

Network Rail: System Operator Observed Data Analytics Report Ashford International to Swanley Freight Services

24/04/2020

Document No: NR/NRSO/ODA/AshtoSw101

	Name	Signature	Date
Document Author	John Rogers		24/04/2020

This document is the property of Network Rail – System Operator. It shall not be reproduced in whole or in part, nor disclosed to a third party, without the written permission of the Observed Data Analytics Team.

Document Revision Information

Draft Number	Details	Date
v001	Initial draft	23/04/2020
v101	Final draft	01/06/2020

Contents

Executive Summary	4
Introduction	4
Methodology.....	6
Basis of Assessment.....	9
Headway Analysis – 6O16 – Swanley to Ashford International (Overall) – Down Direction.....	10
Headway Analysis – 6O16 – Swanley to Otford – Down Direction.....	11
Headway Analysis – 6O16 – Otford to Maidstone East – Down Direction	12
Headway Analysis – 6O16 – Maidstone East to Ashford International – Down Direction	13
Headway Analysis – 6O71 – Swanley to Ashford International (Overall) – Down Direction.....	14
Headway Analysis – 6O71 – Swanley to Otford – Down Direction.....	15
Headway Analysis – 6O71 – Otford to Maidstone East – Down Direction	16
Headway Analysis – 6O71 – Maidstone East to Ashford International – Down Direction	17
Headway Analysis – 4E26 – Ashford International to Swanley (Overall) – Up Direction	18
Headway Analysis – 4E26 – Ashford International to Maidstone East – Up Direction	19
Headway Analysis – 4E26 – Maidstone East to Otford – Up Direction	20
Headway Analysis – 4E26 – Otford to Swanley – Up Direction	21
Headway Analysis – 6M13, 45 – Ashford International to Swanley (Overall) – Up Direction	22
Headway Analysis – 6M13, 45 – Ashford International to Maidstone East – Up Direction.....	23
Headway Analysis – 6M13, 45 – Maidstone East to Otford – Up Direction	24
Headway Analysis – 6M13, 45 – Otford to Swanley – Up Direction	25
SRT Analysis – Swanley to Ashford International – Up Direction.....	26
SRT Analysis – Ashford International to Swanley – Down Direction	27

Executive Summary

At the request of the Kent, Sussex & Wessex Route, the Observed Data Analytics team has undertaken a review headways and sectional running times for the section between Ashford International and Swanley for freight services. The analysis was undertaken from Monday, 15th April 2020 until Thursday, 23rd April 2020.

Our analysis has been undertaken on regularly running freight services between Swanley and Ashford International in both directions with our results having been split into three sections:

Swanley to Otford
Otford to Maidstone East
Maidstone East to Ashford International

The results quite clearly show that signal reset times in the section between Swanley and Otford do perform within the current planned headway value and that any following service planned on minimum headway would usually see green signals. However, in the two sections that make up the area from Otford to Ashford International, signal reset times significantly exceed the current headway value with peaks in particular between Maidstone East and Bearsted in the down direction and two peaks between Maidstone East and Otford Jn in the up direction.

Any following service planned on minimum headway through these sections will encounter restricted aspect signals so some thought may need to be given to an additional planned headway value for freight services.

Secondary analysis has been undertaken on SRTs within this section and the results can be found on pp 26-27 of the report.

Please note that when analysing freight services the data is cleansed to ensure that only services containing **actual** trailing loads up to 200 tonnes less than the planned trailing weight are included. Any services that are over the planned trailing weight or more than 200 tonnes under the planned trailing weight have been removed from the analysis.

Introduction

Observed Data Analytics tool was developed by the Timetable Rules Improvement Programme in 2015 and has been used to analyse Timetable Planning Rules (TPRs) and identify if they are fit for purpose. This is done by using a range of data sources on observed train running, which is then aligned to planning values for headways, sectional running times and dwells times.

At the request of the Kent, Sussex & Wessex Route, the Observed Data Analytics team has undertaken a review headways and sectional running times for the section between Ashford International and Swanley for freight services. The analysis was undertaken from Monday, 15th April 2020 until Thursday, 23rd April 2020.

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 Descriptor 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:

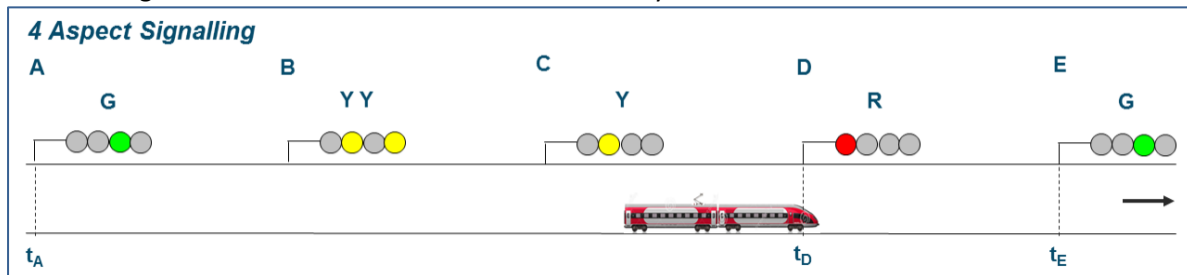
The tool has been developed for the analysis of planning values based on user-defined filters. For this, within the tool there is the capability to analyse headways, sectional running times and dwell times. These can be searched based on location, time, service type and train type parameters.

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

$$\text{Nominal Headway} = t_D - t_A$$

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 been 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:

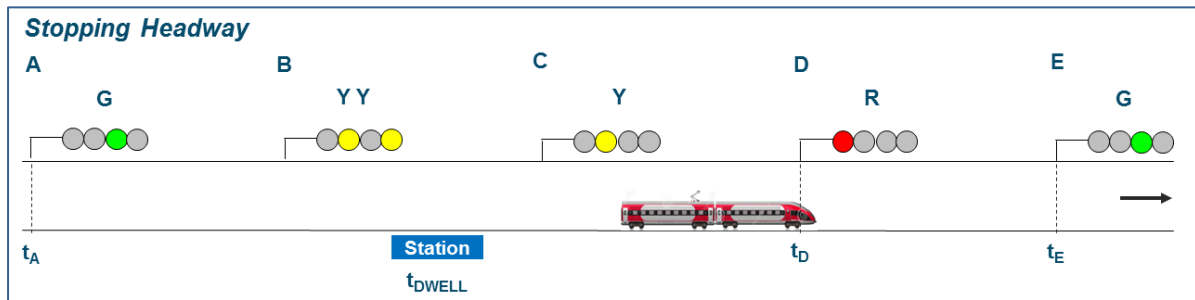
$$\text{Nominal Headway 2} = t_E - t_A$$

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.



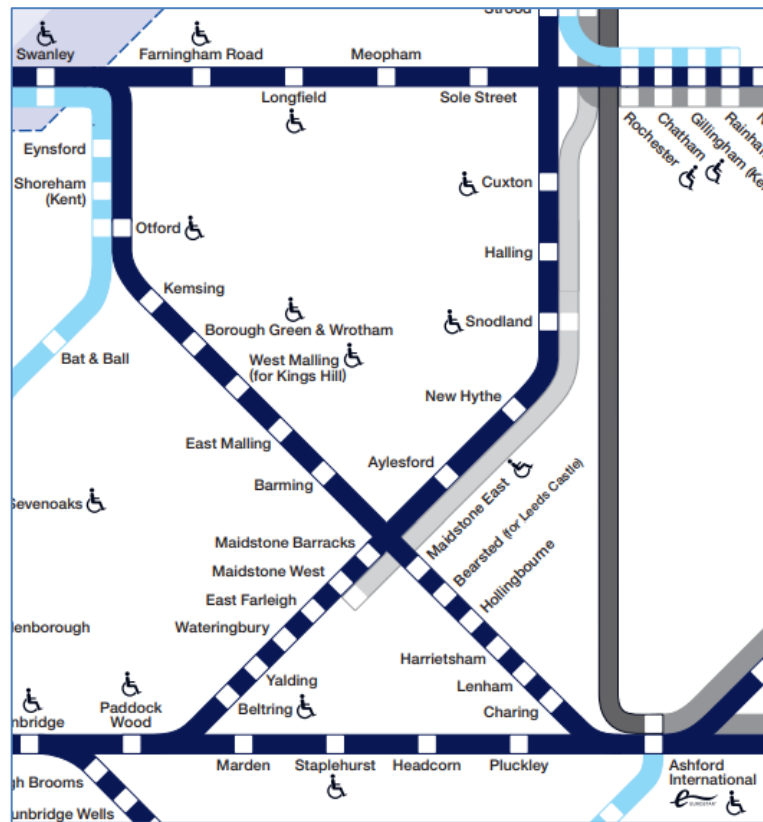
Where a train has a planned station stop, a Stopping Headway is calculated. This is calculated using the same methodology, however the data is adjusted to account for the stationary time of the train during its station stop (dwell time). Where the calculated headway value includes the location of a station,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

$$\text{Nominal Headway} = t_D - t_A - t_{DWELL}$$

$$\text{Nominal Headway 2} = t_E - t_A - t_{DWELL}$$

Basis of Assessment

The geographical coverage of the analysis area is shown in the map below:



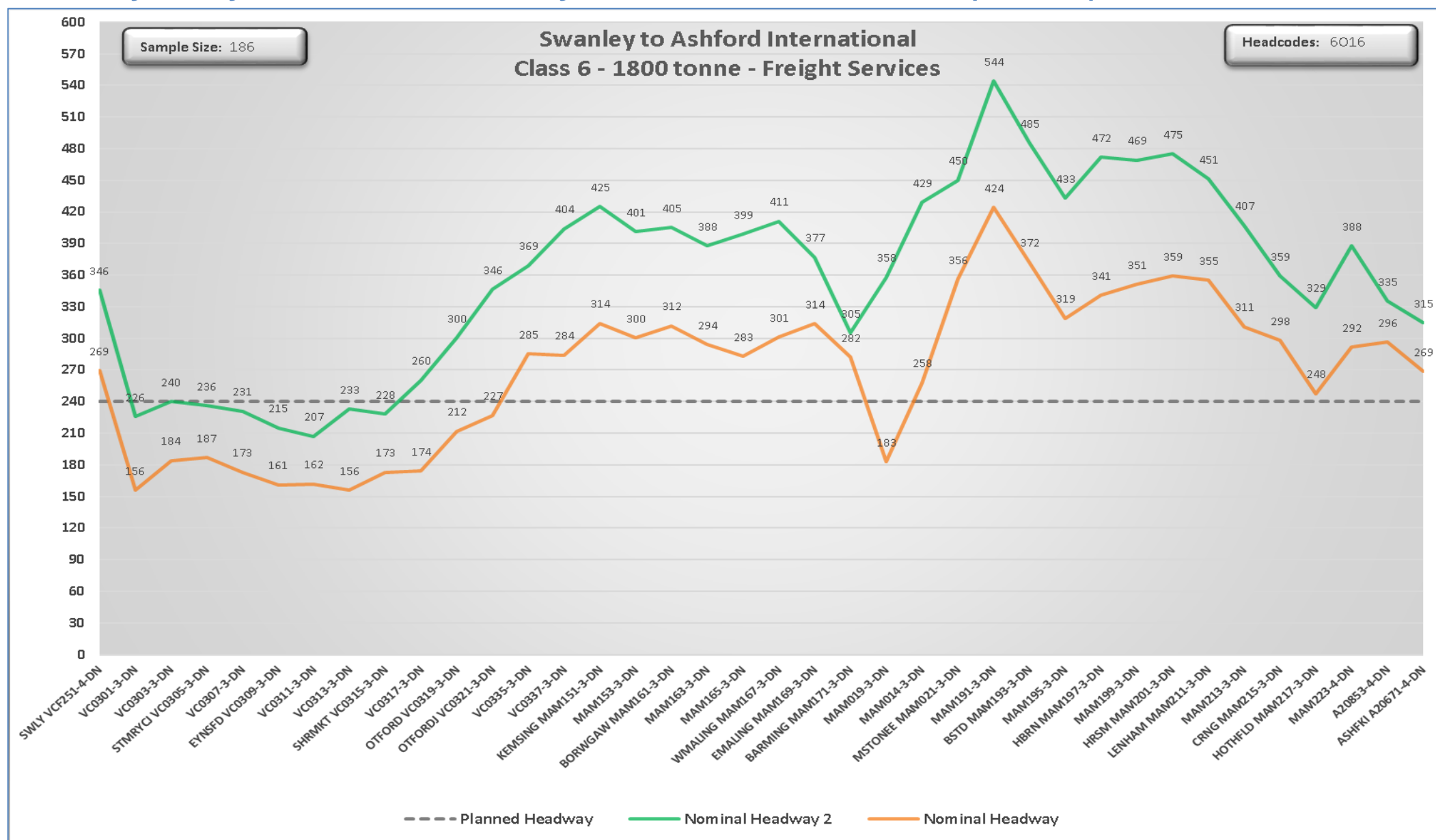
The following routes were included:

- Ashford International to Swanley

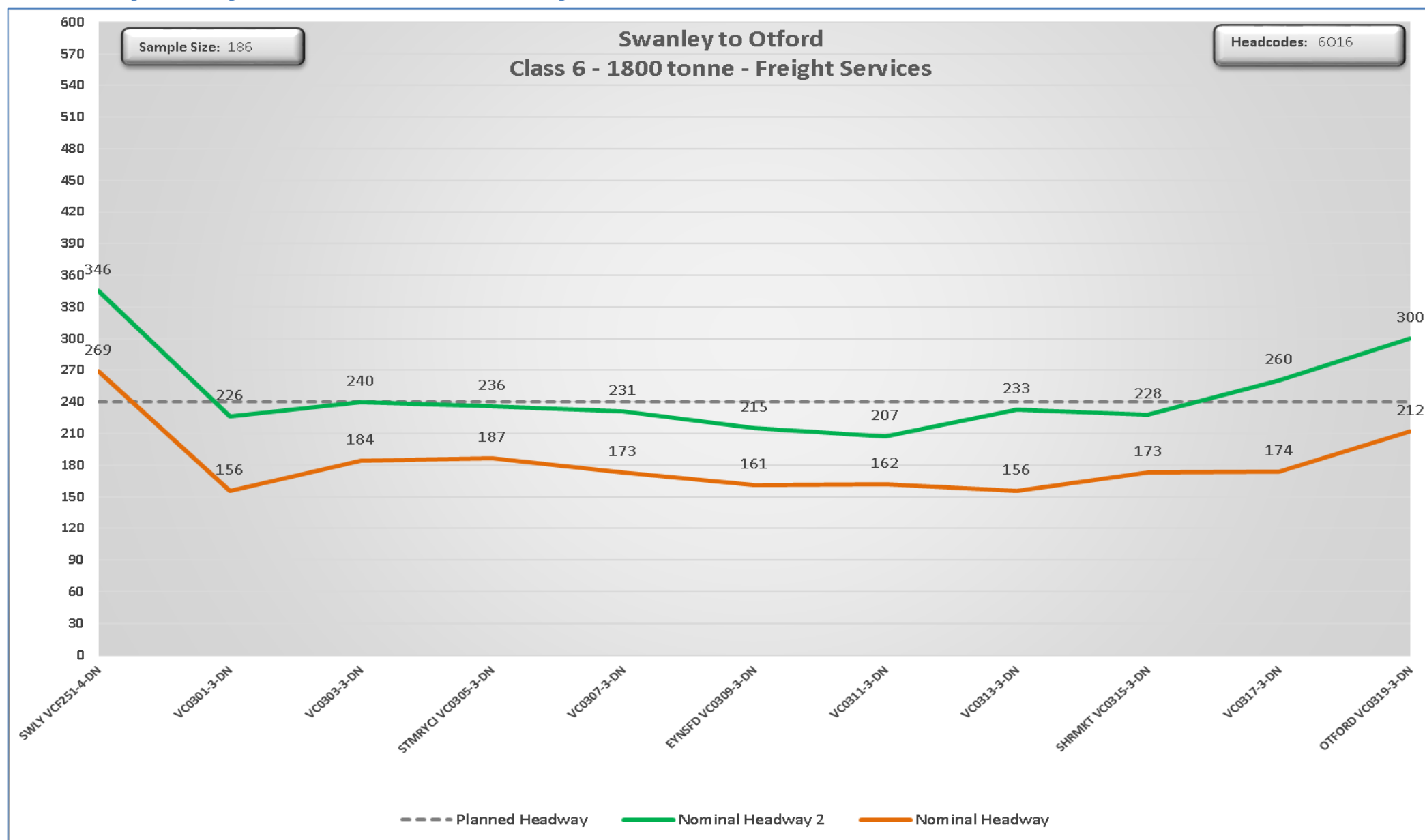
Within this area the following stock has been analysed:

- 600 tonne
- 800 tonne
- 1800 tonne

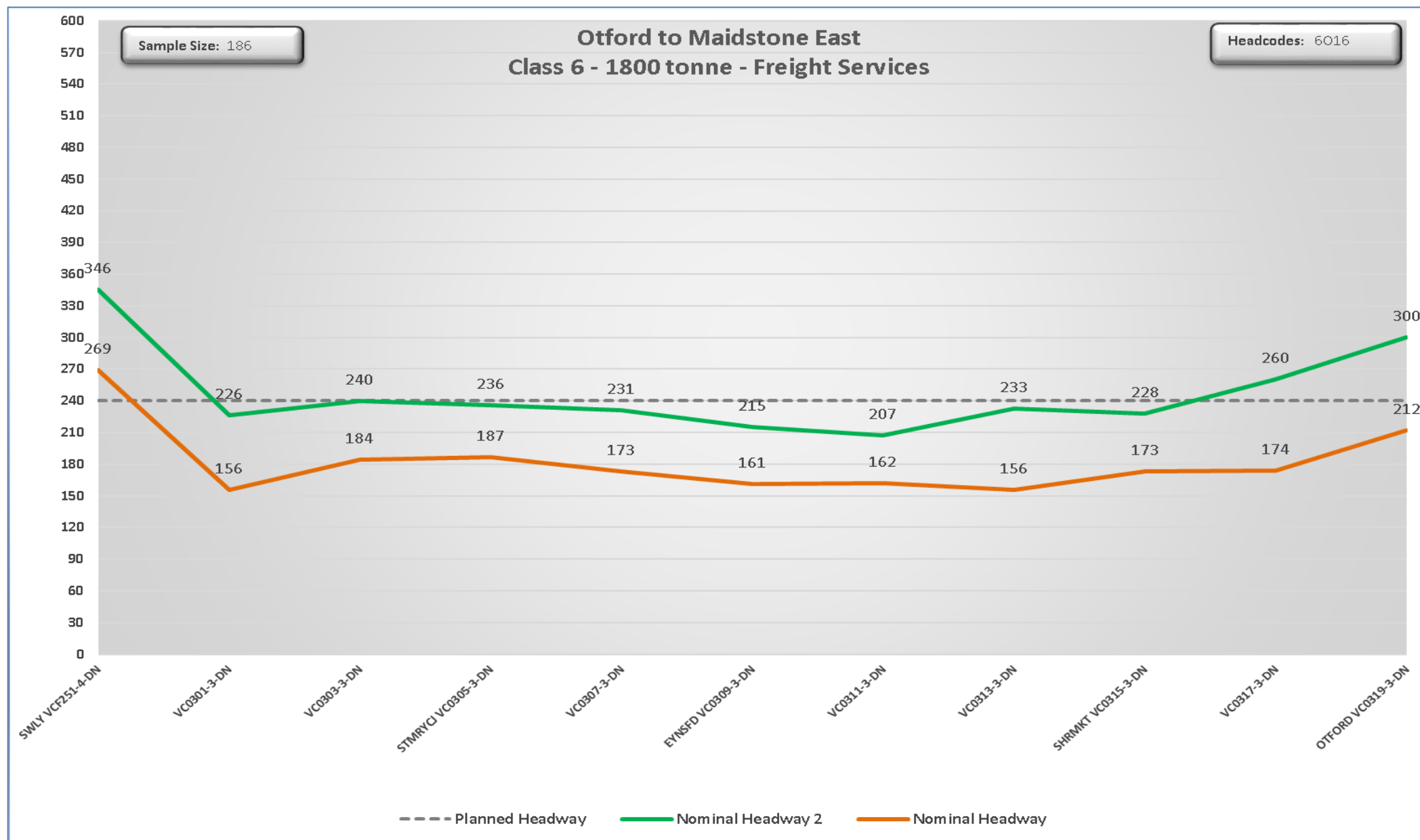
Headway Analysis – 6016 – Swanley to Ashford International (Overall) – Down Direction



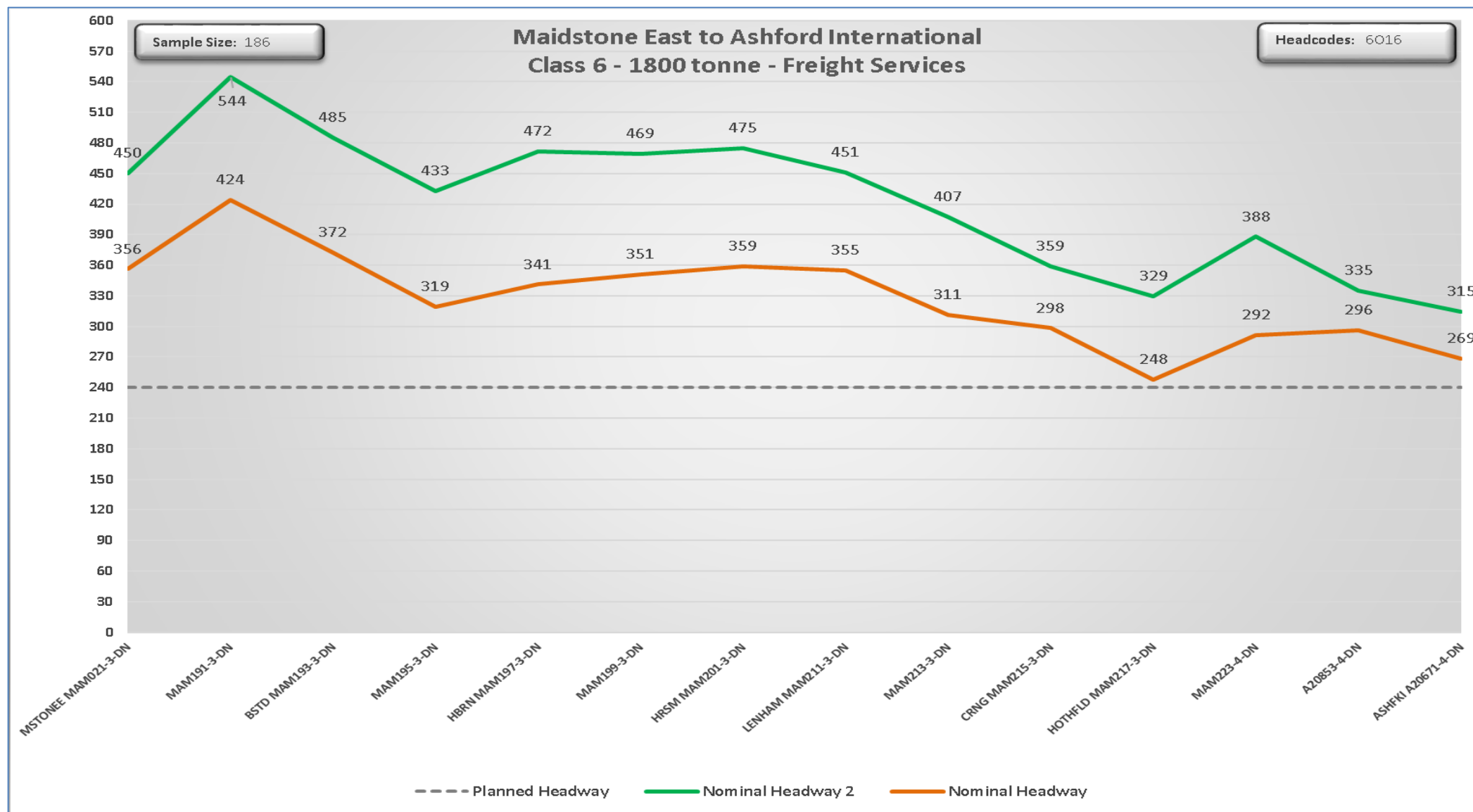
Headway Analysis – 6O16 – Swanley to Otford – Down Direction



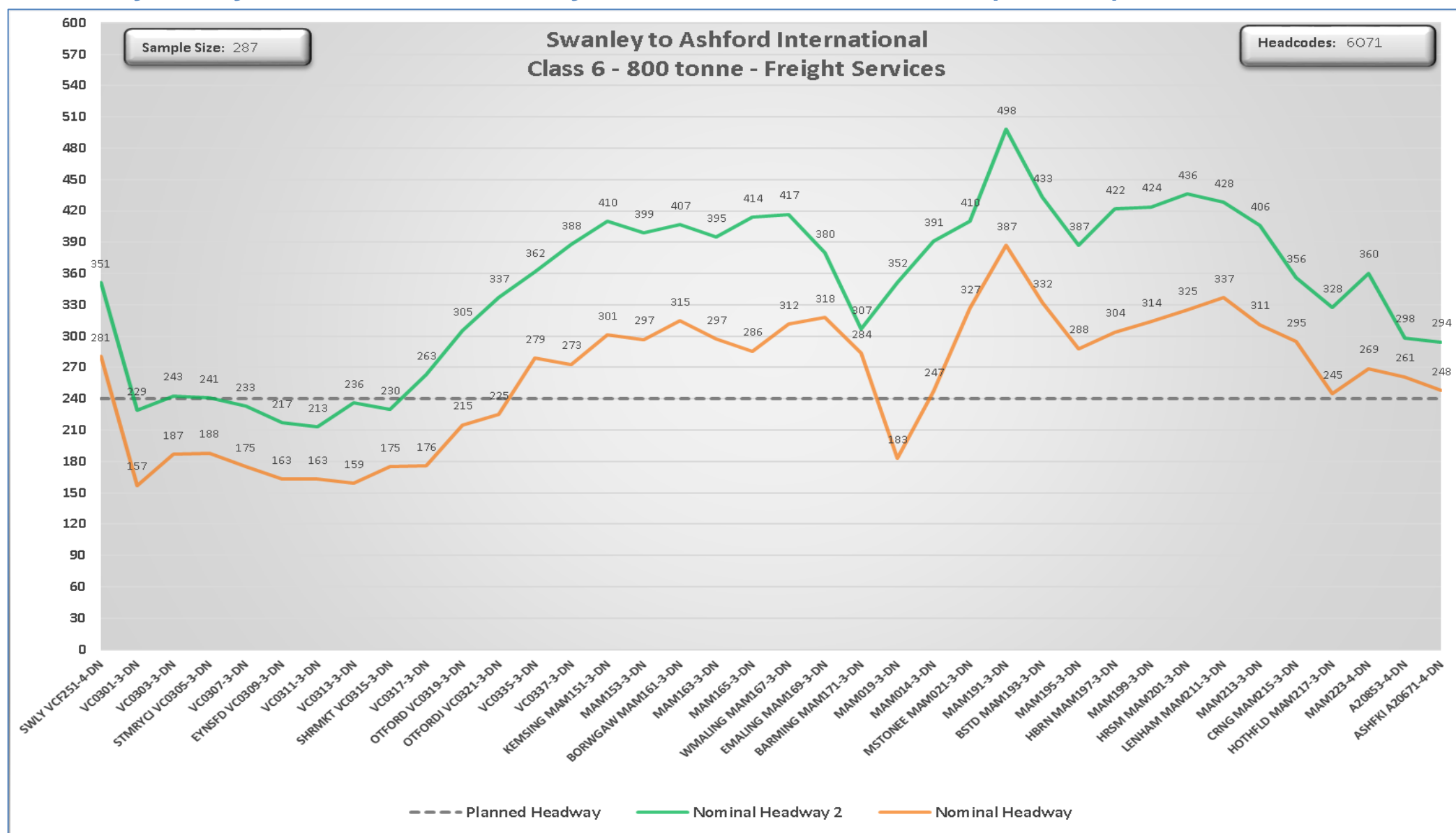
Headway Analysis – 6016 – Otford to Maidstone East – Down Direction



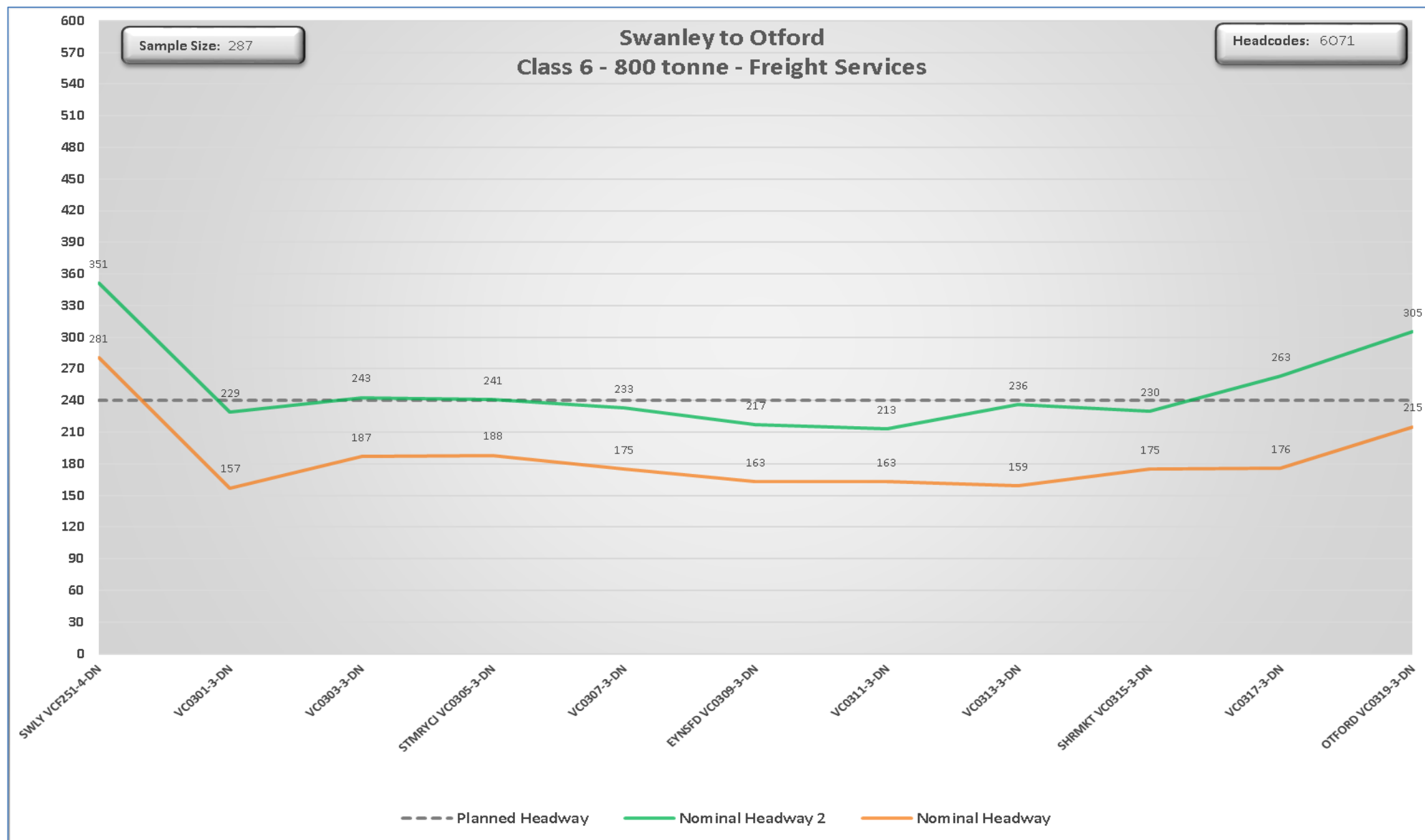
Headway Analysis – 6016 – Maidstone East to Ashford International – Down Direction



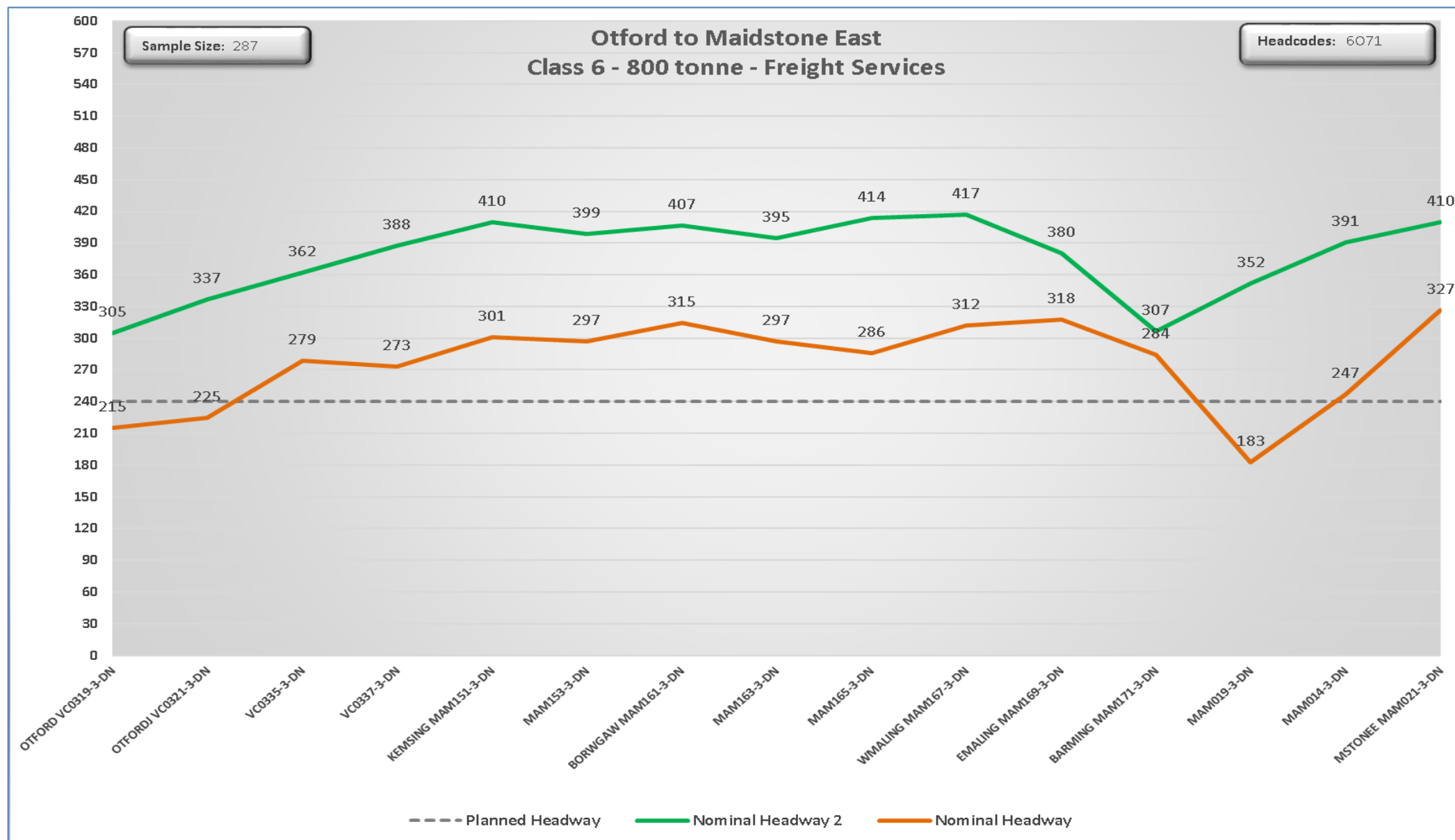
Headway Analysis – 6071 – Swanley to Ashford International (Overall) – Down Direction



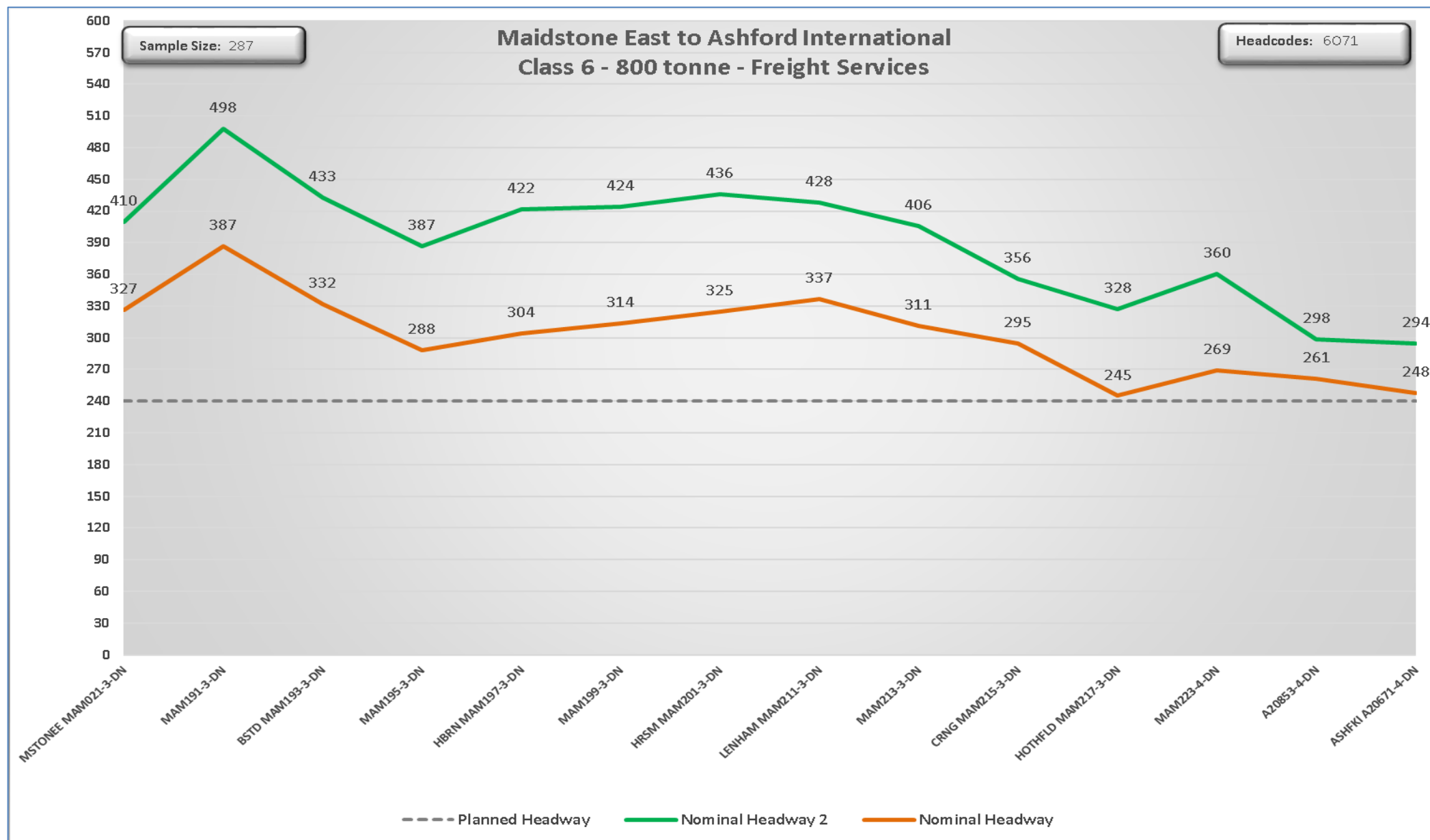
Headway Analysis – 6071 – Swanley to Otford – Down Direction



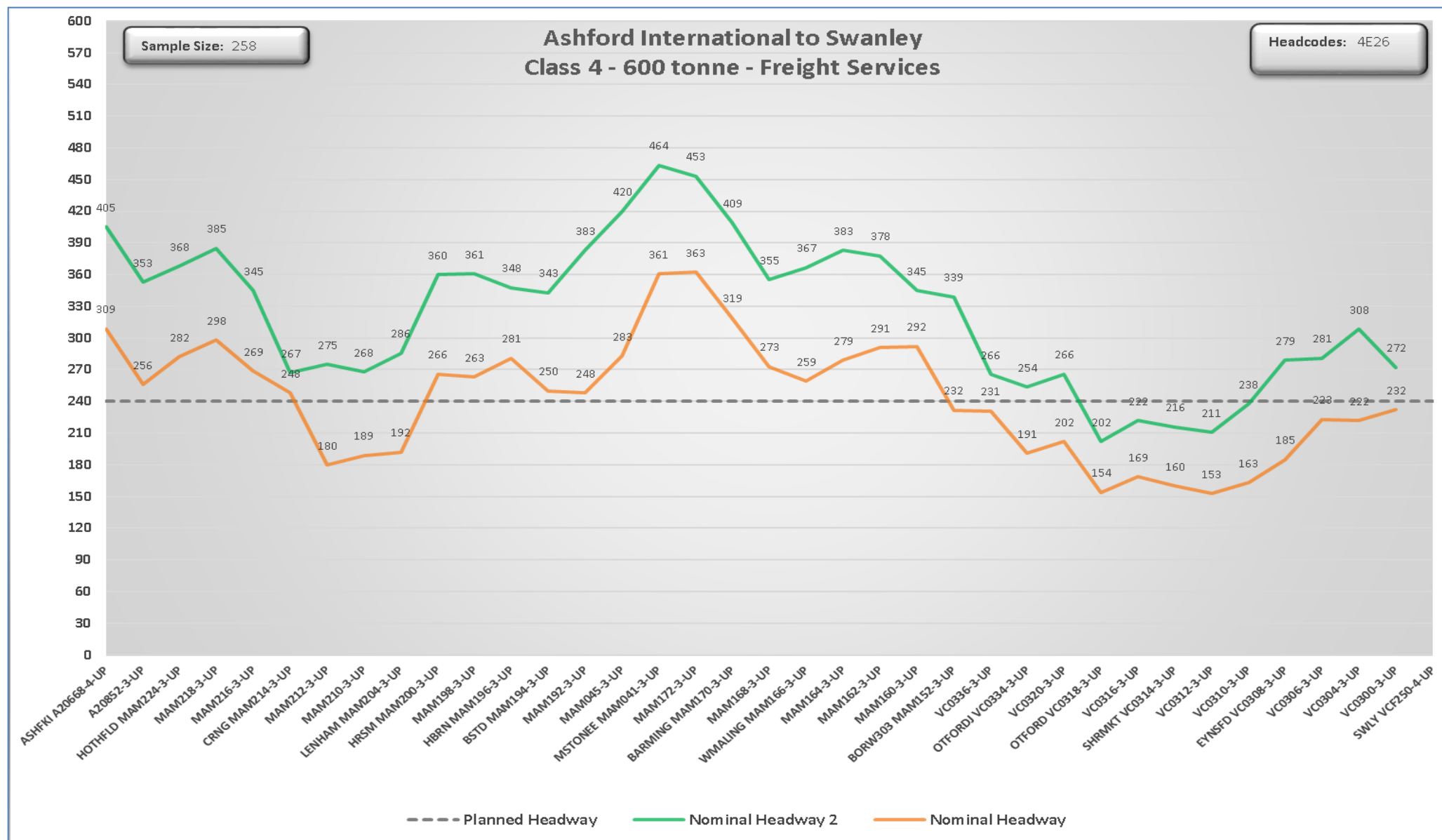
Headway Analysis – 6071 – Otford to Maidstone East – Down Direction



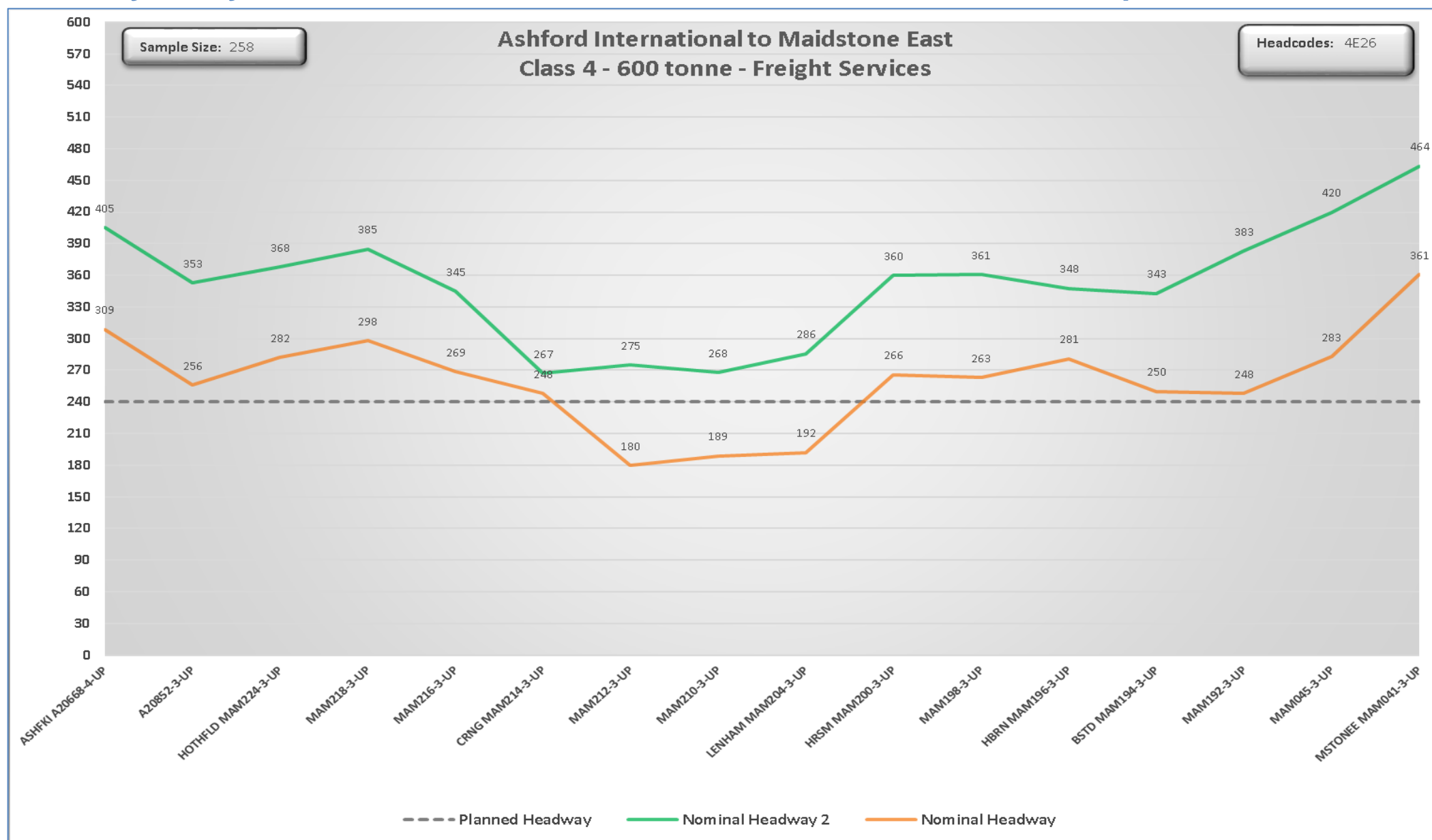
Headway Analysis – 6071 – Maidstone East to Ashford International – Down Direction



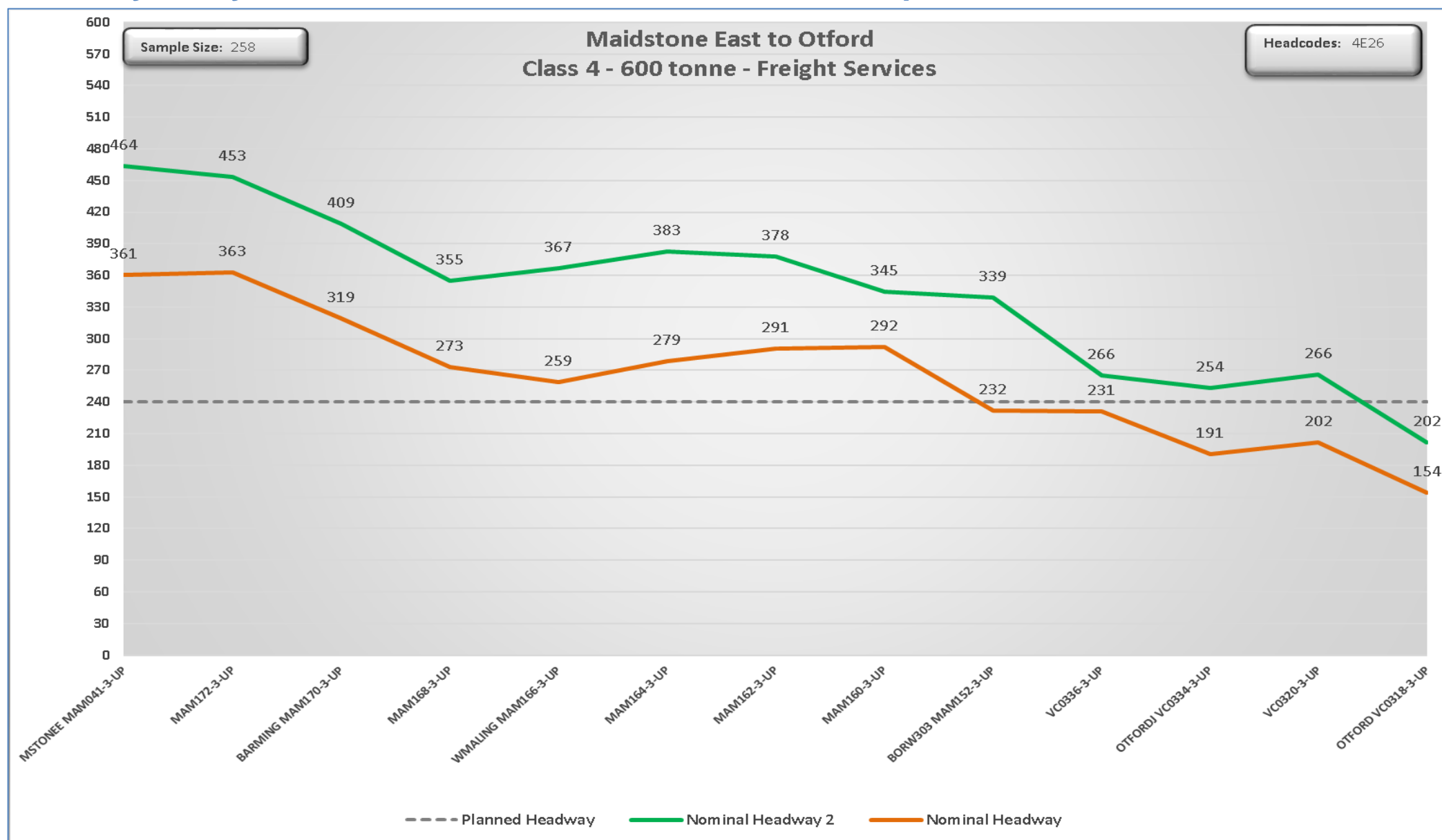
Headway Analysis – 4E26 – Ashford International to Swanley (Overall) – Up Direction



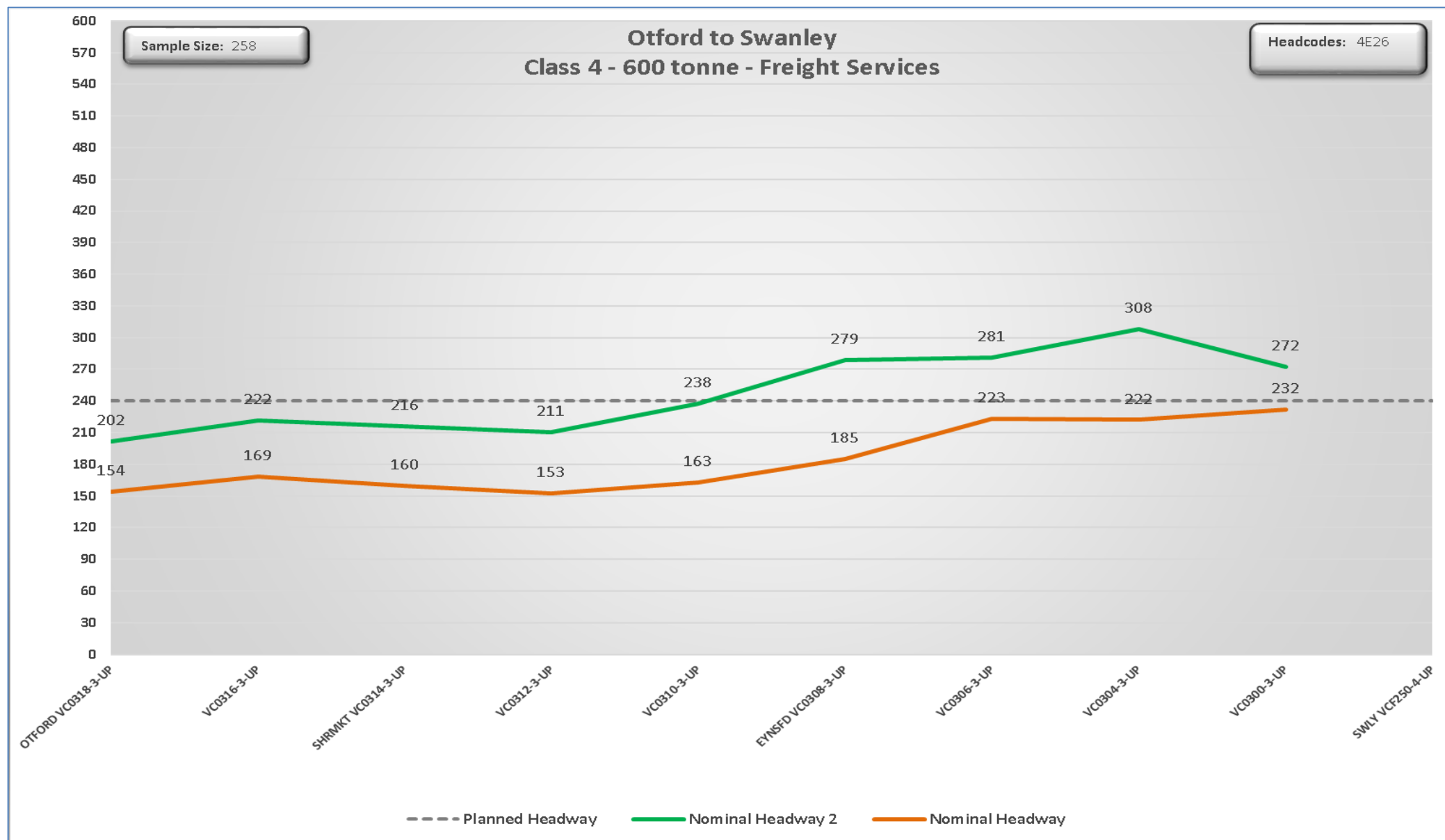
Headway Analysis – 4E26 – Ashford International to Maidstone East – Up Direction



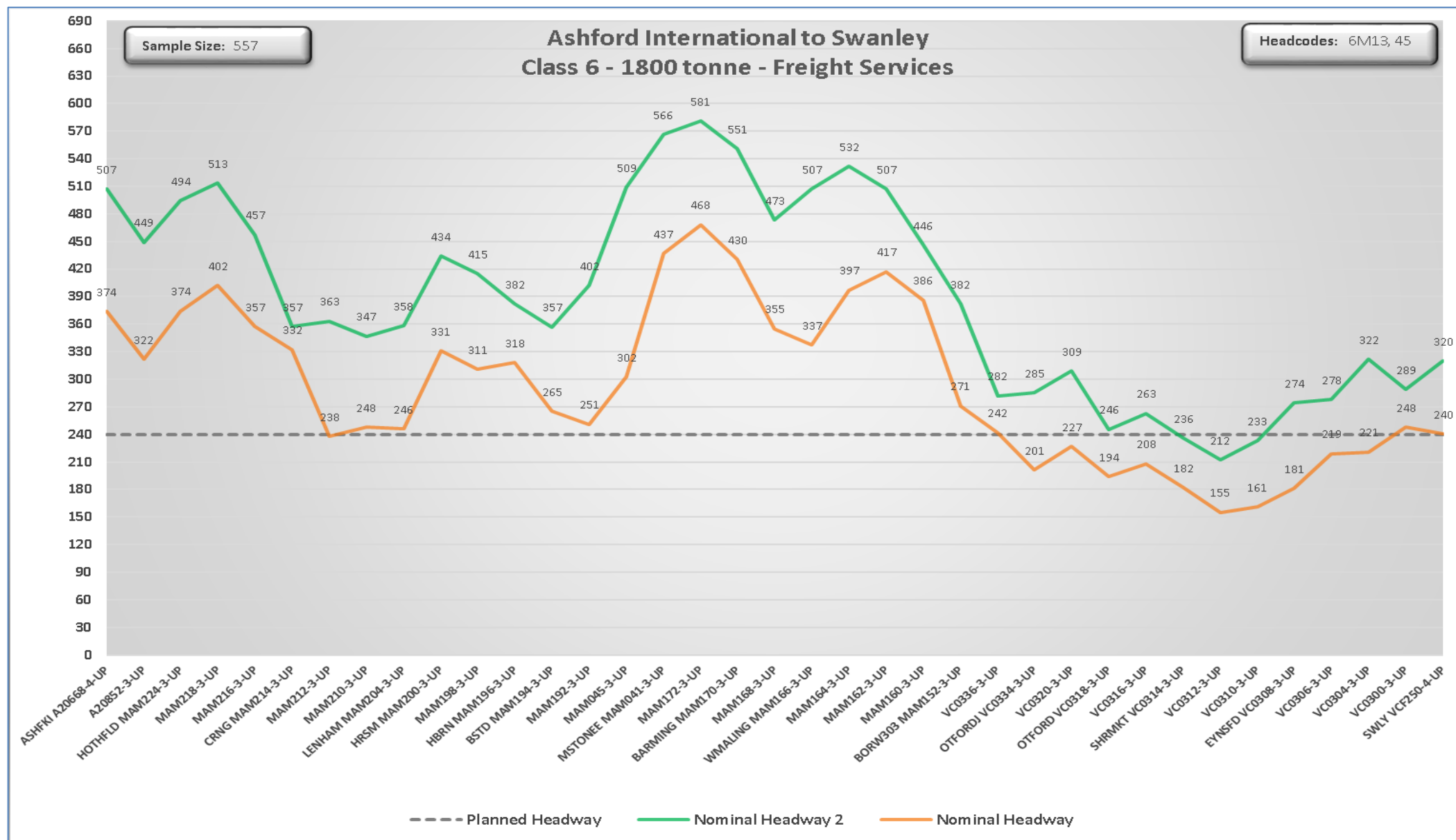
Headway Analysis – 4E26 – Maidstone East to Otford – Up Direction



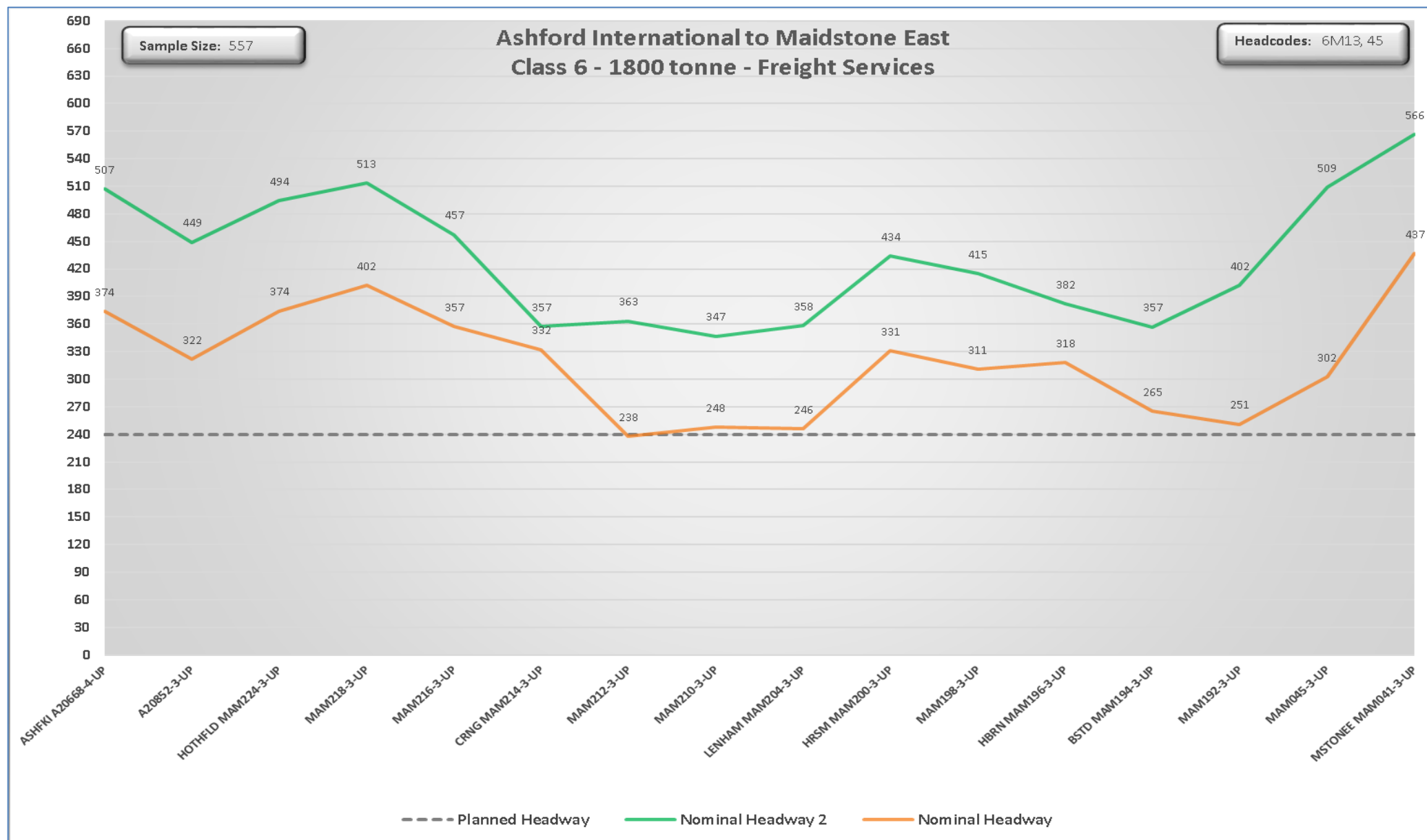
Headway Analysis – 4E26 – Otford to Swanley – Up Direction



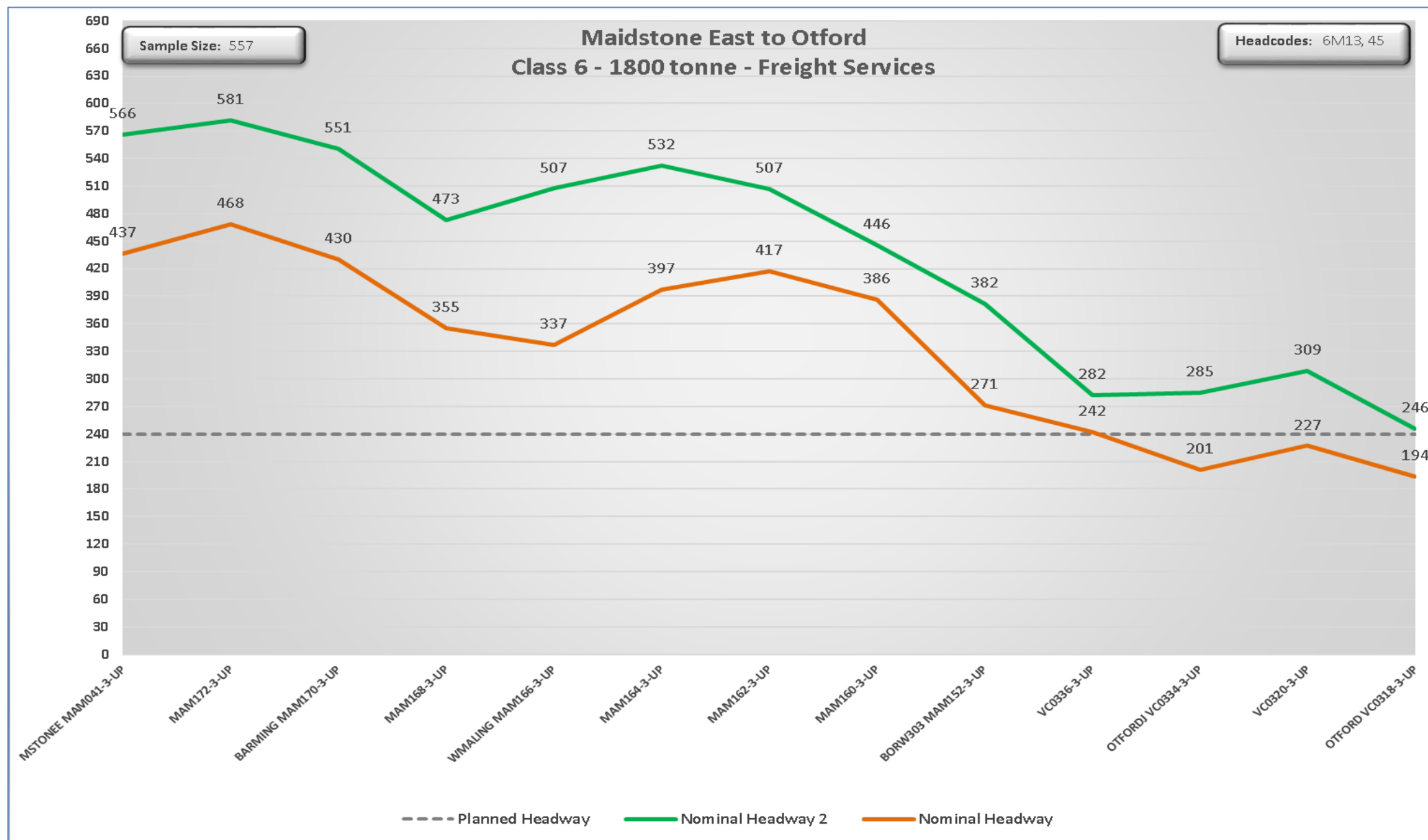
Headway Analysis – 6M13, 45 – Ashford International to Swanley (Overall) – Up Direction



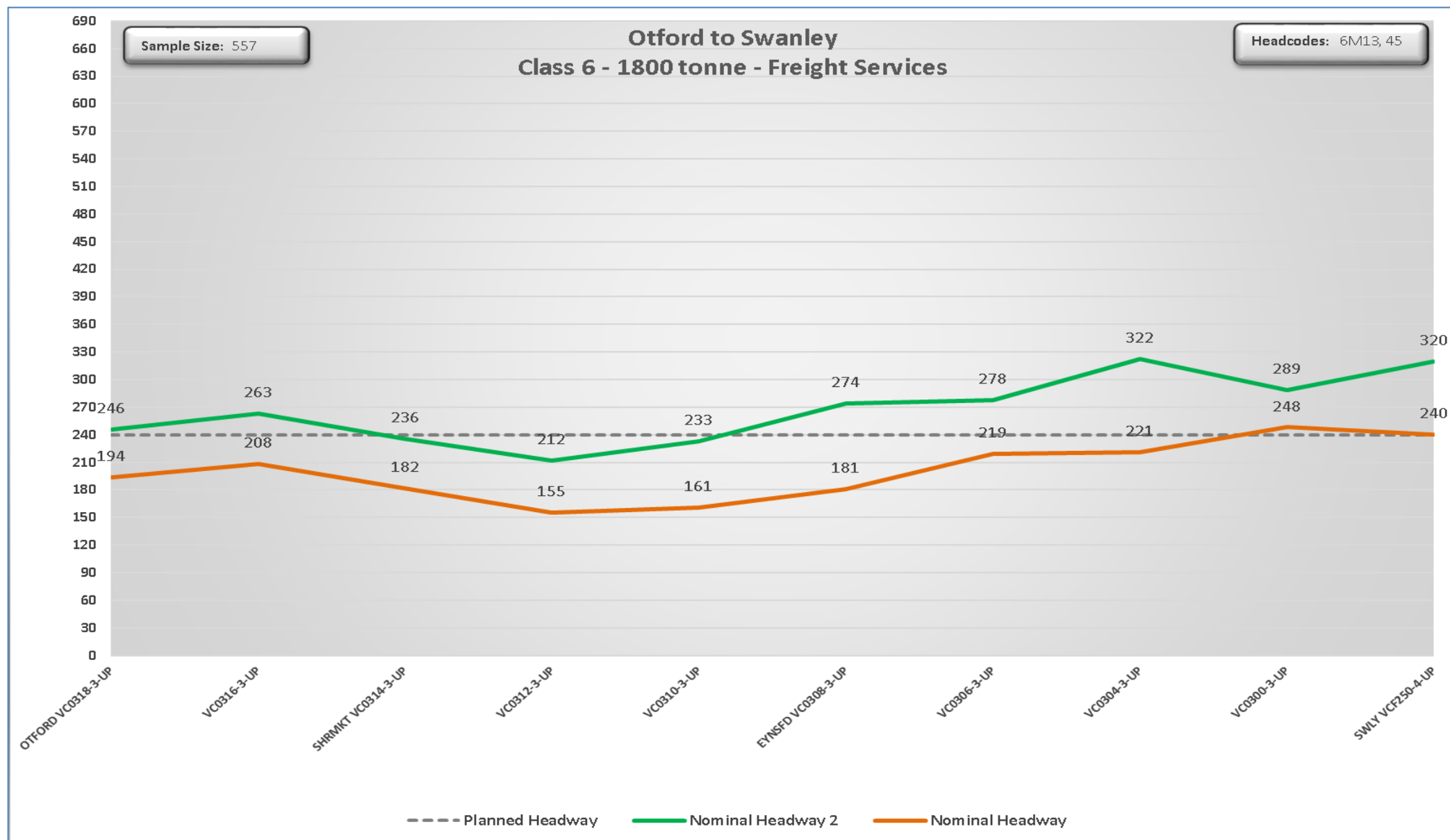
Headway Analysis – 6M13, 45 – Ashford International to Maidstone East – Up Direction



Headway Analysis – 6M13, 45 – Maidstone East to Otford – Up Direction



Headway Analysis – 6M13, 45 – Otford to Swanley – Up Direction



SRT Analysis – Swanley to Ashford International – Up Direction

WA01: Ditton Foundry - Dollands Moor Sdgs
Headcodes: 6016
Class 60/F/66/1800

Start	Start TIPLOC	Exit	Exit TIPLOC	Entry	Exit	Planning Value				Observed Value			Recommended Value				Sample Sizes
						Line Code	B'Plan	Adj/All	Cumulative	SRT	Cumulative	DELTA	SRT	Adj / All	Cumulative	DELTA	
Swanley	SWLY	Otford Jn	OTFORDJ	P	P		11:00		11:00	11:22	11:22	00:22	11:30		11:30	00:08	45
Otford Jn	OTFORDJ	Maidstone East	MSTONEE	P	P		22:00		33:00	20:39	32:01	-00:59	20:30		32:00	-00:01	187
Maidstone East	MSTONEE	Charing	CRNG	P	P		24:30		57:30	18:22	50:23	-07:07	18:30		50:30	00:07	187
Charing	CRNG	Ashford International	ASHFKY	P	P		08:30		06:00	08:32	58:55	-07:05	08:30		59:00	00:05	175
							01:06:00			00:58:55			00:59:00				

WA02: Daventry Recep Sdngs - Dollands Moor Sdgs
Headcodes: 6071
Class 60/F/66/800

Start	Start TIPLOC	Exit	Exit TIPLOC	Entry	Exit	Planning Value				Observed Value			Recommended Value				Sample Sizes
						Line Code	B'Plan	Adj/All	Cumulative	SRT	Cumulative	DELTA	SRT	Adj / All	Cumulative	DELTA	
Swanley	SWLY	Otford Jn	OTFORDJ	P	P		10:00		10:00	11:28	11:28	01:28	11:30		11:30	00:02	37
Otford Jn	OTFORDJ	Maidstone East	MSTONEE	P	P		20:00		30:00	20:56	32:24	02:24	21:00		32:30	00:06	284
Maidstone East	MSTONEE	Charing	CRNG	P	P		18:30		48:30	16:48	49:12	00:42	17:00		49:30	00:18	284
Charing	CRNG	Ashford International	ASHFKY	P	P		08:00		56:30	08:37	57:49	01:19	08:30		58:00	00:11	279
							00:56:30			00:57:49			00:58:00				

SRT Analysis – Ashford International to Swanley – Down Direction

WA03: Dollands Moor Sdgs - Ditton Foundry
Headcodes: 6M13, 45
Class 60C66S18

Start	Start TIPLOC	Exit	Exit TIPLOC	Entry	Exit	Line Code	Planning Value			Observed Value			Recommended Value				Sample Sizes
							B'Plan	Adj/All	Cumulative	SRT	Cumulative	DELTA	SRT	Adj / All	Cumulative	DELTA	
Ashford International	ASHFKY	Charing	CRNG	P	P		09:30		09:30	09:27	09:27	-00:03	09:30		09:30	00:03	507
Charing	CRNG	Maidstone East	MSTONEE	P	P		18:00		27:30	17:47	27:14	-00:16	18:00		27:30	00:16	502
Maidstone East	MSTONEE	Otford Jn	OTFORDJ	P	P		27:00		54:30	24:39	51:53	-02:37	24:30		52:00	00:07	470
Otford Jn	OTFORDJ	Swanley	SWLY	P	P		12:00		06:30	12:03	03:56	-02:34	12:00		04:00	00:04	406
							01:06:30			01:03:56			01:04:00				

WA04: Dollands Moor Sdgs - Scunthorpe
Headcodes: 4E26
Class 75/F/66/600

Start	Start TIPLOC	Exit	Exit TIPLOC	Entry	Exit	Line Code	Planning Value			Observed Value			Recommended Value				Sample Sizes
							B'Plan	Adj/All	Cumulative	SRT	Cumulative	DELTA	SRT	Adj / All	Cumulative	DELTA	
Ashford International	ASHFKY	Charing	CRNG	P	P		07:30		07:30	06:41	06:41	-00:49	06:30		06:30	-00:11	259
Charing	CRNG	Maidstone East	MSTONEE	P	P		14:00		21:30	16:02	22:43	01:13	16:00		22:30	-00:13	124
Maidstone East	MSTONEE	Otford Jn	OTFORDJ	P	P		20:30		42:00	21:22	44:05	02:05	21:30		44:00	-00:05	123
Otford Jn	OTFORDJ	Swanley	SWLY	P	P		10:00		52:00	11:38	55:43	03:43	11:30		55:30	-00:13	115
							00:52:00			00:55:43			00:55:30				