NETWORK AVAILABILITY KPI

Network Availability Reporting Suite (NARS) - Outline Technical Specification

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1. INTRODUCTION AND OBJECTIVES

Purpose of this document

1.1 This document provides a high level functional specification for v0.1 of a Network Availability KPI Reporting Suite (NARS). It provides an overview of proposed Network Availability KPI's, a description of the required calculations, an outline specification of data required for these calculations, and an initial view on structure of data tables that may be required to develop a NARS database. An overview of external process required to derive input parameters and interfaces with legacy Industry Systems is also provided.

1.2 This report does not set out a detailed technical specification for the NARS. A full technical specification will require direct access to legacy systems and confirmation of the format of available outputs which will enable refinement of data tables and calculations. This outline technical specification assumes some data items will be available in the format as described, which is subject to confirmation with system owners.

Background and study objectives

1.3 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 some 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.

1.4 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.

1.5 A key objective for the development of any such KPI was to use existing industry data and systems as far as possible and to avoid unnecessarily complex or resource hungry calculation processes.

Structure of this report

1.6 **Section 2** of this report provides an overview of the proposed NARS including interfaces with existing systems and required modification

1.7 **Section 3** presents the Network Availability Metrics/KPIs to be calculated

1.8 **Sections 4-7** provide and outline specification for the calculation of each metric.

2. SUMMARY OF KEY PRINCIPLES AND MAIN FUNCTIONALITY

System role, objectives and scope

2.1 The purpose of the Network Availability Reporting System (NARS) is to calculate and report Network Availability measures drawing on existing industry data, and reporting KPIs at a level of aggregation, and periodicity that allows meaningful analysis. The NARS may be used to support the implementation of a regulated network availability target over the next control period.

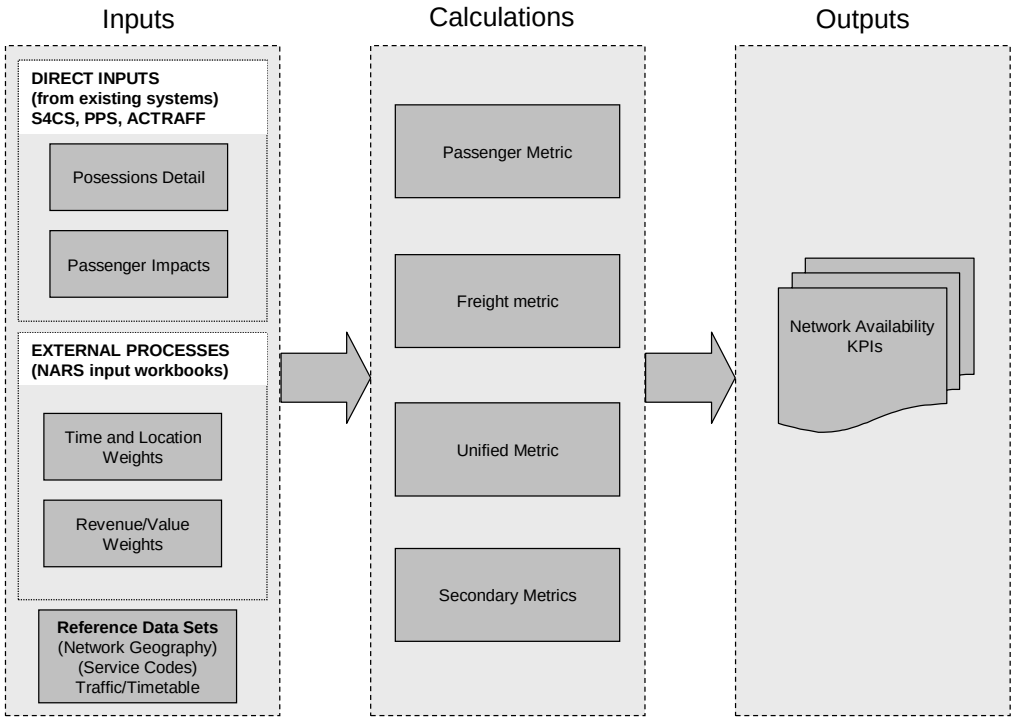
2.2 Key development objectives are:

- To make the best use of existing industry data
- To develop a system that is easy to understand operate and maintain

High level design

2.3 Figure 2.1 provides a high level representation of the NARS, identifying key components and the logic flow of information through the system, and summarising the main types of model inputs, calculations and outputs.

FIGURE 2.1 SYSTEM OVERVIEW – INPUTS, CALCULATIONS, OUTPUTS



2.4 The main components of the NARS are as follows:

- 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
- Inputs derived through external processes set out in NARS .xls workbook(s).

These are periodically defined weights to take account of the relative impacts of possession on different locations on the network, at different times of day/days of the week and on different services.

- Reference data providing average traffic/service levels for the purposes of normalisation, network geography information such as track and route length and other required lookup values required for calculations or reporting.
- Internal database calculation of Primary and Secondary metrics, that may require creation and storage of intermediate data tables, differing by the level of aggregation required for the outputs
- Output reports for each KPI at user selected levels of aggregation.

Network segmentation and reporting

2.5 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.

2.6 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 system) and it proved difficult to find a consistent and usable mapping between geography's, hence Engineering Line References (ELRs) are used as the basis of the network geography, and data is captured at this level. This could be reviewed during detailed development.

2.7 All 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 may assist in identifying trends and forecasting.

Interfaces with existing systems

2.8 As mentioned above, a key objective of the development of the NARS is to minimise costs and resource by making use of existing systems where possible. Table 2.1 sets out proposed system interfaces. Appendix B provides a brief description of each system and an industry contact for future enquiries.

TABLE 2.1 SYSTEM INTERFACES

System	Information	Owner
Direct Interface		
Possession Planning System (PPS)	Possession descriptions (time, location, curation etc)	Network Rail
Schedule 4 Costing System (S4CS)	Passenger impacts of possessions. Service groups affected.	Network Rail
PSS*	Delay and cancellation minutes by causation code	Network Rail
National Timetable	Bus service hours.	Network Rail

Database (TSDB)		
Source Data		
ACTRAFF	Network Actual Traffic Data by ELR	Network Rail
LENNON	Ticket Sales Information, Revenue by Service Group	ATOC
MOIRA	Daily passenger demand profiles	DeltaRail
NETRAFF	Network Planned Traffic Data by ELR	Network Rail
NPS	Passenger journey purpose splits	Passenger Focus
National Timetable Database (TSDB)	Scheduled traffic information	Network Rail

1. Note: this is a new Oracle Data warehouse system which is being introduced to replace PALADIN.

Required modifications to existing systems

2.9 The following modifications to existing systems are required to enable the metrics as specified to be calculated.

Possession Planning System

2.10 Introduce additional field requiring each possession reference to be assigned to one of two categories, 'Partial Route Blockage' and 'Whole Route Blockage'.

2.11 Modify the existing fields or create new fields to capture the identifier code for each ELR affected.

Schedule 4 Costing System

2.12 In the two years of S4CS reference data examined to date, approximately 20 percent of possession entries were prefixed RTP, indicating that they were manually created within the S4CS system and not directly transferred from PPS. We understand that this occurs when PPS data has not been uploaded at the time of entry, or possessions are created late.

2.13 For these entries, time stamp information is not captured within the usual field, but manually entered within the location text field. S4CS will need to be modified to ensure that time stamp information is captured in the same fields as other possessions, or code written to extract start and end time information from the location text fields.

Areas for development/Improvement

Interfaces with existing systems

2.14 This specification identifies a number of interfaces with existing industry systems. The nature of such interfaces will need to be defined, and taken into consideration when selecting the appropriate database architecture/platform for the NARS.

User interface

2.15 A user interface would be required to aid in operation and maintenance of the NARS, this could be web/HTML based, or via the standard interface of a software package such as MS Access that may be chosen as the basis of the NARS.

Reporting suite

2.16 We have not specified the format and frequency of reports that could be generated by the NARs. Report formats and reporting tools should be developed in conjunction with ORR/NR to ensure that current, and potential future requirements are met. The specification of outputs will to some extent drive the nature of the calculation required within the database.

NR systems under development

2.17 We are aware of initiatives within Network Rail to integrate or replace or better integrate existing information systems, some of which have been identified to provide data inputs within this specification. In particular, the development of TASR has been cited as a replacement/upgrade to GEOGIS and ACTRAFF/NETRAFF.

2.18 The scope of these initiatives should be understood, and opportunities explored before finalising a detailed specification of the NARS.

Other

2.19 Data on the possessions cancelled after issue of the Weekly Operating Notice are required for a proposed secondary metric (LPC). This information is currently only recorded manually at area control centres. A new system will need to be designed to set out arrangements to capture this information in a way that enables the data to be aggregated in order to calculate this metric. It is not envisaged that this need be particularly sophisticated and is likely to involve some new instructions to the relevant personnel together with some form of electronic pro forma to be completed and logged centrally.

3. OVERVIEW OF NETWORK AVAILABILITY METRICS

Summary

3.1 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 3.1 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

3.2 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 combined measure of passenger and freight impacts. These metrics are summarised below. Detailed definitions of their calculation and data sources are provided in sections 4 to 6.

3.3 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)

3.4 This metric measures the value of the impact of possessions on the excess journey time as experienced by passenger, normalised to total train-km. It takes account of the effect of cancellations and reflects the economic value of the additional journey time incurred.

3.5 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

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

Freight metric (FwT)

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

3.6 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.

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

Unified metric (RR)

Revenue at risk (RR)

3.7 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:

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

Secondary metrics

3.8 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.

3.9 A summary of the metrics is set out below. Metrics are summarised below. Detailed definitions of their calculation and data sources are provided in section 7.

Rail Replacement Bus Hours (BusHRs)

3.10 This metric measures the rail replacement bus service hours operated due to possessions. It can be measured by extracting bus service hours by 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.

Measurement unit: Bus-hours per period

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

3.11 This metric is calculated as the number of possessions per period with a Notification Factor discount (NFMRE) assigned in accordance with column C of Annex A to Part 3 of Schedule 4 expressed as a percentage of the number of notified possessions in a given period.

Measurement unit: Percentage of possessions per period

Possession Notification Discount Factor (NDF)

3.12 This metric records 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.

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

Late Possession Cancellations (LPC)

3.13 This metric is measured as the number of possessions per period that were cancelled after issue of the Weekly Operating Notice (WON).

Measurement unit: Percentage of possessions per period

Possessions Involving Whole Route Block (WRB)

3.14 This metric expresses the number of possessions recorded as 'whole route blockage' as a percentage of the total number of possessions recorded in each period.

Measurement unit: Percentage of possessions per period

Delay Minutes Due To Possession Overrun (ODM)

3.15 This metric is measured as total delay minutes attributed to possession over-runs, divided by scheduled train-km, and expressed per period.

Measurement unit: Delay minutes per train-km per period

Cancellation Minutes Due To Possession Overrun (OCM)

3.16 This metric is measured as total cancellation minutes attributed to possession over-runs, divided by scheduled train-km, and expressed per period.

Measurement unit: Cancellation minutes per train-km per period

4. PASSENGER METRIC (EPJwVT)

Metric calculation

4.1 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.

4.2 The values of NREJT and WACM are calculated as defined in Schedule 4, Part 3, paras 3.4 I and (b) respectively. These are derived from S4CS based on the values used to determine the Schedule 4 compensation payments to operators (i.e. a blend of comparisons of the Applicable Timetable with the First Working Timetable and the Corresponding Day Timetable).

4.3 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.

4.4 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.

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

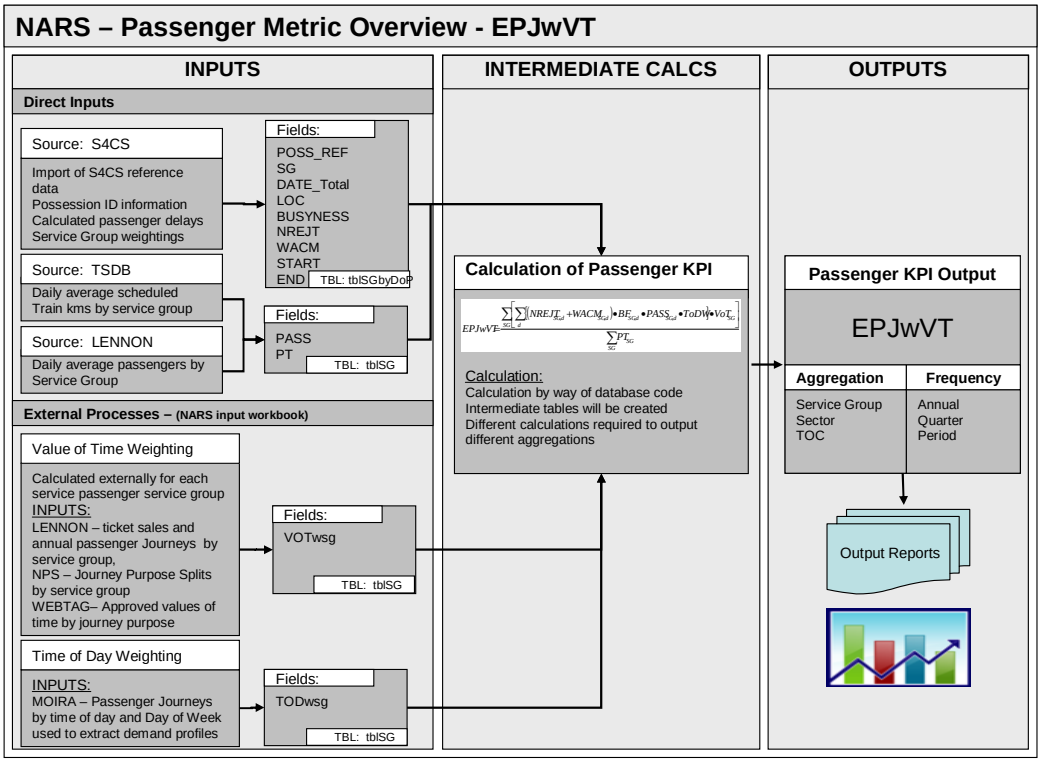
VoT_{SG} is the value of time for the relevant Service Group(s), reflecting the ratios of business, commuter and leisure traffic and associated values of time for each passenger group (as defined in DfT WebTAG appraisal guidelines).

4.6 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 PTSG). 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.

System overview

4.7 Figure 4.1 Provides an overview of the calculation of the passenger metric within the Network Availability Reporting System

FIGURE 4.1 OVERVIEW OF PASSENGER METRIC CALCULATION IN THE NARS



4.8 Inputs to the calculation can be provided directly from existing industry systems, updated each period, or can be pre-determined and calculated externally (within NARS input workbooks) and input into the database as required. Table 4.1 lists the inputs required for the calculation, method of input and source of data. Figure 4.1 references indicative data tables shown in Appendix A.

System outputs

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

4.9 This metric can be calculated as a single network wide value, or calculated for individual service groups and output by Service Group, Operator or Sector.

4.10 Outputs can be calculated on an annual basis or per period.

4.11 A moving annual average aggregated at a Network level is proposed.

System inputs and data dimensions

4.12 Table 4.1 below summarises the inputs required for this metric and the source

TABLE 4.1 INPUT DATA

Element	Dimensions	Description	Source Data
$NREJT_{SG,d}$	Possession Day	Direct Input	S4CS
$WACM_{SG,d}$	Possession Day	Direct Input	S4CS
$BF_{SG,d}$	Service Group Day	Direct Input	S4CS
$PASS_{SG,d}$	Service Group Day	Daily average of annual passengers per Service Group derived from LENNON	LENNON
ToDW	Service Group Day	Percentage of passenger journeys for the relevant Service Group during the time of day and day of week affected by the corresponding possession. These weightings will be determined by distribution profiles of passenger journeys for each Service Group derived from MOIRA.	MOIRA
VoT_{SG}	Service Group	Predefined Input - Calculated in external module The value of time as defined in DfT Appraisal Guidance (WebTAG) is weighted by journey purpose (Business:Commuter:Leisure) for the relevant Service Group. The split by journey purpose is determined from NPS survey data which provides the split by journey purpose and ticket type for each TOC. The values for each TOC are then weighted to give values for each Service Group using the relative proportion of tickets sold by type for each Service Group (derived from LENNON) and applying the journey purpose/ticket type ratio for the relevant TOC.	WebTAG NPS LENNON
PT_{SG}	Service Group	Periodic average of total annual scheduled passenger train-km across all Service Groups. This can be derived from NETRAFF or S4CS.	NETRAFF S4CS

5. FREIGHT METRIC (TwF)

Metric calculation

5.1 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[1], 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).

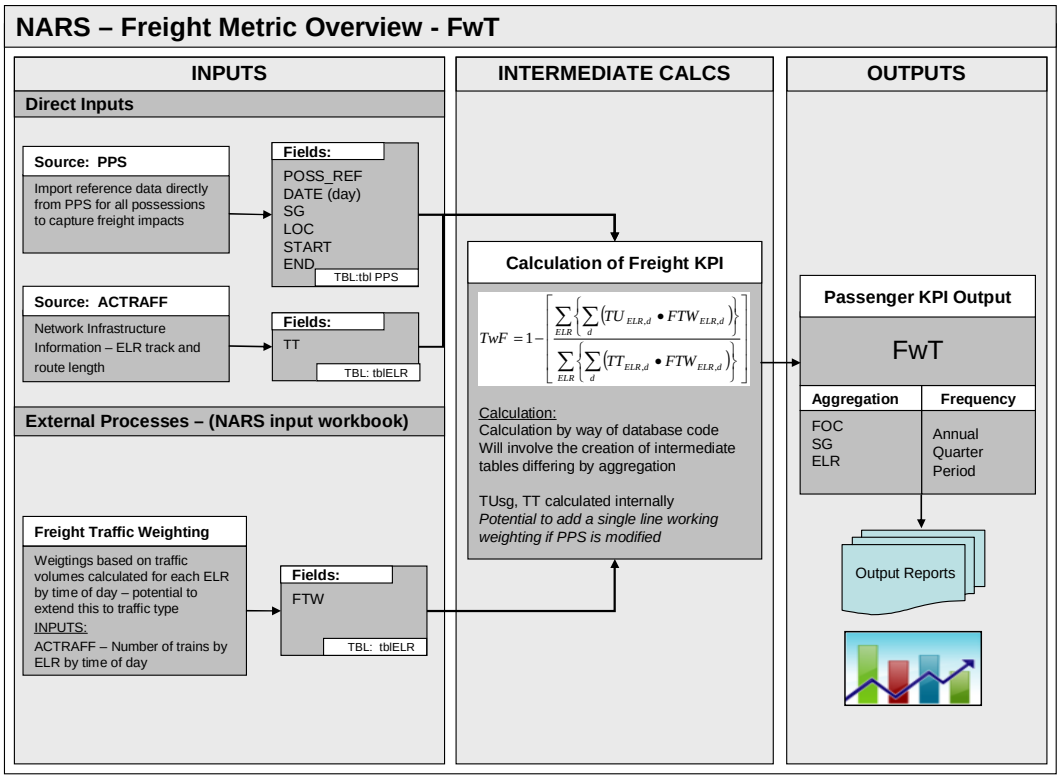
5.2 The values of $DwFT_{ELR,d}$ would be pre-determined as a fixed input, although these could be updated from time to time to reflect changes in freight traffic flows.

System overview

5.3 Figure 4.1 Provides an overview of the calculation of the freight metric within the Network Availability Reporting System

[1] 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.

FIGURE 5.1 OVERVIEW OF FREIGHT METRIC CALCULATION IN THE NARS



5.4 Inputs to the calculation can be provided directly from existing industry systems, updated each period, or can be pre-determined and calculated externally (within NARS input workbooks) and input into the database as required. Table 5.1 lists the inputs required for the calculation, method of input and source of data. Figure 5.1 references indicative data tables shown in Appendix A.

System outputs

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

5.5 It is proposed that this metric is calculated as a single national network measure. However, it can be calculated by geographic regions by summing the calculation for the relevant ELRs as required. It could also be calculated for specific operators by sifting the traffic level weighting ($DwFT_{ELR}$) to only include the relevant FOCs.

5.6 It could also be calculated by commodity type. However, this would require a significant level of data sorting with data from ACTRAFF in order to aggregate from around 1000 commodity codes to an appropriate number of generic commodities.

5.7 Outputs can be calculated on an annual basis or per period.

5.8 A moving annual average aggregated at a Network level is proposed.

System inputs and data dimensions

5.9 Table 4.1 below summarises the inputs required for this metric and the source

TABLE 5.1 INPUT DATA

Element	Dimensions	Description	Source Data
$TT_{ELR,d}$	ELR Day	Expressed in track-km hours where the track-km are aggregated for all ELRs on the network and then multiplied by 24 hours. Track-km for ELRs derived from GEOGIS	GEOGIS
$TU_{ELR,,d}$	ELR Day	The track-km for each ELR affected by possessions for the relevant day are multiplied by the duration of the relevant possession (derived from PPS) and aggregated for each ELR. Track-km for ELRs derived from GEOGIS	PPS GEOGIS
$FTW_{ELR,\ d}$	ELR Day	Predefined Input – Calculated in External Module using the element $DwFT_{ELR,d}$	ACTRAFF
$DwFT_{ELR,d}$	ELR Day	This element is an input to the calculation of FTW A predetermined value of the average freight train movements per day attributed to a relevant ELR is derived from ACTRAFF. The value is then weighted by the proportion of freight trains operated for the relevant day of the week for that ELR. This weighting is also derived from ACTRAFF by deriving the average number of freight trains operating on each day of the week	ACTRAFF

6. UNIFIED METRIC (RR)

Metric calculation

6.1 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.

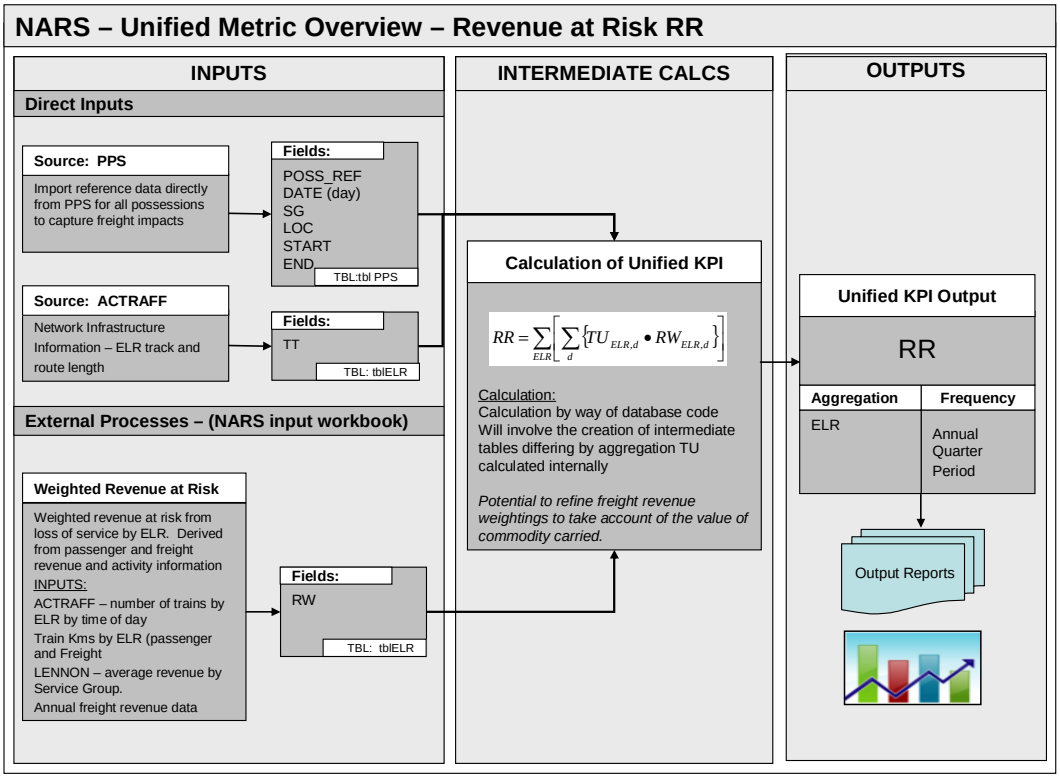
6.2 The values of RFT, FT_{ELR},d, $RPT_{SG,}$ $PT_{SG,ELR,d}$ and TH_{SRS} would be pre-determined as fixed inputs, although again these could be updated from time to time to reflect changes in freight and passenger traffic flows.

6.3 Again, time of day profiles discussed in the context of the previous two measures could be used to further refine the metric. These will be investigated further as part of the more detailed technical specification of the unified metric.

System overview

6.4 Figure 6.1 Provides an overview of the calculation of the unified metric within the Network Availability Reporting System.

FIGURE 6.1 OVERVIEW OF UNIFIED METRIC CALCULATION IN THE NARS



6.5 Inputs to the calculation can be provided directly from existing industry systems, updated each period, or can be pre-determined and calculated externally (within NARS input workbooks) and input into the database as required. Table 6.1 lists the inputs required for the calculation, method of input and source of data. Figure 4.1 references indicative data tables shown in Appendix A.

System outputs

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

6.6 It is proposed that this metric is calculated as a single national network measure. However, it can be calculated by geographic regions by summing the calculation for the relevant ELRs as required.

6.7 It is not considered practical or meaningful to calculate this metric for specific operators.

6.8 Outputs can be calculated on an annual basis or per period.

6.9 A moving annual average aggregated at a Network level is proposed.

System inputs and data dimensions

6.10 Table 6.1 below summarises the inputs required for this metric and the source.

TABLE 6.1 INPUT DATA

Element	Dimensions	Description	Source Data
$TT_{ELR,d}$	ELR Day	Expressed in track-km hours where the track-km are aggregated for all ELRs on the network and then multiplied by 24 hours. Track-km for ELRs derived from GEOGIS	GEOGIS
$TU_{ELR,,d}$	ELR Day	The track-km for each ELR affected by possessions for the relevant day are multiplied by the duration of the relevant possession (derived from PPS) and aggregated for each ELR. Track-km for ELRs derived from GEOGIS	PPS GEOGIS
$RW_{ELR,,d}$	ELR Day	Weighted revenue at risk for each ELR derived from the inputs below	As below
INPUTS to $RW_{ELR,,d}$ (Calculated externally)			
$RF_{ELR,,d}$	ELR, Day	Average daily freight revenue at risk calculated from RFT and $FT_{ELR,d}$	As below
RFT		RFT is the calculated from an estimated aggregate national rail freight revenue (which could be sourced from the FOC published accounts) divided by annual national freight tonne-km derived from NETRAFF.	FOC published annual accounts NETRAFF
$FT_{ELR,d}$	ELR, day	A predetermined value of the average freight train-km per day attributed to a relevant ELR calculated by multiplying the number of freight trains operated per ELR (derived from ACTRAFF) by the route length of the relevant ELR (derived from GEOGIS). The product is then weighted by the % of freight trains operated for the relevant ELR by day of week. This ratio is also derived from ACTRAFF.	ACTRAFF GEOGIS
$RP_{ELR,d}$	ELR, Day	Average daily passenger revenue at risk calculated from RPT_{SG} and $PT_{SG,ELR,d}$	As below
RPT_{SG}	SG	Average daily revenue per passenger train km. Average daily revenue by Service Group derived from LENNON Average daily scheduled passenger train-km by Service Group can derived for the current timetable by SG from S4CS	LENNON S4CS

Element	Dimensions	Description	Source Data
$PT_{SG,ELR,d}$	SG, ELR, Day	A predetermined value of the average passenger train-km per day attributed to a relevant ELR calculated by multiplying the number of passenger trains operated by SG per ELR (derived from ACTRAFF) by the route length of the relevant ELR (derived from GEOGIS). The product is then weighted by the % of passenger trains operated for the relevant ELR by day of week. This ratio is also derived from ACTRAFF.	GEOGIS ACTRAFF

7. SECONDARY METRICS

Rail Replacement Bus Hours (BusHRs)

Measurement unit: Bus-hours per period

7.1 Bus service hours are derived each period for each TOC by the relevant 'BR' code for rail replacement bus service as contained in train plan within the TSDB. The bus-hours for each service listed is calculated by subtracting the scheduled departure time from the scheduled arrival time and aggregating by TOC. It should be noted 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)

Measurement unit: Percentage of possessions per period

7.2 The metric is calculated as the number of possessions per period with a Notification Factor discount (NFMRE) assigned in accordance with column C of Annex A to Part 3 of Schedule 4 expressed as a percentage of the number of notified possessions in a given period.

7.3 The number of qualifying possessions and total number of notified possessions can be sourced from S4CS.

7.4 This metric can be expressed at a national network level or disaggregated by TOC by sifting by the data by the relevant Service Groups. The data can also be arranged to give a comparison between days of the week (e.g. weekday/Saturday/Sunday).

7.5 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.

7.6 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.

Possession Notification Discount Factor (NDF)

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

7.7 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.

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

7.9 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.

7.10 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

7.11 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.

7.12 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.

7.13 There are circumstances where possessions may be 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.

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

7.15 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.

Possessions Involving Whole Route Block (WRB)

Measurement unit: Percentage of possessions per period

7.16 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.

7.17 Both values will be derived from PPS.

7.18 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'.

7.19 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.

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

7.21 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.

Delay Minutes Due To Possession Overrun (ODM)

Measurement unit: Delay minutes per train-km per period

7.22 This metric is measured as total delay minutes attributed to possession over-runs, divided by scheduled train-km, and expressed per period.

7.23 The delay minutes are derived from delay data recorded within PSS and can be extracted as delay minutes attributed to the Delay Causation Code (I5) for possession overruns.

7.24 The weighting by train-km is applied to normalise against changes in the level of services scheduled. Train-km per period per period can be derived for the relevant TOC/FOCs from NETRAFF.

7.25 The metric can be reported at a national level or by operator or geography down to Strategic Route Section by sifting the appropriate reference codes held within PSS.

Cancellation Minutes Due To Possession Overrun (OCM)

Measurement unit: Cancellation minutes per train-km per period

7.26 This metric is measured as total cancellation minutes attributed to possession over-runs, divided by scheduled train-km, and expressed per period.

7.27 The cancellation minutes, as defined in the relevant Track Access Agreements, are derived from delay data recorded within PSS and can be extracted as cancellation minutes attributed to the Delay Causation Code (I5) for possession overruns.

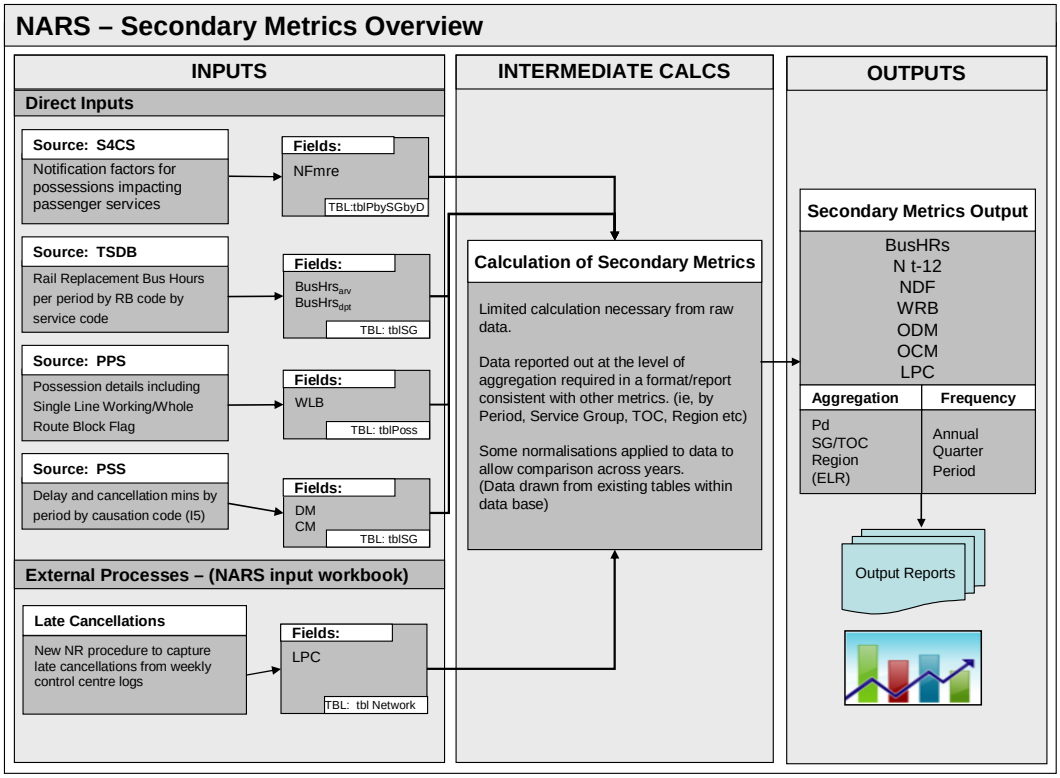
7.28 The weighting by train-km is applied to normalise against changes in the level of services scheduled. Train-km per period per period can be derived for the relevant TOC/FOCs from NETRAFF.

7.29 The metric can be reported at a national level or by operator or geography by sifting the appropriate reference codes held within PSS.

System overview

7.30 Figure 7.1 Provides an overview of the calculation of the Secondary metrics within the Network Availability Reporting System.

FIGURE 7.1 OVERVIEW OF SECONDARY METRIC CALCULATION IN THE NARS



System inputs and data dimensions

7.31 Table 7.1 below summarises the inputs required for the Secondary metrics and the source data.

TABLE 7.1 INPUT DATA

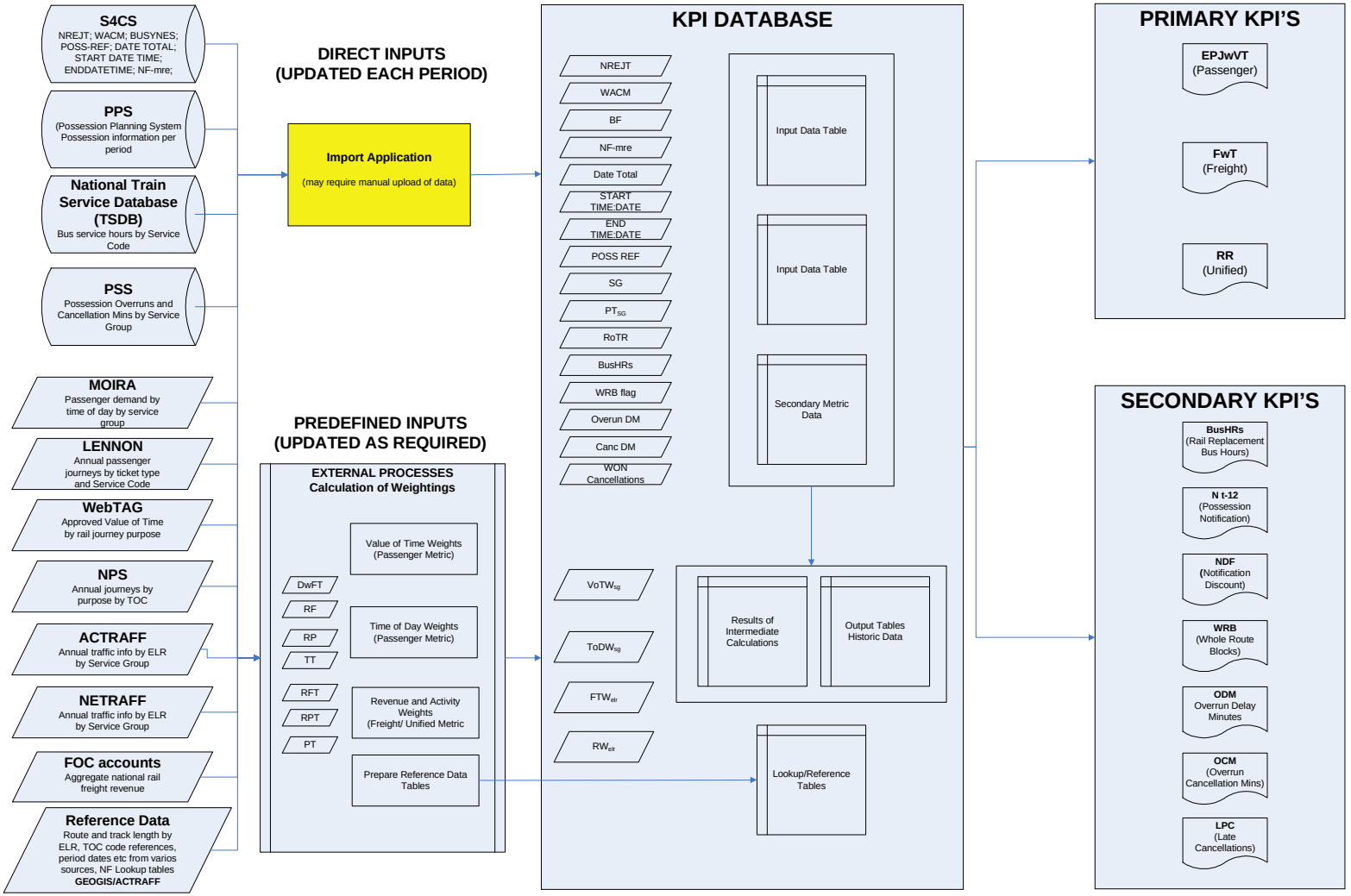
Metric	Element	Dimensions	Description	Source Data
BusHRs	Bus-hours per period	Period Service Group	Bus service hours derived each period for each TOC by the relevant 'BR' code for rail replacement bus service.	TSDB
N t-12	NFMRE	Period Service Group	The number of possessions falling into the relevant NFMRE category can be derived from S4CS. The total number of possession in the relevant period can also be derived from S4CS.	S4CS
NDF	NFMRE	Period Service Group	The number of possessions falling into each NFMRE category can be derived from S4CS.	S4CS

LPC	Cancelled possessions	Period ELR	The number of possessions cancelled after issue of the WON sourced from data logged locally at area control centres.	New system required
			The total number of possession in the relevant period can also be derived from PPS.	PPS
WRB	'Whole Route Blockage'	Period ELR	The number of possessions recorded as 'Whole Route Blockage' divided by total number of possessions recorded in relevant period. Both values to be derived from PPS.	PPS
ODM	delay minutes	Period Service Group Operator	The delay minutes derived from delay data recorded within PSS and can be extracted as delay minutes attributed to the causation code (I5) for possession overruns.	PSS
ODM	Train-km	Operator	Train-km per period per period can be derived for the relevant TOC/FOCs from NETRAFF	NETRAFF
OCM	cancellation minutes	Period Service Group Operator	The delay minutes derived from delay data recorded within PSS and can be extracted as delay minutes attributed to the causation code (I5) for possession overruns.	PSS
OCM	Train-km	Operator	Train-km per period per period can be derived for the relevant TOC/FOCs from NETRAFF	NETRAFF

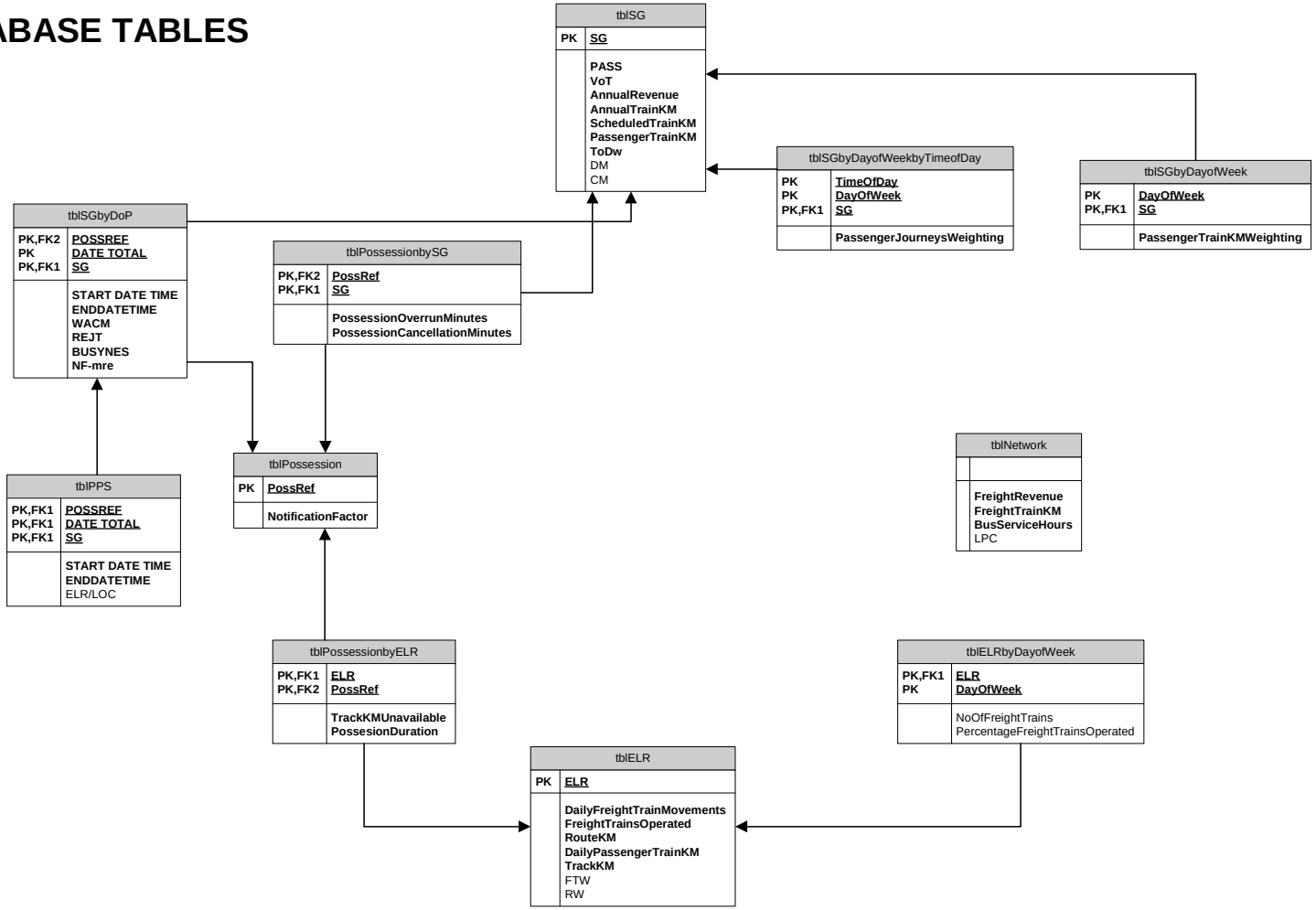
APPENDIX A

INDICATIVE DATABASE STRUCTURE

NETWORK AVAILABILITY REPORTING SYSTEM (NARS) OVERVIEW



DATABASE TABLES



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APPENDIX B

DATA SYSTEMS AND CONTACT DETAILS

B1. DATA SYSTEMS AND CONTACT DETAILS

System Name	System Description	Owner	Contact	Interface Type
PPS	**Possession Planning System** Possession Planning System (PPS). Real time database of possessions. Available to all rail industry stakeholders. The database also holds information regarding Temporary Speed Restrictions (TSRs) The system will produce various reports of possessions by route, territory, or affect on Train Operator. System also produces the Confirmed Period Possession Plan, Weekly Operating Notice, and Supplement to the Weekly Operating Notice. ORACLE Database. Data stored by route, location, date and time period.	Network Rail	Chris Myers Network Access Unit Network Rail 6th Floor, City Exchange 11 Albion Street Leeds t. 0113 341 2233	Direct extract
S4CS	**Schedule 4 Costing System** Schedule 4 (Planned disruptive track access) compensation calculation and reporting tool. Oracle database Data from Possession Planning System (PPS). Other reference tables manually uploaded	Network Rail	Neil Raw Network Rail S4CS Support George Stephenson House Toft Green York	Direct extract
LENNON	**Live Earnings Networked Nationally Overnight** The rail industry's central ticketing system, formerly CAPRI, is the basis for passenger kilometres and journeys data. System captures and stores sales of tickets on each flow nationally.	RSP/ATOC	Contact ORR: Paul Hadley Head of Operations One Kemble Street London WC2B 4AN t. 020 7282 2039 [tbc]	External Process
MOIRA	Timetable-based model of rail market and passenger train choice. Projects future demand and revenue based on timetable alterations, including elasticity of rail market and consequent revenue change.	Model owned by Delta Rail. Authorisation to use national version should be obtained	Jake Cartmell Rail Service Analysis Department for Transport Area 4/33 Great Minster House 76 Marsham Street	External Process

		from DfT	London SW1P 4DR t. 020 7944 5964 Jake.Cartmell@dft.gsi.gov.uk	
ACTRAFF	ACTRAFF is data on the actual traffic and tonnages using the network every 4 week period Detailed files containing the numbers of vehicles using each track section every period and higher level summary files giving period usage for each track section Flat ascii files subsequently loaded into an Oracle database accessible via the Network Rail portal.	Delta Rail providing service to Network Rail	DeltaRail: Gwyn Rowlands Central House Upper Woburn Place London WC1H 0JN t. 0 870 1901436 Network Rail: Stephen Rivers Territory Engineering Knowledge Manager Network Rail t. 0121-345-3294 e. tephen.rivers@networkrail.co.uk	External Process
NETTRAFF	NETRAFF is used to determine track category, annual tonnage, maximum axle-load and equivalent million gross tonnes per annum (EMGTPA) for each section of track. Tonnage information produced by NETRAFF is uploaded into GEOGIS following review and acceptance by the Territory Track Engineer. MS Access database	Network Rail	Network Rail: Stephen Rivers Territory Engineering Knowledge Manager Network Rail t. 0121-345-3294 e. tephen.rivers@networkrail.co.uk	External Process
PSS	PSS is a new Oracle Datawarehouse that is replacing PALADIN as the system that archives train movement information from TRUST, including train formations, actual running times, delay minutes and delay causation / attribution. It is the main industry archive of this data.	Network Rail	Network Rail Nigel Salmon Senior Performance Analyst Melton Street London t. 020 7557 8487	Direct extract

TSDB	National timetable Train Services Database. Central database of train services, including future planned services (up to next major timetable change) and daily / weekly plans for the next year. Contains detailed information on timing of each individual train service.	Maintained by ATOS on behalf of Industry.	[tbc]	Direct extract
WeBTAG	Transport Analysis Guidance Website	DfT	www.webtag.org.uk	External Process
NPS	National Passenger Survey	Passenger Focus	www.passengerfocus.org	External Process
GEOGIS	Geographical information system. providing infrastructure characteristics referenced to ELR.	Network Rail	Richard Lewis Network Rail t. 01793499263 Rodney Hunt Data Analyst Rodney.hunt@networkrail.co.uk	External Process
TASR	New system under development at Network Rail. Possible replacement for GEOGIS that integrates ACTRAFF and NETRAFF	Network Rail	John Vernon Maintenance Systems Application Manger Network Rail T 0207 830 5535	
	Additional NR contact for geographic mappings	Network Rail	Tony Smith Information Analyst National Engineering Reporting Team t. 02075572762	

APPENDIX C

GLOSSARY OF TERMS

GLOSSARY OF TERMS

ACTRAF	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 this 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
SG	Service Group
SRS	Strategic Route Section
TSDB	Train Services Database
TOC	Train Operating Company
TRUST	Real time system for monitoring train movements and performance.
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:	Network Availability Reporting Suite (NARS) - Outline Technical Specification
Client Contract/Project Number:	ORR/CT/351/NAKPI
SDG Project/Proposal Number:	207512-A

ISSUE HISTORY

Issue No.	Date	Details
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1.0	**9/11/07**	**Final Draft to Client**
2.0	**4/12/07**	**Final Update to Client**

REVIEW

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