Selby District Council

SELBY DISTRICT STRATEGIC TRANSPORT MODEL

Transport Data Collection Report

TDCR
JULY 2022

PUBLIC

Selby District Council

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Transport Data Collection Report

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CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 BACKGROUND

1.1.1. Selby is a local government district of North Yorkshire. Selby District Council (SDC) is the local authority for a number of wards within Selby district, including Selby East, Selby West, Tadcaster, Sherburn in Elmet and Eggborough. It is the southernmost district of North Yorkshire, bound by the unitary authority of City of York to its north, East Riding of Yorkshire to its east, Wakefield council to its south and City of Leeds to its west. Selby district has a population of around 84,000 based on 2011 Census information.

1.1.2. The previous Selby Town Traffic model was developed by Mouchel with a base year of 2016. The model study area was around Selby town centre, extending to Cawood to the northwest of the town and Hemingbrough to the southeast. The model was used to test the transport impacts of potential development sites and infrastructure improvements included in the local plan.

1.1.3. WSP were commissioned by North Yorkshire County Council (NYCC) and SDC to develop the updated Selby District Strategic Transport Model (SDSTM) for a 2019 base year. This modelling suite will include a SATURN highway assignment model in addition to a variable demand model (VDM) being developed in CUBE Voyager.

1.1.4. It was agreed with NYCC and SDC that the project methodology will be developed incrementally and to undertake the work in two stages, namely;

- Stage 1- Identify network congestion hotspots

Stage 1 makes use of the currently available Selby Town Strategic model to identify congestion hotpots which could influence the development sites included in the Local Plan.

- Stage 2- Detailed model build

Stage 2 will focus on developing the detailed SATURN model for the areas identified in Stage 1 above to produce a representative robust modelling tool to support and test the proposed Selby District Local Plan.

1.1.5. WSP have completed work outlined in Stage 1 and shared the reports with NYCC and SDC for review, comments, and approval in August 2020.

1.1.6. In the discussion, following submission of the Stage 1 report, it has broadly been accepted that a district wide model update is required to ascertain the strategic highway network impacts of the developments identified within the log.

1.2 NEED FOR ADDITIONAL DATA

1.2.1. The aforementioned Selby Town Traffic Model focuses mainly on Selby Town area, whereas the Selby District Local Plan covers the entire district, implying that additional modelling and hence the need for additional data will be required.

1.2.2. It is stated in TAG Unit M1.1 that "data collection is necessary in order to inform the parameters that represent the model responses (calibration) and to provide a source of information against which the model can be compared to assure its quality (validation)."

1.2.3. To develop the updated transport model to a robust level compliant with TAG, a variety of data types were required either through existing sources or the commission of new Junction turning count surveys (MCC) and Automatic traffic counts (ATC).

1.2.4. This range and scope of data collection was necessitated by several primary purposes including:

- Development of demand matrices by mode (highway);
- Calibration of the highway assignment model through matrix estimation;
- Calibration and validation of the highway assignment model against respective TAG criteria; and
- Validation of journey time routes in the highway assignment model.

1.2.5. Analysis was undertaken of the quality and scope of existing data and then followed by a gap analysis to identify where existing data was insufficient in order to arrange surveys to infill this need.

1.2.6. Other datasets were also required to support this process including network development and assignment parameters.

1.3 PURPOSE OF THIS REPORT

1.3.1. This Transport Data Collection Report (TDCR) has been prepared to document the data collected for development of the updated SDSTM with reference to DfT's Transport Analysis Guidance (TAG) which defines the best practice for transport modelling, with particular reference to Unit M1.2 Data Sources and Surveys.

1.3.2. The content of this report is structured as follows:

- Chapter 2 – travel demand data;
- Chapter 3 – traffic count data;
- Chapter 4 – journey time data;
- Chapter 5 – additional data sources; and
- Chapter 6 – summary and conclusions.

1.3.3. It forms part of the reporting package for the SDSTM development that will include the highway Local Model Validation Report (LMVR) which documents how the data sources described in this report have been applied during the model development process.

2 TRAVEL DEMAND DATA

2.1 INTRODUCTION

2.1.1. Building a transport model necessitates the development of base year travel demand matrices for assignment. This construction required an understanding of the trip-making behaviour for Selby district including trip rates, trip length distributions and travel purpose.

2.1.2. This chapter details the specification and initial verification of the new mobile network data.

2.2 REVIEW OF EXISTING DATA

2.2.1. Due to the requirement for a district-wide model (see 1.2.1), the previous Selby model requires updating to meet this criterion and therefore it was necessary to obtain new travel demand data.

2.3 NEW DATA COLLECTION

2.3.1. Acquiring high quality origin-destination data is difficult. There are various sources identified within TAG however there is no definitive statement on their quality and acceptability for application in models; rather there is information on the advantages, limitations, and biases of these datasets.

2.3.2. Using mobile network data (MND) has the advantages of being captured for a wide area over a suitable period of time – in this case four weeks – therefore it is able to capture the trip making variability across a region which traditional sources such as roadside interview surveys (RSIs) do not. However, it is noted that RSIs will give explicit details for the data they do capture whereas MND relies on spatial analysis and tested algorithms to derive them.

Mobile Network Data

2.3.3. The suitability of different demand data sources was considered as part of the model development scoping exercise and documented in the MSR. It was determined that MND would be used as the primary demand data source.

2.3.4. Telefónica were commissioned to derive mobile phone origin-destination (MPOD) matrices from MND supplied by O2. The data collection period covered all weekdays from 01/10/2019 to 31/10/2019, excluding the dates between 28/10/2019 and 31/10/2019 due to school holidays.

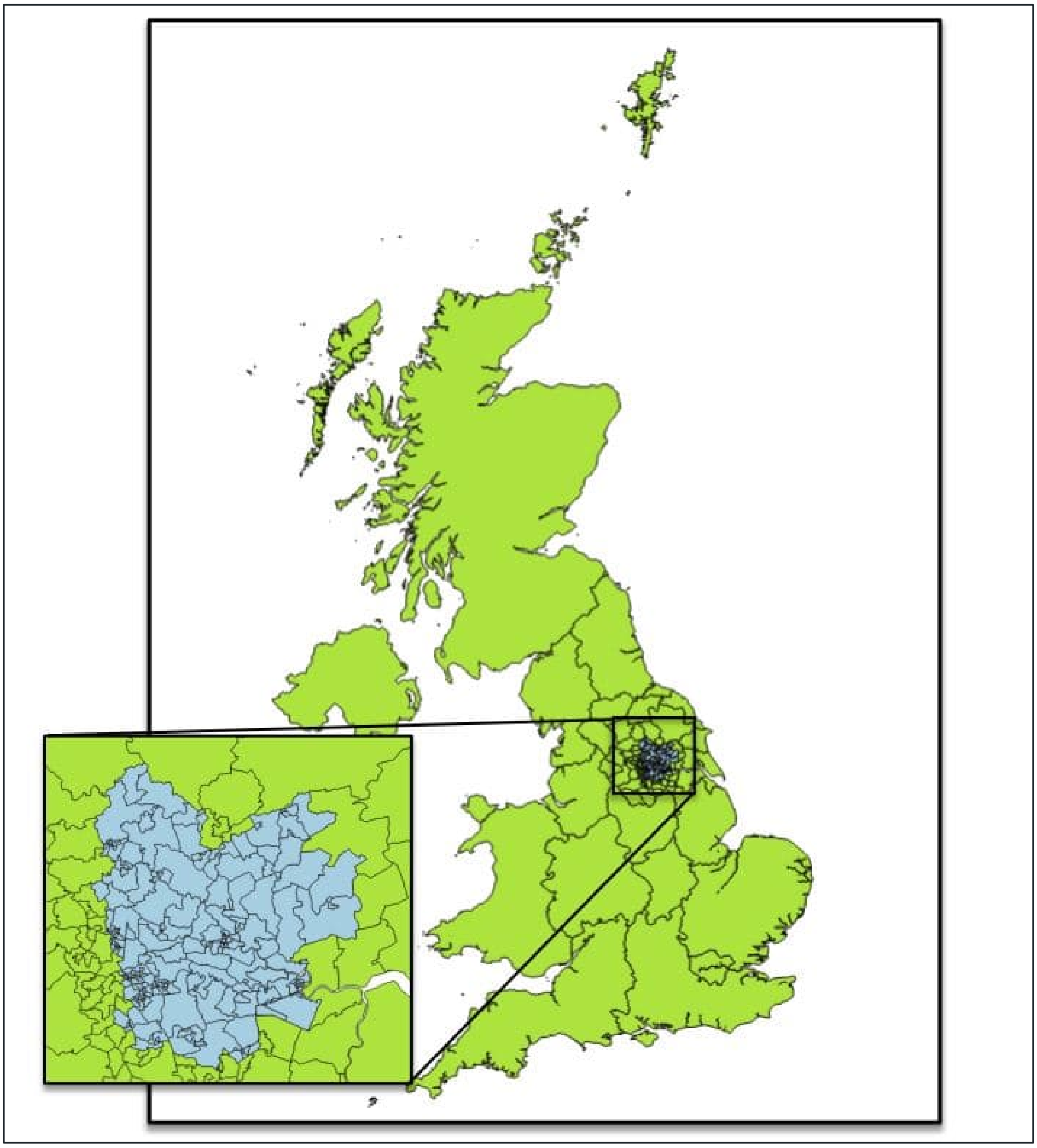
2.3.5. The data specification includes a Study area, and an Outer area. The study area boundary is shown in Figure 2-1. All trips that interact with the study area are included in the outturn MND matrices.

2.3.6. The mobile phone raw events available for this project were available for all zones within the Study area. Only the trips relating to the Study area, i.e., trips from, to and traversing the area are included in the matrix. Therefore, trips for external zones within or overlapping the Study area are only included if they interact with the Study area.

2.3.7. The data was provided in an agreed zone system, referred to as the MND Request Zone system, to make clear the distinction between these zones and the actual assignment model zone system. The MND Request Zone system is less detailed than the assignment zone system since O2 were confident in the spatial accuracy of the MND from LSOA upwards. It comprised 300 zones of which 205 were within the study area. The Request Zone system is illustrated in Figure 2-1.

2.3.8. Details on MND verification is detailed in the highway Local Model Validation Report (LMVR) as well as the Telefónica OD Demand Data Report attached in Appendix A. These documents report on the detailed MND data specification, analysis, and verification.

Figure 2-1 - MND Study Area



2.4 DATA VERIFICATION AND CLEANSING

Mobile Network Data

2.4.1. Details on MND verification is detailed in the highway Local Model Validation Report (LMVR) as well as the Telefónica OD Demand Data Report attached in Appendix A. These documents report on the detailed MND data specification, analysis, and verification.

2.4.2. The key conclusions from that report are summarised as follows:

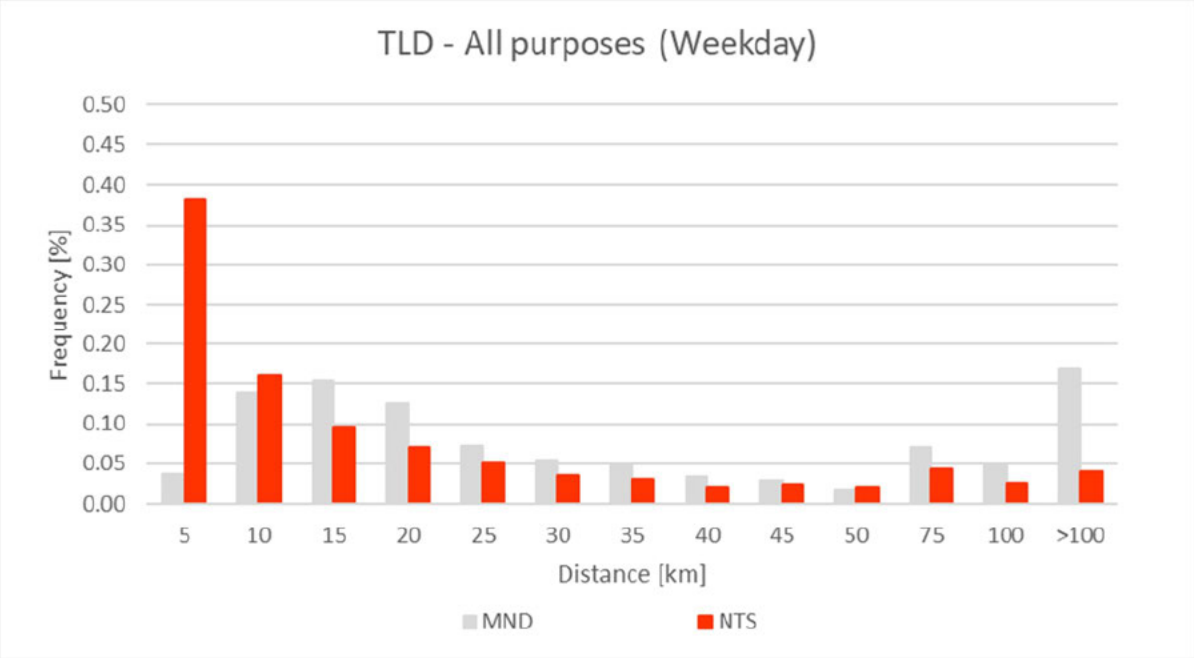
- All the zones within and outside the study area have trips.
- For motorised trips (excluding HGV), the majority of trips in the matrix are the Internal from/to external trips (48%). Long distance trips between the external regions represent a significant 39% whilst the intra-study area trips make up a small proportion (around 14%), of the travel demand from Selby district.
- As regard HGV, the majority of trips in the matrix are the external (around 63%). Intra-study area trips make up around 33%.
- The comparison with TEMPRO total trips showed that the MND matrix is significantly underrepresenting the total amount of trips in the study area.

Table 2-1 – MND Verifications: Average Weekday Total Two-Way Trips – All Modes

District	All Modes		
	MND	TEMPRO	δ Diff.
Selby District	171,993	287,785	0.60

- The TLD analysis showed that a consistent part of this gap is produced by a shortfall in short distance trips for all purposes combined. These gaps will be infilled using the synthetic matrix.

Figure 2-2 – MND Verifications: TLD Comparison - All purposes and all modes



- The purpose split between 'Work' and 'Other' in the MND dataset closely reflected the purpose split in TEMPRO when education and work where defined together in TEMPRO. The matrix build will initially assume that the 'Work' category also contains education trips.

Table 2-2 – MND Verifications: Work/Other Split Proportions

Purpose	MND	TEMPRO
Work (HB and NHB)	0.33	0.38
Other (HB and NHB)	0.67	0.62

- In the MND the category Other includes "employer business" and 'Other' trips. A method will be required to segment the MND into commute, business, and other user classes.
- Other non-car highway trips -LGVs and bus - will need to be subtracted from the motorised component.
- The analysis of the HGV matrix showed that the MND matrix is underrepresenting the HGV trips in the study area. Therefore, additional data will be required to fill these gaps in the matrix.

3 TRAFFIC COUNT DATA

3.1 INTRODUCTION

3.1.1. Traffic count data was required for the calibration and validation of the highway model against the criteria set out in TAG Unit M3.1 including:

- Calibration of the trip matrices through matrix estimation;
- Verification of the trip matrix across screenlines; and
- Verification of individual link flows.

3.1.2. This requires a substantial amount of quality data in order to cover the model study area in sufficient detail. This includes both:

- Automatic traffic counts (ATCs): permanent or temporary (typically a two-week period) surveys at a link level which give more reliable estimates for traffic volumes accounting for some day-to-day variability; and
- Manually classified counts (MCC): single day surveys undertaken for twelve hours which provide a more reliable vehicle classification plus data encoded on specific turning movements.

3.1.3. This chapter describes the review of existing data, the surveys commissioned, and the traffic data verification and cleansing processing undertaken.

3.2 REVIEW OF EXISTING DATA

3.2.1. Prior to considering new count surveys, an exercise was undertaken to establish availability of existing count data within the areas of interest. Existing counts were identified through two pathways. The first was knowledge of common data sources consisting of:

- The Traffic Flow Data System (TRADS) which is a collection of permanent ATCs on the strategic road network (SRN) which record traffic volumes at 15-minute intervals with classification determined by axle length. These are maintained by Highways England and available through their online database WebTRIS; and
- The DfT Count Database which is a collection of traffic counts undertaken on behalf of the DfT for single days on an annual basis at various locations on the major (motorways and A roads) and minor road network which is also available online.

3.2.2. The second pathway involved identification of counts which had been used for previous and ongoing studies including:

- A comprehensive set of ATC (including ATC at RSI sites) and MCC surveys commissioned 2016 as part of the model build by Mouchel;
- Historic count data in the study area provided by NYCC and SDC, as well as contacting additional traffic survey companies; and
- C2 permanent count site dataset hosted by North Yorkshire County Council providing data for parts of the study area.
- MCC surveys in Church Fenton and Tadcaster.

3.2.3. The existing ATC and MCC survey locations are mapped in Figure 3-1. Table 3-1 summarises the existing sources in more detail.

Figure 3-1 - Existing ATC and MCC data locations

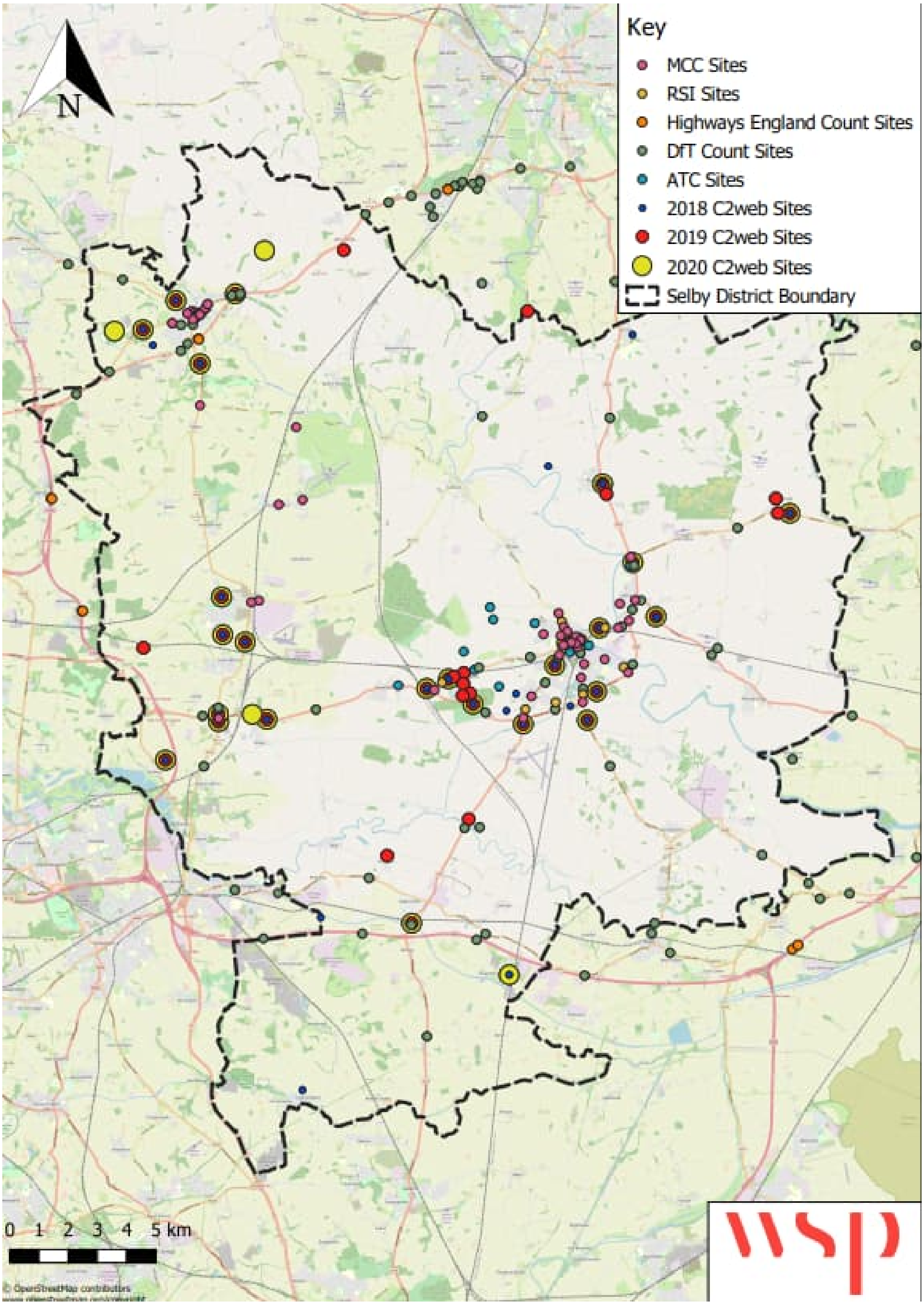


Table 3-1 - Existing Sources of Traffic Count Data

Source	Count Type	Survey Period	Data Type
2016 Model Build	Automatic Traffic Count	Generally two-week periods in various years and	Data available in intervals of between fifteen mins and
	Manual Classified Count	Twelve-hour periods for single days in various years	Counts have been classified into five vehicle classes
TRADS (Highways England)	Permanent automatic count sites on the SRN	Permanent	Data is not fully classified
DfT Counts – Major Roads	Classified counts	Single day counts	Data is generally for classification purposes to support an existing ATC
DfT Counts – Minor Roads	Classified counts	Single day counts	Data is generally for classification purposes to support an existing ATC
NYCC/SDC – historic data	Temporary Automatic Traffic Count	Generally two-week periods in various years and months	Data available in intervals of between fifteen mins and one hour
	Manual Classified Count	Twelve-hour periods for single days in various years and months	Counts have been classified into five vehicle classes (Car/Taxi, LGV, OGV1, OGV2 and PSVs)
North Yorkshire County Council – C2	Permanent automatic count sites in North Yorkshire	Permanent	Data is not fully classified
Other Counts – historic data	Manual Classified Count	Twelve-hour periods for single days in various years and months	Counts have been classified into five vehicle classes (Car/Taxi, LGV, OGV1, OGV2 and PSVs)

3.3 NEW DATA COLLECTION

3.3.1. A gap analysis was undertaken to establish traffic significant links and junctions within the study area which were not covered by the existing data or where deficiencies or limitations had been identified in the existing data such as survey month or consistency with other counts. As a result of this exercise, a large data collection commission was undertaken.

Automatic Traffic Counts (ATC)

3.3.2. There were 54 ATC surveys undertaken over a 3-week period for October 2020, concluding before the start of the half-term holiday (28th October 2020). The data obtained was tabulated by survey day with traffic volume reported in fifteen-minute intervals.

3.3.3. The locations were chosen based on proposed screenlines and cordons, watertight coverage of the district boundary and any other key links not covered by those criteria or existing data. The locations are shown in Figure 3-2 (red pins).

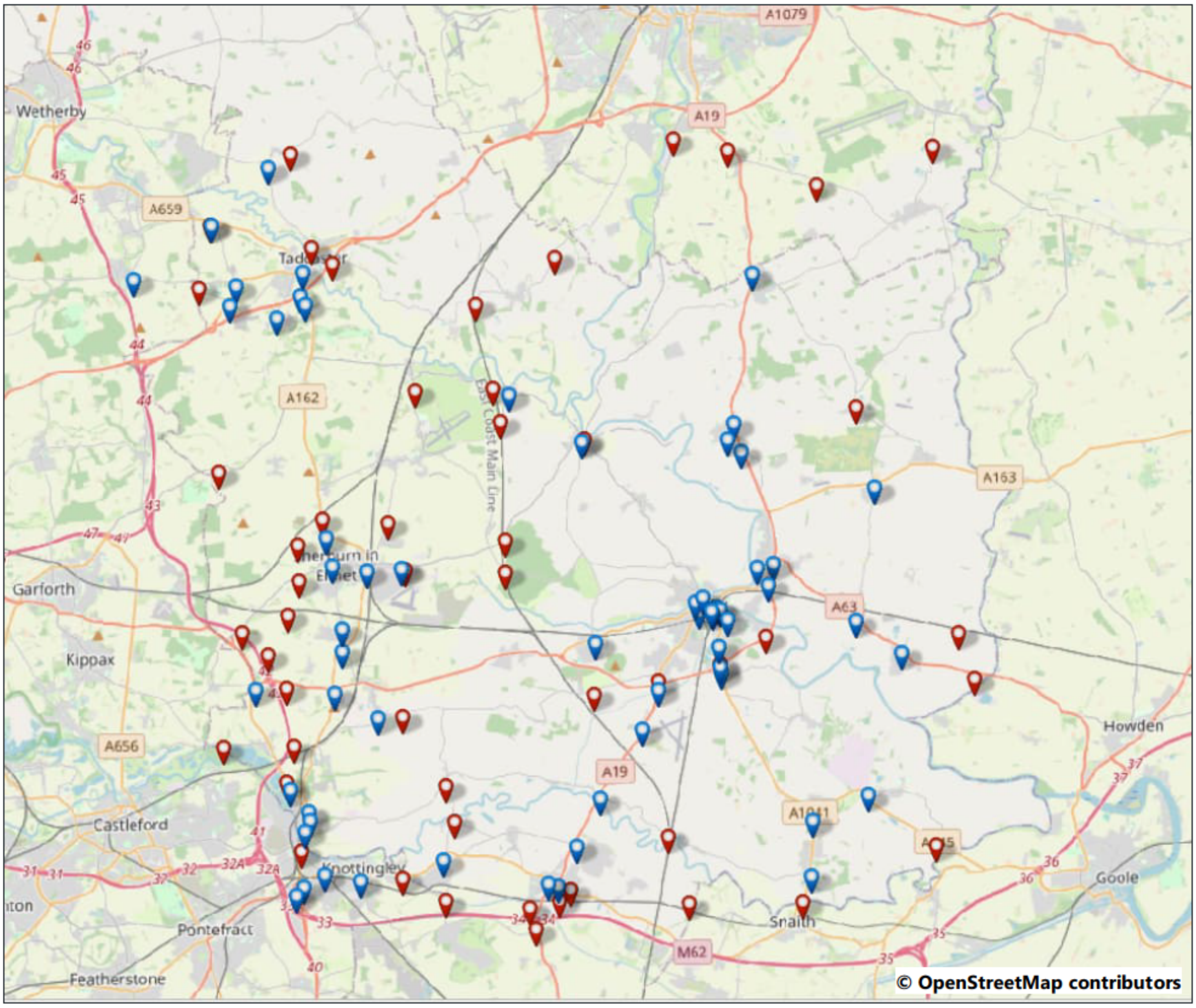
Manually Classified Counts (MCC)

3.3.4. There were 59 MCC surveys undertaken for a twelve-hour period (07:00-19:00) for one day in October 2020. The data was tabulated in fifteen-minute intervals with flow volumes reported by at least six vehicle types:

- Pedal cycle / motorcycle;
- Car;
- Light Goods Vehicle (LGV);
- Other Goods Vehicle Type 1 (OGV1);
- Other Goods Vehicle Type 2 (OGV2); and
- Bus and Coach.

3.3.5. The locations corresponded to an ATC survey and the sample was chosen to provide local classified data for Selby and the key towns across the district to supplementing existing data. The locations are shown in Figure 3-2 (blue pins).

Figure 3-2 - Location of ATC and MCC Surveys (red = ATC; blue = MCC)



3.4 DATA VERIFICATION AND CLEANSING

3.4.1. Due to the quantity and varying formats of count data collected, a structured approach to verifying and cleansing the data was essential to assure consistency of processing across the whole dataset. The steps undertaken are summarised as follows.

Removal of Outliers

3.4.2. Outliers can occur through mechanical fault including equipment failure or tampering but also in the event of traffic incidents which restrict or divert drivers and such that the resultant values are out of line with the typical daily flows recorded during the rest of the data capture period. Commentary of any known incidents or roadworks during the survey periods was provided by Streetwise to assist with identification or explanation for such occurrences.

3.4.3. WebTAG Unit M1.2 recommends that all values outside a range of two standard deviations from the mean are considered as outliers and this calculation was undertaken for all ATCs by hour (Mon-Thu).

Count Factoring

3.4.4. As a large amount of data available was not undertaken in the base year October 2019, a set of seasonal factors based on C2 data were applied to reach a typical average October 2019 weekday. Due to the impact of COVID-19, 2020 count data was factored using all available 2019 and 2020 counts that were located on the same links. This data was then used to derive uplift factors by vehicle type.

Directionality Checks

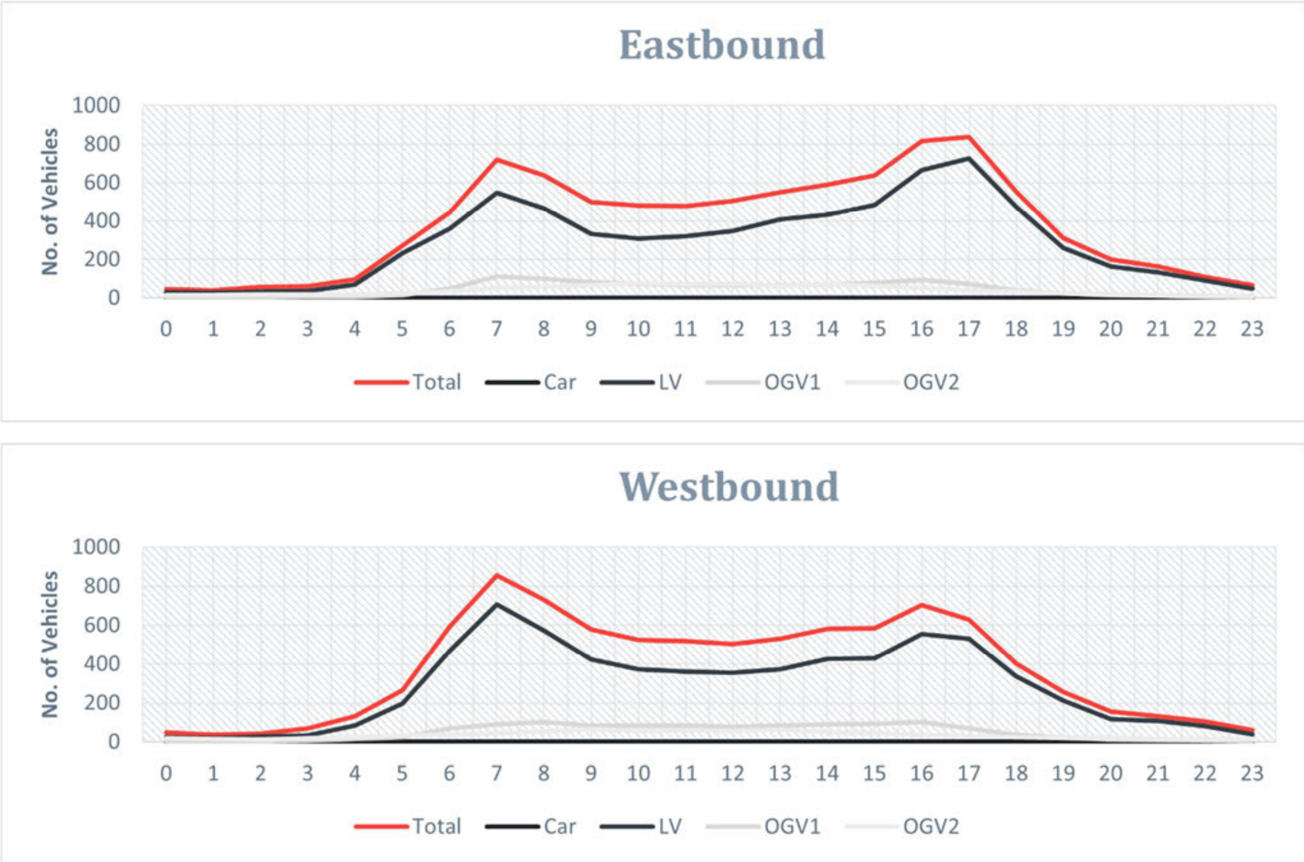
3.4.5. Consideration of directionality – or tidality – was undertaken as a sense check on all of the counts where possible. Tidal patterns in Selby are not as definitive as in a major city where access to/from the city centre would carry a higher inbound flow in the AM peak and a higher outbound flow in the PM peak to account for commuter and business trip patterns. This is due to gravitational pull towards Selby being counter-balanced by the gravitational pull towards York and Leeds. However, where patterns exist, they were applied as checks to the count data.

3.4.6. For example, consider ATC Site 3 A63 to the west of Selby, towards Leeds. It would be expected that the eastbound direction will primarily include trips inbound towards the Selby whereas the westbound direction will primarily include trips outbound from Selby. Due to the traffic to/from Leeds in addition to Selby traffic, it is expected that there would be pronounced peaks in both the AM and PM for both directions. The graphs in Figure 3-4 demonstrates that the observed daily flow at this location is consistent with the expected travel behaviour which provides a level of assurance in the quality of the data and verifies the manual aspect of the processing such as data labelling.

Figure 3-3 - Example of Directionality: ATC Site 3 Location

Source: Reproduced from Site 45 Survey Data

Figure 3-4 - Example of Directionality: ATC Site 3 Weekday Average Traffic



Source: Reproduced from Site 3 Survey Data

Consistency Checks – Multiple Counts

3.4.7. Due to using data from various commissions, there were some locations which had multiple counts covering identical movements or links. A selective approach was used to determine which count should be retained in such cases which was based on various factors including:

- Age of the data with preference for most recent where applicable;
- Year of survey with preference for those which more accurately represent 2019 traffic flows (considering that traffic flows in 2020 were greatly reduced due to COVID -19 lockdowns);
- Month of survey with preference for more neutral months;
- Consistency checks between the counts to establish concurrence or scale of differences; and
- Consistency checks with nearby counts on the same link, where available, as a verification on which is more reliable if differences were established.

3.4.8. This principal extended to some cases with counts from different data sources on adjacent links in the model which had a significant change in volume, but there was no explanation for the magnitude of change. This inconsistency would impact on the calibration and validation if both counts were retained since achieving criteria for one count may exclude the other from achieving the criteria and vice versa. Similar checks were undertaken to review the data quality and consistency to order to determine which count should be retained in those cases.

Classification

3.4.9. As stated in Section 3.3, some ATCs were commissioned with a corresponding MCC on the same link. ATCs were classified into cars, LGVs and HGVs using a global splitting factor from all available MCCs. This approach was also applied to C2 and WebTRIS count classification, using the DfT counts as the source for the splitting factors. It must be noted that separate splitting factors were calculated based on survey year and road type (Motorway, A roads and other roads).

External Area

3.4.10. The existing traffic count data sources available to this study, referenced above, extended to cover parts of Knottingley and near York which are not in the study area. Data was not processed for external areas that would not be part of the model calibration and validation.

Outturn Count Database

3.4.11. The outturn processed traffic count database is attached in Appendix B. This is the count dataset which is being used for highway model calibration and comprises 572 counts, post cleaning, consistency checks and classification. A shapefile has also been produced with supplementary fields including data source. Figures 3-5 and 3-6 summarise the source of data and survey year of data in the outturn count database.

Figure 3-5 - Calibration Count Database: Source of Data

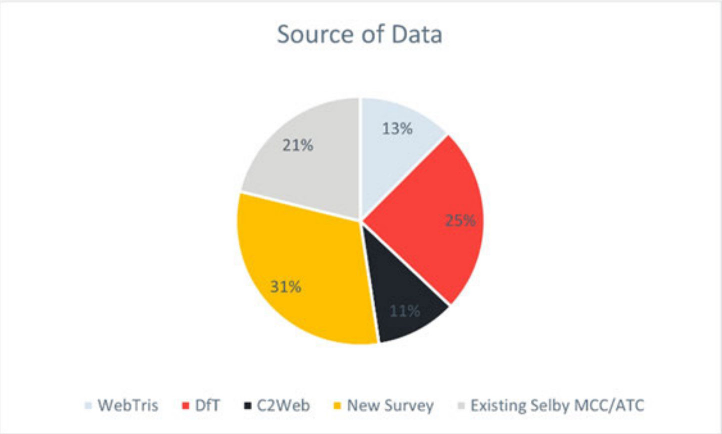
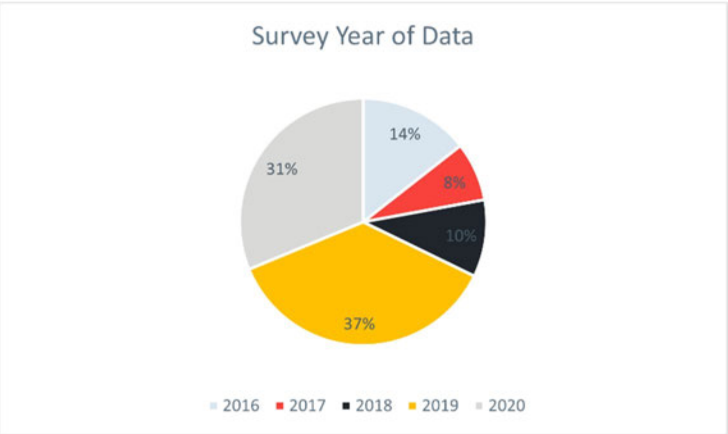


Figure 3-6 - Calibration Count Database: Survey Year of Data



4 JOURNEY TIME DATA

4.1 INTRODUCTION

4.1.1. Journey time data was required for development of the highway assignment model, in line with guidance set out in TAG Unit M3.1, primarily for validation of journey time routes but also to inform the calibration of cruise speeds and to verify large junction delays which may occur in the model.

4.1.2. This section documents the review of existing journey time data and the surveys undertaken, the need for which was determined during the highway model calibration and validation.

4.2 REVIEW OF EXISTING DATA

4.2.1. Trafficmaster journey time data is a dataset owned by the DfT which is sourced via GPS (Global Positioning System) data from devices and trackers fitted to a variety of fleet vehicles (cars, LGVs and HGVs) and buses. The data is collected by the devices through identifying the location of each device every 1 to 10 seconds on ITN (Integrated Transport Network) links. It is acknowledged that the sample population for Trafficmaster can be skewed, including a bias within cars towards high end vehicles and with a higher than representative proportion of LGVs, however it can be considered as the most comprehensive big dataset readily available for journey times data.

4.2.2. Access to Trafficmaster data for this project was provided by NYCC, covering the North Yorkshire area. The data was processed internally and resulted in a summarised dataset listing link distance and average travel time for ITN links.

4.2.3. The data was extracted for thirty-six pre-defined routes, agreed with SDC, and which are illustrated in Figures 4-1 and 4-2. The outturn dataset is summarised in Table 4-1.

4.2.4. The data specification applied was weekday term time for all vehicle types in 2019 for three time periods:

- AM peak hour: 08:00-09:00;
- Inter peak period: 10:00-16:00; and
- PM peak hour: 17:00-18:00.

Figure 4-1 - Journey Time Data Collection Routes: Selby Urban Area

Figure 4-2 - Journey Time Raw Data Routes: Selby District

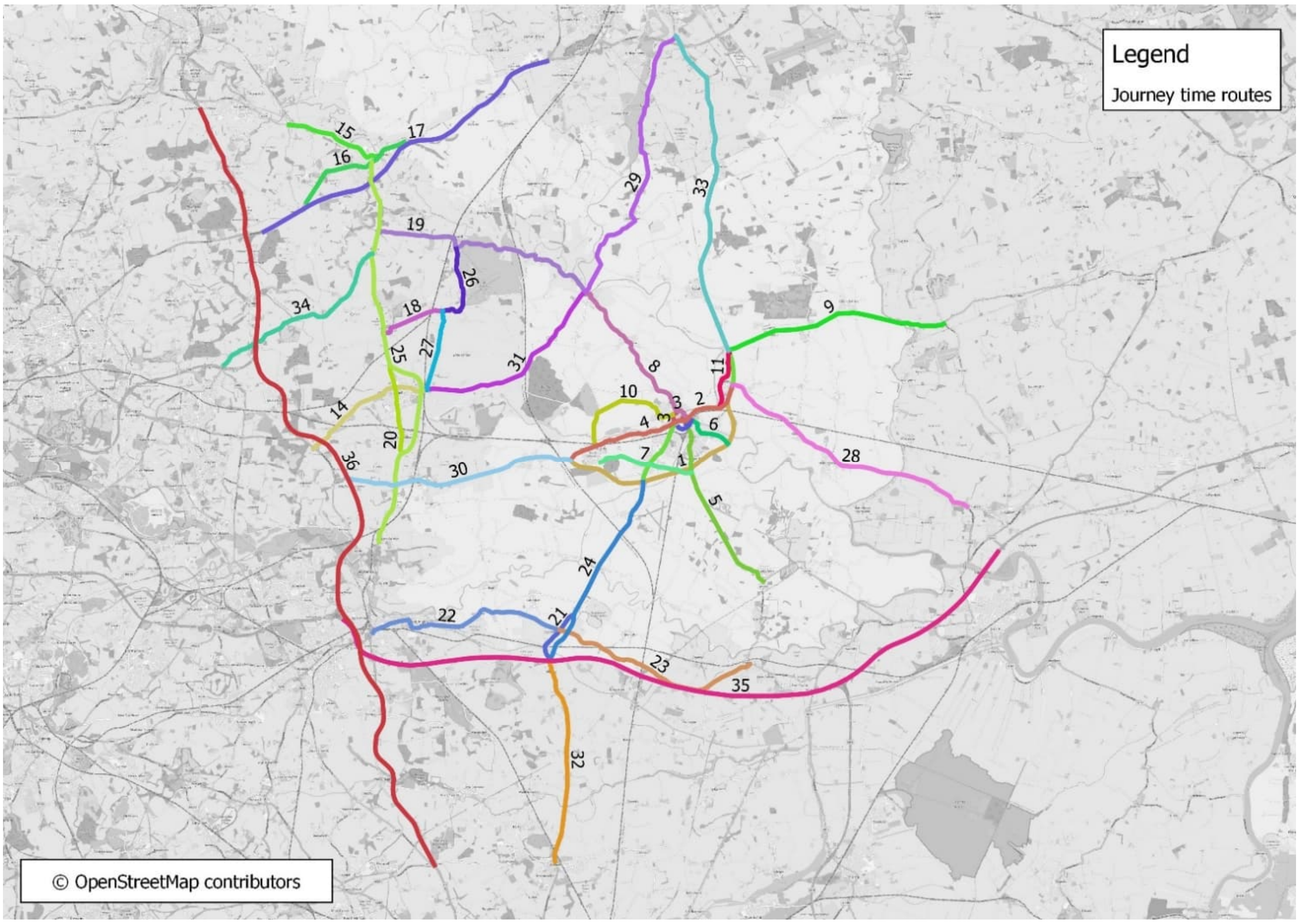


Table 4-1 - Trafficmaster Observed Journey Times

Route	AM Peak	Inter	PM Peak		Route	AM Peak	Inter	PM Peak
1 EB	09:11	08:49	08:52		19 EB	12:51	11:15	10:48
1 WB	09:09	08:53	09:05		19 WB	11:52	11:37	12:29
2 NB	13:46	13:10	13:41		20 SB	06:11	05:48	06:32
2 SB	14:20	13:46	15:54		20 NB	06:25	06:03	06:18
3 ACW	05:49	06:02	06:21		21 NB	03:23	03:23	03:11
3 CW	06:53	06:42	08:16		21 SB	03:49	03:30	03:14
4 EB	13:06	12:48	12:43		22 EB	10:19	10:33	10:52
4 WB	13:46	13:23	15:11		22 WB	10:27	10:35	10:39
5 NB	08:57	08:47	09:04		23 EB	09:34	08:55	09:07
5 SB	08:35	08:22	08:52		23 WB	08:52	08:43	08:35
6 EB	04:19	03:48	04:23		24 NB	08:27	08:08	08:03
6 WB	04:29	04:41	05:13		24 SB	08:14	08:13	08:17
7 WB	05:42	05:32	05:18		25 NB	17:00	16:22	16:03
7 EB	06:03	05:48	05:34		25 SB	16:08	15:50	17:26
8 NB	10:31	10:19	10:36		26 NB	04:15	04:06	03:57
8 SB	11:49	11:15	12:03		26 SB	04:06	04:06	03:51
9 WB	09:16	09:10	09:23		27 NB	03:19	03:06	03:03
9 EB	09:33	09:07	09:05		27 SB	03:14	03:11	03:20
10 EB	06:29	06:07	06:02		28 EB	10:01	09:51	09:46
10 WB	06:21	06:08	06:46		28 WB	10:19	09:57	09:59
11 SB	04:04	03:59	04:22		29 NB	13:41	13:04	12:50
11 NB	04:51	03:53	03:58		29 SB	13:39	12:58	12:35
12 NB	02:02	02:08	01:48		30 WB	10:18	09:50	10:08
12 SB	02:35	02:21	02:12		30 EB	09:44	09:22	10:02
13 EB	02:20	02:47	03:05		31 EB	08:20	08:02	08:02
13 WB	02:19	02:27	02:55		31 WB	07:54	07:51	07:40
14 EB	08:05	07:35	09:41		32 SB	08:11	08:14	08:46
14 WB	07:44	07:26	07:41		32 NB	08:22	08:07	08:02
15 EB	07:24	07:08	07:15		33 NB	15:54	11:42	11:37
15 WB	07:04	06:51	07:00		33 SB	11:41	11:36	13:28
16 WB	07:17	06:39	06:58		34 EB	07:40	07:33	07:22
16 EB	07:39	06:47	07:02		34 WB	07:37	07:33	07:31
17 EB	09:15	08:37	08:42		35 EB	18:19	18:47	18:21
17 WB	08:56	08:53	09:00		35 WB	19:23	18:45	18:23

Route	AM Peak	Inter	PM Peak		Route	AM Peak	Inter	PM Peak
18 EB	04:07	03:38	03:27		36 NB	22:37	21:17	21:01
18 WB	04:21	03:31	03:20		36 SB	21:18	21:46	24:15

4.3 DATA VERIFICATION AND CLEANSING

Trafficmaster data

4.3.1. The Trafficmaster data was verified and checked at a route level including:

- Cross-check of observed times against Google Maps;
- Average speed for the route, removing any links that were unreasonably over the speed limit or less than 5kph;
- Directionality and tidality between periods, particularly on radial routes; and
- Identifying specific locations with very large delays in the data.

5 ADDITIONAL DATA SOURCES

5.1 INTRODUCTION

In addition to the primary survey data discussed in previous chapters, there was a requirement to collect various other data sources to support the model build. This includes:

- Network data;
- Travel data; and
- Modelling parameters.

This chapter introduces each of these datasets and outlines their use within the SDSTM development.

5.2 NETWORK DATA

5.2.1. A large amount of GIS data is available through Ordnance Survey's (OS) OpenData program which can be used freely with copyright acknowledgement. The data obtained from OpenData included:

- Base mapping at various scales for reporting and presentation;
- Shapefiles for various geographical boundary definitions to define the zone system and other sectors and/or reporting areas which are used throughout the reporting.

5.2.2. Ariel and street view images from Google have provided a valuable source of information on the network to be modelled. Physical characteristics of the network, such as the number of lanes, lane markings and flare lengths have been ascertained based on this data source as well as bus lanes and HGV restrictions.

5.2.3. Traffic signal junctions within the model simulation area require operation data in order for them to be coded within SATURN. Traffic signal specifications were obtained from NYCC for the identified junctions which included data such as:

- Phase and stage diagrams;
- Phase minimum/maximum sets;
- Timetables defining minimum and maximum sets to apply by time period; and
- Phase intergreen times.

5.2.4. This data was provided by NYCC for signalised junctions across the network in a template format that was supplied by WSP. It included stage and phasing diagrams and, in most cases, observed green times that span multiple years. Where the year was not 2019, we believe that they are representative of 2019 timings

5.2.5. Where observed green time data was not available min/max times were used as the starting point. In a limited number of locations template coding was used to develop most likely timings.

5.2.6. Bus routing and timetable data was taken from the Routelines Dataset provided by Basemap for the year of 2019. Routelines is a dataset covering the whole of GB which contains a series of road links detailing the shortest journey taken by a bus between stops along a route. In addition, information on the route operator, number and name was recorded, as well as the service number and direction of travel. The dataset also contains service frequency information. All data is contained within a shapefile for each route. The bus routes were joined to the highway network by matching each bus stop to the nearest highway node.

5.3 TRAVEL DATA

National Transport Model

5.3.1. The National Trip End Model (NTEM) is developed by the DfT to forecast the growth in trip origins and destinations up to 2051 as a standardised dataset across transport modelling. The forecasts are derived based on national projections of:

- Population;
- Employment;
- Housing;
- Car ownership (through NATCOP – National Car Ownership Model); and
- Trip rates.

5.3.2. Data from NTEM can be accessed through CTripEnd databases or TEMPRO (Trip End Model Presentation Program) which operates as a front end for NTEM. This has been used at various points in the modelling including:

- Verification of MPOD data;
- Data to support processing of MPOD matrices;
- Trip ends for development of synthetic matrices; and
- Trip end growth for model forecasting.

The latest version as of writing this report is 7.2, which was released in March 2017.

National Travel Survey

5.3.3. NTS is an annual survey undertaken by the DfT containing travel diary information for journeys made from a sample of UK households. It provides a rich data source for understanding the trip making characteristics to be understood against background area type and socio-economic data for a range of variables including:

- Trip purposes;
- Mode share;
- Time of outward and return journeys;
- Trip time and trip length profiles; and
- Vehicle occupancies.

5.3.4. NTS data has been used at various points in the demand matrix development including:

- Verification of MND;
- Trip generalised cost distributions for calibration of synthetic matrices; and
- Trip return time factors for synthetic matrices to convert P/A to O-D.

Census Journey to Work

5.3.5. Census Journey to Work (JTW) is a demand dataset from the 2011 census containing information on mode of travel to work between pairs of MSOAs. The data is encoded for MSOA of residence, MSOA of workplace and mode of travel to work by various categories. This is national dataset and provides an observed volume and distribution of trips between MSOA pairs. The limitations are noted that it only represents one trip purpose segment, and the data is eight years old compared to the Selby District model base year.

5.3.6. JTW data has been used at various points in the demand matrix development including:

- Verification of MND.

Experian Mosaic Data

5.3.7. Additionally, Experian Mosaic data has been used. As Census Journey to Work (JTW) data was collected eight years prior to the model year and the pandemic placing more reliance on the synthetic matrix, it was decided to use the more up-to-date Experian Mosaic dataset to derive the splitting factors for population figures. The Mosaic dataset is postcode based which allowed for easy aggregation of the statistics to the model zone system and the data was cross checked against census data for validation purposes.

5.4 MODELLING PARAMETERS

TAG Databook

5.4.1. The TAG Databook is released by the DfT and includes all of the modelling and appraisal values referenced within the various guidance documents. This provides various parameters for the assignment models in value (base) year (2019) and price year (2010) including:

- Values of time;
- Vehicle operating costs; and
- Vehicle occupancies.

The latest release is Nov 2021 which has been used for the base year modelling.

6 SUMMARY AND CONCLUSIONS

6.1 SUMMARY

6.1.1. This report presents a summary of data collected for the base model development of the updated Selby District Strategic Transport Model (SDSTM) focused on three primary areas of travel demand, traffic counts and journey times. Specifically, the report covers:

6.1.2. Data requirements and specification for the model;

- A review of existing data sources;
- Collection of new data;
- Verification and cleansing of content; and
- Review of additional data sources required.

6.1.3. For each dataset, the initial phase considered the specification of data to meet the technical requirements and assurance required of the model. For travel demand data the requirement for, and technical specification of mobile phone data were covered in detail as part of the project brief and Model Specification Report. The principals established in those prior stages followed through into the data collection and verification stage as reported herein.

6.1.4. For other data types, known sources were reviewed for their coverage and quality within the SDSTM modelled area to assess their suitability for use. In addition to existing data, traffic count surveys were undertaken in October 2020 which followed the analysis to identify gaps or issues with existing data. This represented a large, multi-modal, and comprehensive collection of new survey data.

6.1.5. Following collation of data, verification and cleansing was undertaken to ensure an adequate source of information. Despite the checks being unique to the data in question, similar principles were adopted for each approach which included as a minimum adherence to the specification, completeness, and logic and sense-type checks. Details of these processes are presented in this report with further findings and details to be presented in the respective highway Local Model Validation Report.

6.1.6. In particular, the stepwise approach to cleansing the traffic count data is presented in this report with reference to specific examples where appropriate. The outturn summary reports ~47% of calibration counts were surveyed in 2018 or 2019. Demand data verification is presented in detail within the Mobile Network Verification appendix and forms a robust analysis for informing the requirements of the prior matrix development process. In particular, the reporting indicates a logical set out outcomes from the defined tests with limitations occurring through potential misallocation across variables rather than any fundamental issues with the dataset. In particular, it is concluded that the demand data is fit for purpose for the development of SDSTM.

6.2 CONCLUSIONS

6.2.1. The data collection process for the Selby District Strategic Transport Model development has made use of a diverse range of sources to ensure that network supply, travel demand and model calibration and validation data is appropriately specified for the development of a transport model satisfying all of the attendant requirements of accuracy to subsequently deliver traffic forecasts according to the current agreed model application.

6.2.2. This process followed a systematic approach for each data type. This includes specification of needs, review of quality and availability of existing data, commission of new data surveys and verification and cleansing of data content. The approach will ensure confidence in the model development.

6.2.3. Further data collection will continue in the project including the collation of forecast year information relating to infrastructure and development for which a similarly diligent approach will be adopted.

Appendix A

MOBILE NETWORK DATA VERIFICATION REPORT

O2 business

Mobile phone data provision

WSP Selby | Origin Destination Demand Data

March 2021

Contents

Introduction & Project Scope

Introduction

Telefónica is a mobile network operator (O2 in the UK), providing telephony services to over 22 million UK customers in both the public and private sectors. To ensure this service, Telefónica operates a network which supplies continuous nationwide coverage to each customer phone (device). The network and phone are in frequent communication to provide service. Intimate understanding of these networks allows Telefónica to build a contextual understanding of the movement of devices in space and time in the real world, with each phone creating events at specific points in time and space. These are chained into 'breadcrumbs', demonstrating whether each phone is moving or stationary at any point in time.

The result of Telefónica's processing creates a vast and valuable dataset which describes the movement and flow of O2 users across the UK. We track devices anonymously and associate each device with attributes derived from the user's contract (age, gender, contract type and billing address) or their observed behaviour (affluence, lifestyle, home and work location and other points of interest). In aggregate, therefore, mobile phone data provides a robust insight into the movement patterns of the UK population.

Given the nature of mobile phone data, it can represent movements on a macro basis across larger areas effectively. The technology is generally better at identifying longer trips and those where the user dwells at their destination for a more extended period. For this reason, the data should not be used in isolation but combined with other data sources before application.

Customer privacy is of utmost importance to Telefónica. All events processed are by-products of the core telephony network, and the process does not affect any user's handset. We anonymise the records before storing them in the analysis platform, so all analysis of behaviour is done in a completely anonymous separate environment. We aggregate outputs from the analysis such that we do not provide any individual-level data to clients.

Scope

WSP requested Telefónica to prepare origin-destination matrices for travel around Selby. We included trips if they penetrated a cordon, as shown in Figure 1.

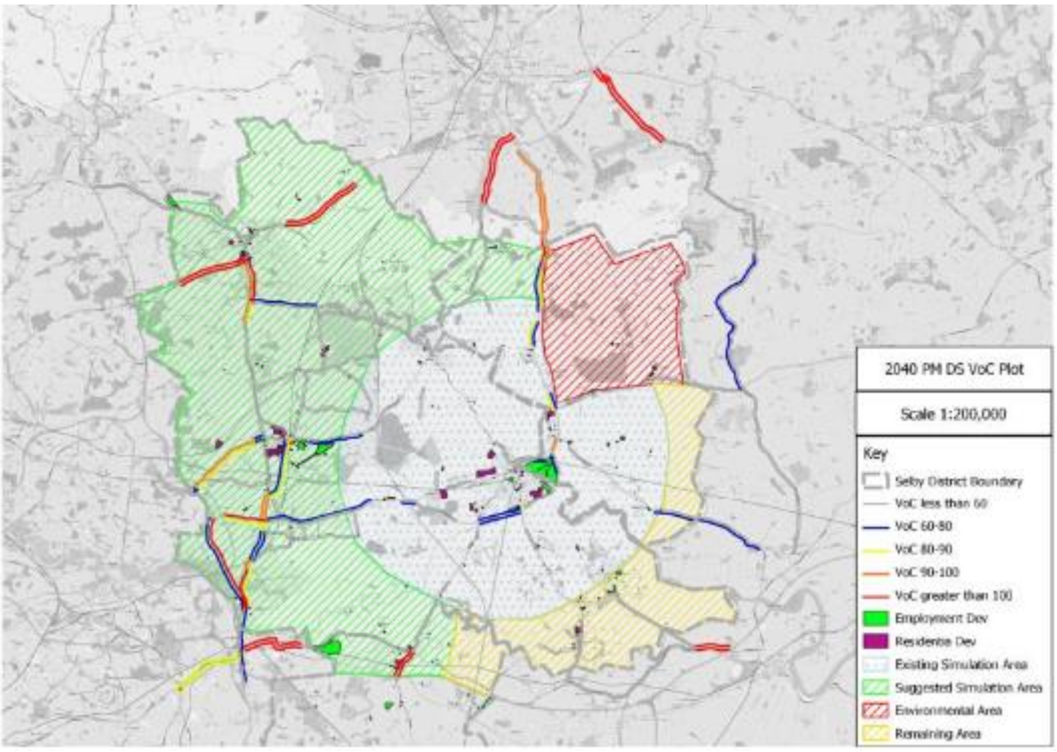


Figure 1: Image showing the extent of the model cordon.

We allocated trips to a start and end zone based on a zone system agreed with WSP, featuring a total of 300 zones. WSP provided the zoning system disaggregated in the following way:

- Cordon area (205 zones)
- Outer zones (95 zones)

Figure 2 shows the full zoning system, including the cordon area.

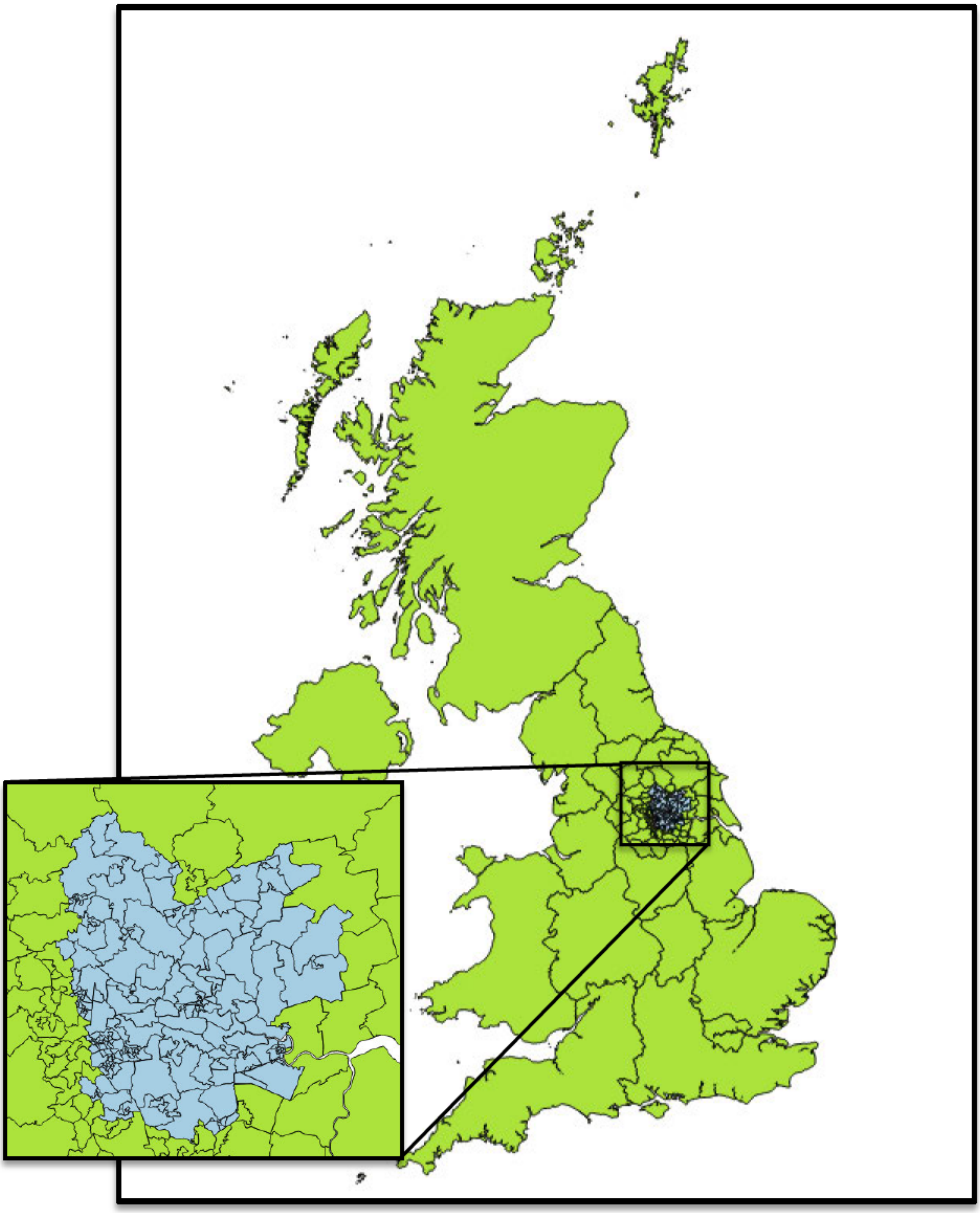


Figure 2: Image showing the zones used to identify the start and end point of trips.

We segmented trips by different variables; the core segmentation variables are as follows:

- By travel mode:
  - Total Motorised Road
  - HGV
- By travel purpose:
  - Outbound home-based work (OB_HBW)
  - Inbound home-based work (IB_HBW)
  - Outbound home-based other (OB_HBO)
  - Inbound home-based other (IB_HBO)
  - Non-home-based work (NHBW)
  - Non-home-based other (NHBO)
- By the time of day period into:
  - AM Peak Period (07:00 – 10:00)
  - Interpeak Period (10:00 – 16:00)
  - PM Peak Period (16:00 – 19:00)

We segmented all trips into these brackets according to the time they entered the cordon.

Study Period

We sampled trips in two separate periods, using weekdays (Monday to Friday) between 1st October 2019 and 31st October 2019. We have excluded the dates between the 28th and the 31st of October 2019 due to school holidays.

The final origin-destination matrices are therefore made-up of 19 days in October 2019.

Mobile Phone Technology

Overview of the Cellular Network

A cellular or mobile network is a wireless network distributed over land areas called cells; each served by at least one fixed-location transceiver which is known as a cell site or base station. In a cellular network, each cell uses a different set of frequencies from neighbouring cells to avoid interference and provide guaranteed bandwidth within each cell. When joined together, these cells provide radio coverage over a wide geographic area, enabling a large number of portable transceivers to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission.

Adjacent cells form groups of cells. The names of these groups depend on the generation of the cells. For simplicity in this document, we will use the 2G grouping, which is LAC. LACs overlap and vary in size, depending on the area. Grouping cells into LACs is essential for the collection of event data.

Event Data

O2 mobiles phones generate "events" as they communicate with the national cell network. We link each event to a persistent yet anonymised user ID. Telefónica stores a timestamp as well as the cell ID of the cell that recorded the event. We can analyse the spatial and temporal distribution of events to determine users' movement patterns. We classify events as either active or passive. It is the combination of both of these types of events that allow Telefónica to build a representative, stable dataset. Without the inclusion of passive events, our sample would be biased toward more active users, and individual user profiles would be biased towards locations where they made calls.

Active Events

Connection events occur when a user turns their phone on or off, loses or regains connection

Call events occur when a user makes or receives a phone call, or moves between cells when on a call

Text events occur when a user makes or receives a text message

Passive Events

Movement events occur when a user moves from one LAC to another. LACs consist of nearby cells in the same band – so users also create passive events when they transition between 2G/3G/4G coverage. These events ensure that the analysis process will record journeys that cover more than one LAC. The collection of these events is vital for accurately observing trips and allocating them to the correct mode.

Time-based events occur whenever a user does not create an event for a sustained period of 3 hours. We use these events to identify longer dwells even if they are in the same LAC as the previous dwell.

Methodology

Process Overview

Figure 3 summarises the process used to create the OD matrix deliverables. We have described each step in more detail in this chapter.

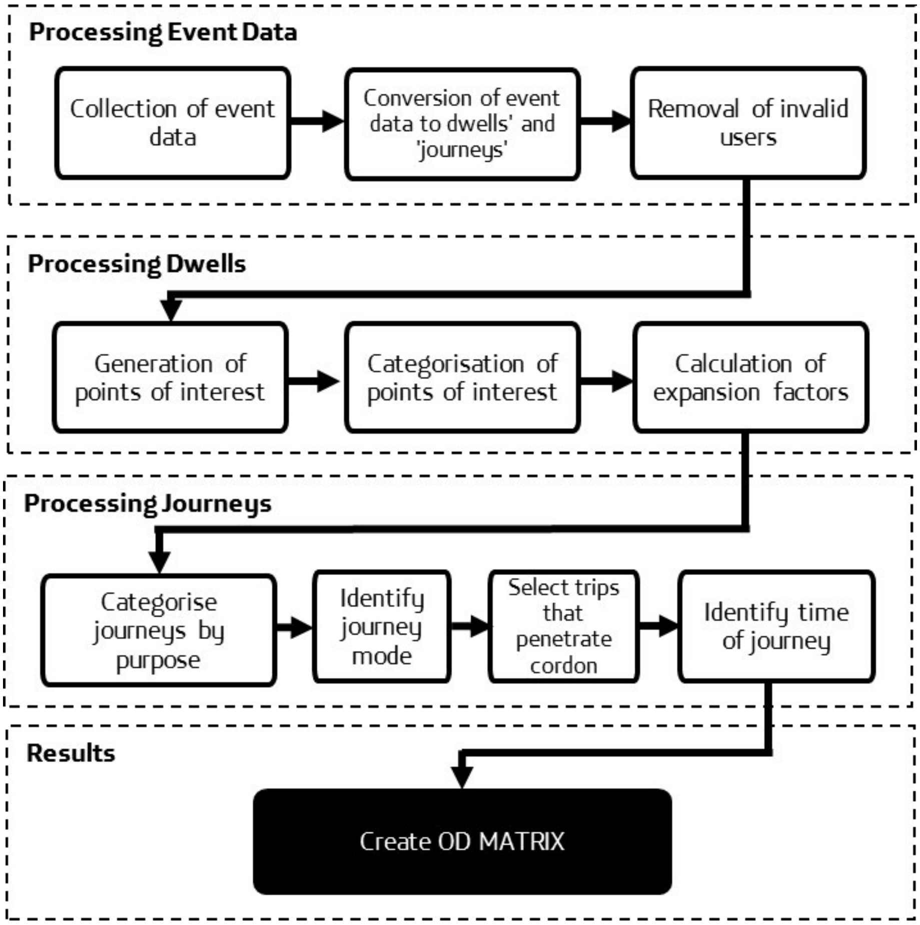


Figure 3: Process diagram of the existing methodology.

Collection of event data

As described in section two, mobile phones regularly generate events. These are collected ('probed') by Telefónica for network management and billing purposes. The events are stored in a database to enable an analysis of travel patterns. Telefónica has access to data relating to the whole of the UK for the last five years, but for this project, we analysed data for 30 specific weekdays. Although only these 30 days were used to create the OD matrix, we used the data from other days to define a number of the core segmentations (e.g. identifying valid users and home locations).

Conversion of Event Data to Dwells and Journeys

Telefónica converts the raw event data into 'dwells' (or settles) and 'journeys'. We consider the geographic proximity of events, the propensity for phones to 'flicker' between cells without changing their location and the timing of each event. In general, we classify a dwell whenever a user is assumed to be stationary in one distinct place for at least 30 minutes. We classify the period between two dwells as a journey. We store the cells of the events and combine them to make up each dwell and each journey as 'via points', these can be interrogated to understand the route of each journey or the location of each dwell. We represent journeys as person trips and not vehicle trips.

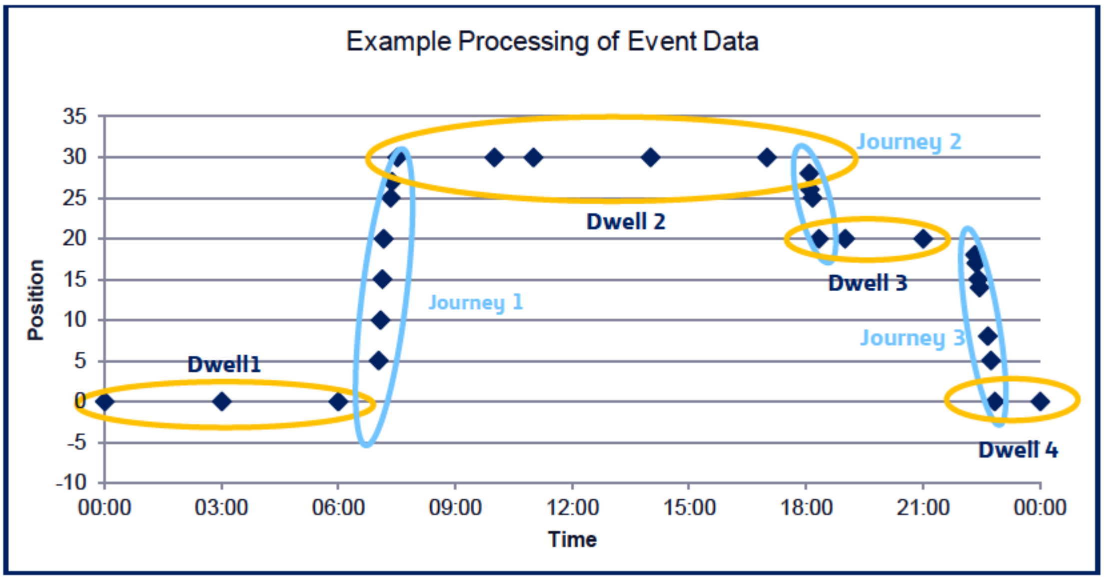


Figure 4: Processing event data: dwells and journeys.

Removal of invalid users

Events are created by all O2 users, corresponding to about 30% of the UK population or circa 22m connections. We allocate each user an anonymised user ID; this ensures that we cannot trace their records back to a particular person. We set up the anonymous ID to make sure that it is consistent even if a user changes their phone. If a user leaves O2 however, their records will cease. We run a filtering process to identify and remove these inconsistent users.

Also at this stage, a filter is applied to ensure that we only include mobile devices; we exclude machine to machine (M2M) devices, tablets and GPS units, as they are less likely to be carried by users at all times. Large business contracts are also removed from the sample to reduce the risk of double-counting users who carry two phones.

Generation of Points of Interest

We define Points of Interest (POI) where a user has multiple dwells which overlap each other. By analysing all of the dwells associated with a particular POI, the position of the POI can be identified with a higher degree of accuracy as we take the cell information from each of the dwells that contribute to the POI. We compare and analyse the relevant cell geographies associated with a POI and match them to the zone system agreed with WSP. We associate each POI with a specific zone. Every time a user visits a cell associated with one of their POIs, we record this as a trip to the associated zone.

The categorisation of Points of Interest

The categorisation of POIs is based on the temporal patterns of a user's dwells at each POI throughout the study period. We classify a POI where a user spends a significant amount of time overnight as their home POI. All users must have a home POI. We classify POIs where users spend a substantial period during the working day as their work POI. We classify all other POIs that are not 'home' or 'work' as 'other' POIs.

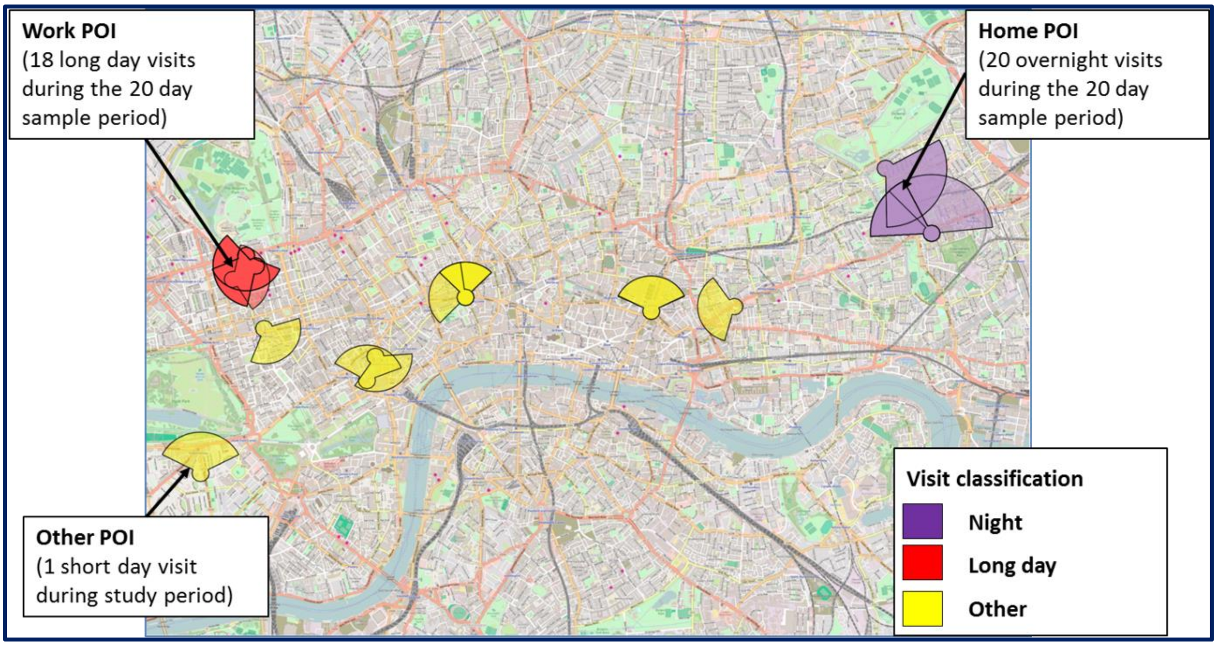


Figure 5: Example POI classification

The POI schematic used is designed to detect regular daytime commuters. As such, it may not correctly capture travel patterns for users who behave in unusual ways:

- **Working from home:** users who work from home will have a home POI, but no work POI.
- **No fixed place of work:** users who have an inconsistent place of work (e.g. plumbers) will not usually have a work POI unless they spend most of the study period working at the same site. We include their trips to work will often in the home-based-other matrix.
- **Shift workers**: users who work unusual hours, e.g. night shifts, will not usually have a work POI – we include their trips in the home-based-other matrix.
- **Education trips**: Users in education that travel to school from home will usually have a home POI and a work POI. Their travel patterns are very similar to regular commuters. Users in education that live on campus or travel a very short distance to school will likely only have a Home POI, as we are unable to differentiate their work/education location from their home location.

Calculation of expansion factors

O2, Tesco Mobile, and Giffgaff combined market share constitute a representative sample of the UK population with over 32% of the UK mobile network provider market-share. This market share varies across the country, under-representing some age, gender and socioeconomic segments due to technology penetration (phone devices ownership) and over-representing others. When expanding mobile data to represent the entire population, we need to take these biases into account. The process for calculating the expansion is as follows:

- For every valid user (everyone with an ongoing contract with O2 during the entire duration of the study period), identify their home POI. We exclude under 12 years old as we understand that they are very poorly represented in the data, and we expect them to be less independently mobile.
- Count the number of primary home POIs in each MSOA (Middle Super Output Area).
- For each MSOA, compare the number of primary home POIs with the mid-year ONS population estimates from 2017 (the most recent available) for the over 12 population, with a small adjustment for growth since then. We associate each MSOA with an expansion factor which is equivalent to the census population as described previously divided by the number of primary home POIs in that MSOA.
- For each region, compare the proportion of primary home POIs for users in each age/gender/socioeconomic bracket with the proportion from the 2017 ONS population estimates. We associate each region with an age/gender/socioeconomic reweighting factor

which is equivalent to the proportion of the census population in that age/gender/socioeconomic bracket divided by the proportion of primary home POIs of users in that age/gender/socioeconomic bracket.

- We attach the expansion factor and the age/gender/socioeconomic reweighting factor based on the user's primary home POI and the age/gender/socioeconomic information of that user.
- All trips made by each user, regardless of origin or destination, are scaled up according to the weight of the user.

Categorising journeys by purpose

Journeys are assigned a travel purpose based on the categorisation of their start and end POI:

Origin POI	Destination POI	Purpose
Home	Work	Outbound Home-Based Work (OB_HBW)
Work	Home	Inbound Home-Based Work (IB_HBW)
Home	Other/Home	Outbound Home-Based Other (OB_HBO)
Other	Home	Inbound Home-Based Other (IB_HBO)
Work	Other/Work	Non-Home-Based Work (NHBW)
Other	Work	Non-Home-Based Work (NHBW)
Other	Other	Non-Home-Based Other (NHBO)

Table 1: Trip Purpose Categories

Education trips: Tertiary education trips made by users will usually be included in the home-based work trips because they are trips between home and a place where the user regularly spends long periods during the time. We recommend that the customer uses alternative datasets to split out and supplement education trips from the matrices.

Note that education escort trips, where observed, will usually be included in home-based-other trips.

Identify journey mode

At this stage, we analyse the route and characteristics of each journey to allocate the journey to one of the following modes:

- **Rail** – we classify journeys which follow the rail network and which exhibit 'clustering' (see description below) as rail trips.
- **Motorised Road** – we take any remaining trips will be allocated to the road matrix – note that this includes coach, bus, and LGV trips as well as car trips.
- **HGV** – we have developed an algorithm to split HGV trips out from other motorised road modes. The algorithm considers, on a user basis, the number of long-distance trips and the average distance travelled in a week per user. We consider users who frequently travel long distances on the road, and we identify HGV drivers using a speed percentile calculation, with the assumption that HGV travel is consistently slower than other road traffic. For each user classified as an HGV driver, we consider all their non-home-based trips as HGV trips.
- **Slow mode** – as a final step in the mode detection methodology, we identify a percentage of trips in each of the shorter distance bands as "walking/cycling" trips. The methodology classifies the slowest trips (by travel speed) as "walking/cycling" trips. We do not expect to capture all walking/cycling trips in the mobile network data, as a large proportion of these types of trips in the lower distance bands will be too short. The journeys that we classify as

walking/cycling will only be a sub-set of walking/cycling journeys made; for this project, we have removed these journeys from the motorised road matrix.

Clustering: we distinguish between road and rail journeys by identifying cell pairs that show characteristic travel time patterns for either of the two modes. When a train crosses the boundary of a LAC, the phone of every O2 customer on board will generate a passive event. These events will occur in quick succession (depending on the length and speed of the train, as well as the device type and the current state of the mobile network), which will result in clearly identifiable clustering patterns. We classify specific cell pairs as "rail" when these patterns become apparent. When we do not observe clustering, we classify them as a road pair. On the road, we usually observe a continuous flow of cars, and events (i.e., movements from one LAC to another) also occur continually. An algorithm examines the clustering patterns of all the journeys in the system to identify rail and road journeys.

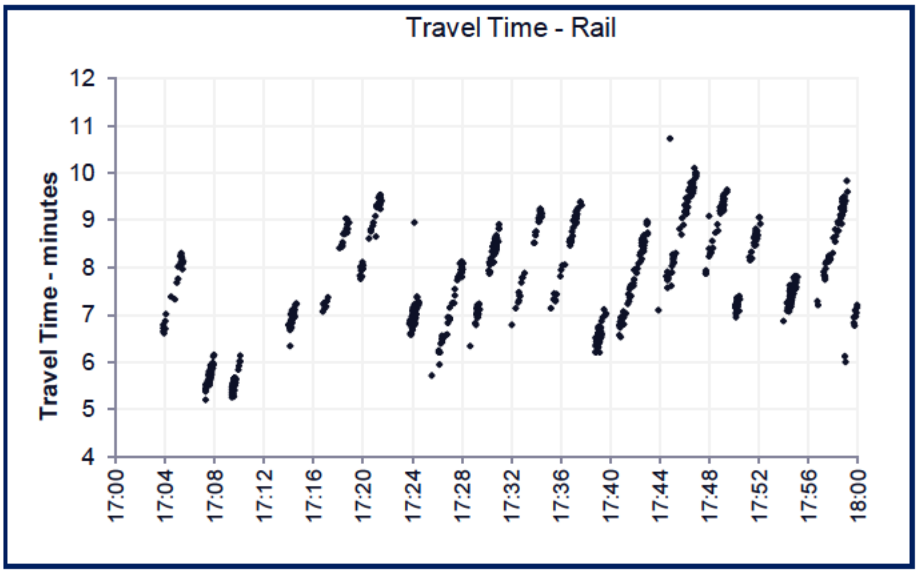


Figure 6: Characteristic clustering pattern of a rail cell pair

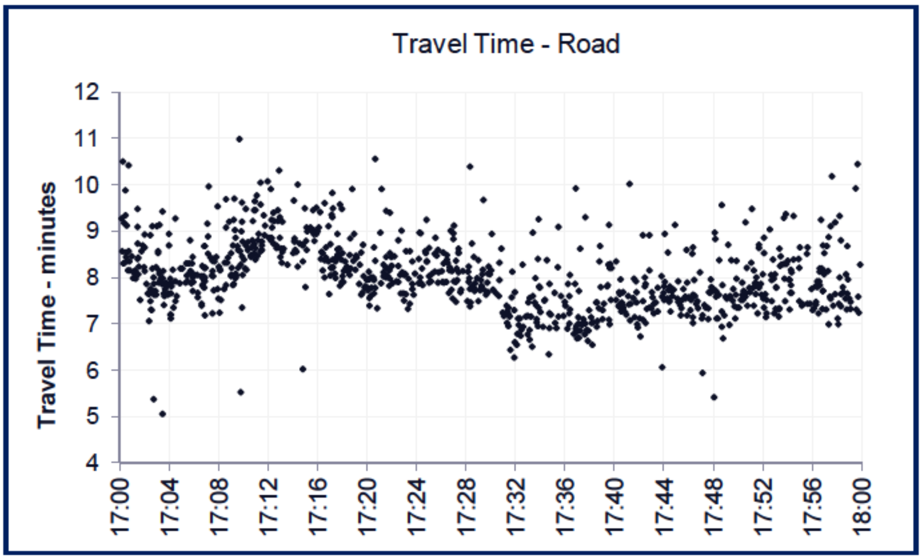


Figure 7: The lack of any identifiable cluster indicates a road cell pair

Select Trips that penetrate cordon

Once every journey is associated with a mode, we map it to a route based on the events (via points) generated during the journey. We compare these routes against the cordon agreed with WSP and only included those trips which penetrate this cordon in the matrix.

Identify the time of the journey

We allocate journeys are to a time band based on their start time entering the cordon.

Create OD matrix split by mode

Once we allocate all journeys a time, purpose and mode, it is straightforward to create the OD matrix outputs. We allocate trips to a time-period, mode and purpose and include them in the relevant part of the matrix.

Stochastic rounding: to preserve personal data, Telefónica does not provide outputs relating to the movement of individuals. In the context of an origin-destination matrix, we achieve this by creating an average result representing multiple days of observations, and by rounding results to integer values.

Applying standard rounding methods would cause errors in the outputs because they would cause many cells in the matrix to be rounded to zero, reducing the volume of trips in the data. To avoid this, we use stochastic rounding whereby the probability of rounding a value up or down depends on a fractional part – so a value of 0.1 has a 90% probability of being rounded down to zero and a 10% probability of being rounded up to one. This method of rounding preserves the overall volumes of the matrix (and the size of any part of the matrix large enough for the rounding interval to be negligible) while also preventing the disclosure of individual-level data.

Validation

Before releasing the data, Telefónica carries out a range of validation checks to ensure internal consistency and check against relevant alternative data sources. Checks are usually limited to zones which are within the cordon because we only include trips if they penetrate the model cordon.

Comparison of Mobile Network Data (MND) home-based trip origins against Census zone home population

Figure 8 shows the number of outbound home-based trips starting in each zone within the cordon on an average day in the study period against that zone's home population, based on the 2017 mid-year Census (we extracted the population of each client zone from the Output Areas within each zone). The correlation between the census population and outbound home-based trips has an R^2 of 0.51.

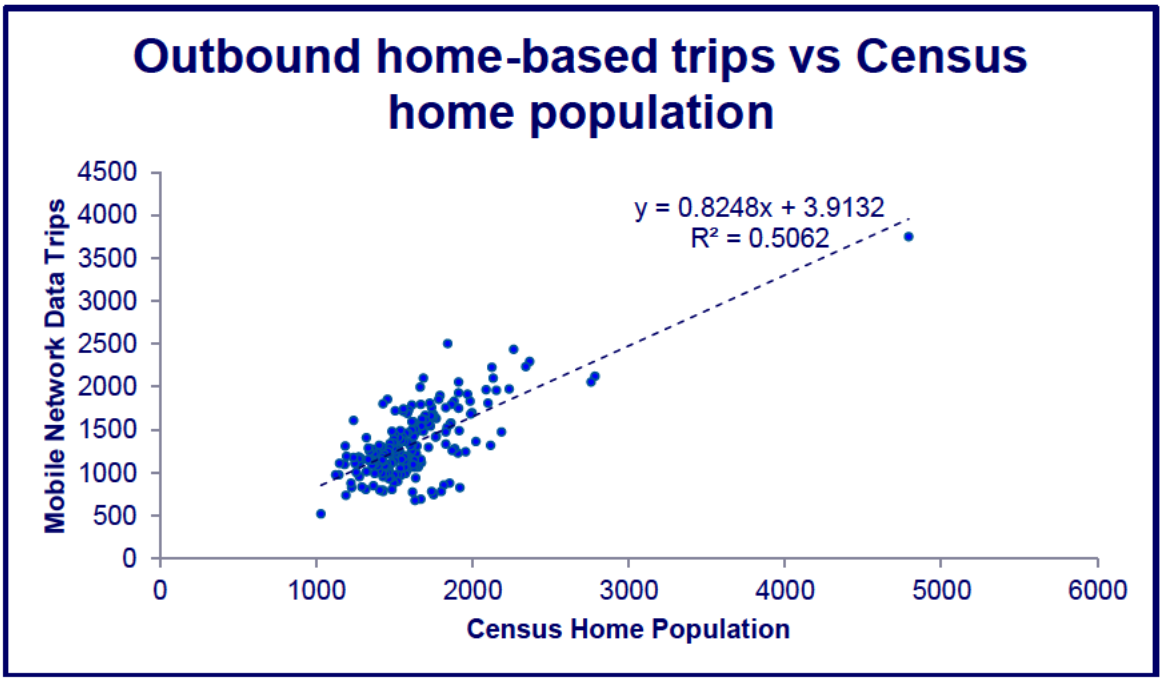


Figure 8: Outbound Home-Based vs Census Home Population in Urban areas

Comparison of MND work-based trip destinations against Census zone workplace population

Figure 9 shows the number of outbound home-based work trips arriving at each zone within the cordon during a typical day in the study period against the work population of each zone (based on Census workplace statistics). The figure below includes part-time workers from Census workplace population and will include part-time workers where a work POI was identified as per the definition given in the methodology section in this document. We identified a strong correlation with an R^2 of 0.97.

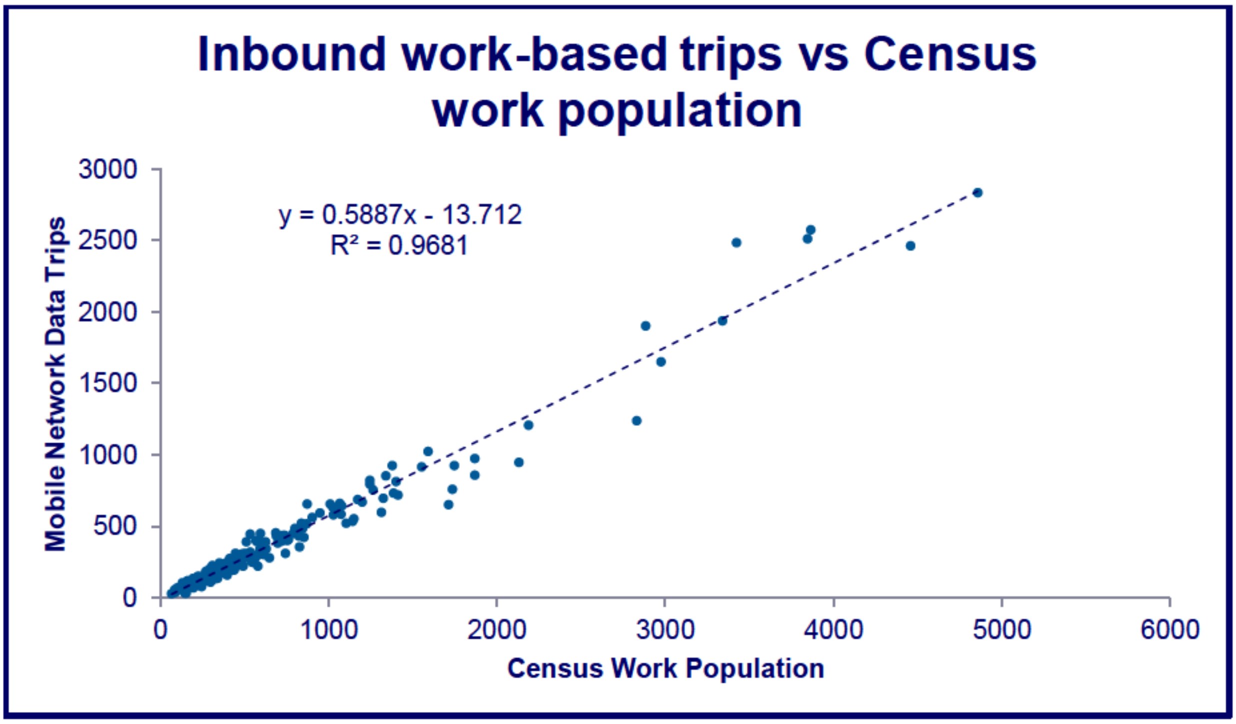


Figure 9: Inbound work-based trip destinations vs Census Work Population

Comparison of inbound trips and outbound trips per zone

Figure 10 shows a comparison of the number of trips starting (by all modes and purposes) with the number of trips ending in each zone. As expected, we see a very strong correlation, with an R^2 of 0.99.

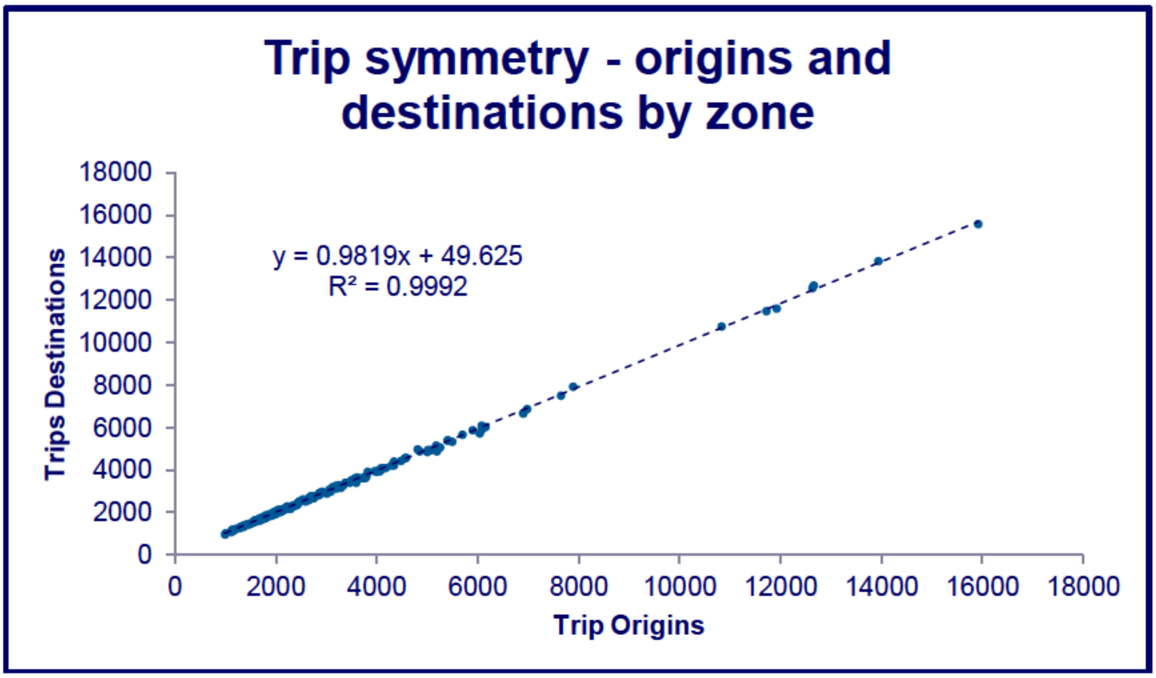


Figure 10: Trip Symmetry by Zones

Comparison of the MND trip length distribution for all trips against NTS trip length distribution

Figure 11 shows a comparison of the trip length distribution for trips starting in the cordon (by all modes and purposes) with the trip length distribution reported in the National Travel Survey (NTS) for the Yorkshire and The Humber (NTS9911).

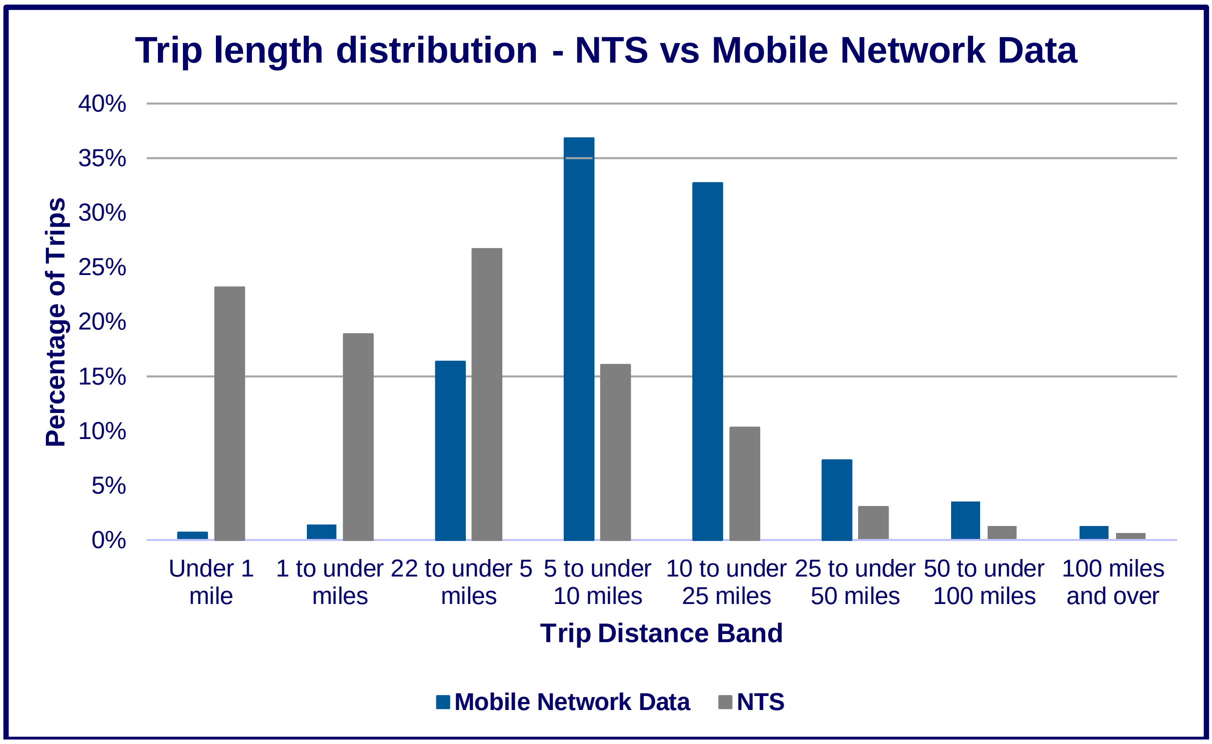


Figure 11: Trip Length Distribution (Mobile Network Data vs NTS)

At first glance, the match between the two datasets is poor, with the NTS containing more trips below five miles and the mobile data containing more trips above five miles. However, we find a better match when we compare trips above five miles in length (Figure 12):

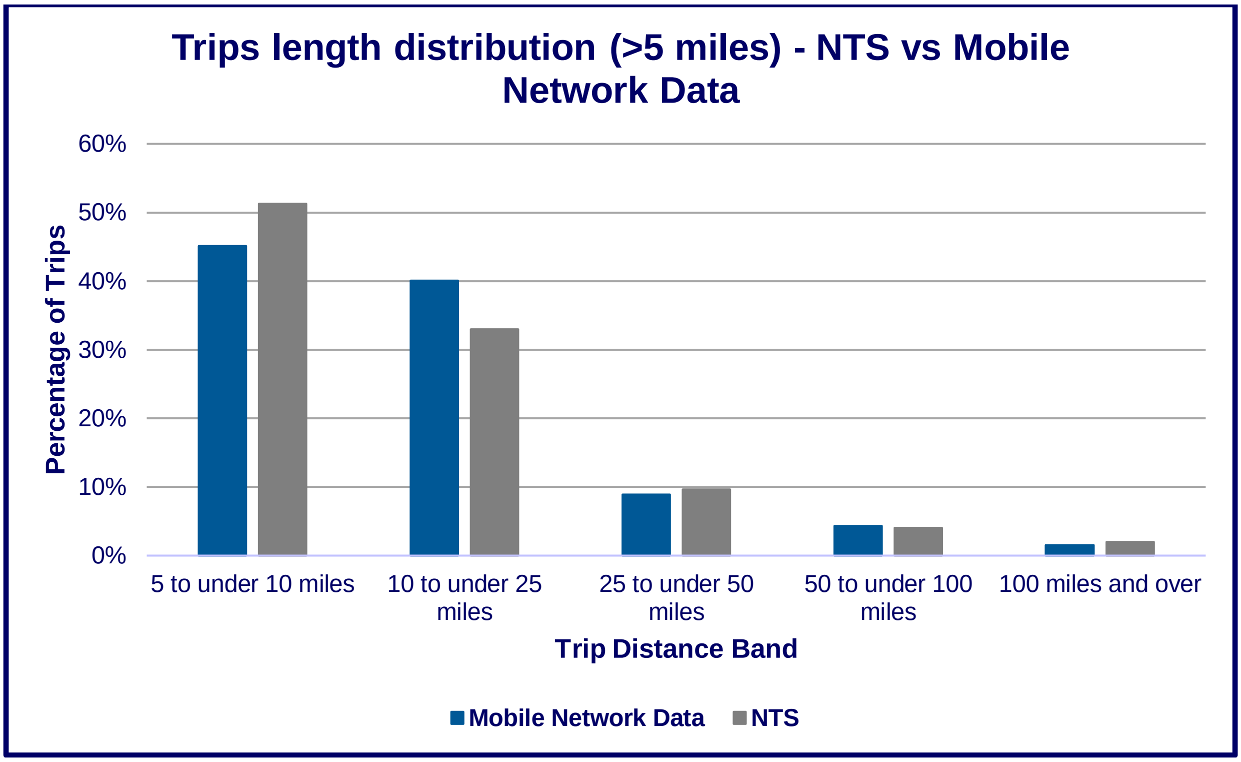


Figure 12: Trip Length Distribution for trips greater than 5 miles.

This result indicates that trips above five miles in better represented in the mobile phone data, while trips below five miles in length are only partially represented in the mobile phone data. Short trip under-representation is a well-known limitation of mobile phone data as we can only represent trips if the device moves between cells, which in rural areas, can be large. We recommend that the customer uses secondary datasets to correct for this bias in the mobile phone data.

Comparison of the MND trip length distribution of commutes against Census journey to work data

We compare the trip length distribution from the Mobile Network Data against the Census journey to work (JTW - WU03EW) data for road trips. The graph below represents the distance profile of all journeys captured in the matrix of over 5,000 metres.

For this chart, we are using the straight-line distance between MSOA pairs to calculate the journey distance of commutes. We are also only considering MSOA pairs (usual place of residence / usual place of work) in which there is a value in both the Mobile Network Data matrix and the Census Journey to Work matrix.

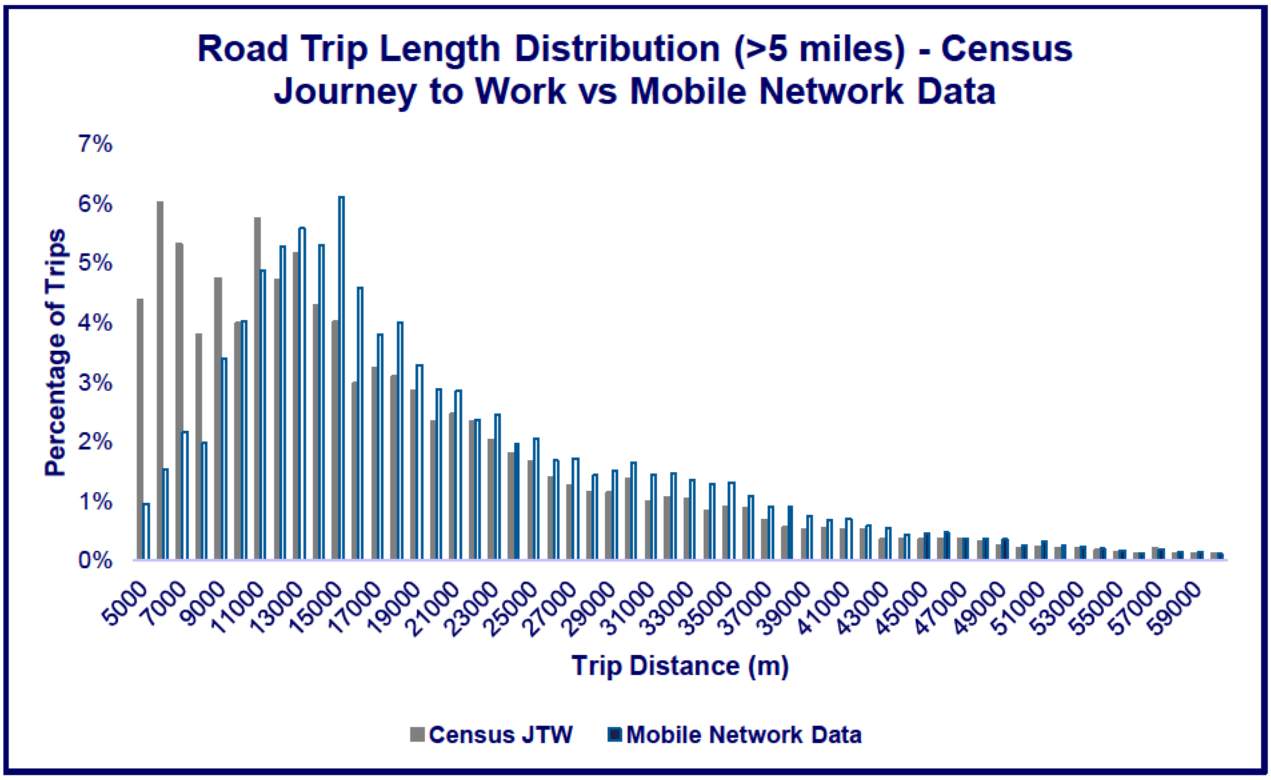


Figure 13: Trip Length Distribution for road-based commutes greater than 5km (Mobile Network Data v Census)

In Figure 13 we can see that the trip length distribution for commutes greater than 8,000 metres show a significant alignment with Journey to Work Census.

Comparison of trip rates based on expansion targets against the zonal trip-ends derived.

We calculate the trip rate for the period of study and compare it against the NTS9903 table for the equivalent transport modes as follows:

NTS trip rate: the sum of car drivers, van drivers, car passengers, van passengers, motorcycles, local bus users, other private transport users divided by 365 days in a year. Please note, this trip rate considers the entire UK population, not just the population of over-12s.

Telefónica matrix: the total weighted number of trips divided by the total weighted number of users captured in the matrix with a home located inside the study cordon.

NTS resulted in a trip rate of 2.75 against the Telefónica trip rate of 1.16. Several factors contribute to these differences:

- The lack of short-trips observed in the mobile network data. In the Yorkshire and The Humber region of England, approximately 40% of all trips made are shorter than 2 miles.
- We are only considering trips made by users with a home located inside the cordon that start/end or pass through the cordon area, not all trips a user makes (i.e. trips that don't interact with the cordon). The relative size of the area studied will have an impact on this metric as many journeys (external to external, not crossing the cordon) will not be captured.

HGV trips against WebTRIS Annual Daily Flow

Figure 14 shows a comparison between MND and WebTRIS hourly flow data and MND trips assigned as HGV on the 24 of October 2019 from a node of the M62. A selection of our internal routing nodes are compared with the closest WebTRIS count points (see figure 15 for locations) on the same road and in the same direction.

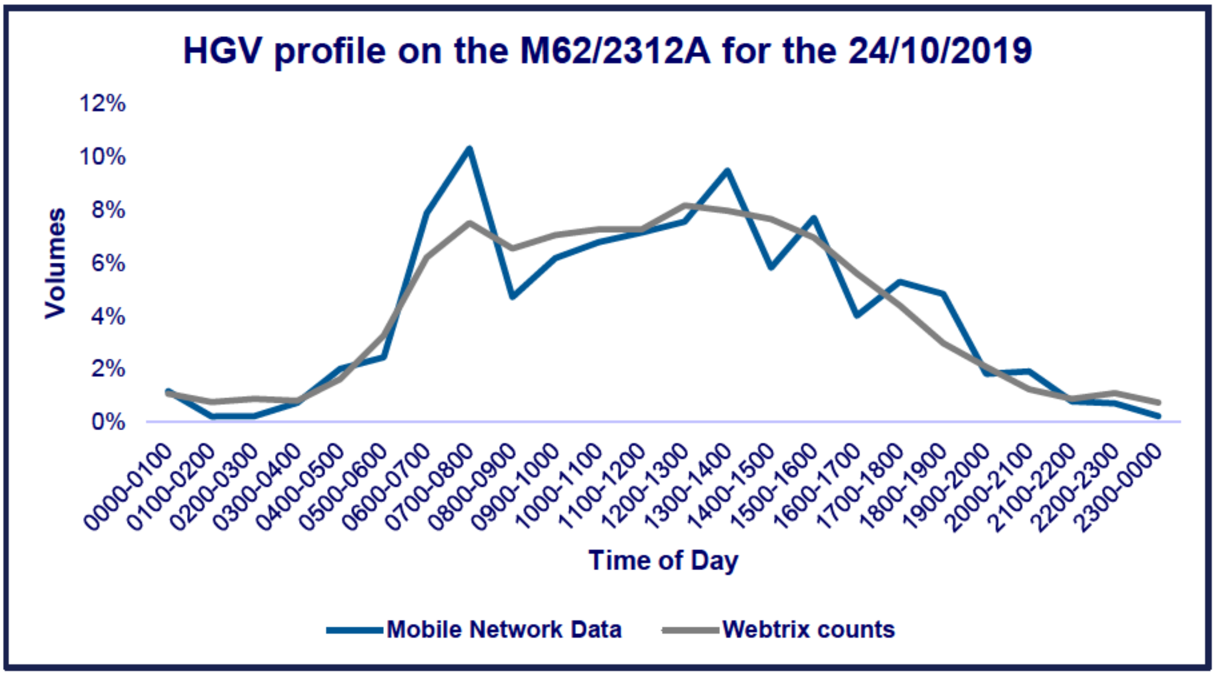


Figure 14: Comparison of HGV trips between MND and WebTRIS data for 1st November 2018

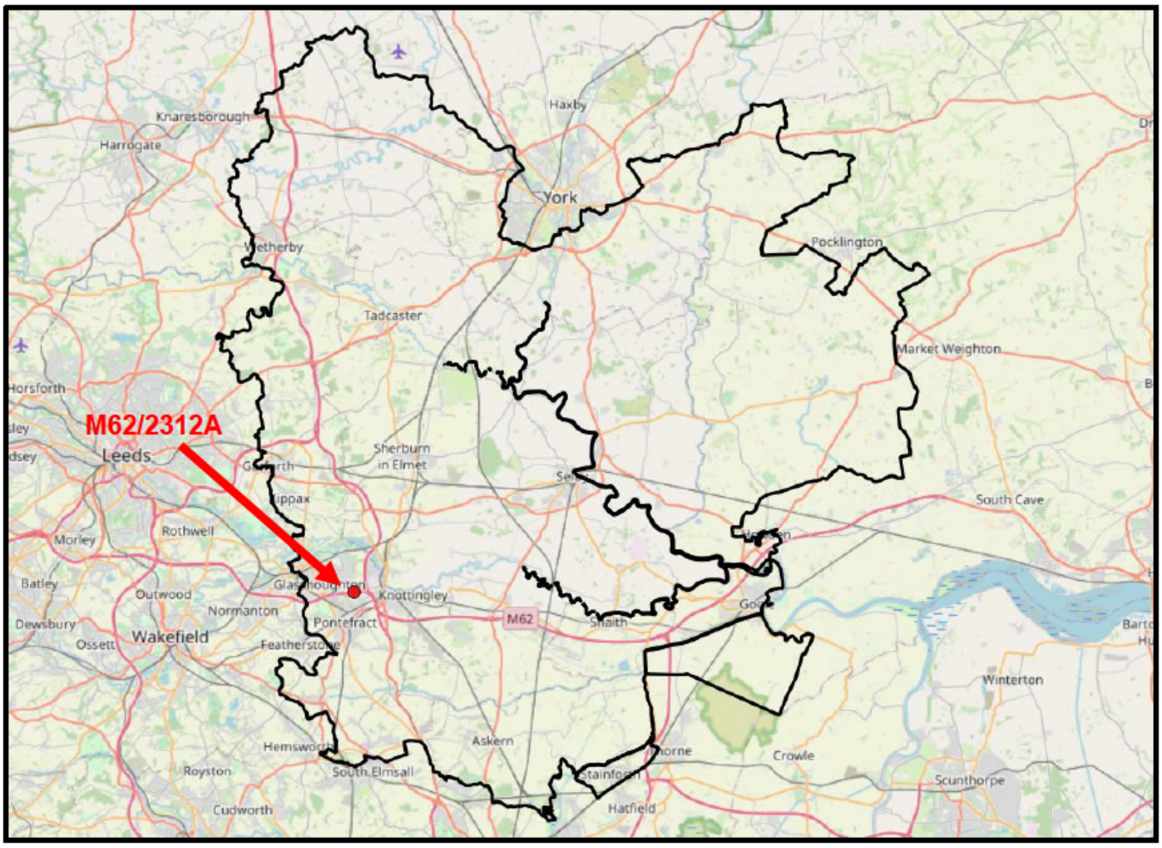


Figure 155: Location of MND routing node and WebTRIS count point

Summary

The data for this project has been collected on a 19-day sample using established and proven methodologies for the application of mobile phone data to transport modelling. We have shown through validations that the mobile data provided is internally consistent and compares well to the secondary datasets. We performed checks that are limited to publicly available datasets and are not intended to be exhaustive. We, therefore, advise further comparisons with appropriate local datasets before applying the matrices to a transport model.

We have highlighted a few biases in the methodology and validation sections, all of which are recognised limitations of mobile phone data. The core limitations are as follows:

- We are only representing trips made by those over 12 years old.
- Comparisons with trip length distributions from NTS indicate that trips below 5 miles are likely to be under-represented in the mobile phone data. However, this will depend on the cell resolution – in urban areas short distance trips are more likely to be represented, while in rural areas the threshold may be slightly higher.

We recommended that the customer uses secondary data sources to enhance the mobile phone data to correct for them.

Appendix B

TRAFFIC COUNT DATABASE

Site Ref	A-Node	B-Node	AM_Car	AM_LGV	AM_HGV	IP_Car	IP_LGV	IP_HGV	PM_Car	PM_LGV	PM_HGV
ATC 1	5061	5060	129	18	6	96	18	5	205	20	3
ATC 1	5060	5061	157	22	7	113	21	6	209	21	3
ATC 2	80063	80067	10	1	0	12	2	1	29	3	0
ATC 2	80067	80063	26	4	1	9	2	1	17	2	0
ATC 3	80674	79912	631	108	60	429	91	57	915	106	34
ATC 3	79912	80674	722	124	69	429	91	57	688	80	25
ATC 4	80314	80313	13	2	1	8	1	0	12	1	0
ATC 4	80313	80314	10	1	0	8	1	0	22	2	0
ATC 7	5015	5014	155	26	15	150	32	20	272	32	10
ATC 7	5014	5015	191	33	18	144	31	19	240	28	9
ATC 8	80366	80365	13	2	1	13	2	1	14	1	0
ATC 8	80365	80366	12	2	1	11	2	1	16	2	0
ATC 9	80545	80378	186	26	8	107	20	6	254	25	4
ATC 9	80378	80545	169	23	7	95	17	5	189	19	3
ATC 10	80392	80391	376	64	36	173	37	23	374	43	14
ATC 10	80391	80392	344	59	33	179	38	24	424	49	16
ATC 11	42131	42130	5	1	0	4	1	0	4	0	0
ATC 11	42130	42131	3	0	0	4	1	0	4	0	0
ATC 12	80409	72579	340	58	32	194	41	26	371	43	14
ATC 12	72579	80409	333	57	32	184	39	24	350	41	13
ATC 13	80341	80340	123	17	5	62	11	4	126	12	2
ATC 13	80340	80341	98	13	4	62	11	4	130	13	2
ATC 15	5072	5073	99	14	4	39	7	2	75	7	1
ATC 15	5073	5072	71	10	3	38	7	2	107	11	2
ATC 21	3251	3252	87	12	4	69	13	4	186	18	3
ATC 21	3252	3251	130	18	6	64	12	4	113	11	2
ATC 22	2034	2035	75	10	3	56	10	3	155	15	2
ATC 22	2035	2034	110	15	5	62	11	4	93	9	1
ATC 24	80055	80523	38	5	2	18	3	1	24	2	0
ATC 24	80523	80055	28	4	1	20	4	1	34	3	1
ATC 25	80051	80053	23	3	1	18	3	1	26	3	0
ATC 25	80053	80051	23	3	1	19	3	1	19	2	0
ATC 26	79973	80014	212	29	9	74	14	4	107	11	2
ATC 26	80014	79973	94	13	4	89	16	5	248	25	4
ATC 27	79924	79926	159	27	15	110	23	15	185	22	7
ATC 27	79926	79924	171	29	16	101	22	13	175	20	6
ATC 28	1521	1170	138	19	6	37	7	2	59	6	1
ATC 28	1170	1521	143	20	6	44	8	3	55	5	1
ATC 29	80183	80205	96	13	4	69	13	4	166	16	3
ATC 29	80205	80183	120	17	5	72	13	4	116	11	2
ATC 30	2040	2041	149	21	6	68	12	4	129	13	2
ATC 30	2041	2040	113	16	5	80	15	5	189	19	3
ATC 32	80657	80656	183	25	8	73	13	4	89	9	1
ATC 32	80656	80657	83	11	4	80	15	5	173	17	3
ATC 33	72805	1184	963	165	92	500	106	66	732	85	27
ATC 33	1184	72805	583	100	56	514	109	68	1084	126	40
ATC 35	80704	80705	107	15	5	76	14	4	164	16	2
ATC 35	80705	80704	145	20	6	72	13	4	116	12	2
ATC 36	80499	80498	109	15	5	90	17	5	237	24	4
ATC 36	80498	80499	195	27	8	78	14	4	99	10	2
ATC 37	4049	1581	5	1	0	4	1	0	6	1	0
ATC 37	1581	4049	4	1	0	4	1	0	4	0	0
ATC 38	4049	1251	257	44	25	180	38	24	380	44	14
ATC 38	1251	4049	289	49	28	179	38	24	376	44	14
ATC 39	5003	5002	278	48	26	196	42	26	435	51	16
ATC 39	5002	5003	386	66	37	184	39	24	348	40	13
ATC 40	5009	80651	278	48	26	196	42	26	435	51	16
ATC 41	80457	80458	31	4	1	24	4	1	36	4	1
ATC 41	80458	80457	20	3	1	19	3	1	35	3	1
ATC 46	80905	80827	86	12	4	46	8	3	81	8	1
ATC 46	80827	80905	52	7	2	48	9	3	94	9	1
ATC 49	5103	5045	92	13	4	45	8	3	82	8	1

ATC 49	5045	5103	82	11	4	49	9	3	91	9	1
ATC 50	80459	80460	38	5	2	21	4	1	32	3	0
ATC 50	80460	80459	31	4	1	20	4	1	31	3	0
ATC 51	1461	42203	21	3	1	14	3	1	28	3	0
ATC 51	42203	1461	18	2	1	12	2	1	18	2	0
ATC 52	1366	80201	9	1	0	6	1	0	13	1	0
ATC 52	80201	1366	9	1	0	5	1	0	8	1	0
ATC 53	80430	70505	51	7	2	38	7	2	57	6	1
ATC 53	70505	80430	31	4	1	30	6	2	73	7	1
Error 2042	5077	80560	580	117	57	394	91	56	807	103	26
Site1	1007	1407	380	59	20	267	45	20	531	49	9
Site1	1407	1007	442	69	24	279	47	21	460	43	8
Site2	1149	1150	165	22	3	119	16	2	169	15	1
Site2	1150	1149	123	17	2	125	17	2	162	15	1
Site3	3028	3321	131	18	3	91	12	1	113	10	0
Site3	3321	3028	84	11	2	90	12	1	160	15	1
Site4	1119	1120	492	77	26	384	64	29	471	44	8
Site4	1120	1119	369	57	20	403	67	30	536	50	9
Site5	3086	3089	208	28	4	237	32	4	232	21	1
Site5	3089	3086	192	26	4	257	35	4	331	30	1
Site7	3101	3104	113	15	2	141	19	2	169	15	1
Site7	3104	3101	123	17	2	122	17	2	157	14	1
Site8	3207	80272	129	17	3	74	10	1	179	16	1
Site8	80272	3207	113	15	2	63	9	1	86	8	0
Site9	3257	3259	84	11	2	65	9	1	120	11	0
Site9	3259	3257	78	11	2	70	9	1	112	10	0
Site10	3254	3256	71	10	1	56	8	1	109	10	0
Site10	3256	3254	82	11	2	63	9	1	96	9	0
Site11	3250	3323	37	5	1	39	5	1	74	7	0
Site11	3323	3250	49	7	1	36	5	1	45	4	0
140200	80288	72893	14	2	1	14	3	1	17	2	0
140200	72893	80288	21	3	1	14	3	1	24	2	0
5060124	80546	42130	474	90	52	280	62	43	597	72	24
5060124	42130	80546	496	95	54	307	68	47	544	65	22
5060272	80556	5065	310	59	34	241	54	37	694	83	28
5060272	5065	80556	515	98	56	244	54	37	370	44	15
6080125	5068	5066	220	42	24	127	28	19	250	30	10
6080125	5066	5068	167	32	18	151	34	23	292	35	12
6080130	80901	80484	141	27	15	106	24	16	214	26	9
6080130	80484	80901	177	34	19	104	23	16	212	25	9
6080223	5058	80123	154	23	6	125	24	5	206	21	3
6080223	80123	5058	207	31	8	151	29	6	243	25	3
7080276	80913	1009	457	87	50	256	57	39	444	53	18
7080276	1009	80913	385	74	42	249	56	38	602	72	24
8100167	1151	1050	257	39	9	170	32	6	235	24	3
8100167	1050	1151	220	33	8	165	31	6	356	36	5
12130277	1012	80915	312	60	34	183	41	28	339	41	14
12130277	80915	1012	299	57	33	183	41	28	406	49	16
12130279	80917	1160	350	67	38	286	64	44	459	55	19
12130279	1160	80917	423	81	46	278	62	42	529	64	21
12140213	1079	1080	473	90	52	311	69	47	635	76	26
12140213	1080	1079	587	112	64	306	68	47	633	76	26
14150274	80920	1023	488	93	54	317	71	48	582	70	24
14150274	1023	80920	482	92	53	319	71	48	631	76	26
16170149	1116	1117	338	64	37	264	59	40	343	41	14
16170149	1117	1116	258	49	28	263	58	40	324	39	13
16180207	79932	1026	287	55	32	134	30	20	295	35	12
16180207	1026	79932	343	65	38	133	30	20	231	28	9
19200168	1066	1155	288	44	11	308	58	12	443	45	6
19200168	1155	1066	359	54	13	298	57	11	359	36	5
20210150	1156	1130	383	73	42	272	60	41	377	45	15
20210150	1130	1156	265	51	29	284	63	43	450	54	18
20220275	1134	1135	247	47	27	212	47	32	469	56	19

20220275	1135	1134	377	72	41	202	45	31	330	40	13
22240127	5120	80741	211	40	23	228	51	35	586	71	24
22240127	80741	5120	563	107	62	206	46	31	346	42	14
22240166	1038	1037	608	116	67	443	99	67	913	110	37
22240166	1037	1038	703	134	77	440	98	67	753	91	30
24260205	72754	5083	191	36	21	144	32	22	282	34	11
24260205	5083	72754	231	44	25	148	33	22	272	33	11
19819031	1095	1157	396	75	43	232	52	35	494	59	20
19819031	1157	1095	345	66	38	247	55	38	447	54	18
J1-A-Entry	3325	1054	70	12	7	75	16	5	205	25	2
J1-B-Entry	1219	1054	222	25	10	135	24	4	231	21	7
J1-D-Entry	1053	1054	367	29	11	184	35	10	343	37	5
J5-D-Entry	4057	1077	112	66	20	132	52	14	241	48	7
J14-A-Entr	1583	1136	121	15	3	63	13	3	116	12	0
J14-B-Entr	80480	1136	392	81	24	220	51	26	388	40	13
J14-C-Entr	3153	1136	54	7	1	19	6	1	22	1	0
J14-D-Entr	1145	1136	242	64	36	228	59	29	508	92	18
J15-A-Entr	1582	1141	12	4	1	13	4	2	23	2	0
J15-C-Entr	3314	1141	64	9	0	29	7	1	34	0	0
J16-A-Entr	80494	3163	53	12	7	59	15	5	107	15	1
J16-B-Entr	3164	3163	243	48	17	126	33	21	232	36	10
J16-C-Entr	3162	3163	91	19	7	47	12	9	68	10	1
J16-D-Entr	3166	3163	209	66	36	136	36	23	236	42	15
J17-C-Entr	3211	3320	142	21	5	78	21	5	128	11	0
J18-A-Entr	3221	3217	68	7	4	63	14	2	120	14	0
J18-D-Entr	3211	3216	119	22	4	71	17	4	116	11	3
J18-E-Entr	3322	3216	45	13	4	38	8	4	57	6	0
J18-F-Entr	3322	3217	81	8	3	30	7	1	55	5	1
J19-C-Entr	3221	1045	140	16	3	58	14	3	75	8	0
J20-A-Entr	72767	80507	598	104	70	547	105	53	1130	118	23
J20-B-Entr	80509	80507	160	12	6	87	14	8	124	19	4
J20-C-Entr	80506	80507	859	112	61	436	88	50	652	84	20
J22-B-Entr	80104	80103	17	5	27	29	15	36	187	15	23
J24-A-Entr	80125	5058	179	25	4	194	24	4	382	21	0
J24-C-Entr	80119	5058	326	27	20	210	30	6	326	18	4
J24-D-Entr	80184	5058	225	51	13	168	35	7	397	27	1
J25-C-Entr	5098	5055	213	20	7	113	11	6	202	12	2
J26-A-Entr	70417	5059	287	24	7	191	31	6	294	30	0
J26-C-Entr	80086	5059	240	39	7	166	26	5	315	48	1
J26-D-Entr	80060	5059	63	5	2	48	8	2	94	4	4
J28-B-Entr	80274	5066	425	102	45	226	67	60	423	71	31
J31-C-Entr	80325	80321	70	11	1	48	13	1	91	16	0
J32-A-Entr	80330	5076	318	43	12	250	57	9	448	68	8
J32-B-Entr	80327	5076	135	20	2	86	21	2	92	19	2
J32-C-Entr	42100	5076	348	77	7	252	55	12	533	70	2
J33-A-Entr	5114	42099	524	73	7	376	88	19	681	112	14
J33-C-Entr	1426	1505	100	9	2	37	5	1	62	6	0
J35-A-Entr	80641	1532	502	68	38	391	73	57	677	64	24
J35-B-Entr	70396	5017	67	4	1	45	7	1	61	1	1
J35-D-Entr	80639	5017	609	127	87	473	96	75	811	95	41
J35-E-Entr	1550	1567	232	18	4	148	32	5	276	29	5
J36-A-Entr	70278	5087	398	42	11	285	31	11	415	29	3
J36-B-Entr	80576	5087	510	77	28	457	60	31	736	69	11
J36-C-Entr	80615	5087	308	27	20	239	34	21	360	26	11
J36-D-Entr	80573	5087	456	75	51	361	58	49	669	55	29
J44-A-Entr	1088	1089	614	94	55	330	84	61	567	76	32
J44-B-Entr	1091	1089	434	80	54	208	51	43	512	57	24
J44-C-Entr	1090	1089	564	60	37	268	64	25	487	55	22
J45-B-Entr	80474	5003	102	7	4	43	12	4	71	6	2
J45-E-Entr	1093	5003	385	47	39	228	56	42	571	57	23
J46-A-Entr	80257	80006	35	9	2	25	5	0	49	2	1
J46-B-Entr	80258	80007	104	8	0	38	7	1	58	4	1
J46-C-Entr	80259	79951	21	1	0	9	3	0	9	1	0

J46-D-Entr	79934	79951	62	6	2	27	5	1	64	5	1
J47-A-Entr	80003	79935	176	29	8	89	26	21	183	12	13
J47-B-Entr	79934	79935	115	7	1	30	6	1	32	6	2
J47-C-Entr	79936	79935	191	53	25	106	30	19	262	25	13
J47-D-Entr	1170	79935	187	6	0	26	1	0	27	2	0
J49-A-Entr	79927	79926	175	28	3	110	18	2	187	7	0
J51-A-Entr	80521	5044	45	9	2	25	7	1	27	2	0
J51-B-Entr	5093	5044	19	2	1	10	5	1	26	2	0
J51-C-Entr	5092	5044	23	7	0	18	5	1	57	7	0
J55-C-Entr	80966	79959	80	20	3	90	18	4	257	20	5
J59-A-Entr	4189	3105	138	27	5	131	29	3	204	27	0
J59-B-Entr	3107	3105	113	25	0	72	19	1	133	14	1
J59-C-Entr	3106	3105	64	29	4	87	25	3	153	17	0
J60-A-Entr	79939	79937	53	1	0	18	2	0	26	2	0
J60-B-Entr	1521	79937	176	11	0	50	5	0	61	2	0
J60-C-Entr	80729	79937	107	7	1	47	5	1	79	5	0
J1-A-Exit	1054	3325	161	15	4	62	14	5	131	12	1
J1-B-Exit	1054	1219	247	19	8	140	25	6	238	27	4
J1-D-Exit	1054	1053	254	33	16	194	36	8	412	43	10
J5-D-Exit	1077	4057	232	71	23	124	49	13	125	27	3
J14-A-Exit	1136	1583	89	20	2	61	13	4	113	11	1
J14-B-Exit	1136	80480	255	61	34	225	58	30	501	93	18
J14-C-Exit	1136	3153	63	4	1	23	5	1	40	5	0
J14-D-Exit	1136	1145	402	82	27	221	55	23	379	37	11
J15-A-Exit	1141	1582	10	5	2	16	4	2	9	1	0
J15-C-Exit	1141	3314	19	4	0	25	7	1	64	10	0
J16-A-Exit	3163	80494	126	27	6	47	14	6	49	5	5
J16-B-Exit	3163	3164	162	51	24	126	30	18	215	45	5
J16-C-Exit	3163	3162	55	20	8	51	12	8	106	12	6
J16-D-Exit	3163	3166	252	47	29	144	40	25	273	40	11
J17-C-Exit	3320	3211	144	37	4	87	20	4	166	20	3
J18-A-Exit	3217	3221	135	19	3	63	15	1	88	12	1
J18-D-Exit	3216	3211	91	16	5	67	16	5	92	10	0
J18-E-Exit	3216	3322	72	9	6	35	9	4	70	5	3
J18-F-Exit	3217	3322	37	5	1	34	6	1	75	8	0
J19-C-Exit	1045	3221	43	12	5	56	11	2	153	15	0
J20-A-Exit	80507	72767	992	121	64	497	96	56	742	102	24
J20-B-Exit	80507	80509	134	16	10	99	21	5	227	19	1
J20-C-Exit	80507	80506	491	90	63	475	91	50	937	100	22
J22-B-Exit	80103	80104	128	15	31	22	11	46	10	1	19
J24-A-Exit	5058	80125	291	21	8	174	17	4	316	11	3
J24-C-Exit	5058	80119	247	24	8	257	34	7	510	31	0
J24-D-Exit	5058	80184	281	41	12	170	44	6	296	31	1
J25-C-Exit	5055	5098	173	22	2	139	18	4	296	19	0
J26-A-Exit	5059	70417	265	38	9	175	27	7	329	45	5
J26-C-Exit	5059	80086	252	24	7	175	29	6	286	25	0
J26-D-Exit	5059	80060	80	8	2	50	7	1	75	8	0
J28-B-Exit	5066	80274	267	92	54	231	62	56	656	75	26
J31-C-Exit	80321	80325	80	6	0	46	13	2	74	7	0
J32-A-Exit	5076	80330	342	64	5	218	48	11	436	51	2
J32-B-Exit	5076	80327	97	24	2	86	18	2	172	29	1
J32-C-Exit	5076	5114	361	53	14	284	68	11	465	77	9
J33-A-Exit	1506	42100	542	108	18	365	72	23	733	97	9
J33-C-Exit	1505	1426	107	6	0	37	6	1	59	6	0
J35-A-Exit	1532	80641	523	86	53	408	70	56	739	71	29
J35-B-Exit	5017	70396	39	6	0	50	9	2	71	10	0
J35-D-Exit	5017	80639	524	47	13	401	62	12	642	57	8
J35-E-Exit	1567	1550	319	77	66	205	67	68	370	51	35
J36-A-Exit	5087	70278	399	45	7	308	39	8	461	50	3
J36-B-Exit	5087	80576	536	74	39	498	63	34	821	51	12
J36-C-Exit	5087	80615	314	39	21	179	26	20	291	20	15
J36-D-Exit	5087	80573	423	64	42	357	56	50	606	57	24
J44-A-Exit	1089	1088	715	110	78	353	89	60	654	77	44

J44-B-Exit	1089	1091	428	44	42	184	46	41	411	44	18
J44-C-Exit	1089	1090	470	81	25	269	64	28	501	67	16
J45-B-Exit	5003	80474	185	11	5	49	12	4	116	7	1
J45-E-Exit	5003	1093	455	80	61	220	52	44	526	59	22
J46-A-Exit	80006	80257	43	7	0	31	5	1	46	2	1
J46-B-Exit	80007	80258	73	12	2	35	9	1	90	5	2
J46-C-Exit	79951	80259	12	2	1	8	1	0	18	1	0
J46-D-Exit	79951	79934	94	4	1	26	5	1	26	4	0
J47-A-Exit	79935	80003	269	51	24	90	25	19	211	24	13
J47-B-Exit	79935	79934	75	7	1	34	7	1	80	5	2
J47-C-Exit	79935	79936	229	33	9	105	30	21	199	17	13
J47-D-Exit	79935	1170	95	5	0	22	2	0	14	0	0
J49-A-Exit	79926	79927	173	16	3	112	19	3	178	20	1
J49-B-Exit	79926	79930	9	2	0	6	2	0	6	0	0
J51-A-Exit	5044	80521	24	8	1	22	7	2	57	6	0
J51-B-Exit	5044	5093	21	5	2	9	5	1	15	2	0
J51-C-Exit	5044	5092	43	6	0	22	6	1	37	4	0
J55-C-Exit	79959	80966	228	29	5	64	19	4	93	18	2
J59-A-Exit	3105	4189	93	31	4	95	26	3	189	25	1
J59-B-Exit	3105	3107	91	21	2	76	16	1	153	15	0
J59-C-Exit	3105	3106	131	29	3	119	31	3	147	18	0
J60-A-Exit	79937	79939	58	4	0	20	3	0	21	1	0
J60-B-Exit	79937	1521	148	5	0	46	4	1	66	4	0
J60-C-Exit	79937	80729	130	8	0	48	4	1	66	5	0
J2-A-Entry	1104	1147	443	46	8	283	47	7	361	31	1
J2-D-Entry	1013	80916	385	41	21	208	47	30	474	38	11
J4-A-Entry	1077	80921	549	151	27	531	95	23	909	84	4
J4-C-Entry	1078	1022	855	114	23	447	68	27	782	64	15
J6-A-Entry	1069	1070	300	52	1	437	53	6	588	32	3
J6-B-Entry	3106	1070	151	53	10	167	47	7	238	31	1
J8-A-Entry	3290	1062	401	48	2	445	43	5	574	31	2
J8-B-Entry	1153	1062	312	51	13	281	39	3	347	31	5
J8-C-Entry	1126	1062	324	45	3	354	37	5	415	32	2
J8-D-Entry	4207	1062	305	25	7	194	23	2	215	22	0
J10-B-Entr	1154	1065	425	68	13	374	53	4	445	39	4
J10-C-Entr	1064	1065	301	57	4	316	44	3	420	27	3
J11-B-Entr	1067	1066	395	65	9	410	51	3	560	36	5
J11-C-Entr	1154	1066	293	47	4	321	41	3	445	27	3
J12-A-Entr	1067	1068	370	41	2	365	49	5	468	25	3
J12-B-Entr	1435	1068	36	5	0	30	3	1	100	2	0
J12-D-Entr	3092	1068	140	19	2	265	17	1	301	13	0
J14-C-Entr	3339	2002	71	13	2	141	17	1	190	16	1
J15-A-Entr	2005	2006	278	55	3	303	45	3	477	46	0
J15-B-Entr	3293	2006	204	25	8	237	27	2	289	28	0
J17-A-Entr	2011	2010	204	20	2	131	21	4	198	15	0
J17-B-Entr	3297	2010	23	5	0	19	3	1	24	2	0
J18-A-Entr	3261	3262	115	9	1	69	11	1	130	13	2
J18-B-Entr	3266	3264	36	3	0	22	4	0	46	2	0
J18-C-Entr	3265	3263	69	11	1	78	11	1	156	10	1
J20-A-Entr	1025	1024	622	79	64	331	76	79	767	82	26
J20-B-Entr	1023	1024	558	104	56	315	64	68	616	72	31
J20-C-Entr	3133	1024	60	41	20	56	12	12	155	20	10
J22-C-Entr	1031	80922	589	110	63	337	69	67	716	87	27
J22-D-Entr	1131	80923	301	51	32	310	44	38	548	40	22
J23-A-Entr	4008	3186	160	20	0	98	10	1	119	15	0
J23-B-Entr	3188	3187	98	7	2	32	5	1	62	3	0
J23-C-Entr	3184	3185	116	14	0	98	14	0	170	21	0
J2-A-Exit	1147	1104	372	45	10	295	45	6	565	51	2
J2-D-Exit	80916	1013	337	56	31	200	42	25	385	24	11
J4-A-Exit	80921	1077	812	147	19	517	94	25	883	82	11
J4-C-Exit	1403	1078	677	98	33	460	74	30	871	75	11
J6-A-Exit	1070	1069	568	76	7	464	58	7	596	37	5
J6-B-Exit	1070	3106	150	49	4	136	36	8	179	22	4

J8-A-Exit	1062	3290	368	45	8	394	35	3	464	32	1
J8-B-Exit	1062	1153	351	56	5	354	44	5	430	29	4
J8-C-Exit	1062	1126	441	44	10	384	44	5	460	37	3
J8-D-Exit	1062	4207	181	25	2	141	19	2	198	16	1
J10-B-Exit	1065	1154	279	52	3	291	38	3	383	24	3
J10-C-Exit	1065	1064	396	63	13	336	45	3	385	35	4
J11-B-Exit	1066	1067	372	40	2	345	46	4	433	23	3
J11-C-Exit	1066	1154	429	67	10	365	53	4	428	37	5
J12-A-Exit	1068	1067	402	64	9	402	49	3	546	34	5
J12-B-Exit	1068	1435	85	2	0	37	3	1	74	0	0
J12-D-Exit	1068	3092	306	13	1	261	20	0	253	16	0
J14-C-Exit	3098	3097	48	7	1	75	8	1	94	4	0
J15-A-Exit	2006	2005	302	37	12	246	39	3	331	41	0
J15-B-Exit	2006	3293	332	35	1	284	35	3	396	33	0
J17-A-Exit	2010	2011	136	27	2	137	17	3	213	16	0
J17-B-Exit	2010	3297	8	8	0	21	3	1	27	0	0
J18-A-Exit	3262	3261	79	10	1	75	10	1	148	7	1
J18-B-Exit	3264	3266	19	4	0	18	3	0	43	8	0
J18-C-Exit	3263	3265	122	9	1	77	13	1	141	11	2
J20-A-Exit	1024	1025	580	111	64	341	68	65	712	80	25
J20-B-Exit	1024	1023	493	79	68	306	71	81	700	71	35
J20-C-Exit	1024	3133	167	34	8	54	13	13	127	23	7
J22-C-Exit	80922	1031	644	86	58	337	78	71	761	85	27
J22-D-Exit	80923	1131	480	50	35	282	50	42	385	50	17
J23-A-Exit	3186	4008	104	11	1	88	12	1	134	16	0
J23-B-Exit	3187	3188	87	9	0	37	6	0	80	11	0
J23-C-Exit	3185	3184	183	21	1	104	11	1	138	12	0
J1-B-Entry	80026	79948	370	31	13	188	31	14	286	18	4
J1-C-Entry	80009	79948	329	39	19	231	29	16	348	29	9
J4-B-Entry	80021	79956	211	14	6	107	16	3	140	10	1
J4-C-Entry	79941	79956	263	18	4	171	18	4	234	21	2
J1-B-Exit	79948	80026	183	32	18	209	30	16	402	32	11
J1-C-Exit	79948	80009	290	36	14	235	31	15	366	34	7
J4-B-Exit	79956	80021	145	16	3	109	15	2	163	7	2
J4-C-Exit	79956	79941	302	26	7	159	20	3	286	13	1
J1-C-Entry	79956	80022	271	31	7	214	33	3	360	25	1
J1-D-Entry	79945	79942	4	0	0	2	0	0	9	0	0
J2-B-Entry	79961	79960	16	1	2	24	6	1	43	4	0
J3-B-Entry	1533	79944	232	41	4	284	30	2	421	38	0
J4-A-Entry	79962	5082	501	74	4	459	64	9	786	74	1
J6-A-Entry	1496	1533	13	1	0	86	4	0	111	9	0
J9-C-Entry	80039	80038	80	11	0	138	8	1	223	20	0
J10-A-Entr	79980	79957	395	48	7	220	40	8	355	43	1
J10-B-Entr	79971	79957	125	16	0	59	10	1	87	5	0
J10-C-Entr	80038	79957	442	78	15	308	50	10	559	57	4
J10-D-Entr	80041	79957	165	21	4	136	25	5	364	25	0
J1-B-Exit	80001	79960	91	8	1	82	10	0	156	10	0
J1-C-Exit	80022	79956	321	45	5	211	30	3	378	26	0
J1-D-Exit	79942	79945	11	0	0	1	0	0	8	0	0
J2-A-Exit	79960	5082	431	68	13	269	38	9	396	35	3
J2-B-Exit	79960	79961	38	3	2	18	5	3	24	0	0
J3-C-Exit	79943	79942	188	34	3	190	22	2	338	27	0
J4-A-Exit	5082	79962	296	62	10	191	32	8	332	31	3
J4-C-Exit	5082	1533	345	45	4	277	30	2	374	36	0
J6-A-Exit	1533	1496	122	5	0	81	3	0	52	7	0
J9-B-Exit	80038	80035	487	65	3	358	51	9	647	65	1
J9-C-Exit	80038	80039	92	11	0	139	8	1	208	24	0
J10-A-Exit	79957	79980	285	57	15	241	37	8	465	38	3
J10-B-Exit	79957	79971	74	24	1	59	9	2	118	11	0
J10-C-Exit	79957	80038	488	58	3	307	49	9	580	63	1
J10-D-Exit	79957	80041	280	24	7	117	30	5	202	19	1
16055	72577	72587	1264	440	476	801	280	503	1975	324	319
16055	72585	72578	1600	331	517	938	326	467	1488	362	311

46054	72590	72597	1303	423	395	1497	385	397	2603	341	239
46054	72596	72588	1516	351	419	1555	443	382	1813	276	150
58447	80400	80399	298	61	25	110	29	15	190	33	10
58447	80399	80400	142	26	22	122	38	19	392	62	17
80919	1209	80918	603	104	67	308	80	61	614	71	24
80919	80918	1209	448	103	44	318	88	60	497	64	17
81558	79912	5066	360	132	109	273	55	110	824	85	67
81558	5066	79912	664	97	98	268	63	99	496	87	64
27424	1575	1551	473	79	24	412	72	24	540	76	6
27424	1551	1575	417	85	16	429	74	19	561	44	10
37473	4062	80420	172	31	49	91	21	46	258	30	16
37473	80420	4062	188	26	43	95	25	47	203	15	26
46087	80310	80309	247	48	8	119	29	4	219	31	1
46087	80309	80310	179	27	3	109	24	5	267	50	0
58295	1047	1048	765	139	42	384	69	37	580	57	17
58295	1048	1047	420	86	33	374	75	45	922	104	18
60060	72993	5002	503	114	51	362	76	47	556	61	30
60060	5002	72993	472	98	65	380	86	44	468	45	22
80918	1076	1433	601	110	25	463	75	20	716	68	4
80918	1433	1076	407	99	21	484	84	17	688	43	8
99071	1365	80786	188	34	26	90	24	18	245	38	7
99071	80786	1365	195	29	13	90	31	18	208	19	6
7407	80581	1535	260	53	19	269	59	24	441	36	4
7407	1535	80581	340	55	18	281	60	22	374	60	9
37559	5007	5008	329	65	21	201	52	28	438	46	12
37559	5008	5007	352	50	20	177	53	26	356	48	4
56747	5067	5066	305	54	101	306	69	100	409	32	48
56747	5066	5067	386	82	111	249	57	111	463	40	52
73708	79928	79927	152	31	3	124	23	2	221	13	0
73708	79927	79928	167	22	0	131	21	2	209	22	2
74008	5078	42098	429	80	49	340	95	46	713	148	19
74008	5113	5077	509	98	57	373	77	61	685	93	28
81557	80297	80298	468	60	44	228	67	69	312	103	53
81557	80294	73084	280	84	35	191	55	50	541	59	14
800650	1576	80787	20	11	12	15	9	11	69	5	6
800650	80787	1576	40	9	6	18	10	14	36	4	10
800948	80316	5112	64	7	1	52	14	1	37	4	0
800948	5112	80316	42	12	1	43	9	1	56	14	1
800954	1078	3046	212	36	5	151	20	2	295	32	0
800954	3046	1078	221	23	1	144	28	1	175	28	0
800974	3022	3021	19	3	3	23	4	1	35	2	1
800974	3021	3022	51	3	2	23	4	1	27	1	0
802399	80334	5102	30	9	1	19	4	1	22	3	4
802399	5102	80334	24	8	1	17	3	1	34	5	1
802426	80436	80438	34	6	1	20	3	1	32	2	0
802426	80438	80436	14	1	1	23	4	1	58	11	0
802431	3334	1082	0	0	0	1	0	0	1	0	0
802431	1082	3334	1	0	0	1	0	0	3	0	0
803953	3261	3260	68	20	1	73	9	2	78	9	0
803953	3260	3261	83	5	1	62	8	2	87	14	0
805320	5068	1571	3	0	0	3	1	0	1	1	0
805320	1571	5068	3	1	0	2	0	0	3	1	0
806077	80487	80486	91	14	0	49	7	2	73	7	1
806077	80486	80487	54	8	0	48	10	1	120	14	0
949836	1470	80526	33	3	0	24	3	2	30	4	0
949836	80526	1470	9	0	0	27	3	2	37	0	0
26091	80293	80062	659	104	68	214	50	42	267	75	31
26091	80063	80294	228	70	48	206	52	46	842	64	25
36634	1508	80824	731	86	69	256	62	44	452	64	17
36634	80824	1508	320	95	43	247	63	40	701	75	10
56056	72566	72576	1436	511	454	1095	330	545	2379	377	298
56056	72575	72565	1771	397	538	1119	392	476	1741	317	305
56609	72217	72219	1724	517	209	1299	245	151	2464	202	70

56609	72218	70354	1829	248	137	1230	326	178	1963	342	128
81550	80833	80662	1844	569	621	1502	450	587	2241	424	391
81550	72502	80832	1489	414	519	1623	452	591	2426	408	434
81552	73131	73157	1827	410	608	1369	304	586	1937	302	400
81552	73134	80772	1267	428	482	1448	489	554	1883	375	364
81554	73136	72568	1490	532	483	1270	370	586	3171	502	376
81554	72567	73137	1878	396	551	1271	407	519	1793	309	320
89186	80694	72776	603	113	34	335	73	37	624	86	14
89186	72776	80694	661	118	45	457	111	48	816	96	18
806735	4050	5056	230	28	10	118	24	6	164	11	1
806735	5056	4050	127	29	4	141	24	6	320	18	1
806987	1377	80543	51	12	4	55	11	2	123	17	1
806987	80543	1377	74	13	4	62	13	2	128	22	0
807101	80447	80446	31	9	0	15	3	1	22	1	0
807101	80446	80447	18	2	2	11	2	1	14	1	0
807379	3008	1006	49	5	0	17	3	0	26	3	0
807379	1006	3008	50	6	0	19	3	0	33	1	0
808127	3152	3154	24	3	0	13	4	1	25	4	0
808127	3154	3152	22	6	0	11	3	0	13	1	0
808636	3002	3005	13	1	0	6	1	0	16	2	0
808636	3005	3002	15	0	0	6	1	0	8	0	0
810501	4053	80456	15	4	2	26	7	1	26	6	3
810501	80456	4053	30	4	1	22	9	1	32	7	1
810776	80470	80472	5	5	1	7	4	1	9	2	0
810776	80472	80470	15	1	1	6	5	1	10	1	0
810840	2010	2009	178	25	2	141	26	3	139	13	3
810840	2009	2010	115	22	3	138	23	3	196	15	1
812030	80542	80538	14	0	0	8	2	0	20	2	0
812030	80538	80542	6	1	0	8	2	0	15	2	0
812221	80439	80647	72	9	10	74	13	7	93	9	5
812221	80647	80439	67	20	13	73	14	6	104	14	6
949552	2043	80515	207	17	1	64	10	0	88	8	0
949552	80515	2043	49	14	0	60	10	0	234	23	0
949642	4188	3156	12	1	0	6	2	0	2	3	0
949642	3156	4188	4	0	0	7	2	0	10	4	0
ATC 40	80651	5009	385	66	37	240	51	32	451	52	17
Error 2042	42099	5078	569	88	50	405	98	55	744	105	27
J19-B-Entr	1044	1045	720	98	55	361	76	48	547	63	26
J49-B-Entr	79930	79926	14	0	0	6	1	0	12	1	0
J19-B-Exit	1045	1044	426	85	64	396	85	51	789	113	27
J22-A-Entr	1425	80924	994	124	52	548	116	60	1001	117	13
J22-A-Exit	80924	1425	761	150	55	576	100	51	1119	109	17
J1-A-Entry	79960	79948	264	50	12	317	41	11	557	52	7
J1-A-Exit	79948	79960	490	52	12	292	40	9	425	33	2
J1-B-Entry	79960	80001	168	19	2	65	13	1	114	5	0
J2-A-Entry	5082	79960	294	35	3	258	40	8	484	43	1
J3-C-Entry	79942	79943	218	31	5	170	26	2	271	22	1
J9-B-Entry	80035	80038	449	84	15	360	53	10	605	63	4
57855	72769	73102	2047	209	128	1318	382	136	2360	338	77
57855	80533	80799	1949	503	202	1250	274	122	2596	266	70
Site 1-A-Er	72807	72806	254	45	31	0	0	0	597	60	10
Site 1-D-Er	72813	72814	692	108	55	0	0	0	889	96	16
Site 1-E-Er	80911	72818	550	68	37	0	0	0	784	57	15
Site 2-B-Er	72669	72992	364	105	48	0	0	0	585	86	26
Site 2-C-Er	1208	1210	250	27	83	0	0	0	362	39	52
Site 1-A-Ex	72809	72808	462	84	36	0	0	0	346	33	9
Site 1-D-Ex	72812	72811	753	95	47	0	0	0	860	70	21
Site 1-E-Ex	72818	80911	550	80	26	0	0	0	769	68	7
Site 2-B-Ex	72992	72669	523	117	58	0	0	0	576	72	29
Site 2-C-Ex	1211	1208	319	53	77	0	0	0	302	37	62
Site 1	80239	5045	57	10	0	0	0	0	135	13	0
Site 1	80248	5045	75	4	0	0	0	0	22	4	0
Site 1	5045	80239	130	17	0	0	0	0	70	10	0

Site 1	5045	80248	46	7	0	0	0	0	89	7	0
Site 2	79963	5046	238	71	18	0	0	0	599	77	13
Site 2	79923	5046	194	20	6	0	0	0	76	12	1
Site 2	80209	5046	434	52	22	0	0	0	243	18	4
Site 2	5046	79923	50	18	7	0	0	0	162	14	2
Site 2	5046	79963	594	67	25	0	0	0	288	26	5
Site 2	5046	80209	223	58	14	0	0	0	469	67	11
Site 3A	80203	5047	249	60	12	0	0	0	586	74	10
Site 3 A	79920	5047	111	9	2	0	0	0	32	5	0
Site 3A	79921	5047	422	44	19	0	0	0	333	21	4
Site 3 A	5047	79920	54	13	1	0	0	0	127	5	0
Site 3A	5047	79921	223	49	11	0	0	0	500	69	10
Site 3 A	5047	80203	505	51	21	0	0	0	324	26	4
Site 3B	79920	79921	43	8	1	0	0	0	15	1	0
Site 3B	79919	79921	427	45	19	0	0	0	335	22	4
Site 3B	79921	79920	5	1	0	0	0	0	2	1	0
Site 3B	79921	79919	265	57	12	0	0	0	515	70	10
Site 3C	80207	79920	153	17	3	0	0	0	47	6	0
Site 3C	79920	80207	59	14	1	0	0	0	129	6	0
A1M/9586	1557	72205	2181	745	542	2006	487	585	3098	365	323
M62/2300A	71397	80829	2056	574	634	1792	565	801	3325	551	475
9252/1	72219	72749	1512	454	183	1243	234	145	2150	176	61
9251/1	72748	72218	1541	209	116	1204	319	174	1793	313	117
30361363	72749	72759	1842	377	165	1360	279	144	2318	252	79
30361364	72758	72748	1494	306	134	1421	292	151	2194	239	74
A1M/9435	73143	73146	1780	485	487	1432	389	436	2040	343	289
A1M/9436	73145	73142	1376	375	377	1492	405	454	2182	367	309
Site 1-C-Er	1034	72812	33	6	0	0	0	0	369	8	1
Site 1-C-Ex	72815	1034	149	8	0	0	0	0	251	8	2
A1M/9462	73149	73145	297	81	81	236	64	72	391	66	55
A1M/9650	72252	72256	1933	526	529	1879	510	572	2386	401	338
M62/2351K	72554	72566	233	65	72	161	51	72	266	44	38
A1M/9646	72257	72256	559	152	153	388	105	118	770	129	109
M62/2352L	72565	72545	231	64	71	154	48	69	301	50	43
A1M/9650	72252	72255	111	30	30	68	19	21	158	27	22
A1M/9592	72207	1558	2500	436	408	1955	623	631	2462	719	480
M62/2348E	72565	72567	1491	416	460	985	311	440	1505	249	215
M62/2346A	72568	72566	1198	334	369	1000	315	447	1981	328	283
A1M/9646	72258	72259	685	187	188	378	103	115	783	132	111
A1M/9592	72207	72206	335	91	92	205	56	62	397	67	56
A1M/9468	73147	73151	222	61	61	97	26	30	157	26	22
000100048	5060	1445	93	14	3	101	19	4	147	15	2
000100048	1445	5060	93	14	3	89	17	3	136	14	2
J1-A-Entry	80228	5049	81	10	3	0	0	0	73	9	0
J1-B-Entry	5050	5049	30	3	1	0	0	0	19	5	0
J1-C-Entry	80222	5049	50	5	1	0	0	0	70	3	1
J1-A-Exit	5049	80228	51	6	0	0	0	0	64	3	0
J1-B-Exit	5049	5050	23	5	2	0	0	0	36	3	1
J1-C-Exit	5049	80222	88	8	3	0	0	0	62	10	0
J4-B-Entry	80097	5053	52	34	41	0	0	0	351	24	20
J4-D-Entry	80099	1483	92	15	20	0	0	0	106	19	10
J4-B-Exit	5053	80097	330	53	36	0	0	0	111	12	32
J4-D-Exit	1483	80099	97	20	23	0	0	0	100	10	9
J3-A-Entry	1231	1491	202	27	15	0	0	0	323	23	8
J3-B-Entry	1482	1490	359	88	88	0	0	0	850	56	48
J3-C-Entry	80092	1489	572	82	100	0	0	0	381	33	50
J3-D-Entry	80094	1488	388	46	7	0	0	0	291	19	2
J3-A-Exit	1491	1231	280	17	18	0	0	0	144	10	5
J3-B-Exit	1490	1482	717	113	104	0	0	0	506	33	59
J3-C-Exit	1489	80092	276	62	78	0	0	0	624	35	44
J3-D-Exit	1488	80094	247	52	10	0	0	0	571	53	1
9255/1	72779	72813	2039	417	183	1525	313	162	2361	257	80
9256/1	72811	72781	1754	359	157	1490	306	158	2458	268	83

9257/1	1235	72861	1919	393	172	1229	252	130	1945	212	66
9258/1	1236	72807	1429	292	128	1289	265	137	2208	241	75
9568A	72220	72213	3477	947	952	2818	765	858	4591	772	650
9568B	72234	1182	3326	906	910	3035	824	924	4403	740	624
York15	80562	80563	445	29	12	91	16	4	235	23	3
York15	80563	80562	250	31	4	169	22	7	374	21	7

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