered a combined metric based on a common denominator such as train-km, but without any basis for the relative importance of passenger train-km compared to freight train-km this would seem to have limited merit.

3.59 We therefore propose an approach that aims to get closer to an economic value by identifying the 'revenue at risk' for both passenger and freight operators on different parts of the network and using this as a basis for a combined metric.

Freight Metric

3.60 The specific interests of the rail freight industry are such that there seems to be merit in having a KPI that monitors trends in possession impacts on freight traffic. As discussed above, there are many difficulties in capturing information to determine the actual impacts on freight operators, but we have put forward a measure that we believe to be practical and realistic. This will offer a significant improvement from the current situation where there is no means of determining whether network availability for freight operators is improving or deteriorating.

Passenger Metric

3.61 The S4CS provides an effective and readily available mechanism to capture the direct impacts on passenger train services with considerable precision. This provides an opportunity to introduce a metric that goes a long way towards meeting the objectives set for the Network Availability KPI. Whilst it is limited only to passenger services we believe it is essential to include it as a primary measure of network availability.

Secondary Metrics

3.62 We have also propose some 'secondary' metrics. These would complete the three 'primary' metrics referred to above and would serve as diagnostic tools to monitor other dynamics that would be affected by Network Rail's possession strategy. They could also be used to monitor and discourage potential perverse effects (e.g. shortened possessions leading to increased risk of overrun).

4. PROPOSED NETWORK AVAILABILITY KPI's

Introduction

4.1 As discussed in Section 3, there are a number of issues that make a single Network Availability metric that reflects the value to all users particularly difficult to define and calculate. We have therefore proposed a suite of 'primary' metrics that show how the value of impacts on the user can be represented for passenger, freight and both combined. We also propose some 'secondary' metrics which could be used to monitor and discourage potential perverse effects.

4.2 The measure of Network Availability is proposed to be recorded by way of three primary metrics and six secondary metrics as summarised in the table below.

TABLE 4.1 SUMMARY OF KPI'S

Primary KPI's		Secondary KPI's	
Passenger	EPJwVT	Rail Replacement Bus Hours	BusHRs
Freight	TwF	Possession Notification	N t-12
Unified	RR	Possession Notification	NDF
		Late Possession Cancellations	LPC
		Whole Route Block	WRB
		Overrun Delay (Delay Min)	ODM
		Overrun Delay (Canc Min)	OCM

Primary metrics

4.3 Three primary metrics have been developed, that can be used to monitor possession activity, and the impact of this activity on Passengers and Freight Operators. A revenue based metric has also been developed that provides a combined measure of passenger and freight impacts. These metrics are described below. Further details on their definition and data sources are provided in the specification document[4].

4.4 It is anticipated that these primary metrics may form the basis of a regulatory output target for Network Rail commencing in the next Control Period (CP4).

Passenger metric (EPJwVT)

Excess passenger journey time and weighted cancellation minutes (EPJ,) weighted by busyness, passenger journeys and user value of time (wVT)

Measurement unit: £/train-km representing the value of the excess journey time per train-km per period.

4.5 This metric measures the value of the impact of possessions on the excess journey time as experienced by the passenger, normalised to total train-km. It takes account of

[4] Network Availability Reporting Suite (NARS) - Outline Technical Specification, November 2007

the effect of cancellations and reflects the economic value of the additional journey time incurred.

4.6 The measure is calculated as follows:

$$EPJwVT = \frac{\sum_{SG}\left[\sum_{d}\left\{\left(NREJT_{SG,d} + WACM_{SG,d}\right) \bullet BF_{SG,d} \bullet PASS_{SG,d} \bullet ToDW\right\} \bullet VoT_{SG}\right]}{\sum_{SG} PT_{SG}}$$

The first part of the measure is derived from the outputs of S4CS where:

$NREJT_{SG,d}$ is the average extended Journey Time per train as a result of a possession (Network Rail Restriction of Use) in respect of the relevant Service Group(s) calculated daily; and

$WACM_{SG,d}$ is the weighted average of Cancellation Minutes per train for the relevant Service Group (s) calculated daily.

4.7 The values of NREJT and WACM are calculated as defined in Schedule 4, Part 3, paras 3.4 (c) and (b) respectively.

4.8 The second part of the measure represents a weighting to reflect the number of passenger journeys affected for the relevant Service Group(s).

Individual terms are defined as follows:

$BF_{SG,\,d}$ is the busyness factor applicable to the relevant day and Service Group(s), as defined as in Schedule 4, Part 3, para 3.4 (d); and

$PASS_{SG,\,d}$ is the average number of passenger journeys per day for the relevant Service Group(s) multiplied by a time of day weighting (ToDW).

Where ToDW is a pre-determined fraction representing the percentage of passenger journeys for the relevant Service Group during the time of day (average values for each hour of the day) and day of week (three average values: for weekdays, Saturdays and Sundays) affected by the corresponding possession.

The calculation for daily values is then aggregated for each Service Group by period.

4.9 In each case, the relevant calculation takes account of Monitoring Point weightings, as defined in Schedule 8 of the Track Access Agreements, and hence these measures reflect differing levels of passenger demand across individual Service Groups by location for the relevant day.

4.10 The aggregated daily values are then multiplied by the weighted value of time for the relevant Service Group(s) defined as follows:

VoT_{SG} is the value of time for the relevant Service Group(s), reflecting the ratios of business, commuter and leisure traffic and associated values of time for each passenger group (as defined in DfT WebTAG appraisal guidelines).

4.11 The calculation is then normalised against changes in train service level by dividing the whole by the sum of scheduled passenger train-km across all Service Groups (shown in calculation as PT_{SG}). This normalisation will offset the tendency of the numerator in the expression to increase with the number of train services regardless of any change in the underlying pattern of possessions. The metric nevertheless requires an explicit calculation of the total economic value of disruption caused by possessions in a given period or year.

4.12 It is proposed that this metric is calculated as a single national network measure. However, it can be calculated for specific operators or geographic regions by summing the calculation for the relevant Service Groups required.

4.13 A summary assessment of this metric against the key criteria is shown in the table below. The metric performs well against many of the criteria, although it is acknowledged that it has some inherent complexity making it potentially difficult to convey to a wider stakeholder audience.

TABLE 4.2 SUMMARY ASSESSMENT OF PASSENGER METRIC (EPJWVT)

Assessment of metric against key criteria	Comment	Rating
Ease of understanding within the industry and across a wider group of stakeholders	Some basic understanding of the concept of Extended Journey Time and the economic value of time is required.	Fair
Ease of calculation given existing data sources and systems	Can be calculated from existing S4CS and pre-determined input parameters for passenger VoT weightings.	Good
Potential level of disaggregation	Can be expressed at operator and SG level, and potentially at ELR level.	Good
Sensitivity of the KPI to changes in parameter values	Analysis shows that the metric reflects a similar profile to Schedule 4 compensation payments. The metric is relatively insensitive time of day demand profiles, but is dependent on the demand factored Monitoring Point Weighting and Busyness Factors.	Good
Ability to reflect relative user values by time of day, day of week and seasonality	Value of time reflected and weighting can be further refined to reflect daily, weekly and seasonal profiles. Inclusion of Busyness Factor also ensures that seasonality can be reflected.	Good
Ability to update the KPI to take account of changes in rail strategy and policy	The metric is dependent on the Schedule 4 regime and S4CS.	Fair
Robustness against potential for introducing perverse incentives on Network Rail	Doesn't incentivise against strategies which favour passenger services at the expense of freight. Doesn't incentivise against short term notification.	Fair

Freight metric (FwT)

Track-km availability weighted by freight traffic level (TwF)

Measurement unit: Weighted percentage of track-km available per period

4.14 This metric measures the availability of track-km weighted by the level of freight traffic operated over each ELR. The measure takes the level of non-availability by ELR and applies a weighting to reflect the intensity of freight traffic scheduled over that section on the relevant day of the week. It is calculated daily taking account of the proportion of freight traffic operating by day of the week and aggregated to give a measure per period.

4.15 The measure is calculated as follows:

$$TwF = 1 - \left[\frac{\sum_{ELR} \left\{ \sum_{d} \left(TU_{ELR,d} \bullet FTW_{ELR,d} \right) \right\}}{\sum_{ELR} \left\{ \sum_{d} \left(TT_{ELR,d} \bullet FTW_{ELR,d} \right) \right\}} \right]$$

Where:

$TU_{ELR,d}$ is the track-km hours unavailable due to possessions for the relevant ELR on the relevant day;

$TT_{ELR,d}$ is the total track-km hours for the relevant ELR for the relevant day;

$FTW_{ELR,d}$ is freight traffic weighting[5], calculated as:

$$FTW_{ELR,d} = \frac{DwFT_{ELR,d}}{\sum_{ELR} \sum_{d} DwFT_{ELR,d}}$$

Where:

$DwFT_{ELR}$ is the average freight train movements per day attributed to a relevant ELR. The value is then weighted by the proportion of freight trains operated for the relevant day of the week for that ELR (such that the sum of the weightings for the seven days Sunday to Saturday would equal 1).

4.16 The values of $DwFT_{ELR,d}$ would be pre-determined as a fixed input, although these could be updated from time to time to reflect changes in freight traffic flows.

4.17 A summary assessment of this metric against the key criteria is shown in the table below. The metric performs well against some of the criteria, although it is acknowledged that an inherent weakness is that it does not measure the value of

[5] Note that the value of $FTW_{ELR,d}$ varies by ELR and day, and is multiplied by the corresponding value of $TU_{ELR,d}$ or $TT_{ELR,d}$, as appropriate, before the summation across days and ELRs is applied.

possession disruption to freight users.

TABLE 4.3 SUMMARY ASSESSMENT OF FREIGHT METRIC (TWF)

Assessment of metric against key criteria	Comment	Rating
Ease of understanding within the industry and across a wider group of stakeholders	Consistent with existing Network Rail availability KPI with a weighting for freight.	Good
Ease of calculation given existing data sources and systems	Requires variable data sourced from PPS and pre-determined data from ACTRAFF.	Fair
Potential level of disaggregation	Can be expressed by network geography down to ELR level.	Good
Sensitivity behaviour of the KPI to changes in parameter values	This metric would be sensitive to changes in the freight traffic weighting. An appropriate periodicity for the review of this pre-determined input will be determined in the design specification for this metric.	Fair
Ability to reflect relative user values by time of day, day of week and seasonality	Only freight traffic variability by day of week is reflected. User value not measured.	Poor
Ability to update the KPI to take account of changes in rail strategy and policy	The basic measures of track availability should continue to be possible to determine, whatever the rail strategy or policy.	Good
Robustness against potential for introducing perverse incentives on Network Rail	As a complementary measure to a passenger metric, could act as a check against strategies which favoured passenger at the expense of freight.	Fair

Unified metric (RR)

Revenue at risk (RR)

Measurement unit: Weighted revenue (£) at risk per period

4.18 This metric aims to provide a single unified measure of Network Availability, weighted by passenger and freight user value. Given the lack of data to support compatible parameters for passenger and freight, a measure of 'revenue at risk' is proposed as a proxy for user value. It is designed to utilise available data sources. The metric measures the average operator revenue at risk due to possessions.

4.19 The measure is calculated as follows:

$$RR = \sum_{ELR}\left[\sum_{d}\left\{TU_{ELR,d} \bullet RW_{ELR,d}\right\}\right]$$

Where:

$TU_{ELR\ d}$ is the possession track-km-hours calculated daily for the relevant ELR;

$RW_{ELR,d}$ is the weighted revenue at risk for the relevant ELR and the relevant day, calculated as:

$$RW_{ELR,d} = \frac{RF_{ELR,d} + RP_{ELR,d}}{TT_{ELR,d}}$$

$RF_{ELR,d}$ is the average daily freight revenue at risk for the relevant ELR;

$RP_{ELR,d}$ is the average daily passenger revenue at risk for the relevant ELR; and.

TT_{ELR} is the total track-km for the relevant ELR multiplied by the hours per day.

$RF_{ELR,d}$ is calculated as follows:

$$RF_{ELR} = RFT \cdot FT_{ELR,d}$$

Where:

RFT is the average revenue per freight train-km; and

$FT_{ELR,d}$ is the average freight train-km weighted by day of week for the relevant ELR and relevant day. The day of week weighting is calculated as the % of average weekly freight trains operated on the relevant ELR for the relevant day of week.

RP_{ELR} is calculated as follows:

$$RP_{ELR,d} = \sum_{SG} \left[RPT_{SG} \bullet PT_{SG,ELR,d} \right]$$

Where:

RPT_{SG} is the average daily revenue per passenger train-km for the relevant Service Group; and

$PT_{SG,,ELR,d}$ is the average daily passenger train-km for the relevant ELR weighted by day of week for the relevant Service Group. The day of week weighting is calculated as the % of average weekly passenger trains operated on the relevant ELR for the relevant day of week.

4.20 The values of RFT, FT_{ELR},d, $RPT_{SG,}$ $PT_{SG,ELR,d}$ and TH_{SRS} would be pre-determined as fixed inputs, although again these could be updated from time to time to reflect changes in freight and passenger traffic flows.

4.21 A summary assessment of this metric against the key criteria is shown in the table below. The metric achieves the aim of providing a single measure of Network Availability and goes some way to addressing most of the criteria, but it is a relatively coarse measure and therefore it is suggested that it forms part of a suite of metrics as proposed in this paper.

TABLE 4.4 SUMMARY ASSESSMENT OF UNIFIED METRIC (RR)

Assessment of metric against key criteria	Comment	Rating
Ease of understanding within the industry and across a wider group of stakeholders	Some explanation of the definition of 'revenue at risk' will be required.	Fair
Ease of calculation given existing data sources and systems	Requires variable data sourced from PPS. Robust measures of RTF may be difficult to derive due to commercial sensitivities.	Fair
Potential level of disaggregation	Can be expressed by network geography down to ELR level.	Fair
Sensitivity behaviour of the KPI to changes in parameter values	This metric would be sensitive to changes in the freight and passenger traffic weightings. An appropriate periodicity for the review of this pre-determined input will be determined in the design specification for this metric.	Fair
Ability to reflect relative user values by time of day, day of week and seasonality	Provides a proxy for user value. Doesn't capture revenue at risk varying by time of day, day of week and seasonality. There are difficulties in weighting freight traffic flows by commodity.	Fair
Ability to update the KPI to take account of changes in rail strategy and policy	Dependent on source of possession track-km-hours by SRS, but does not rely on any performance regime (e.g. Schedule 4).	Fair
Robustness against potential for introducing perverse incentives on Network Rail	Provides some incentive to recognise value of passenger and freight operations, but does not incentivise by time of day sensitivities.	Fair

Secondary metrics

4.22 Seven Secondary metrics have been developed in conjunction with the primary metrics. These secondary metrics will not form regulated targets, but are designed to:

- provide diagnostic monitors of factors relevant to operators which are not fully reflected in the Primary Metrics;
- facilitate identification of possible underlying causes of trend;
- act as a check against any perverse behaviours that might result from strategies designed to drive improvements against the Primary Metrics.

4.23 These metrics are described below. Further details on their definition and data sources are provided in the specification document[6].

[6] Network Availability Reporting Suite (NARS) - Outline Technical Specification, November 2007

Rail replacement bus Hours (BusHRs)

Measurement unit: Bus-hours per period

4.24 Whilst the primary passenger metric reflects the impact on passenger journeys, it does not take account of the disruptive aspects of transfers to rail replacement bus services, nor does it reflect the significant costs to operators of operating such bus services. We therefore consider that a metric that monitors the extent to which possessions have necessitated the requirement for rail replacement bus services would also be useful.

4.25 This metric can be used as an indicator of an important component of additional costs to the operator. It will be influenced by the extent to which an alternative route is retained for the operator (e.g. by using Single Line Working or use of diversionary routes).

4.26 The metric measures the rail rail replacement bus service hours operated due to possessions. It can be measured by extracting bus service hours by 'BR' Service Code from the national timetable Train Service Database (TSDB). It will be possible to split the metric by geography or TOC by sifting by the relevant Service Code. It has been drawn to our attention that not all rail replacement bus services are identifiable by a 'BR' code, however we believe these to be relatively few and therefore should not materially affect the overall measure.

Possession Notification by T-12 Timetable (N t-12)

Percentage of Possessions included in T-12 timetable

Measurement unit: Percentage of possessions per period

4.27 We consider that there is merit in having a separate metric which captures the extent to which Network Rail provides notification of possessions to the operator. As noted by some stakeholders, a key issue, especially to the passenger, is whether the timetable as published incorporates provisions for possessions.

4.28 The incorporation of the revised timetable resulting from a possession into the National Timetable Database 12 weeks in advance of the event was cited as an important issue by the operators that we interviewed. This helps ensure that most passengers are informed of the correct timetable when planning their journey. This is also important for on line reservations which are becoming increasingly popular. Thus a measure of possessions which are either incorporated in the First Working Timetable or are notified by the T-12 week cut off date for inclusion in the National Timetable Database would be useful in this regard. The T-12 threshold is also significant given its inclusion as condition in Network Rail's licence.

4.29 The metric would be measured as the percentage of possessions (excluding those unplanned possessions which would be subject to Schedule 8 compensation) per period that are either incorporated into the First Working Timetable and or entered into the National Timetable database at least 12 weeks before the date of the possession.

4.30 This metric can be expressed at a national network level or disaggregated by network geography by ELR or by operator down to TOC or Service Group. Using Service Groups, the measure could also be split by peak and off-peak. The data can also be arranged to give a comparison between days of the week (e.g. weekday/Saturday/Sunday).

4.31 We also note that in the event that future modifications to Schedule 4 introduce other Notification Period thresholds, this metric could be adapted accordingly.

Possession Notification Discount Factor (NDF)

Measurement unit: Percentage of possessions per period for each of three values

4.32 As noted in section 3, there are difficulties in determining notification of possessions to operators. However, in respect of passenger train operators, the Schedule 4 notification discount factors provide a reliable mechanism to the trends in the level of notification for possessions to be monitored.

4.33 This metric would record for each period the percentage of possessions falling into each of the three notification factor discount thresholds (NFMRE) as defined in columns C to E of Annex A to Part 3 of Schedule 4 corresponding with the following thresholds:

- In first working timetable
- In T-12 working timetable
- Later than T-12 working timetable

The number of possessions falling into each NFMRE category can be derived from S4CS.

4.34 This metric could be reported by Operator or Sector by sifting the S4CS possession data by the relevant Service Groups.

4.35 It would also be possible to disaggregate by network geography down to ELR but this would require ELR references to be additionally imported to S4CS or separately extracted from PPS by way of relevant possession reference codes.

4.36 It is not proposed to include freight services within this metric, since robust notification data is only obtainable from S4CS which does not include freight services.

Late Possession Cancellations (LPC)

Measurement unit: Percentage of possessions per period

4.37 As noted in section 3, there are difficulties in reliably determining possession cancellations. However, this metric is proposed to monitor late possession cancellations. This would capture those possessions that are cancelled after the issue of the Weekly Operating Notice and therefore are likely to result in abortive costs as operators will have planned resources to accommodate such possessions and there

may be little time left to notify their customers..

4.38 This metric is calculated as the number of possessions per period that were cancelled after issue of the Weekly Operating Notice (WON), divided by the total number of possessions recorded in the relevant period.

4.39 Possession cancellations after issue of the WON are recorded locally in the area control centres. A system will need to be established to enable such possessions to be logged and collated into a central database and potentially capable of being linked to NARS. Details to be logged and collated should include:

- Possession identification reference No. as previously allocated in PPS;
- Date and time at which possession was cancelled;
- It would also be useful to include a standardised list of causes for such cancellations, such that each entry is logged with a cause. This would aid diagnostic analysis of late possession cancellations by cause.

4.40 The total number of possessions recorded in the relevant period would be derived from PPS.

4.41 It could also be useful to monitor this metric by geographic region. This could be achieved by way of a look up to the relevant possession reference codes contained with PPS and use of the ELR codes to sift the data by region as required.

4.42 We are aware of some cases where possessions have been notified as cancelled where the work to be undertaken has not been cancelled but instead amalgamated under another possession reference. It will therefore be necessary to provide guidelines on the definition of possession cancellations to be recorded for the purpose of this metric.

Possessions Involving Whole Route Block (WRB)

Measurement unit: Percentage of possessions per period

4.43 As noted in section 3, consideration has been given to a measure of the extent of use of Single Line Working. Given the associated complexities and difficulties in capturing a meaningful measure, we propose instead a measure that monitors the proportion of possessions that result in a whole route blockage.

4.44 This metric is calculated as the number of possessions recorded as 'whole route blockage' divided by the total number of possessions recorded in the relevant period.

4.45 This metric will require inclusion of an additional field introduced into PPS such that each possession is recorded as a 'partial route blockage' or a 'whole route blockage'.

4.46 It will be possible to disaggregate by network geography by sifting the PPS possession data by the relevant ELR codes.

4.47 It could also be possible to disaggregate by operator by way of an ELR – operator reference table. This would enable a sift of the PPS possession data by the relevant

ELR codes.

4.48 Guidelines will need to be provided to ensure clarity of the definition of 'whole route blockage'. The intent is to reflect possessions where no trains are able to operate over the section of route within the immediate vicinity of the possession.

Delay Minutes Due To Possession Overrun (ODM)

Measurement unit: Delay minutes per train-km per period

4.49 There is a risk that incentives on Network Rail to reduce the duration of possessions lead to strategies that result in a greater number of possession overruns. These can be highly disruptive to passengers and operators alike, especially on busy commuter routes such as those in the London and South East sector where an overnight or weekend possession overrun can impact on morning peak traffic. This metric provides a means of monitoring the effects of possession overruns and can be disaggregated by operator (including freight and passenger).

4.50 This metric is measured as total delay minutes attributed to possession over-runs, divided by scheduled train-km, and expressed per period by operator or Strategic Route or at a national level. The weighting by train-km is applied to normalise against changes in the level of services scheduled.

Cancellation Minutes Due To Possession Overrun (OCM)

Measurement unit: Cancellation minutes per train-km per period

4.51 This metric is linked to the previous metric and is required to reflect cancellation minutes attributed to possession overruns since these are determined separately from delay minutes for Schedule 8 purposes. The metric is measured on the same basis as delay minutes but expressed as total cancellation minutes attributed to possession over-runs, divided by scheduled train-km, and expressed per period.

5. CONCLUSIONS

5.1 No single metric has been identified which would meet all of the criteria satisfactorily, although we have proposed a single unified metric weighted by revenue at risk as a proxy for user value, which would complement separate metrics for passenger and freight users.

5.2 We have proposed a suite of primary and secondary KPIs to provide a more comprehensive measure of Network Availability. We believe that secondary metrics can provide a useful role as monitors to check against perverse behaviours by Network Rail that could otherwise be incentivised by one or more primary measures.

5.3 All of the proposed KPIs will be able to be reported by standard Rail Periods, or annually. Once sufficient historical data is established, it will be possible to calculate moving averages that would assist in identifying trends and forecasting.

5.4 The absence of a systematic mechanism for capturing the costs of possessions to operators is an inhibitor to reflecting this component in a Network Availability metric. However, should revisions to Schedule 4 or other systematic mechanisms be implemented to compensate operators for costs arising from possessions, then it may be possible to incorporate a parameter linked to such a mechanism to reflect operator costs in a Network Availability KPI.

5.5 The absence of a compensation regime (other than Part G of the Network Code) for freight operators makes it difficult to develop metrics which reasonably reflect the value of the impacts on rail freight. The opportunity to address this may, at least in part, depend on the willingness of FOCs to submit additional data.

5.6 The quest for a useful freight related metric could be significantly advanced if the effect of possessions on freight timetables could be easily discerned. This is currently not available.

5.7 Whilst the proposed metrics are all output based, it was notable that a number of stakeholders interviewed expressed an interest in some input measures that would provide assurance of the efficiency and utilisation of possessions by Network Rail and the nature of the work carried out.

5.8 In order to implement a system to measure and report the proposed KPIs, the following modifications to existing systems will be required:

Possession Planning System :

- Introduce additional field to record ‘Partial Route Blockage’ or ‘Whole Route Blockage’;
- Modify the existing fields or create new fields to capture the identifier code for each ELR affected.

Schedule 4 Compensation System:

- System or process modification to ensure that start and end time information for possessions can be captured in a consistent and usable format.

5.9 Further details of these modification requirements are documented in the specification document[7].

5.10 An outline plan for the implementation of these KPI's for the commencement of Control Period 4 is summarised in section 6.

[7] Network Availability Reporting Suite (NARS) - Outline Technical Specification, November 2007

6. OUTLINE PLAN FOR IMPLEMENTATION

Milestones

6.1 It is an objective for the primary KPIs as proposed in this paper to be capable of being implemented as regulated target measures for Network Rail for the duration of Control Period 4 (CP4) effective from April 2009.

6.2 In order to achieve this there are a number of critical milestones that will have to be met:

- Network Rail will need to include projections of the Network Availabilty KPI's (NAKPI) in their revised Strategic Business Plan (SBP) which is required for issue April 2008;
- Moving annual averages of the KPI measures will need to be reported from the commencement of CP4 in April 2009, thus requiring the measures to be recorded from one year prior, i.e. April 2008;
- Network Rail will need to update the projections of NAKPI in response to ORR's draft determinations on the SBP in June 2008;
- ORR will finalise its determination on the SBP including setting the targets for NAKPI in October 2008; and
- Network Rail will be monitored against the NAKPI targets with effect from April 2009.

Implementation Tasks

6.3 In order to implement measurement of the NAKPI the following tasks are identified:

- Determine system interfaces required to derive data required for calculation of NAKPI;
- Design and implementation of a Network Availability Reporting System;
- Design and implementation of modifications to existing systems;
- Development and population of the databases that inform the pre-defined inputs to the calculation of the KPIs;
- Validation of pre-defined input values (for weightings and normalisation factors); and
- Activation of variable input data required from systems including PPS and S4CS.

Determine system interfaces

6.4 For each of the proposed metrics the relevant system interfaces need to be identified. For the primary metrics there are two types of system interface, direct inputs and

external inputs:

- Direct inputs from existing industry systems providing details of possessions on the network including time, location and (broadly speaking) service affected, impacts on passenger journey time, traffic/service volumes; and
- Pre-defined inputs derived through external processes. These are periodically defined weights to take account of the relative impacts of possessions on different locations on the network, at different times of day/days of the week and on different services.

6.5 Each of the secondary metrics is dependent on single interfaces with different systems.

Design and implementation of NARS

6.6 We have suggested a system-architecture, as outlined in the specification document[8], to provide a metric reporting suite (Network Availability Report Suite). However, the choice of solution should be determined by Network Rail with due regard to its other system requirements.

Modifications to existing systems

6.7 Modifications are required to the Possession Planning System to enable geographic location identifiers to be assigned to possessions and differentiate whole route blockages from partial route blockages. We also believe some relatively small adjustment may be required to S4CS to enable automated selection of date and time data.

6.8 Consideration should also be given to the implications for the accuracy of the input processes to these systems. It may be necessary to make specific provisions in the design of the input interfaces or to provide specific guidelines for the input operatives.

6.9 A new system will need to be designed to set out arrangements to capture possessions cancelled from the Weekly Operating Notice in a way that enables the data to be aggregated in order to calculate the Late Possession Cancellations metric. Details of these modifications are also referenced in the specification document.

Development and population of databases

6.10 Development and population of the databases that inform the pre-defined inputs to the calculation of the KPIs will be required. These include:

- Value of time weights (passenger metric);
- Day of week weights (passenger and freight metric);
- Time of day weights (passenger metric);

[8] Network Availability Reporting Suite (NARS) - Outline Technical Specification, November 2007

- Revenue and traffic weights (freight and unified metrics); and
- Reference data tables (including ELR characteristics).

Validation of pre-defined input values

6.11 Pre-defined inputs for weightings and normalisation factors will need to be validated to ensure that they are appropriate and current for the relevant period. These include:

- Annual scheduled passenger train-km by Service Group;
- Average freight train movements per day by ELR;
- Average revenue per freight train-km;
- Average daily revenue per passenger train-km by ELR and Service Group;
- Total track-km hours per ELR; and
- Train-km per period by operator.

6.12 Whilst these input values should be updated annually, it may be necessary to up date certain values more frequently, for example to reflect significant changes to the timetable.

Validation of metric disaggregation

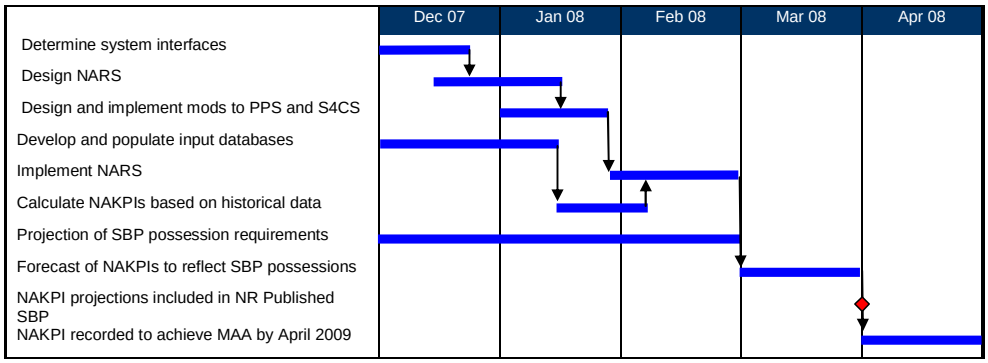
6.13 The metrics have been designed first and foremost to provide network wide measures but with a capability for disaggregation. The sensitivity of the metrics to localised effects should be tested by validating them in disaggregated form.

Activation of variable input data

6.14 System linkages will need to be set up to enable systematic capture of the variable data outputs required from for the primary metrics and from PPS, S4CS, TSDB and PSS for the secondary metrics. These linkages may be achieved by fully automated system interfaces or manual processing of outputs and inputs.

6.15 An indicative suggested outline programme for these implementation tasks is shown below in Figure 6.1.

FIGURE 6.1 INDICATIVE IMPLEMENTATION TIME LINE



Forecasting

6.16 Forecasts of the proposed KPIs will be required to reflect the implications of the SBP. Forecasts for the KPIs should be aligned with the expected possession activity associated with the projects and engineering activity planned within the SBP. There are two key components for which forecasts will be required:

a) Projections for traffic and demand related data (e.g. train-km, number of trains, passenger and freight revenue, passenger demand). These should be determined in line with assumptions that have informed the development of the SBP.

b) Projections for possession activity. This will potentially be a more complex task, as in order to reflect the planned maintenance, renewal and enhancements set out in the SBP, a relationship between activity expenditure and possession activity will need to be derived. We believe that Network Rail has already undertaken a similar task in order to determine forecasting and budgeting of Schedule 4 compensation for the current and future Control Periods. Therefore it is expected that a similar methodology could be developed and applied to forecast changes in possession activity that would enable projections of the proposed KPIs.

6.17 A potential approach to forecasting is suggested for each metric in Table 6.1 below.

6.18 It should be noted that completion and implementation of the NARS will not be required to enable calculation of the KPIs using historical data. This can be done by way of collation of historical and input data parameters and then calculating the metrics using a basic spreadsheet approach. In this way it will be possible to derive forecasts for the KPIs from the historical derivations in parallel to the implementation of NARS.

TABLE 6.1 APPROACH TO FORECASTING METRICS

Metric	Possible approach	Data requirement
Primary	1. Derive profile of historical possessions using categories to reflect location (e.g ELR to SRS) and duration (e.g. <8hr, 8-24hr, 24-52hr, >52hr). 2. Estimate historical and future possession activity as per SBP by geography and possession duration	Historical possession data set (2 -3 years) from S4CS and PPS. Possession activity estimates by geography and duration for each year of SBP. SBP estimates for pre-defined

Metric	Possible approach	Data requirement
	categories. 3. Factor historical possession data set by future/historical ratio for each geographic/duration category combination to derive possession driven component of calculation.. 4. Apply pre-defined inputs to calculation based on SBP forecasts (e.g. train-km).	inputs (e.g. train-km, passenger demand growth, etc).
Secondary	BusHRs: Derive correlation between bus hours and possession activity by category (including partial/whole route blockage) using historical data. Project future measure by applying forecast/historical possession activity ratio plus a factor to reflect forecast change in proportion of whole-line blockages.	Historical possession data set (2 -3 years) from S4CS. Historical data of % of whole route block possessions. Possession activity estimates by geography and duration for each year of SBP.
	N t-12: Project future possession frequency by applying forecast/historical ratio. Factor trend by projected improvement in level of advanced possession planning.	Historical possession data set (2 -3 years) from S4CS. Forecast future possession activity for each year of SBP.
	NDF: Project future possession frequency by applying forecast/historical ratio. Factor trend by projected improvement in level of advanced possession planning.	Historical possession data set (2 -3 years) from S4CS. Forecast future possession activity for each year of SBP.
Secondary	LPC: Project future possession frequency by applying forecast/historical ratio. Analysis of historical record of late cancellations. Factor trend by projected improvement in possession management.	Forecast future possession activity for each year of SBP. Since records of late cancellations may not be easily accessible it may be necessary to derive records from sampling.
	WRB: Project future possession frequency by applying forecast/historical ratio. Analysis of historical possessions to determine trend in % of whole route blockages. Factor trend by projected possession management strategy to reduce whole route blockages.	Historical data of % of whole route block possessions. Forecast future possession activity for each year of SBP.
	ODM and OCM: Project future possession frequency by applying forecast/historical ratio. Analysis of historic possession overrun delay/cancellation trend. Apply factor to reflect forecast change in possession frequency. Factor trend by projected possession management strategy to reduce possession overruns.	Historical delay and cancellations due to possession overrun sourced from PSS. Forecast future possession activity for each year of SBP.

Preparation of targets

6.19 An underlying objective for the targets for the Network Availability KPIs should be to set an improving trajectory for each metric. Network Rail should identify its strategy and initiatives for improving possession efficiency and effectiveness. This should help inform the degree of improvement to be expected throughout the duration of the SBP. However, due account should also be taken of the level of engineering activity associated with the SBP and the implications for the quantum of possessions required and the targets should reflect this accordingly.

APPENDIX A

GLOSSARY

ACTRAFF	Actual Traffic Database (Network Rail)
ELR	Engineers' Line Reference
FOC	Freight Operating Company
FWTT	First Working Timetable (as defined in Schedule 4)
GJT	Generalised Journey Time
ICM	Infrastructure Cost Model
LENNON	The rail industry's central ticketing system
MRE	Marginal Revenue Effect
NARS	Network Availability Reporting Suite (a new term proposed in conjunction with the KPI specification)
NMF	Network Modelling Framework
NF-mre	Notification Factor marginal revenue effect (as defined in Schedule 4)
NR	Network Rail
NREJT	Extended journey time resulting from a Network Rail Restriction of Use (as defined in Schedule 4 of the Track Access Agreements)
ORR	Office of Rail Regulation
PPS	Possession Planning System
S4CS	Schedule 4 Compensation System
SBP	Network Rail's Strategic Business Plan
SG	Service Group
SRS	Strategic Route Section
TSDB	Train Services Database
TOC	Train Operating Company
WACM	Weighted Average of Cancellation Minutes resulting from a Network Rail Restriction of Use (as defined in Schedule 4 of the Track Access Agreements)

WebTAG	Web Based Transport Appraisal Guidance
WON	Weekly Operating Notice

CONTROL SHEET

Project/Proposal Name:	NETWORK AVAILABILITY KPI
Document Title:	Final Summary Report
Client Contract/Project Number:	ORR/CT/351/NAKPI
SDG Project/Proposal Number:	207512-A

ISSUE HISTORY

Issue No.	Date	Details
1	**19th Nov 2007**	**Final Draft**
2	**27th Nov 2007**	**Concluding Report with Implementation Plan**
3	**4th Dec 2007**	**Final Update to Client**

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