Methodology

Data Sources:

At the heart of the ODA tool is a database that combines information from a range of data sources on how services were planned and how they actually ran. This database contains information back to the December 2013 WTT change and is updated at the end of each Period. The primary data sources utilised are:

* Train Describer Feed – Data on train movements past signals to one-second accuracy
* Working Timetable – WTT schedules for train movements
* ACTRAFF – Actual train formation data giving train length & weight
* Train Performance – Data on if each service achieves PPM & CaSL
* SMART TR Berth Offsets – Industry agreed offset values that adjust time at signal to time at TIPLOC

TPR Analysis:

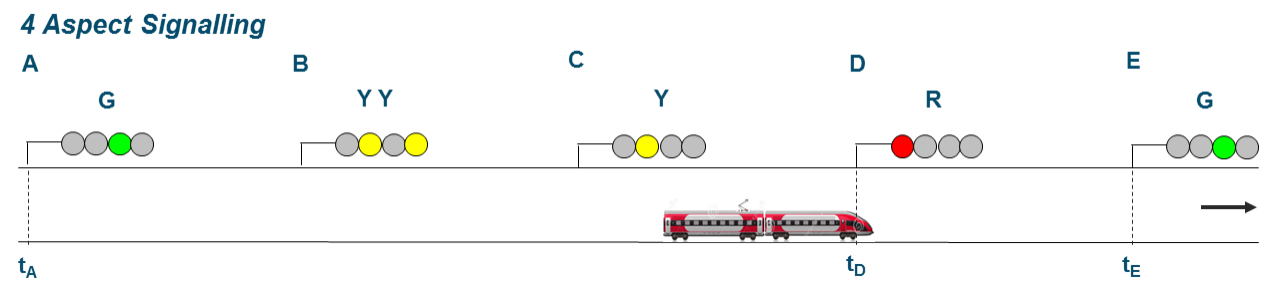
The tool has been developed for the analysis of planning values based on user-defined filters. For this, within the tool there is the capability to analyse headways, sectional running times and dwell times. These can be searched based on location, time, service type and train type parameters.

Analysis of headways allows both actual headway between services and the technical headway for a service to be analysed against the planning value. The technical headway for a service calculates the signal reset time on which headway is based by identifying how long each service takes to traverse subsequent signal berths. The resultant output is presented in a similar manner to a Signalling Performance Assessment.

Analysis of sectional running times and dwell times is based on observed data from services. For SRTs, the observed data is analysed alongside the planning SRT value for the relevant train type, with actual dwells identified against the planned dwell times. In both instances, the observed values can be analysed in detail based on individual headcodes, period, day, time of day and train formation.

Headway Methodology:

The ODA tool calculates headways utilising the recorded times of trains passing consecutive signals. This produces a range for the technical signal reset value at each individual signal. These signal reset values along a line of route form the technical headway for that route.



Technical signal reset time is calculated by using the recorded time from the train describer feed of a train passing Signal A & Signal D. These times record when the front axle of the train passing the berth overlap associated with each of the signals. This is used as the Nominal Headway value in the ODA headway graphs. The formula used for this is

Nominal Headway = tD – tA

This time reflects the minimum theoretical signal reset time at Signal A. This is based only on the front axle of the train and does not account for the time taken for the rear of the train to have passed Signal D. The rear of the train would have to have be clear of Signal D to allow Signal A to reset to the least restrictive aspect it can display (green). The time taken for this would be related to the speed and length of the train.

To account for the time taken for the rear of a train to have cleared Signal D and allowed Signal A to reset to its least restrictive aspect, an additional signal reset time is calculated using data for the next signal, Signal E. In most circumstances the length of a signal berth will be greater than the length of the train. As such, when a train is recorded as passing Signal E it is assumed that the previous signal, Signal D, will have been cleared. The time reflects the maximum theoretical signal reset time at Signal A. This is shown on the graphs as Nominal Headway 2. The formula used for this is:

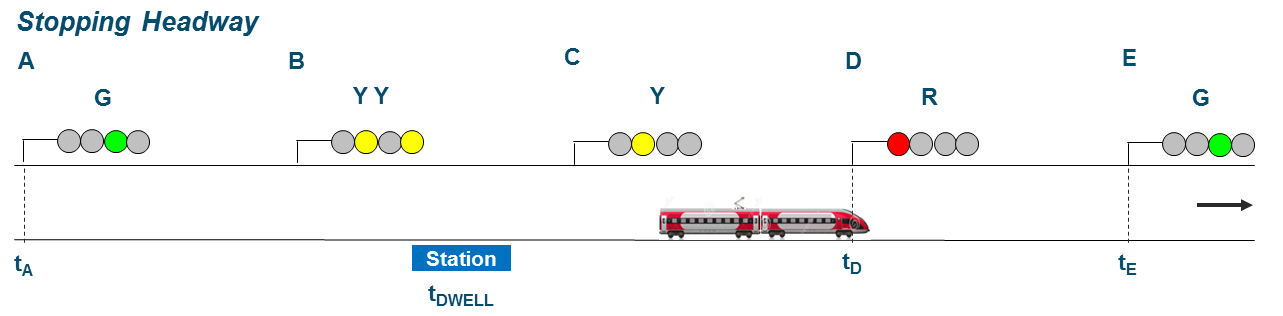
Nominal Headway 2 = tE – tA

In addition the calculations for Nominal Headway exclude three additional factors that convert the technical signal reset time to the minimum technical headway value at a signal.

These are:

* The berth overlap (the distance between the physical location of a signal and the location of the track circuit that triggers the signal). The time for this would depend on the length of the berth overlap and speed of the train.
* The signalling response (signal reset) time to a train moving between signal berths. The standard value taken for this is 3 seconds.
* The signal sighting time for the driver. The standard value taken for this is 8 seconds, but this is dependent on the speed of the train and the nature of the geography at each signal.

For most locations the Nominal Headway 2 value will be greater than the technical headway value. As such the Nominal Headway 2 value is used in making headway recommendations unless specified otherwise.



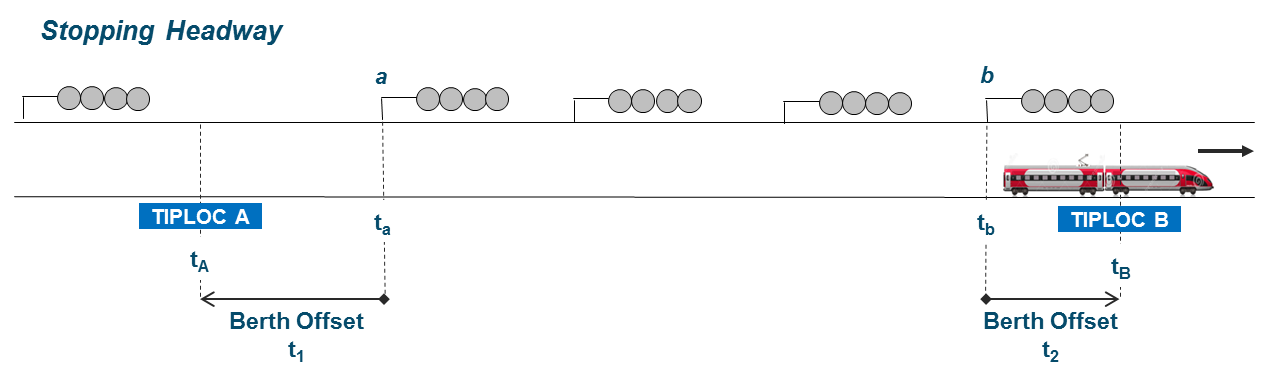
Where a train has a planned station stop, a Stopping Headway is calculated. This is calculated using the same methodology, however the data is adjusted to account for the stationary time of the train during its station stop (dwell time). Where the calculated headway value includes the location of a station, the median actual dwell time (tDWELL) at the station is removed in order to calculate the stopping headway. The revised formula are:

Nominal Headway = tD – tA – tDWELL

Nominal Headway 2 = tE – tA – tDWELL

Sectional Running Time Methodology:

The ODA tool calculates Sectional Running Times (SRTs) utilising the recorded times of trains passing signals associated with TIPLOCs. These times are adjusted using berth offset times to produce observed times for each train for each SRT.



The SRT is the time taken for a train to go from TIPLOC A to TIPLOC B. As the train describer feed data only records the time passing signals the time at TIPLOC A and TIPLOC B has to be estimated using the times at signals. This is done using industry agreed values that adjust the time at a signal to reflect the time at a TIPLOC, known as berth offsets.

The time at TIPLOC A (tA) is calculated using the time at Signal *a* (ta). This is adjusted using the berth offset between TIPLOC A and Signal *a* (t1). The formula for this is

tA = ta – t1

The time at TIPLOC B (tB) is calculated using the time at Signal *b* (tb). This is adjusted using the berth offset between TIPLOC B and Signal *b* (t2). The formula for this is

TB = tb – t2

Using the derived time at TIPLOC A and TIPLOC B the observed value for the SRT can be calculated for a train. The formula for this is:

Observed SRT= tB – tA

The SRTs are analysed over the journey of a train. For each SRT the lower quartile (25th percentile) of all observed values are used to calculate the planning value. The proposed planning value for the SRT is rounded to the nearest 30 seconds. Where a journey is formed of multiple SRTs, the effect of this rounding is considered to ensure that the cumulative observed times for the SRT and the cumulative values of the rounded SRTs do not usually diverge by more than ±15 seconds.

## ODA Graph Guidance

The charts are presented showing the path of the service from left to right, with each point at a Signal Berth. The distances between these Signal Berths are not shown to scale.

On each chart, there are five data sets shown:

* The black dashed-line represents the current planning value at the designated signal. This is taken from the December 2017 TPR rules.
* The blue line is the 15th percentile\* of actual headway values at the designated signal. This is the time between the first service being recorded as passing the designated signal and the next service being recorded as passing the same signal.
* The green line is the 15th percentile\* of the minimum possible headway value at the designated signal. This is calculated from the time taken for each service to travel through enough subsequent signal berths to allow the designated signal to return to displaying an unrestrictive (green) aspect.
* The orange solid-line is an indicator of the upper limit of the technical headway value at the designated signal. This is calculated from the time taken for each service to travel through enough subsequent signal berths to allow the designated signal to return to displaying an unrestrictive (green) aspect, plus one further signal berth. The value displayed is the 15th percentile value.
* The orange dashed-line is the proposed future headway value. Where the proposed future value is identical to the current value an orange dashed-line will not be displayed.

All headway graphs are based on services operating Monday – Friday – unless otherwise stated.

All values are in seconds – unless otherwise stated.

\*Unless otherwise stated