

# Schedule 8 Recalibration CP7 Years 3 to 5 Methodology Report - Final

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# 1 Introduction

## Context

‘Schedule 8’ refers to Schedule 8 of the Track Access Contract between Network Rail (NR) and Train Operators. The Office of Rail and Road (ORR) states that Schedule 8 “is designed to incentivise Network Rail and train operators to improve train performance, and it provides financial protection to operators against unplanned disruption.” The core purpose of Schedule 8 is to:

- Provide train operators with appropriate protection from losses arising from delays and cancellations considered outside their direct control;
- Provide financial incentives for both the Infrastructure Manager and train operators to minimise disruption and improve performance for the benefit of customers; and
- Provide information on the costs of delays, to support an efficient allocation of resources.

In addition to this, the Schedule 8 regime should:

- Reduce the likelihood of undue discrimination between different services;
- Reduce the likelihood of perverse incentives; and
- Provide consistent performance incentives across the industry.

Schedule 8 is typically recalibrated at a national level every five years at the start of each Control Period (CP). There are also bespoke sub-national recalibrations if there are major changes that are expected to materially impact performance and revenue. It is important that parameters should be a reasonably accurate representation of expectations for the remainder of the current Control Period – that is, Benchmarks are set so as for Schedule 8 to be ‘financially neutral on expectation’ and Payment Rates represent a reasonable estimate of the expected marginal revenue effects of performance changes.

The latest recalibration covers Control Period 7 (CP7) Years 3 to 5, which ORR committed to as part of ORR’s 2023 periodic review (PR23). ORR’s intention was for the recalibration to “... better reflect industry conditions” as a consequence of rail’s changing service and demand patterns in the recovery from the COVID-19 pandemic.

This report provides the methodology for the national recalibration of Schedule 8 of the Track Access Contracts for Control Period 7 (CP7) Years 3 to 5 for passenger Train Operating Companies (TOCs). The scope of Steer’s role in the recalibration of the passenger operator Schedule 8 regime covers five parameters. A summary is shown in Table 1.1 with detailed descriptions provided in Sections 2 to 6 of this report.

**Table 1.1: Schedule 8 regime parameters that are in Steer's scope for this recalibration**

| Parameter                               | Description                                                                                                                                                       | Disaggregation                                                                                  |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| NR Payment Rates (NRPR)                 | Represents the expected financial impact of a given unit of performance and are based on the relationship between unplanned disruption and modelled revenue loss. | Service Group<br>(Some Service Groups are disaggregated further with peak and off-peak splits.) |
| TOC Payment Rates (TOC PRs)             |                                                                                                                                                                   |                                                                                                 |
| NR Benchmarks (NR BM)                   | Represents the average historical level of performance across the recalibration timeframe with a trajectory applied to Years 3 to 5.                              | Service Group<br>(Some Service Groups are disaggregated further with peak and off-peak splits.) |
| TOC Benchmarks (TOC BM)                 | Represents the average historical level of performance across the recalibration timeframe.                                                                        |                                                                                                 |
| Sustained Poor Performance (SPP) Regime | Provides an additional component to account for when performance, at a TOC level, is substantially worse than expectations for a significant length of time.      | TOC                                                                                             |

## Recalibration Terminology

There is a need to be clear on the terminology used to disambiguate the current recalibration from the earlier recalibration, both of which apply to CP7. We use the terms 'PR23 Recalibration' and 'CP7 Years 3 to 5 Recalibration' as detailed in Table 1.2.

**Table 1.2: Recalibration Definitions**

|                                                                                             | PR23 Recalibration                                                                                                                                                       | CP7 Years 3 to 5 Recalibration                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Timeframe in which the work was <b>carried out</b> .                                        | This was the original recalibration carried out in 2022/23                                                                                                               | This recalibration is the subject of this report and carried out in 2024/25                                                                                                                                                                                    |
| Years that the recalibration is <b>applied to</b> in the calculation of Schedule 8 and SPP. | CP7 Year 1: 2024/25<br>(1 <sup>st</sup> April 2024 to 31 <sup>st</sup> March 2025)<br>CP7 Year 2: 2025/26<br>(1 <sup>st</sup> April 2025 to 31 <sup>st</sup> March 2026) | CP7 Year 3: 2026/27<br>(1 <sup>st</sup> April 2026 to 31 <sup>st</sup> March 2027)<br>CP7 Year 4: 2027/28<br>(1 <sup>st</sup> April 2027 to 31 <sup>st</sup> March 2028)<br>CP7 Year 5: 2028/29<br>(1 <sup>st</sup> April 2028 to 31 <sup>st</sup> March 2029) |
| Base data used                                                                              | 2021/22 P08 to 2022/23 P07<br>(17 <sup>th</sup> Oct 2021 to 15 <sup>th</sup> Oct 2022)                                                                                   | 2023/24 P10 to 2024/25 P09<br>(10 <sup>th</sup> Dec 2023 to 7 <sup>th</sup> Dec 2024)                                                                                                                                                                          |

## Purpose and Outline of the Methodology Report

The purpose of this methodology report is to provide an overview of the modelling assumptions, calculations, and processes for the calculation of each of the Schedule 8 parameters, where these apply to passenger TOCs. This report is one part of a set of documents, models, and databases that comprise the output of the recalibration.

The individual chapters of this report provide detail on the methodology. In the table below, we highlight key points from the calculation of each of the parameters:

| Report Section                           | Key points                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>2. Recalibration Approach</b>         | <ul style="list-style-type: none"> <li>General approach to Schedule 8 recalibration followed, with some key variations from previous recalibrations.</li> </ul>                                                                                                                                                                                                                                                              |
| <b>3. Network Rail Payment Rates</b>     | <ul style="list-style-type: none"> <li>Use of semi-elasticities as a means of calculating the relationship between performance outputs and impact on revenue.</li> </ul>                                                                                                                                                                                                                                                     |
| <b>4. Base Benchmarks</b>                | <ul style="list-style-type: none"> <li>Application of changes in Cancellation Minute Multipliers, Monitoring Point locations and their weightings, Signal Berth Offsets, and any changes in public/working timetable differentials to rebase the TOC and Network Rail benchmarks accordingly.</li> </ul>                                                                                                                     |
| <b>5. Network Rail Annual Benchmarks</b> | <ul style="list-style-type: none"> <li>Application of regressions to convert TOC-level Network Rail delay per 1,000 miles trajectories (provided to the recalibration team) into service group-level AML values.</li> <li>Application of a calculation to convert TOC-level Network Rail cancellations trajectories (provided to the recalibration team) into service group-level Deemed Minutes Lateness values.</li> </ul> |
| <b>6. TOC Payment Rates</b>              | <ul style="list-style-type: none"> <li>Application of a Responsibility Matrix to calculate the TOC Payment Rates for each service group.</li> </ul>                                                                                                                                                                                                                                                                          |
| <b>7. Sustained Poor Performance</b>     | <ul style="list-style-type: none"> <li>Calculation of the regime, including the use of a 'taper' in 2026/27 that enables the SPP rate to progressively reflect the impact of the changes in Network Rail Payment Rates.</li> </ul>                                                                                                                                                                                           |
| <b>Appendices</b>                        | <ul style="list-style-type: none"> <li>A comprehensive set of appendices provides a deep dive into the technical detail of the methodology.</li> </ul>                                                                                                                                                                                                                                                                       |

## 2 Recalibration Approach

### Overview

The approach to recalibrating Schedule 8 parameters follows a standard, mechanistic approach which has been used in previous recalibrations. The methodology adopted for the CP7 Years 3 to 5 recalibration therefore follows the approach used in the PR18 and PR23 recalibrations for CP6 and CP7 respectively. The PR23 Recalibration methodology<sup>1</sup> provides an overview of the approach taken for the recalibration of the CP7 Years 1 and 2 parameters.

Whilst the majority of the techniques set out in this report have been established in previous Schedule 8 recalibrations, there are some assumptions, techniques and processes that are specific to the CP7 Years 3 to 5 recalibration. We have shown below the key changes for this recalibration (the impact of these changes is discussed further in the main body of this report).

### General Approach

#### *Modelling Process*

The recalibrated Schedule 8 parameters are generated based on revenue, performance and other inputs provided by TOCs, Network Rail and other parties. Models developed for previous recalibrations have been used for the CP7 Years 3 to 5 recalibrations and in some cases updated and enhanced. Outputs have been provided to key parties at four stages of the process, allowing time for feedback into the modelling. These were:

- Initial Draft Results (NRPR): June 2025
- Initial Draft Results (All Parameters): August 2025
- Near Final Results (All Parameters): December 2025
- Final Results (All Parameters): January 2026

#### *Stakeholder Engagement*

In the CP7 Years 3 to 5 Recalibration, ORR undertook a high proportion of the direct industry engagement with TOCs and Network Rail (in the PR23 recalibration, the Arup-Steer project team undertook industry engagement). For example (but not limited to), ORR led engagement activity related to proposed changes to Monitoring Points (MP), Cancellation Minutes Multipliers (CMMs) and Monitoring Point Weighting (MPW) data, gathering inputs from NR and TOCs and providing the results to Steer for inclusion in the modelling. ORR also led the Recalibration Working Group (RWG) with meetings held regularly between mid-2024 and late-2025.

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<sup>1</sup> <https://www.orr.gov.uk/sites/default/files/2024-08/pr23-sch8-recalibration-methodology-report-november-2023.pdf>

The Steer activity with the industry was focused on detailed engagement to support understanding of the assumptions of bespoke inputs for particular TOCs and Service Groups, as well as responding to queries and comments before preparing further iterations of the draft results. In addition, Steer held meetings with several TOCs in February and April 2025. These one-to-one meetings were used to discuss specific requirements around remapping of services. Throughout the project, there were also several meetings with Network Rail and TOCs to discuss inputs, data requirements and diagnostics, as well to support the identification of specific queries and associated iteration post the August release of model outputs.

### *Third Party Auditor*

ORR commissioned SYSTRA as a third-party auditor of the recalibration methodology, and its implementation. SYSTRA have provided independent quality assurance and an iterative review process. The Steer project team engaged with the audit team on a regular basis from April 2025. A full audit report has been provided concurrently to the near-final issue of this report.

## **Key Areas of Variation from PR23 Methodology**

### *Techniques Deployed*

There are a small number of changes to the database processing, and spreadsheet tools that we have used (see the individual sections of the report for details). These were undertaken to reduce the processing time, and to aggregate code and processes into a smaller number of processes. The modelling of Benchmarks has moved from being undertaken in Access, to R software. This streamlines the process of generating outputs for a large number of Service Groups. We have also modified the diagnostic outputs to remove calculations that are no longer required, and to enable the industry participants to see the underlying calculations for the NR BMs parameter derivation.

### *Recalibration Timeframe*

Following a programme of engagement between ORR, the TOCs and Network Rail, ORR instructed Steer to use as base year for the Recalibration Timeframe (RT), thirteen periods between 2023/24 Period 10 and 2024/25 Period 9 (10th December 2023 to 7th December 2024). For most parameters, we therefore use this recalibration timeframe as the assumed best available representation of expectations for Years 3 to 5 of the Control Period. One request was received for a bespoke recalibration period to be adopted for a specific TOC, which has been accommodated in the recalibration. For Network Rail Benchmarks (NR BM), forward-looking regulatory performance trajectories are overlaid onto the base Performance Minutes position.

## *Semi-elasticity Parameters*

The semi-elasticity parameters (i.e. the values that convert changes in performance into revenue) have changed in CP7 Years 3 to 5 Recalibration and these new semi-elasticity parameters impact the output NRPRs. This is a result of a decision made by ORR, that was informed by evidence and discussions at the 'Schedule 8 Recalibration Working Group Revenue Sub-committee'. The derivation of the values used is provided in the Steer Synthesis<sup>2</sup> paper, which has been provided to relevant parties with the distribution of draft parameters.

## *Revenue adjustments*

In the PR23 Recalibration, there were a large number of adjustments made to attempt to account for changes in revenue as a result of COVID restrictions. There were a substantially smaller number of revenue adjustments made in the Years 3 to 5 recalibration.

## *New and Missing Monitoring Points*

The methodology adopted for previous recalibrations for dealing with MPs with no data in PEARS<sup>3</sup> (either because they are new MPs at this recalibration, or PEARS does not contain data for the MP for one or more periods of the recalibration) has been adjusted to a small extent in this recalibration. In addition to the use of PSS data (PSS is a repository of performance data) and Proxy MPs, we have also considered a small number of instances where there are no records in PEARS for an existing MP and no trains called at the MP in the May 2025 timetable. If timetable changes were not proposed in the Years 3 to 5 period, the lateness at these locations was set to zero to better reflect future PEARS data for the MP. Where locations were set to zero lateness, the relevant TOCs and Network Rail were informed at the time of the provision of draft results.

## *Remapping*

The remapping of train services from the allocation in PEARS to different Service Groups or TOCs was requested on two occasions, both of which have been accommodated in the recalibration. One remapping reflects the swapping of two services between Service Groups within a TOC, whilst the other reflects the transfer of a service from one TOC to another. Discussions have been held with the TOCs involved to ensure that an agreed methodology for the remapping in the recalibration has been adopted.

## *Trajectory Regression approach*

ORR set out 'passenger train performance targets' in its 'CP7 passenger train performance reset'<sup>4</sup> documentation. For CP7 Years 3 to 5, these have been set based on two measures:

- NR Delay Minutes per 1,000 Train Miles, for punctuality; and
- NR Cancellations (%), for reliability

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<sup>2</sup> Semi-elasticities - Synthesis 2025 v1.0 FINAL.pdf

<sup>3</sup> PEARS is an abbreviation for the Paladin Data Extract and Reporting System. It is the underlying system that underpins the data for Schedule 8.

<sup>4</sup> <https://www.orr.gov.uk/media/27870/download>

NR has converted these regional trajectories to TOC-level trajectories (using the same measures), for use in the application of the trajectory to NR benchmarks. For each Service Group, the RT values for the two measures were calculated and the trajectory applied pro-rata. The calculation of the change in Actual Minutes Lateness (AML) due to the trajectory requires a conversion and regression between Delay Minutes per 1,000 Train Miles and AML to be calculated. The change in AML calculated is then applied to the NR base position Performance Minutes to produce the NR benchmarks.

Note: in the PR23 Recalibration a regression between On-Time and AML was used.

In both the PR23 Recalibration and the CP7 Years 3 to 5 Recalibration a direct relationship between Cancellations and Deemed Minutes Lateness (DML) has been used.

# 3 Network Rail Payment Rates

## Overview

This section provides an overview of the methodology used to calculate the Network Rail Payment Rates (NRPR) for the CP7 Years 3 to 5 recalibration of Schedule 8.

The NRPR represents the modelled revenue loss associated with one additional performance minute over a single day, for a given service group. Payment rates account for passenger (farebox) revenue only – i.e. they exclude car park revenue, compensation payments made by operators to passengers, and any impact on operating costs due to delays, such as driver taxis or fuel.

The NRPRs are derived from the Marginal Revenue Effect (MRE) of changes in performance for each service group. The MRE represents the modelled change in revenue for that service group in response to a one-minute change in performance minutes over a given recalibration period. The MRE is calculated by multiplying the **real revenue** (nominal revenue, adjusted to a consistent price base) in the timeframe by a semi-elasticity parameter. The revenue is processed from LENNON<sup>5</sup> earnings data, the process for which is described below.

## Network Rail Payment Rates calculation

To calculate the NRPR, the MRE is converted into the modelled revenue change for a one-minute change in performance minutes for a **single day**, by dividing the MRE by a Busyness Factor. Busyness Factors are a measure of the planned number of scheduled stops in the applicable timetable<sup>6</sup> for a rail period, compared to the average number scheduled in the bi-annual working timetable.

Each service group has its own NRPR. The calculation of the NRPR is based on four key elements:

- The total revenue generated within the recalibration timeframe for each service group;
- The price base factor applied to adjust nominal LENNON revenue to real payment rate values;
- The semi-elasticity applied, i.e. the degree to which revenue is influenced by changes in performance; and

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<sup>5</sup> LENNON is the rail industry ticketing and revenue system providing a repository of demand and revenue data.

<sup>6</sup> The passenger timetable which reflects the working timetable for the Passenger Services required to be drawn up by Network Rail in accordance with the Track Access Conditions, as at 22:00 on the immediately preceding day.

- The busyness factor applied i.e. a measure of the planned number of scheduled stops in the applicable timetable for a rail period compared to the average number scheduled in the bi-annual working timetable.

A simplified version of the NP PR process is shown in Figure 3.1.

**Figure 3.1: Overview of the key steps in the Network Rail Payment Rate process**



The Network Rail Payment Rate (NRPR) for a Service Group (SG) can be expressed mathematically as:

$$NRPR = \frac{Price\ Base\ Factor \times \sum_{Segment} (-1 \times Revenue_{Segment} \times Semi-elasticity_{Segment})}{\sum_{Segment} Busyness\ Factors}$$

Where:

The **NRPR** for each SG is equivalent to the modelled change in the Service Group's revenue for a one-minute average change in Performance Minutes (PM) for a single day. PM are a combination of the effect of delays and cancellations on passenger journeys, calculated as a weighted average across specified Monitoring Point (MP) locations.

The **SG** is a subset of the TOC's services denoted by a four-character code (e.g., HF01). Some SGs are split into Peak and Off-Peak.

The **Price Base Factor** is a multiplier converting the NRPRs in outturn prices from the Recalibration Timeframe (RT) to the values for the start of CP7 (see Appendix 1).

**Revenue** is the total value of the tickets sold for the RT as allocated in the LENNON Earnings data (with TOC specific adjustments).

The **Semi-Elasticity** is a parameter reflecting how revenue is expected to vary with changes in PM. Revenue and Semi-Elasticities are defined at a Segment level, where a Segment is the combination of Sector and Ticket Category, as per Table 3.1.

**Table 3.1: Semi-Elasticities (source: Semi-Elasticities – Synthesis 2025 v1.0 FINAL).**

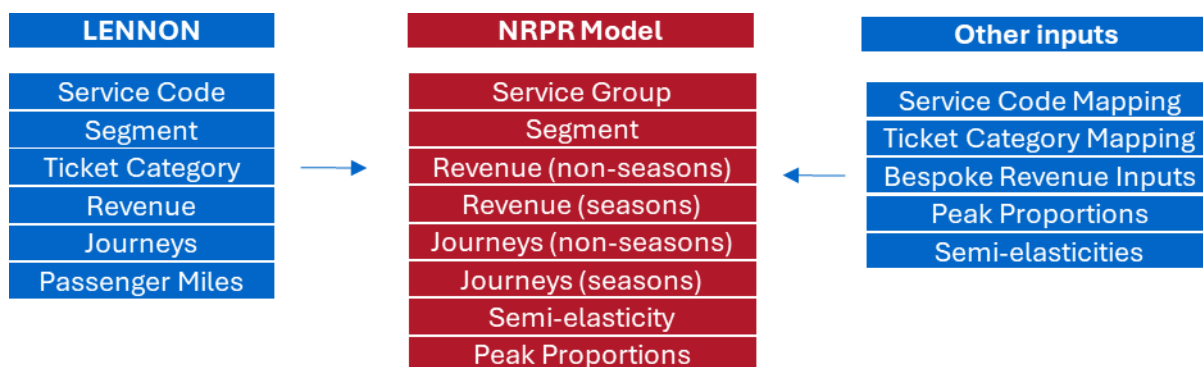
| Passenger Demand Forecasting Handbook (PDFH) Sector | Non-Season | Seasons |
|-----------------------------------------------------|------------|---------|
| London Travelcard Area (TCA)                        | -0.027     | -0.026  |
| Airport                                             | -0.012     | -0.010  |
| Long Distance flows to/from London                  | -0.010     | -0.007  |
| Rest of GB >20 miles                                | -0.010     | -0.014  |
| Rest of GB <=20 miles                               | -0.029     | -0.021  |
| SE to/from SE                                       | -0.028     | -0.019  |
| SE to/from London                                   | -0.013     | -0.010  |

**Busyness Factors** measure the planned number of scheduled stops in the applicable timetable for a Rail Period compared to the average number scheduled in the bi-annual working timetable. The sum of all the periodic Busyness Factors across the RT is used to convert the NRPR into a daily rate (see Appendix 2).

## Processing LENNON Revenue data into Segment and Ticket Categories

This section provides the process for allocating revenue data from LENNON into the relevant Segment, an overview is shown in (Figure 3.2).

**Figure 3.2: Revenue data processing steps**



### Step 1: Processing LENNON data

Rail Delivery Group (RDG) processed the LENNON Earnings data (i.e., revenue allocated to each TOC and Service Code) for each TOC for the RT. Table 3.2 shows the fields extracted and their purpose.

**Table 3.2: Fields used extraction of LENNON data**

| Field                      | Purpose of field                                                                                                                         |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Origin                     | To enable Segment to be determined                                                                                                       |
| Destination                | To enable Segment to be determined                                                                                                       |
| Service Code               | To enable the aggregation to SG. (4-digit Service Code equivalent to the 3rd, 4th, 5th and 6th digits of the 8-digit train service code) |
| Fares Group                | To enable aggregation to Seasons, Non-Seasons and Other                                                                                  |
| Adjusted Earnings Sterling | Revenue input to NRPR calculation                                                                                                        |

### Step 2: Aggregating into Ticket Category

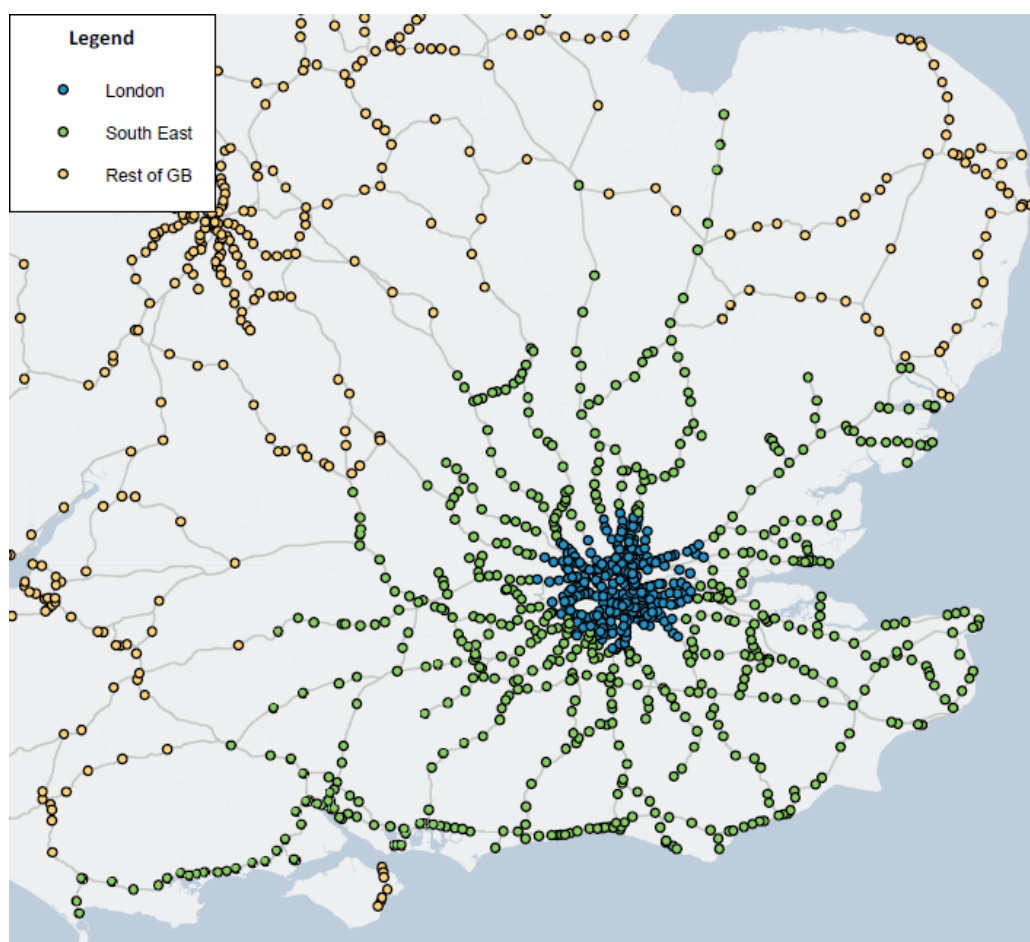
We applied the mapping in Table 3.3 to assign each Fares Group into Seasons, Non-Seasons, and Unallocated ticket categories. The Unallocated revenue is typically a very small proportion of the total revenue. We applied a pro-rata of this data into the Seasons and Non-Seasons so that this revenue is incorporated in the total. It is important that refunds are included as this avoids overestimating the total revenue in scope.

**Table 3.3: Ticket Category to Primary Product Group mapping**

| Ticket Category | Fares Product Group Description (Code)                                                                         |
|-----------------|----------------------------------------------------------------------------------------------------------------|
| Seasons         | Seasons (FG05)<br>Season Refunds (SG28)                                                                        |
| Non-Seasons     | Anytime / Peak (FG01)<br>Off-Peak (FG02)<br>Super Off-Peak (FG03)<br>Advance (FG04)<br>Ordinary Refunds (SG27) |
| Unallocated     | Other (FG06)<br>N/A Fares Group entries                                                                        |

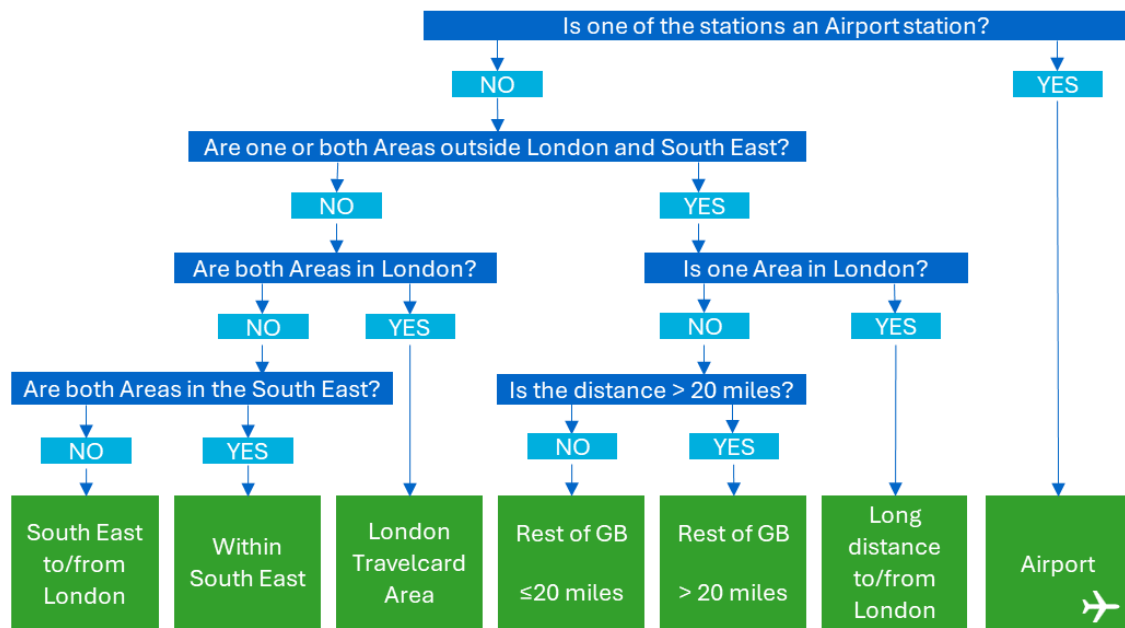
### Step 3: Area mapping

Each (non-airport) station is, for consistency with PDFH sector definitions, mapped into one of three geographic areas: London, South East, and Rest of GB. For all locations, we add an 'Area' field to the data, based on geographic Area definitions as shown in Figure 3.3. Areas not shown in the map are all 'Rest of GB'.

**Figure 3.3: Mapping of Stations to Areas**

### Step 4: PDFH Segment Mapping

The allocation in Figure 3.4 was used by RDG to map combinations of Origin Area and Destination Area into the Segments.

**Figure 3.4: Sector mapping flowchart (Source: Steer interpretation of PDFH)**

### Step 5: Allocating revenue to a peak type

LENNON data does not provide any information on the actual time of travel. To convert the LENNOR data into Peak and Off-Peak (for those SGs that have this distinction), we use the Fares Group splits in combination with the Peak Proportions for each Fares category. Further information on this allocation is provided in Appendix 3.

### Step 6: TOC-Specific Adjustments

We have incorporated information provided by the operators to adjust the Flow data to account for places where the standard process (described in Steps 1 to 5) does not fully capture all the input information. These adjustments may contain commercially sensitive information and are therefore not shown in this methodology document. TOC-Specific Adjustments can be classified as follows:

- Removal of revenue generated on sections of route for which NR is not the Infrastructure Manager;
- Additional sources of revenue not captured in LENNOR (i.e., tickets sold at airports);
- Information to disaggregate non-geographic records (e.g., Passenger Transport Executive tickets);
- Adjustments to the modelled peak/off-peak splits calculated in Step 5;
- Adjustments to the allocation of revenue to service codes;
- Information to ensure Refunds and Non-Issues are dealt with appropriately; and
- Identification of Non-Marginal Revenues (i.e., those that are not affected by performance) that have significant amounts of revenue on Full, Reduced or Seasons rather than Other.

In the PR23 Recalibration for CP7 there was a revenue adjustment for post-COVID 19 pandemic revenue recovery. There has not been a similar revenue adjustment for the CP7 Years 3 to 5 recalibration.

## 4 Base Benchmarks

### Overview

The Base Benchmarks we describe here reflect performance during the agreed Recalibration Timeframe (RT), adjusted to account for changes to Monitoring Points (MP), Monitoring Point Weightings (MPWs) and Cancellation Minutes Multipliers (CMMs) that have happened or are expected prior to the start of Year 3 of CP7 in April 2026. We also incorporated the following impacts:

- Changes to Signal Berth Offsets (BO) were implemented after the start of the RT and prior to the beginning of Year 3 of CP7.
- Changes to advertised time or 'Public Differential' (PD), defined as difference between the public (GBTT) and working (WTT) timetables, which for the purposes of the Year 3 recalibration were provided in a similar format to changes in Signal Berth Offsets.

One request for a bespoke RT was accommodated in the calculation of the benchmarks.

The Network Rail and TOC Base Benchmarks comprise 'AML' (Actual Minutes Lateness, caused by delays) and 'DML' (Deemed Minutes Lateness, due to cancellations). For example, the Network Rail AML and DML for a (Victim) SG with new MPWs, new CMMs and with adjustments applied are calculated as follows:

$$NR\ AML = \sum_{MPs} NewMPW \cdot \frac{\sum_{RT-Dates} [(Lateness + Adjustments) \cdot NRDelay\%_{SGT}]}{\sum_{RT-Dates} Trains}$$

$$NR\ DML = NewCMM \cdot \sum_{MPs} NewMPW \cdot \frac{\sum_{RT-Dates} NR\ Cancellations}{\sum_{RT-Dates} Trains}$$

Where:

RT-Dates = Dates in RT minus any to be removed

Adjustments = Berth Offset Impact per Train x (Trains – Cancellations)

NRDelay%SGT = Network Rail and TOC-on-TOC (TOT) share of responsibility for Delay Minutes on relevant Date for SG and Peak Type corresponding to MP, according to PEARS

Trains = Trains planned to call at MP on the day

For the versions of these formulae with TOC responsibility, simply replace the Network Rail Delay % and Cancellations with TOC Delay % and TOC Cancellations.

Prior to the start of Year 3, two TOCs (TransPennine Trains and Northern), made significant changes to their routes and service patterns on two Service Groups, for which a recalibration exercise was carried out and implemented by way of an adjustment to existing benchmarks. We agreed with these TOCs that the impact of these changes on the

Year 3 recalibration would be calculated by applying the same adjustments as a percentage change to the Base Benchmarks and TOC Payment Rates, calculated using the current MPWs.

One service change was incorporated into the recalibration where the straightforward movement of trains in two Service Codes from one SG to another made it relatively easy to implement (where Service Code is a sub-set of a service group).

The remainder of this section outlines the key inputs, calculations, checks carried out and outputs produced.

## **Data collection**

This section describes the key input datasets to the Base Benchmark calculations.

### *MP + CMM repository*

Network Rail and the TOCs, under the guidance of ORR, submitted proposals for changes to MPs (new or removed), MPWs and CMMs for each operator. Steer utilised these to generate inputs to benchmark calculations and to identify any new locations proposed, for which there would be no historical PEARS data.

### *PEARS databases*

The daily PEARS data only contains data at MPs that were valid during the RT. This is the main data source for lateness minutes and the number of cancellations at a MP level. Network Rail provided us with a download of the database for each of the TOCs in scope.

### *PSS On Time data for new MPs*

For new MP locations at which data was not available in PEARS, where possible we used the PSS 'On Time' data provided by Network Rail, which included information on lateness and cancellations at each location, as well as Direction and Peak Type. Lateness was capped at the value specified in PEARS.

### *Cancelled trains*

Network Rail provided cancellation data for 2023/24 and 2024/25 by service and responsibility type, which enables the functionality to assign responsibility for the cancellations identified in the PSS On Time data for the Recalibration Timeframe.

### *Impact of changes to Signal Berth Offsets*

Network Rail provided files showing the estimated impact per train of changes to Signal Berth Offsets (BO) on lateness at individual MPs, together with another file showing the date that the changes were implemented. Together these allowed us to identify (a) the impact of BO changes on lateness by MP and, (b) to which periods of the RT – prior to their implementation – these impacts needed to be retrospectively applied.

### *Impact of changes to Public Differential*

Where an operator advised that the PD, or advertised time – the difference between the public and working timetables – was to be removed at destination locations, we used data provided by Network Rail in the same format as for Signal Berth Offsets (see above) in the model.

## Assumptions

Network Rail and TOC shares of responsibility for delays and cancellations are left unchanged irrespective of any changes to services and new MPs. For example, if responsibility for delays on a particular date and SG were in the ratio of 60:40 then this same ratio was used to divide responsibility for lateness at a new MP on that SG.

In general, where new MPs have been proposed we have assumed that services will call at them, and hence that they should be included in our calculations, even where no historical data exists. However, in those instances where no data was available for a MP in either PEARS or PSS and where no trains were forecast to call at the MP in the May 2025 timetable, we set lateness to zero, effectively removing the MP from our calculations. Affected operators were provided with a “Data Source Decisions” file including a sheet listing any MPs at which lateness was “set to 0” for review.

The historical PSS data provided by Network Rail included Direction and Peak Type columns, which we assumed would be sufficiently accurate for the purposes of this exercise.

## Approach for new MPs or those with missing data

We developed two approaches for estimating lateness at new MPs or those with missing data depending on whether historic data was available:

- Where historical data was available, we used the PSS On Time data provided by Network Rail.
- Where no historical data was available for the new MPs, we identified existing ‘Proxy MPs’ that we deemed to be appropriate approximations for the new ones and extracted the relevant PEARS data for these proxies. Again, for affected operators we included a sheet in the “Data Source Decisions” file listing the Proxy MPs selected.

In some cases, historical data was only partially available, such as where a new MP was introduced at the beginning of CP7. In these cases we only used the Proxy MP for those periods with missing data.

Where there were no data for an existing MP and no trains were scheduled to call at the station in December 2024, a third approach was taken, to set the lateness to zero.

For more information, see Appendix 4.

## Signal Berth Offset and Public Differential Changes

Using files provided by Network Rail (see section on the impact of changes to berth offsets, above), we first made sure that we could match each SBO change to an existing MP and then aggregated the impacts (measured in minutes per train run) across MPs by period. We merged these impacts – which only apply to periods prior to their implementation – with the historical PEARS data to calculate revised lateness (capped at minimum of zero lateness) at each MP. A worked example is provided below.

## Worked example

Table 4.1 below is a close approximation of how we apply berthing offset adjustments with an example for a hypothetical MP at which parties have agreed to +0.1 minutes per train run SBO adjustment, which is only applied prior to its implementation in 2023/24

P03. In this example, Total AML increases from 0.67 to 0.72 due to the SBO adjustment. Note that these values are ‘unweighted’ – they do not include the application of the MPW.

**Table 4.1: Example calculation of adjusted AML and DML (unweighted)**

| Period | Trains (T) | Cancs (C) | Total DML | Trains Run (R) = T – C | Total Lateness - Raw (A) | Total AML - Raw = A/T | SBO Impact / Train Run (B) | Lateness - Adj. (E) = A + (B x R) | Total AML - Adj. = E/T |
|--------|------------|-----------|-----------|------------------------|--------------------------|-----------------------|----------------------------|-----------------------------------|------------------------|
| 23_10  | 1000       | 5         | 0.45      | 995                    | 500.0                    | 0.50                  | 0.1                        | 599.5                             | 0.60                   |
| 23_11  | 1000       | 2         | 0.18      | 998                    | 1000.0                   | 1.00                  | 0.1                        | 1099.8                            | 1.10                   |
| 23_12  | 1000       | 40        | 3.60      | 960                    | 2000.0                   | 2.00                  | 0.1                        | 2096.0                            | 2.10                   |
| 23_13  | 1000       | 0         | 0.00      | 1000                   | 500.0                    | 0.50                  | 0.1                        | 600.0                             | 0.60                   |
| 24_01  | 1000       | 5         | 0.45      | 995                    | 500.0                    | 0.50                  | 0.1                        | 599.5                             | 0.60                   |
| 24_02  | 1000       | 2         | 0.18      | 998                    | 200.0                    | 0.20                  | 0.1                        | 299.8                             | 0.30                   |
| 24_03  | 1000       | 10        | 0.90      | 990                    | 300.0                    | 0.30                  | 0.1                        | 399.0                             | 0.40                   |
| 24_04  | 1000       | 0         | 0.00      | 1000                   | 200.0                    | 0.20                  |                            | 200.0                             | 0.20                   |
| 24_05  | 1000       | 5         | 0.45      | 995                    | 500.0                    | 0.50                  |                            | 500.0                             | 0.50                   |
| 24_06  | 1000       | 2         | 0.18      | 998                    | 1000.0                   | 1.00                  |                            | 1000.0                            | 1.00                   |
| 24_07  | 1000       | 10        | 0.90      | 990                    | 500.0                    | 0.50                  |                            | 500.0                             | 0.50                   |
| 24_08  | 1000       | 0         | 0.00      | 1000                   | 500.0                    | 0.50                  |                            | 500.0                             | 0.50                   |
| 24_09  | 1000       | 1         | 0.09      | 999                    | 1000.0                   | 1.00                  |                            | 1000.0                            | 1.00                   |

## Service Remapping

We generated separate results for SGs where it was possible to approximately reflect planned changes to the train service within the raw data, without needing to make many subjective and impractical assumptions. To generate these results, we took the raw data and applied two adjustments:

- **Daily MP lateness:** We remapped the victim service codes suffering lateness at each MP in the detailed daily PEARS and PSS data using the logic provided by the operator and assigned the corresponding new SG.
- **Daily delay:** We adjusted the Network Rail and TOC shares of daily delay minutes in PEARS by applying the relative percentage change in the Network Rail share of the total, as calculated in the Responsibility Matrix (see section on TOC Payment Rates).

Having made these adjustments, the remapped data was used in the benchmark calculations in the same way as the raw data for other SGs.

## Benchmark diagnostics and worked example

We adjust each parameter sequentially, calculating versions of AML and DML at each step to enable comparisons to be made between each step in the calculation:

- With current MPWs and CMMs (baseline)
- With current MPWs and new CMMs (to show impact of new CMMs)
- With new MPWs and new CMMs (to show impact of new MPs)
- As above with revised lateness after applying SBO and PD adjustments (to show impact of adjustments)
- As above with remapped SGs (to show impact of remapping)

This process is repeated with disputes set to operators and to Network Rail, which generates two sets of outputs to which we then apply dispute reallocation (see below).

Table 4.2 below illustrates comparisons (i) and (iv) above, together with the approach used when adding new MPs (as outlined earlier in this section). Current MPWs and CMMs (i) are highlighted blue; new ones (iv) are highlighted in green.

**Table 4.2: Example calculation of Benchmark (PM) comparisons**

| Measure                                     | MP1<br>(current) | MP2<br>(current) | MP3<br>(new) | MP4<br>(new)       | Total |
|---------------------------------------------|------------------|------------------|--------------|--------------------|-------|
| Source                                      | PEARS            | PEARS            | PSS          | Proxy = MP2        |       |
| MPW-Current (wC)                            | 0.5              | 0.5              |              |                    |       |
| MPW-Current (wN)                            | 0.35             | 0.45             | 0.15         | 0.05               |       |
| CMM-New (mC)                                | 90               | 90               | 90           | 90                 |       |
| CMM-New (mN)                                | 80               | 80               | 80           | 80                 |       |
| Trains (T)                                  | 12,950           | 12,950           | 1,000        | No historical data |       |
| Network Rail Lateness (A)                   | 5,594            | 5,000            | 600          |                    |       |
| TOC Lateness (B)                            | 3,729            | 3,000            | 400          |                    |       |
| Network Rail Cancellations (C)              | 19               | 20               | 5            |                    |       |
| TOC Cancellations (D)                       | 28               | 30               | 5            |                    |       |
| Network Rail Average Lateness (E) = A/T     | 0.43             | 0.39             | 0.60         | 0.39               |       |
| TOC Average Lateness (F) = B/T              | 0.29             | 0.23             | 0.40         | 0.23               |       |
| Network Rail Cancellations % (G) = C/T      | 0.15%            | 0.15%            | 0.50%        | 0.15%              |       |
| TOC Cancellations % (H) = D/T               | 0.22%            | 0.23%            | 0.50%        | 0.23%              |       |
| Network Rail PM-Current = (E + mC x G) x wC | 0.28             | 0.26             | 0.00         | 0.00               | 0.54  |
| Network Rail PM-New = (E + mN x G) x wN     | 0.19             | 0.23             | 0.15         | 0.03               | 0.60  |
| TOC PM-Current = (F + mC x H) x wC          | 0.24             | 0.22             | 0.00         | 0.00               | 0.46  |
| TOC PM-New = (F + mN x H) x wN              | 0.16             | 0.19             | 0.12         | 0.02               | 0.49  |

## Disputed minutes reallocation

The final step is to reallocate the disputed minutes. Based on a methodology agreed by the RWG for CP7, any minutes in dispute at the time of extracting the data from PEARS are allocated in line with the TOC/Network Rail share of undisputed minutes across the full RT. This is done separately for AML and DML. For example, on a SG:

- Network Rail undisputed AML is 3.0 mins (60% of the total undisputed AML)
- TOC undisputed AML is 2.0 mins (40% of the total undisputed AML)
- The level of disputed AML is 0.5 mins.
- Network Rail is assigned 0.3 (i.e.,  $0.5 \times 60\%$ ) of disputed mins, giving a Network Rail AML of 3.3 mins.
- TOC is assigned 0.2 (i.e.,  $0.5 \times 40\%$ ) of disputed mins, giving a TOC AML of 2.2 mins.
- The same process was also carried out for DML.

## Checks

We carried out checks on the benchmark calculations, the results of which are as follows:

- We have no duplicate data sources for any MP in any period.
- Once MPs at which we have set lateness to 0 are taken into account, the sum of the MPWs across all MPs equals 1, meaning that we have no missing data points.
- We have matched all berthing offset changes provided by Network Rail to an MP.

# 5 Network Rail Benchmarks

## Overview

The Network Rail Benchmarks (NR BM) consist of PM suffered by a Victim SG that is caused by delays and cancellations for which responsibility rests with the 'Perpetrator' which is either Network Rail or other passenger, freight and charter train operators

ORR set out 'passenger train performance targets' in its 'CP7 passenger train performance reset'<sup>7</sup> documentation. The Delay per 1,000 miles and Cancellations trajectories are then applied to the NR BM calculations. In this section, we explain how these trajectories are used in the calculation of the annual Network Rail Benchmarks.

## Methodology

The Network Rail Benchmark is made up of multiple components: Passenger TOC-on-TOC (TOT), Freight-on-TOC (FOT), Charter-on-TOC (COT) as well as 'Network Rail Only'. The methodology requires the NR BM figure to be split into these separate components with a trajectory applied to the Network Rail Only element before the component parts are re-combined to form the NR BM.

### *Shares of responsibility for Network Rail Benchmarks*

We use the historical PSS data for the RT provided by Network Rail to calculate the TOT, FOT, COT and NR shares of delay minutes and cancellations for each SG, to enable the responsibility for the AML and DML parts of the Network Rail benchmarks to be disaggregated. This is an output of the TOC Responsibility Matrix (see also the section on TOC Payment Rates).

### *Passenger TOC-on-TOC*

The passenger TOT contribution to the Network Rail Benchmark is kept constant throughout CP7 Years 3 to 5. It is the average PM suffered by the Victim SG within the RT.

### *Freight- and Charter-on-TOC*

The FOT and COT contributions to the Network Rail Benchmarks are not uplifted and are kept constant throughout CP7 Years 3 to 5. This is based on a direction provided to Steer by ORR at CP7.

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<sup>7</sup> <https://www.orr.gov.uk/media/27870/download>

## Apply Network Rail Trajectories (AML)

Performance trajectories are applied to the base NR Performance Minutes, to develop NR Benchmarks for each year (3 to 5 of CP7) that reflect that trajectory. The trajectories are determined by ORR at a NR Region-level and then converted to TOC-level trajectories.

The CP7 Years 3 to 5 trajectories are provided in terms of:

- Network Rail Delay Minutes per 1,000 Train Miles for punctuality; and
- Network Rail Cancellations (%), for reliability.

The NR trajectories are applied to the NR base position by relating AML to Network Rail Delay per 1,000 Train Miles and DML to Network Rail Cancellations at a Service Group level.

The application of NR Regional trajectories to the NR Benchmarks involved six Phases of work, shown in Table 5.1. Phases 1 to 3 have been determined by the industry (i.e. NR, TOCs and ORR) and are outside the scope of this report. Phases 4 and 5 have been developed by Steer and are described in more detail below.

**Table 5.1: Phases in applying Network Rail Trajectories**

| Phase   | Description                                                                                                                                                                                                          | Organisation               |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Phase 1 | ORR determines regional Delay and Cancellation trajectories                                                                                                                                                          | ORR                        |
| Phase 2 | Network Rail assumptions for TOC level performance                                                                                                                                                                   | Network Rail               |
| Phase 3 | Convert regional Delay and Cancellations trajectories to Network Rail attributable delay and cancellations trajectories at a TOC-level                                                                               | Network Rail model for ORR |
| Phase 4 | Convert Network Rail Delay per 1,000 train miles at a TOC-level to a SG-level                                                                                                                                        | Steer                      |
| Phase 5 | Convert annual Network Rail Delay per 1,000 train miles trajectory into a NR-caused AML trajectory for each SG<br>Convert annual Network Rail Cancellations trajectories into a NR-caused DML trajectory for each SG | Steer                      |
| Phase 6 | Combining AML and DML components together                                                                                                                                                                            | Steer                      |

### Phase 4: Converting TOC-level Network Rail Trajectories to Service Group-level trajectories.

Network Rail provided NR Delay per 1,000 Train Mile trajectories for each TOC. In each case, the relevant value was provided for the RT and then the trajectory values provided for each year of CP7.

In the case of three TOCs that are expected to be impacted by the December 2025 timetable change on the East Coast Main Line, but which also operate services on other Regions, NR split the trajectories into an Eastern Region Trajectory and a non-Eastern Region Trajectory. For each of the three TOCs' SGs, NR also provided the proportion of total delays over the RT that were located on the Eastern Region. For these SGs a blended trajectory was calculated in the following way:

$$Trajectory_{Blended} = Trajectory_{Eastern} \times \%Delay_{Eastern} + Trajectory_{Rest} \times \%Delay_{Rest}$$

The trajectory was converted from a TOC-level trajectory to a Service Group trajectory by

$$Trajectory_{SG\ Year} = Dp1000m_{SG\ RT} \times \frac{Dp1000m_{TOC\ Year}}{Dp1000m_{TOC\ RT}}$$

Where, Dp1000m is NR Delays per 1,000 Train Miles.

### Phase 5: Converting Service Group-level Network Rail Delay per 1,000 miles Trajectories to AML.

The Network Rail share of the Base AML for each SG is calculated as follows:

$$AML_{NR\ only,Base} = AML_{NR\ only+TOT+FOT+COT,Base} \times \frac{Delay_{NR\ Only,Base}}{Delay_{NR\ Only+TOT+FOT+COT,Base}}$$

The SG-level NR Dp1000m trajectory is then applied to the Network Rail proportion of the Network Rail Benchmark, using the Network Rail part of the Base Benchmark as a start point and overlaying a regression between Total (NR and TOC) Actual Minutes Lateness, adjusted to reflect changes to measurement process (MPWs etc.) for CP7 Years 3 to 5, and Total (NR and TOC) Delay per 1,000 miles.

The regression analysis was undertaken to evaluate the relationship between Total AML and Total Dp1000m at a SG-level, with the:

- Independent variable (also known as X variable): Total Dp1000m at a SG level.
- Dependent variable (also known as Y variable): NR AML + TOC AML = Total AML, adjusted for the impact of changes to MPWs and Signal Berth Offsets.

Note: Total delay and total AML are used because the relationship between delay and AML is not thought to vary materially as to whether delays are caused by Network Rail or operators. This approach also simplifies calculations. The regression relationship is determined by Ordinary Least Squares estimation at a SG level.

Where the regression did not provide a good fit, even after removing outliers, we did not apply this to the trajectory calculation. The regression was regarded as inappropriate if the R-squared value was below 45%.

The Network Rail portion of AML at SG level in each year is calculated as follows:

$$AML_{NR\ only,Year\ x} = AML_{NR\ only,Base} + \alpha_1(NRDp100km_{Year\ x} - NRDp100km_{Base})$$

Where  $\alpha_1$  is the regression parameter between AML and  $NRDp100km$

The Network Rail share of the Base DML for each SG is calculated as follows:

$$DML_{NR\ only,Base} = DML_{NR\ only+TOT+FOT+COT,Base} \times \frac{Cancellations_{NR\ Only,Base}}{Cancellations_{NR\ Only+TOT+FOT+COT,Base}}$$

The Network Rail portion of DML is assumed to have the same trajectory as the TOC-level Network Rail cancellations trajectory.

$$DML_{NR\ only,Year\ x} = DML_{NR\ only,Base} \times \frac{Cancellations_{NR\ Only,Year\ x}}{Cancellations_{NR\ Only,Year\ Base}}$$

## Phase 6: Combining Components

The Network Rail Benchmarks (Network Rail BM) for each SG in each year are calculated as follows:

$$\text{NRBM}_{\text{Year } x} = \text{NRAML}_{\text{Year } x} + \text{NRDML}_{\text{Year } x}$$

Where:

$$\text{NRAML}_{\text{Year } x} = \text{NRonlyAML}_{\text{Year } x} + \text{TOTAML}_{\text{Base}} + \text{FOTAML}_{\text{Base}} + \text{COTAML}_{\text{Base}}$$

$$\text{NRDML}_{\text{Year } x} = \text{NRonlyDML}_{\text{Year } x} + \text{TOTDML}_{\text{Base}} + \text{FOTDML}_{\text{Base}} + \text{COTDML}_{\text{Base}}$$

$\text{NRonlyAML}_{\text{Year } x}$  = Network Rail-on-TOC AML suffered by the Victim SG during the RT, varied annually according to the application of the NRDp1000m trajectory for that SG.

$\text{TOTAML}_{\text{Base}}$  = TOT AML suffered by the Victim SG during the RT.

$\text{FOTAML}_{\text{Base}}$  = Freight-on-TOC AML suffered by the Victim SG during the RT.

$\text{COTAML}_{\text{Base}}$  = Charter-on-TOC AML suffered by the Victim SG during the RT.

$\text{NRonlyDML}_{\text{Year } x}$  = Network Rail-on-TOC DML suffered by the Victim SG during the RT, varied annually according to the application of the Cancellation trajectory for that SG.

$\text{TOTDML}_{\text{Base}}$  = TOT DML suffered by the Victim SG during the RT.

$\text{FOTDML}_{\text{Base}}$  = Freight-on-TOC DML suffered by the Victim SG during the RT.

$\text{COTDML}_{\text{Base}}$  = Charter-on-TOC DML suffered by the Victim SG during the RT.

## 6 TOC Payment Rates

### Overview

This section describes the process of calculating the Schedule 8 TOC Payment Rates for each SG. The TOC Payment Rate (TOC PR) is the amount an operator pays to/receives from Network Rail per minute of TOC-on-Self PM on a single day, for each SG. The rate is calculated as a function of the cost to NR of TOC-on-TOC (TOT) disruption that is:

- **Caused by each Perpetrating SG (PSG)** – the SG which causes the performance incident, and;
- **Suffered by each Victim SGs (VSGs)** – the SGs which suffer delays and/or cancellations from said incident.

The TOC PRs are intended to (on average) hold Network Rail financially neutral to these TOT delays through the application of each VSG's NRPR to the proportion of its total Network Rail PM (including TOT disruption) that is caused by each Perpetrating SG.

We begin this section by describing how we calculate the TOC PRs for each SG and then work back to show how we derive the information from the input data sources, along with the process for applying TOC-specific adjustments.

### Methodology

The TOC PR for a (Perpetrating) SG is calculated as follows:

$$TOC\ PR = \frac{\sum_{VSG=1}^n (PRC\ Delay_{VSG:PSG} + PRC\ Cancellations_{VSG:PSG})}{TOC\ BM}$$

Where:

$$PRC\ Delay_{VSG:PSG} = \frac{Delay\ Minutes_{VSG:PSG}}{NR\ \&\ TOT\ Delay\ Minutes_{VSG}} \times NR\ AML_{VSG} \times NRPR_{VSG}$$

$$PRC\ Cancellations_{VSG:PSG} = \frac{Cancellations_{VSG:PSG}}{NR\ \&\ TOT\ Cancellations_{VSG}} \times NR\ DML_{VSG} \times NRPR_{VSG}$$

The Payment Rate Cost (PRC) between a VSG and PSG pair (denoted VSG: PSG) is the amount of money Network Rail is assumed to pay to a VSG as a result of Delays and Cancellations caused by a PSG.

PRC Delay VSG: PSG is the contribution to PRC VSG: PSG from the PSG's Delay Minutes.

PRC Cancellations VSG: PSG is the contribution to PRC VSG: PSG from the PSG's Cancellations.

The TOC BM is the TOC Benchmark for the PSG (calculated as per the section on Base Benchmarks). This is used as a divisor to convert the PRC which is an absolute value into the TOC PR which is a per-minute value.

Delay and Cancellation Minutes are calculated in the TOC Responsibility Matrix (see section below).

Delay Minutes are the above-threshold<sup>8</sup> 'PfPI minutes' from PSS Delay Data. (Where PfPI is the required delay minutes metric).

Delay Minutes VSG: PSG is the Delay Minutes caused by the PSG on the VSG, with adjustments to (a) 'Spread' minutes for which no valid PSG was provided in the data and (b) reallocate disputes.

NR&TOT Delay Minutes VSG is the total Delay Minutes caused by Network Rail and TOT on the VSG, adjusted to better match PEARS.

Cancellations Minutes are the 'PfPI minutes' as output by PSS for cancellations, which attempts to replicate the PEARS treatment of cancellations using a multiplier (CMM).

Cancellations VSG: PSG is the Cancellation Minutes caused by the PSG on the VSG, again with adjustments (a) and (b) as above for delay.

NR&TOT Cancellations VSG is the total Cancellation Minutes caused by Network Rail and TOT on the VSG.

## Assumptions

We use the 'PfPI Minutes – AT' column in the PSS data provided, which includes only 'above threshold' (AT) minutes – excluding sub-threshold delays. This is assumed to sufficiently approximate similar calculations in PEARS.

The detailed PSS data we received from Network Rail (for the purpose of remapping delays and cancellations caused by TOCs with material service changes) did not include the impact on freight operators. As such, in the Responsibility Matrix calculations we have assumed that there will be no change in TOC-on-freight disruption caused by the remapping.

## TOC Responsibility Matrix

The purpose of the Responsibility Matrix is, for each VSG, to calculate the proportion of Network Rail and TOT delay and cancellation minutes caused by each PSG. This calculation also applies service remapping to both the victim and responsible service codes. By comparing pre- and post-remapped data, we calculate the impact of remapping on the TOC/Network Rail share of delays, which in turn is an input to the Base Benchmarks calculations (see Base Benchmarks section of this report).

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<sup>8</sup> These are delays  $\geq 3$  minutes, the threshold for delay attribution.

The key calculation steps are:

- Apply an adjustment to Network Rail and TOT delays to reflect PEARS treatment of unexplained and un-investigated 'Z-coded' incidents – responsibility is shared between Network Rail and the TOC affected; this adjustment reduces the NR+TOT total slightly, and hence leads to a small increase in each perpetrating TOC's share.
- 'Spread' minutes across any gaps in the raw data where the PSG is 'invalid' (e.g., because it is not populated or is inconsistent with the Responsible Organisation) using the distribution of minutes across valid data.
- Replicate the treatment of disputed minutes that is applied in the benchmark calculations (see Base Benchmarks section of this report); disputed minutes in PSS are shown as TOC-on-Self responsibility with an Attribution Status of 'Attribution Disputed'.
- Apply the remapping to victim and perpetrator Service Codes.
- Aggregate minutes across the RT.

## Network Rail VSG Parameters

For all VSGs, we need the AML and DML parts of the Network Rail benchmark, as well as the corresponding Network Rail payment rate. The sources of these inputs are different for passenger TOCs, and freight and charter operators.

### *Passenger TOCs*

The AML and DML parts of the Network Rail PM are outputs of the Base Benchmarks calculations (see Network Rail Benchmarks section of this report), where:

- The Network Rail AML VSG are the portion of the NR+TOT PM for the VSG due to NR+TOT Actual Minutes Lateness.
- The Network Rail DML VSG are the portion of the NR+TOT PM for the VSG due to NR+TOT Deemed Minutes Lateness.

The Network Rail Payment Rates for the VSGs (NRPR VSG) are as output by the relevant model in 2023/24 price base (see section on Network Rail Payment Rates).

### *Freight and Charter Operators*

The freight and charter benchmarks are as outputted by the corresponding recalibration exercise for PR23. These benchmarks do not have AML and DML parts in the same way as those for the passenger SGs do:

- AML: This is the corresponding Freight or Charter benchmark, specified in terms of delay minutes per 100 train miles.
- DML: We have not incorporated the Freight and Charter cancellations benchmark in our calculations, see the section below on Payment Rate Cost calculations.

For Freight and Charter as Victim, the NRPR are those provided by ORR.

### *Freight and Charter Payment Rate Costs*

The Freight as Victim and Charter as Victim calculations differ from the TOC as Victim calculations for:

- Payment Rate Cost Delay
- Payment Rate Cost Cancellations

### Payment Rate Cost Delay

The Freight and Charter Payment Rates for Delays are based on the Freight and Charter NRPRs for delay, which are provided as a cost per delay minute figure. These are converted into equivalent figures to those used by passenger TOCs. This conversion is calculated as follows:

$$\text{Freight PR Delay} = \text{Freight NRPR} \times \text{Actual Freight mileage} \div (100 \times \text{annualisation factor})$$

$$\text{Charter PR Delay} = \text{Charter NRPR} \times \text{Actual Charter mileage} \div (100 \times \text{annualisation factor})$$

The Payment Rate Cost Delay calculations are then carried out in the same way for Freight and Charter as Victim as they are for TOC as Victim.

### Payment Rate Cost Cancellations

In relation to Cancellations in the Freight and Charter performance regimes, those caused by passenger operators would strictly generate a cost to Network Rail. However, we agreed with ORR to follow the approach used for PR18, not to include Freight and Charter cancellations in the passenger TOC Payment Rate calculations, noting also that their contribution to payment rates would be small.

## Worked example

A simplified illustration of the TOC Payment Rates calculation is shown in Table 6.1. The contribution to PRC from the PSG's delay minutes is calculated as follows:

$$PRC\ Delay_{VSG:PSG} = \frac{\text{Delay Minutes}_{VSG:PSG}}{NR\ \&\ TOT\ Delay\ Minutes_{VSG}} \times NR\ AML_{VSG} \times NRPR_{VSG}$$

**Table 6.1: Worked example of the TOC Payment Rate (Delay) calculation**

| TOC | VSG  | PRC Delay VSG: AA01 | Delay Minutes Suffered by VSG |   |                              | Network Rail AML |   | NRPR    |
|-----|------|---------------------|-------------------------------|---|------------------------------|------------------|---|---------|
|     |      |                     | Caused by AA01                |   | Caused by Network Rail & TOT |                  |   |         |
| BB  | BB01 | £475                | 5,000                         |   | 20,000                       | 1.9              |   | £1,000  |
| BB  | BB02 | £40                 | 250                           |   | 10,000                       | 0.8              |   | £2,000  |
| BB  | BB03 | £643                | 2,000                         | ÷ | 14,000                       | 1.5              | x | £3,000  |
| CC  | CC01 | £0                  | 0                             |   | 25,000                       | 2.2              |   | £5,000  |
| CC  | CC02 | £1,448              | 3,000                         |   | 58,000                       | 2.8              |   | £10,000 |

$$PRC\ Delay_{VSG:PSG} = £475 + £40 + £643 + £0 + £1,448$$

$$PRC\ Delay_{VSG:PSG} = £2,606$$

The contribution to PRC from the PSG's cancellations is calculated as follows:

$$PRC\ Cancellations_{VSG:PSG} = \frac{\text{Cancellations}_{VSG:PSG}}{NR\ \&\ TOT\ Cancellations_{VSG}} \times NR\ DML_{VSG} \times NRPR_{VSG}$$

**Table 6.2: Worked example of the TOC Payment Rate (Cancellations) calculation**

| TOC | VSG  | PRC Canc<br>VSG: AA01 |     | Cancellation Minutes<br>Suffered by VSG |   |                                    |     | Network<br>Rail DML |   | NRPR    |
|-----|------|-----------------------|-----|-----------------------------------------|---|------------------------------------|-----|---------------------|---|---------|
|     |      |                       |     | Caused<br>by AA01                       |   | Caused by<br>Network Rail<br>& TOT |     |                     |   |         |
| BB  | BB01 | £175                  | = ( | 35                                      | ÷ | 240                                | ) x | 1.2                 | x | £1,000  |
| BB  | BB02 | £75                   |     | 5                                       |   | 120                                |     | 0.9                 |   | £2,000  |
| BB  | BB03 | £315                  |     | 15                                      |   | 100                                |     | 0.7                 |   | £3,000  |
| CC  | CC01 | £0                    |     | 0                                       |   | 400                                |     | 0.3                 |   | £5,000  |
| CC  | CC02 | £292                  |     | 35                                      |   | 600                                |     | 0.5                 |   | £10,000 |

$$PRC\ Cancellations_{VSG:PSG} = £175 + £75 + £315 + £0 + £292$$

$$PRC\ Cancellations_{VSG:PSG} = £857$$

With a TOC Benchmark of 1.5 for this dummy calculation the TOC Payment Rate is then calculated as:

$$TOC\ PR = \frac{\sum_{VSG=1}^n (PRC\ Delay_{VSG:PSG} + PRC\ Cancellations_{VSG:PSG})}{TOC\ BM}$$

$$TOC\ PR = \frac{£2,606 + £857}{1.5}$$

$$TOC\ PR = £2,309$$

# 7 Sustained Poor Performance

## Overview

ORR states that: ‘The Sustained Poor Performance regime is intended to provide additional compensation to a TOC when lateness and cancellations attributable to Network Rail reach a specified threshold, beyond which it is considered the liquidated sums nature of Schedule 8 could start significantly to undercompensate the TOC. That additional compensation is measured in relation to the benchmark level of Network Rail’s performance.’

There are three steps of calculation:

- SG Period SPP component
- TOC Period SPP
- Annual Periodic Liability TOC

The difference between ‘Annual Value’ and ‘Annual Periodic Liability’ is explained in Step 3 of the methodology below. We provide the formulae for each step, followed by a worked example at the end of this section.

## Methodology

### Step 1: Service Group Period SPP

At a Service Group level, the SPP component in a given period is calculated as follows:

$$SPP_{\text{Period, Year } X} = NRBM_{\text{Year } X} \times NRPR_{\text{Year } X} \times \text{Busyness Factor} \times \text{Threshold SPP}$$

Where:

$NRBM_{\text{Year } X}$  = Network Rail Benchmark for the SG in Year X

$NRPR_{\text{Year } X}$  = Network Rail Payment Rate for the SG in a Year X

Busyness Factor = A parameter to convert daily Network Rail Payment Rates to a periodic figure. This is a constant value of 28.

Threshold SPP = The constant parameter that defines at what deviation from the Benchmarks should the Sustained Poor Performance regime be triggered. For CP7 Years 3 to 5, this value has been set at an absolute deviation of 20% above the benchmark.

### Step 1: Special Case: 2026/27

As a result of the more significant changes in NRPR at the CP7 Years 3 to 5 recalibration, it has been specified by ORR that the Tapering approach will also apply to Year 3 i.e., 2026/27. Therefore, the SG Periodic SPP for Year X-1, where X-1 = 2025/26 is based on the PR23 values, denoted PR23(2526), and is calculated as follows:

$$SPP_{\text{Period}(2526)} = NRBM_{\text{PR23}(2526)} \times NRPR_{\text{PR23}(2526)} \times \text{Busyness Factor} \times \text{Threshold SPP}$$

## Step 2: TOC Period SPP

At a TOC level, the SPP for a period is calculated as follows:

$$SPP_{\text{Period, Year X}} = \sum_{SG} SPP_{SG, \text{Period, Year X}}$$

## Step 3: Annual Periodic Liability Tapering

Annual Periodic Liability (APL) is provided for the third, sixth, tenth and thirteenth reporting period and gives a moving annual cost of being 20% above the Trajectory Benchmark based on the number of the 13 periods that fell in the previous year (multiplied by that year's rate) and the number in the current year (multiplied by that year's rate). This Tapering is done as follows:

$$APL_{\text{Period 3, Year X}} = (3 \times SPP_{\text{Year X}}) + (10 \times SPP_{\text{Year X-1}})$$

$$APL_{\text{Period 6, Year X}} = (6 \times SPP_{\text{Year X}}) + (7 \times SPP_{\text{Year X-1}})$$

$$APL_{\text{Period 10, Year X}} = (10 \times SPP_{\text{Year X}}) + (3 \times SPP_{\text{Year X-1}})$$

$$APL_{\text{Period 13, Year X}} = (13 \times SPP_{\text{Year X}}) + (0 \times SPP_{\text{Year X-1}})$$

## Worked example

The example below uses three SGs to demonstrate the calculations to expand to a TOC-level. We show the SG Period calculations for Year X-1 (Table 7.1), Year X (Table 7.2), and then the Annual Periodic Liability in Year X (Table 7.3).

**Table 7.1: Example Inputs – Year X-1**

| Phase | NR BM | NRPR    | Busyness Factor | SPP Threshold | SPP <sub>Period</sub> |
|-------|-------|---------|-----------------|---------------|-----------------------|
| SG_A  | 1.0   | £15,000 | 28              | 20%           | £84,000               |
| SG_B  | 3.0   | £10,000 | 28              | 20%           | £168,000              |
| SG_C  | 2.0   | £5,000  | 28              | 20%           | £56,000               |
| TOC   |       |         |                 |               | £308,000              |

**Table 7.2: Example Inputs – Year X**

| Phase | NR BM | NRPR    | Busyness Factor | SPP Threshold | SPP <sub>Period</sub> |
|-------|-------|---------|-----------------|---------------|-----------------------|
| SG_A  | 0.8   | £15,000 | 28              | 20%           | £67,200               |
| SG_B  | 3.2   | £10,000 | 28              | 20%           | £179,200              |
| SG_C  | 2.0   | £5,000  | 28              | 20%           | £56,000               |
| TOC   |       |         |                 |               | £302,400              |

**Table 7.3: Example Inputs – Annual Periodic Liability in Year X**

| Phase        | Period 3          | Period 6          | Period 9          | Period 13         |
|--------------|-------------------|-------------------|-------------------|-------------------|
| Year X-1     | 10 * £308,000     | 7 * £308,000      | 4 * £308,000      | 0 * £308,000      |
|              | +                 | +                 | +                 | +                 |
| Year X       | 3 * £302,400      | 6 * £302,400      | 9 * £302,400      | 13 * £302,400     |
|              | =                 | =                 | =                 | =                 |
| <b>Total</b> | <b>£3,987,200</b> | <b>£3,970,400</b> | <b>£3,953,600</b> | <b>£3,931,200</b> |

# Appendix 1: Price Base Factor

The Network Rail Payment Rates have been presented in 2023/24 price terms. To achieve this, revenue data from LENNON (within the recalibration timeframe) has been **deflated** using the Consumer Prices Index (CPI) published by the Office for National Statistics (ONS). The price base adjustment factor is calculated as follows:

$$\text{Price Base factor} = \frac{\text{Average CPI April 23–March 24}}{\text{Average CPI Dec 23–Nov 24}}$$

Note: The Price Base Factor only adjusts for inflationary changes up to the NRPR Price Base (or in the case of this CP7 Years 3 to 5 Recalibration to deflate back to 2023/24 prices). It does not adjust for any other impact (i.e., revenue growth).

# Appendix 2: Busyness Factors to convert MREs to NRPRs

## Overview

Busyness Factors measure the planned number of scheduled stops (as defined by the Schedule 8 Monitoring Points and their weightings) in the applicable timetable for a Rail Period compared to the average number scheduled in the bi-annual working timetable. The sum of all the Busyness Factors across the RT is used to convert the Payment Rate into a daily rate (see Section 2).

## Methodology

We use the sum of Busyness Factors ( $\Sigma BF$ ) across the RT as the divisor in the NRPR equation. We use  $\Sigma BF$  rather than number of days as  $\Sigma BF$  is better aligned with the formula for the calculation of performance payments.

By way of example, taking a given year in CP7 and assuming that Network Rail Performance Minutes for a SG exceed the Network Rail benchmark for the year by one minute:

(a) The amount of revenue lost would be the MRE for that SG.

(b) The total amount paid out will be SG NRPRs  $\times \Sigma BF$  for that SG.

If (a) equals (b), then  $MRE = NRPRs \times \Sigma BF$

Rearranging this equation gives  $NRPRs = MRE \div \Sigma BF$

If the Busyness Factor is increased in CP7 compared to CP6 for any reason (e.g., there are fewer engineering possessions), then it would be reasonable to assume that revenue would increase in the same proportion to the Busyness Factors. Therefore, there should be a higher amount paid out per minute over the Benchmarks (i.e., while NRPRs is constant the  $\Sigma BF$  increases).

## Appendix 3: Peak Proportions

LENNON data does not provide any information on the actual time of travel. To allocate Revenue to PEARS Peak and Off-Peak categories, we applied modelling assumptions on the proportion of Seasons and Non-Seasons journeys that are made on services at Peak times of the day based on the methodology used in PR18. We considered both the PEARS Peak hour definitions as well as the variation in daily distribution of travel demand for 'London', 'Core Cities' and 'Other Stations' (note that 'Other Stations' is not applied in the modelling).

Peak flows are defined in specific directions i.e., to Manchester in the am peak and from Manchester in the pm peak. Contra-peak flows are considered as off-peak. Table A5 shows the SG, City and City Type.

**Table 0.1: Cities, City Type, Peak Hours of Operation and Service Groups**

| City       | AM Peak       | PM Peak       | Service Groups                                                                                                                                                                                                                            |
|------------|---------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| London     | 07:00 – 09:59 | 16:00 – 18:59 | EB02, EB03, EB04, EB06, EB07<br>EF05<br>EJ05<br>EK01, EK02, EK03, EK04<br>ET01, ET02, ET03, ET04, ET05, ET08, ET09, ET10, ET11,<br>ET12, ET13<br>EX01, EX02<br>HO01, HO02, HO03, HO04<br>HT01<br>HY01, HY03, HY04, HY05, HY06, HY07, HY08 |
| Manchester | 06:00 – 09:30 | 16:00 – 18:30 | ED08, ED10                                                                                                                                                                                                                                |
| Birmingham | 07:30 – 09:00 | 16:30 – 18:00 | EJ01, EJ03                                                                                                                                                                                                                                |
| Cardiff    | 06:31 – 09:00 | 16:01 – 18:00 | HL05. HL05 also has a Saturday Peak, which includes dep / arrivals at Cardiff Central, Cardiff Queen Street or Cardiff Bay) from 09:01 to 17:00.                                                                                          |

We note that demand recovery has varied significantly between Seasons and Non-Seasons ticket categories. We have assumed that within Seasons the proportion between Peak and Off-Peak is similar to that of CP6. Similarly, we have assumed that within non-Seasons that the proportion between Peak and Off-Peak is similar to CP6.

The CP6 proportions were based on the 'Calibrated Demand Profiles' and 'Calibrated Day of Week Splits' from MOIRA2.2 (which were based on more recent information than that used in MOIRA 1). The Calibrated Demand Profiles table defines peak profiles in terms of the percentage of the total number of passengers that are travelling in 15 minutes time-bands throughout the day. This is segmented by journey purpose, flow type and journey length. The 'Calibrated Day of Week Splits', apportioned demand into Weekday, Saturday, and Sunday by Ticket Type.

## Appendix 4: Calculating Lateness at New or Missing MPs

Where new MPs were requested at the CP7 Years 3 to 5 recalibration, or existing CP7 MPs did not have data for the full RT, three approaches were taken to incorporating data for these MPs into the benchmarks model. Where PEARS data existed for one or more periods in the RT, this data was used in the Benchmarks Model and one of the following approaches taken for the 'missing' periods of data. The model allows the source of data used in the Benchmarks Model to vary by period.

### Approach 1

Where data is available for new or missing MPs during the RT, a script was written in R to extract the lateness and cancellations data relating to those MPs from PSS. NR provided PSS lateness data for the relevant MPs for the CP7 Years 3 to 5 recalibration. This data could be used to process both lateness and cancellations data for each MP.

#### *Lateness*

Lateness data was calculated on a train-by-train basis as the difference between the actual time a train was at the MP and the planned (GBTT) time at the location. This lateness is assigned to a Service Group and is capped at a minimum value of zero and maximum value based on the standard PEARS caps for that Service Group. Lateness data is summed to provide daily total lateness figures. The NR/TOC responsibility split is applied separately within the Benchmarks Model therefore a combined lateness figure is imported into that model.

#### *Cancellations*

Cancellations are identified at a MP by the presence of a Reliability Event Flag of 'Y' in the PSS data. The cancellations are assigned to a Service Group and responsibility is assigned to the cancellations in the following way:

- Two years of train-level cancellations which include the RT period were downloaded from NR SharePoint.
- This provided data on the responsibility for cancellations on a train-by-train basis.
- Responsibility for each cancellation record in PSS was matched based on the date and Train ID.

The number of cancellations is summed to provide total, NR and TOC cancellations on a daily basis.

### *Number of trains*

The number of PSS records at each MP by Service Group (including cancellations) are counted for each day and output with the lateness and cancellations data described above.

## **Approach 2**

Where no PEARS or PSS data is available, due to the MP not currently existing or no services calling there during the RT (where Approach 3 might be used instead), an appropriate Proxy MP has been identified. In these cases, the average lateness and cancellations from the corresponding Proxy MP selected are extracted and it has been assumed that services will call at these new MPs during CP7.

### *Identifying MPs with no data and selecting proxy locations*

By comparing the full list of new MPs with those for which there was historical data in PSS, 'missing' MPs with no historical data available were identified. These were then reviewed one by one to determine appropriate Proxy MPs.

In some cases, selecting a proxy was straightforward: Kirkby is the obvious proxy for Headbolt Lane as it is less than 1km further down the line. In other cases, it was less easy, either because no service called at a similar station, or no similar service called at the same station, or both. These were addressed on a case-by-case basis.

### *Processing PEARS data for Proxy MPs*

Data was extracted from PEARS for the Proxy MPs and fed back into our calculations, to ensure that lateness and cancellation estimates were included for all proposed MPs.

## **Approach 3**

Where data appeared to be missing for an existing MP, this could be because no trains in that Service Group called at the MP during that period of time. The view was taken that the calculation of the benchmarks should follow what is expected to happen during CP7 Years 3 to 5 in terms of the calculation of periodic Performance Minutes. If trains were unlikely to call at the MP during Years 3 to 5 then the lateness was set to zero for these MPs in this recalibration.



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