



Chelmsford Traffic and Access Strategy

Essex County Council

Park and Ride and Station Parking Model - Technical Note

Park and Ride and Station Parking Model | Final April 2017



Park and Ride and Station Parking Model Technical Note



Chelmsford Traffic and Access Strategy

Project no:	B3553T37
Document title:	Park and Ride and Station Parking Model Technical Note
Document No.:	Parking Model Technical Note
Revision:	Final
Date:	23 August 2017
Client name:	Essex County Council
Client no:	Essex County Council
Project manager:	Csaba Kelen
Author:	Georgios Christou
File name:	O:\Projects\B3553F26 Chelmsford Modelling\1.Project Management\Deliverables\!Final Delivery 04042017\Park and Ride and Station Parking Model Final.docx

Jacobs U.K. Limited

New City Court 20 St Thomas Street London SE1 9RS United Kingdom T +44 (0)20 7939 6100 F +44 (0)20 7939 6103 www.jacobs.com

© Copyright 2016 Jacobs U.K. Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This report has been prepared on behalf of, and for the exclusive use of Jacobs' Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Document history and status

Revision	Date	Description	Ву	Review	Approved
Draft	19/12/2016	Park and Ride and Station Parking Model Technical Note	Georgios Christou	Csaba Kelen	Csaba Kelen
Revised Draft	26/01/2017	Park and Ride and Station Parking Model Technical Note	Georgios Christou	Csaba Kelen	Csaba Kelen
Revised Draft	22/02/2017	Park and Ride and Station Parking Model Technical Note	Georgios Christou	Csaba Kelen	Csaba Kelen
Final	04/04/2017	Park and Ride and Station Parking Model Technical Note	Georgios Christou	Csaba Kelen	Csaba Kelen



Contents

Execu	Itive Summary	1
1.	Introduction	2
2.	Park and Ride Data Collection	3
2.1	Introduction	3
2.2	Volumetric data at Chelmsford Station (Townfield Street car park)	3
2.3	Revealed Preference Survey at Chelmsford Station (Townfield Street car park)	3
2.4	Revealed Preference Survey at the Sandon/Chelmer Valley Park and Ride facilities	5
2.5	Parking Capacity Data	12
3.	Transportation Supply Model	14
3.1	Highway Transport Network	14
3.2	Public Transport Network	15
4.	Transport Demand Model	16
4.1	Model Characteristics	16
4.1.1	Zonal Structure	16
4.1.2	Journey purpose, vehicle class and user class segmentation	17
4.1.3	Modelled Time Periods	18
4.1.4	Modelled time horizons	18
4.2	Parking Assignment Model Methodology	18
4.3	Beaulieu Park Station Parking Model	19
4.4	Widford and Boreham Park and Ride Model	21
5.	Park and Ride Trip Assignments	26
5.1	Year 2021 Highway Assignments	26
5.2	Year 2036 Highway Assignments	28
6.	Public Transport Trip Assignments	31
6.1	Year 2021 Public Transport Assignment	31
6.2	Year 2036 Public Transport Assignment	32
7.	Conclusions	36

Appendix A. Chelmsford City Centre Car Park Survey questionnaire (January 2015) Appendix B. Chelmsford Park and Ride questionnaire (June 2011) Appendix C. Link type specification



Figures

Figure 1 Car park entry/exit counts at Chelmsford Station (Townfield car park)	3
Figure 2 Current catchment area of the Townfield Street car park	4
Figure 3: Trip frequency at the Townfield Street car park	4
Figure 4: Trip purpose at the Townfield Street car park	5
Figure 5: Duration of stay at the Townfield Street car park	5
Figure 6 Current catchment area heat map of the Sandon Park and Ride facility (2011)	6
Figure 7: Trip frequency at the Sandon Park and Ride facility (2011)	7
Figure 8 Duration of stay at the Sandon Park and Ride facility (2011)	7
Figure 9 Trip purpose at the Sandon Park and Ride facility (2011)	8
Figure 10 Revealed travel mode prior to opening the Sandon Park and Ride facility (2011)	8
Figure 11: Arrival time profile at Sandon P&R – 9 th June 2011	9
Figure 12 Current catchment area heat map of the Chelmer Valley Park and Ride facility (2011)	10
Figure 13: Trip frequency at the Chelmer Valley Park and Ride facility (2011)	10
Figure 14 Duration of stay at the Chelmer Valley Park and Ride facility (2011)	10
Figure 15 Trip purpose at the Chelmer Valley Park and Ride facility (2011)	11
Figure 16 Revealed travel mode prior to opening the Chelmer Valley Park and Ride facility (2011)	11
Figure 17: Arrival time profile at Chelmer Valley P&R – 9 th June 2011	12
Figure 19 Administrative and Urban Areas	14
Figure 20 Zonal structure level of detail	16
Figure 21: Catchment area of railway stations around Chelmsford in 2021 and 2036	19
Figure 22: Car connectors to Beaulieu park Station in the 2021 model	20
Figure 23 Catchment area of the Park and Ride facilities around Chelmsford in 2036	22
Figure 24 Car connectors to Beaulieu park station, Widford and Boreham Park and Ride facilities in the 2036	;
	22
Figure 25 Park and Ride bus route between Boreham and Widford	24
Figure 26 Car trips to/from Beaulieu Park station parking in the AM peak hour in 2021	26
Figure 27 Car trips to/from Beaulieu Park station parking in the PM peak in 2021	27
Figure 28 Car trips to/from Beaulieu station parking and Borenam Park and Ride in the AM peak in 2036	28
Figure 29 Car trips to/from Widford Park and Ride in the AM peak in 2036	28
Figure 30 Car trips to/from Beaulieu station parking and Borenam Park and Ride in the average IP in 2036	29
Figure 31 Car trips to/from Widford Park and Ride in the average IP in 2036	29
Figure 32 Cartinos to/from Beaulieu station parking and Borenam Park and Ride in the PM peak in 2030	30
Figure 33 Car trips to/from Widford Park and Ride in the average Pivi peak in 2036	30
Figure 34 Public transport trips near Deaulieu Park station in the AM peak in 2021	31 22
Figure 35 Public transport trips near Deaulieu Park station in the PM peak in 2021	3Z
Figure 36 Public transport tips near Beaulieu Park station and Borenam Park and Ride in the Awi peak in 20	130 22
Figure 27 Dublic transport trips poor Widford Park and Pido in the AM pook in 2026	აა 22
Figure 37 Fublic transport trips near Widiolu Fark and Ride in the Aw peak in 2050	55
2036	21
Figure 39 Public transport trips pear Widford Park and Ride in the average IP in 2036	54 2/
Figure 40 Public transport trips near Regulieu Park station and Roreham Park and Ride in the DM peak in 20	136
Tigure to Fusile iransport inporteal beaulieu Faik station and borenam Faik and true in the FM peak III 20	35
Figure 41 Public transport trips near Widford Park and Ride in the PM neak in 2036	35
r iggi σ τ r	



Tables

Table 1 Capacity assumed for the new station parking and P&R facilities in Chelmsford	13
Table 2 Zone structure summary table	17
Table 3 Purpose, User Class and Vehicle Class Correspondence	17
Table 4 Park and ride penalties for station parking	20
Table 5 Modelled Station Parking trip arrivals and departures at Beaulieu Park Station in 2021	21
Table 6 Modelled Station Parking trip arrivals and departures at Beaulieu Park Station in 2036	21
Table 7 Park and ride penalties for Park and Ride facilities	23
Table 8 Modelled Park and Ride trip arrivals and departures to/from the Boreham Park and Ride facility in	ı 2036
	24
Table 9 Modelled Park and Ride trip arrivals and departures to/from the Widford Park and Ride facility in 2	2036
	24



Executive Summary

This technical note summarises the development and performance of the Park and Ride and Station Parking Model (in short: Parking Model). Standard technical reports about the model have been issued previously, specifically the Model Specification Report (MSR), the Local Model Validation Report (LMVR) and the Travel Forecast Report (TFR). Due to the timing of the development of the Parking Model within the project program, this note was issued separately. The Parking Model is integrated into the Chelmsford Strategic Model forecasts for years 2021 and 2036, and follows the same general methodology, as described in the TFR and the Variable Demand Modelling (VDM) note. The model has been developed and validated according to the WebTAG guidance.

The role of the Parking Model is to model the impact of the new station parking facilities at Beaulieu Park and the new Park and Ride facilities at Widford and Boreham in 2021 and 2036. The impact of these combined trips is modelled via the PT assignment model by using a simplified elasticity approach. The PT and car legs of the combined trips are loaded on the respective assignment models. Due to data limitations, existing station and park and ride facilities are not modelled explicitly.

The Parking Model was developed on the basis of extensive data collection via revealed preference (RP) surveys, carried out historically and during the project lifetime. The RP data provided information about trips to the Chelmsford railway station and to Sandon and Chelmer Valley Park and Ride facilities, as well as the various aspects of car park utilization. The model made direct use of the following survey information: (1) origin-destination location and time (2) trip frequency (3) trip purpose (4) duration of stay (5) travel mode prior to opening the facility. The survey results are shown in Chapter 2.

Chapter 3 summarises the parking supply model, which consists of highway, cycling, and walking network components. The key feature of the model is the park and ride car connectors between the zones and the parking facilities.

Chapter 4 provides a detailed description of the parking demand model development. The model is based on a public transport assignment methodology, which takes advantages of coding drive connectors to the parking facilities, as well as using regular walk connectors. The assignment follows a simplified elasticity methodology, which has been benchmarked against historic park and ride survey count data. The parking model has been built for forecast years of 2021 and 2036 in the AM peak, average inter-peak and PM peak periods.

Based on information from ECC, Beaulieu Park station is assumed to be operational by 2021, and therefore is included in both the 2021 and 2036 time horizons. The new Park and Ride facilities at Widford and Boreham are expected to become operational at a later stage, and therefore are modelled only in the 2036 time horizon. Forecast results for the car leg of the park and ride trips by 2021 and 2036 are shown in Chapter 5. Forecast results for the public transport leg of the park and ride trips by 2021 and 2036 are shown in Chapter 6.



1. Introduction

Chelmsford City is facing the challenge of meeting increasing travel demands while actively encouraging economic growth. Jacobs has been commissioned to build a multi-modal transport model for the city of Chelmsford to understand the current and future transport issues in Chelmsford and to help bid for funding that will be made available via the Local Enterprise Partnership (LEP) and national funding sources.

Further background to the study is provided by the County Council's "Essex County Growth Deal" which forms part of the South East Local Enterprise Partnership's (SELEP) £1.2 Billion bid to Government to leverage £10 Billion of investment into the South East. The Essex County Growth Deal identifies a number of transport schemes and initiatives to help realise and promote the growth planned for the city of Chelmsford.

The scale of the potential proposals is such that the funding approval process will require the development of WebTAG compliant transport models. To this end, a strategic multi-modal model was developed to assess the strategic transport impacts of the various transport schemes in the city. The model was needed to evaluate the following infrastructure and policy interventions, to be implemented in Chelmsford:

- · Residential, industrial and commercial land use developments,
- · Road infrastructure improvements (roadways, junctions),
- · Public transport service improvements (stations/stops, routes, timetables),
- · Public transport policy (fares, information),
- · Parking infrastructure and policy (car parks, parking costs),
- · Cycling infrastructure and policy (bicycle lanes, parking).

Due to the need to assess the impact of new Park and Ride and station parking infrastructure and policies, station parking and Park and Ride models have been incorporated into the Chelmsford Strategic Model for the time horizons of 2021 and 2036.

The PTV VISUM14 software package has been used for modelling parking to be consistent with the rest of the Chelmsford Strategic Model. The model provides detailed spatial and network coverage of the whole Chelmsford Administrative and Urban Area, but also extend beyond its boundaries to ensure detailed representation of the key adjacent areas.



2. Park and Ride Data Collection

2.1 Introduction

Data was collected during the commission to provide station parking information for the model building, including volumetric counts and revealed preference surveys. In addition, historic park and ride travel surveys were carried out in 2011, which have also been used for this work. The purpose of the data analysis was (1) to summarise the survey results and to (2) identify data from which to validate the parking model.

2.2 Volumetric data at Chelmsford Station (Townfield Street car park)

Vehicle counts were undertaken in January 2015 at both entrances/exits of the Townfield car park. Vehicles entering and exiting the car park were counted between 7:00 am and 7:00 pm in 15 minute intervals. The traffic counts to/from the car park are shown in the following figure.



Figure 1 Car park entry/exit counts at Chelmsford Station (Townfield car park)

In total, 414 vehicles entered the car park and 475 vehicles exited the car park during the 12 hours of data collection. The difference is attributable to vehicles that entered/exited the car park outside of the counted time periods. The peak hour for arrivals (car park entries) occurred between 7:00 and 8:00 am, with a total of 311 vehicles. Peak hour for departures (car park exits) occurred between 6:00 and 7:00 pm, with a total of 242 vehicles.

Essentially all vehicles arrived at the car park before 9:30 am, while all vehicles departed after 3 pm. Trip arrival was virtually zero between 9:30 am and 7:00 pm, while trip departure was virtually zero between 7:00 am and 3:00 pm. This observation corresponded with the survey results, as described below.

2.3 Revealed Preference Survey at Chelmsford Station (Townfield Street car park)

An RP survey and a corresponding car park entry/exit count were carried out at Chelmsford station in January 2015. The objective of the survey was to collect data about the station car park (Townfield



Street car park) users, and the corresponding trips they made. The survey questionnaire can be found in Appendix A.

The mail-back RP survey at the Townfield Street car park was carried out in January 2015. A total of 63 questionnaires were collected, which corresponds to a response rate of about 12.4%. The survey results provided insights into the trips being made to the station car park – trip origins, trip length, trip purpose, trip frequency, duration of stay and average vehicle occupancy. This information, summarised below, informed the station parking model development for the forecast years 2021 and 2036.



Figure 2 Current catchment area of the Townfield Street car park



Figure 3: Trip frequency at the Townfield Street car park





Figure 4: Trip purpose at the Townfield Street car park



Figure 5: Duration of stay at the Townfield Street car park

As the above figures show, the catchment area of the station car park at Townfield Street extends to about 15 kilometres from Chelmsford railway station, particularly to the north and east of the city. The trips to the station car park are dominated by the home-based work (HBW) trip purpose (97%). Drivers tend to make this trip on a daily basis, as only 9% of them use the car park less than four times a week. The duration of stay is typically between 10-14 hours, with 83% of trip makers falling into this category. Average vehicle occupancy at the car park reflects the dominance of HBW trips, with 1.19 passengers per vehicle.

2.4 Revealed Preference Survey at the Sandon/Chelmer Valley Park and Ride facilities

The mail-back revealed preference surveys at the Sandon and Chelmer Valley Park and Ride facilities were carried out in June 2011. The results of these surveys, performed by Mouchel on behalf of Essex County Council, were analysed to gain insights into the trips using the Park and Ride facilities. A total of 1119 and 359 questionnaires were collected for Sandon and Chelmer Valley Park and Ride facilities, respectively. Using this data, trip origins, trip length, trip purpose, trip frequency,



duration of stay and average vehicle occupancy were analysed. This data informed the Park and Ride model development for the forecast years 2021 and 2036. The survey questionnaire can be found in Appendix. Travel patterns at the Sandon Park and Ride facility are summarised in the figures below.



Figure 6 Current catchment area heat map of the Sandon Park and Ride facility (2011)¹

¹ Darker colour means a higher concentration of Park and Ride trip origins





Figure 7: Trip frequency at the Sandon Park and Ride facility (2011)



Figure 8 Duration of stay at the Sandon Park and Ride facility (2011)

As the above figures show, the catchment area of the Sandon Park and Ride facility extends to about 25 kilometres from Chelmsford to the east and south of the city. Almost 70% of the drivers tend to make this trip at least three times a week, while the remaining 30% use the car park less frequently. The duration of stay varies between 1 and 12 hours, out of which 53% stay between 4 and 8 hours.





Figure 9 Trip purpose at the Sandon Park and Ride facility (2011)



Figure 10 Revealed travel mode prior to opening the Sandon Park and Ride facility (2011)

As the above figures show, the trips to the car park are dominated by home-based (HBW) work trip purpose (75%), with most of the other trip purposes being home-based other (HBO) trips. Average vehicle occupancy at the car park reflects the dominance of HBW trips, with 1.19 passengers per vehicle. Prior to opening the Park and Ride facility, 72% of the travellers used the car to get to their destination, 9% used public transport, 1% walked/cycled, and 18% did not travel (these are trips induced by the Park and Ride facility and bus service).





Figure 11: Arrival time profile at Sandon P&R – 9th June 2011

Figure 11 summarises the number of cars arriving at Sandon P&R on 9th June 2011 (Thursday). According to the chart, the peak period for arrivals at Sandon P&R is between 7:00 and 10:00 am. Specifically, 83% of the arrivals between 7:00 am and 12:00 pm (survey time) happened between 7:00 and 9:00 am. A total of 366 vehicles arrive in the peak hour, which occurs between 8:00 and 9:00 am. These results were expected, as during this period most of the travellers are commuting to work, and they are using Sandon P&R to access the city.

Travel patterns at the Chelmer Valley Park and Ride facility are summarised in the figures below.







Figure 12 Current catchment area heat map of the Chelmer Valley Park and Ride facility (2011)²

Figure 13: Trip frequency at the Chelmer Valley Park and Ride facility (2011)



Figure 14 Duration of stay at the Chelmer Valley Park and Ride facility (2011)

² Darker colour means a higher concentration of Park and Ride trip origins





Figure 15 Trip purpose at the Chelmer Valley Park and Ride facility (2011)



Figure 16 Revealed travel mode prior to opening the Chelmer Valley Park and Ride facility (2011)

As the above figures show, the catchment area of the Chelmer Valley Park and Ride facility extends to about 25 kilometres from Chelmsford to the north of the city. The trips to the car park are dominated by the HBW trip purpose (74%), with most of the other trip purposes being HBO trips. 75% of the drivers tend to make this trip at least three times a week, while the remaining 25% use the car park less frequently. The duration of stay varies between 1 and 12 hours, out of which 56% stay between 4 and 8 hours. Average vehicle occupancy at the car park reflects the dominance of HBW trips, with 1.18 passengers per vehicle.

Prior to opening the Park and Ride facility, 86% of the travellers used the car to get to their destination, 4% used public transport, 5% walked/cycled, and 5% did not travel (these are trips induced by the Park and Ride facility and bus service).





Figure 17: Arrival time profile at Chelmer Valley P&R – 9th June 2011

Figure 17 summarises the number of cars arriving at Chelmer Valley P&R on 9th June 2011 (Thursday). According to the chart, the peak period for arrivals at Chelmer Valley P&R is between 7:00 and 10:00 am. Specifically, 81% of the arrivals between 7:00 am to 12:00 pm (survey time) happened between 7:00 and 9:00 am. A total of 125 vehicles arrive in the peak hour, which occurs between 8:00 and 9:00 am. These results were expected since during this period most of the travellers are commuting to work, and they are using Chelmer Valley P&R to access the city.

2.5 Parking Capacity Data

The existing Park and Ride facilities of Sandon and Chelmer Valley have a capacity of 1400 and 1003 vehicles, respectively.

The new Beaulieu Park Station is assumed to be operational by the year 2021, and therefore it has been modelled in the year 2021. The station is expected to have a car park with a total capacity of 1400 vehicles³.

³ Beaulieu Park, Chelmsford, Proposed Station, Transport Statement, January 2012, Section 4.9



In addition, the proposed Widford and Boreham Park and Ride facilities are expected to come into operation a few years later. These Park and Ride facilities, based on information from ECC, will both have a capacity of 700 vehicles. Therefore, the Park and Ride bus service and the Park and Ride facilities have been modelled in the year 2036.

The planned car parks are summarised in the table below.

Facility	Assumed Capacity	Model horizon	
Beaulieu Station parking	1400 vehicles	2021, 2036	
Boreham P&R	700 vehicles	2036	
Widford P&R	700 vehicles	2036	

Table 1 Capacity assumed for the new station parking and P&R facilities in Chelmsford



3. Transportation Supply Model

3.1 Highway Transport Network

The purpose of the supply model is to represent the network topology and the physical properties of the highway network that provides accessibility to the city of Chelmsford.

A modelled network consists of sections of roads (known as links) connected by junctions (known as nodes). Links are formed by creating connections between node points. For further analysis of model outputs to inform noise, air quality and other outputs, it is important that all junctions are coded with the correct local coordinate system reference.

The highway network inside the Chelmsford Urban Area includes all streets and roads that are to be used by motor vehicles. The Chelmsford Administrative Area I also includes all major and minor roads with proportional treatment of local roads. Outside of the Chelmsford Administrative Area major and minor roads are be coded while the model has a lower resolution as we move further away from the Essex County boundaries, Figure 18 contains a schematic map of the different areas.



Figure 18 Administrative and Urban Areas

A total of 96 different highways classes or types were be coded in VISUM software, classifying roads based characteristics such as: road class, number of lanes, speeds, and modes allowed, etc. a full list of all the defined link types can be found in Appendix. The main roadway types are listed below:

- Motorways
- A roads

Park and Ride and Station Parking Model Technical Note



- B roads
- · Minor roads
- · Local roads (residential streets etc.)
- Ancillary roads (bus links, cycle lanes, etc.)

In the external model area, only major highways (selected Motorways, A roads and B roads) were be coded in order to guarantee good levels of accessibility to and from the Chelmsford Administrative area. Network topology was coded according to design, but physical attributes were coded notionally in order to accommodate traffic volumes to and from the external areas.

3.2 Public Transport Network

The model includes every public transport service (rail, coach and local bus), which serve the modelled area (Chelmsford Administrative Area). Individual lines and timetables were coded into VISUM software so that, for the modelled area, each line route, for each variation, has been coded to run along the correct route and stops at each stop at the scheduled time.

Services that are either partially inside of the Chelmsford Administrative Area or within the Essex County boundaries are also fully represented. Public transport services were coded using 2014 timetables.

Services that are partially inside the county or in the external model (the rest of mainland United Kingdom) were coded using headway-based timetables. This includes national rail, London Underground and key long distance bus services. The decision as to which services to include was made based on accessibility criteria, which required that access is provided between each pair of model zones.

The following auxiliary network components were coded in the model, at a different level of detail depending on their proximity to the internal model area:

- · Walk access/egress connectors;
- · Drive access/egress connectors; and
- Park and ride access/egress connectors.

Walk access/egress connectors were coded between zones and either railway stations or bus stops within urban areas inside of the boundary of the county of Essex. They provide access to zones and have been coded to model the walking/cycling times as accurately as possible. Drive access/egress connectors were coded to provide connectivity between rural zones and railway stations. Park and ride access/egress connectors were coded to provide to provide connectivity between any zone within the catchment area of the parking facility, and the car parking facility itself.

In the external area, outside of the county of Essex, the objective was to provide an accurate representation of routes and journey times via the national network. For more details, please refer to the LMVR Chapter 4.2.



4. Transport Demand Model

4.1 Model Characteristics

4.1.1 Zonal Structure

The model uses geographic zones to represent locations of trip origins and destinations. The level of zonal detail of the model varied as follows:

- Chelmsford Administrative Area use Lower Level Super Output Area (LSOA) and Middle Level Super Output Area (MSOA) to define the zonal system. Infrastructure topology and land use were taken into account and further divisions were added on this basis;
- Middle Level Super Output Area (MSOA) was used to define the zonal system immediately surrounding Chelmsford Administrative Area;
- · District or unitary authority level for the counties surrounding the county of Essex; and
- County or regional level for the rest of mainland United Kingdom, with the exception of London, where zones were defined at aggregated borough level.

These four levels of spatial detail were being applied according to the illustration below:



Figure 19 Zonal structure level of detail

The intermediate model area contains the remaining region of the county of Essex outside of the Chelmsford Administrative area. Different parts of the intermediate model area was coded at a different level of resolution, such as MSOAs were used for zones immediately surrounding



Chelmsford Administrative area, and district or unitary authority definitions further away. The zone structure by geographic area is summarised in the table below.

Geographic Area	Zone ID	Number of Zones
Chelmsford Admin Area	1-146 (excluding 115)	143
Essex Area	147-269 (including 115)	122
Rest of mainland UK	301-321	21
Total		286

Table 2 Zone structure summary table

4.1.2 Journey purpose, vehicle class and user class segmentation

The journey purpose, vehicle class and user class segmentation of the model have been specified in detailed in the LMVR of the Chelmsford model. The cycling model made it necessary to append to the list of motorised trip purposes, user classes, and vehicle types.

The relationships between purpose, vehicle class and user class, including non-motorised (cycling) trips, are summarised in the table below:

Purpose	User Class (UC)	Vehicle Class (VC)	
Home Based Work (HBW)	UC1: Commute		
Home Based Employer's Business (HBEB)	UC2: Business		
Non-Home Based Employer's Business (NHBEB)		VC1: Car	
Home Based Other (HBO)	UC3: Other		
Non-Home Based Other (NHBO)			
LGV (All Trips)	UC4: LGV	VC2: LGV	
HGV (All Trips)	UC5: HGV	VC3: HGV	
Cycles (All Purposes)	UC6: Cycle	VC4: Cycle	

Table 3 Purpose, User Class and Vehicle Class Correspondence

In line with WebTAG Unit 2.6, user classes are defined to differentiate between travellers with various perceptions of travel cost, such as commute, business and other trips. Light and Heavy Goods Vehicles on employers' business are kept separate from cars on employers' business as their origins, destinations and trip distribution are likely to be substantially different.

Cycle assignment is performed separately from the rest of the user groups, where the capacity available for cyclists is informed by the assignment of the motorised user groups. Since cycle travel demand is not included in WebTAG for appraisal calculations, it was sufficient to use a single purpose cycling user class.

Buses are loaded onto the network as fixed pre-loads based on the coded timetables, therefore, they do not form part of a discrete assignment user class.



4.1.3 Modelled Time Periods

In line with the highway and PT models, the parking model was also built for AM peak, inter-peak periods. In summary, the main travel demand model is between 07:00 to 10:00 in the morning and between 16:00 to 19:00 in the evening, and is based on the average hour between 10:00 and 16:00 for the inter-peak.

The assignment models were developed for the peak hours in order model the most critical traffic conditions. The following standard time periods were used:

- Morning peak hour (08:00-09:00);
- Average inter-peak hour (average hour for 10:00-16:00); and
- Evening peak hour (17:00-18:00).

4.1.4 Modelled time horizons

The year 2014 was selected as the base year time horizon for the Chelmsford Strategic Model.

ECC requested that the travel forecast year model was developed for years 2021 and 2036 in order to be consistent with the council planning horizon. Local and national planning data was used to inform the forecast year demand models.

The new Beaulieu Park Station is assumed to become operational by the year 2021. In addition, the 2036 model includes the proposed Widford and Boreham Park and Ride facilities.

4.2 Parking Assignment Model Methodology

The Chelmsford Strategic Model was developed such that the existing station parking facilities (Townfield Street car park), and Park and Ride facilities (Sandon and Chelmer Valley) were not modelled explicitly. This was because the base year demand model was developed from mobile phone origin-destination data, which was divided into only two travel demand strata: car trips and public transport trips. Hence model calibration and validation for highway and public transport trips were each based on a single user class. The resulting base year model is accurate for both highway and public transport trips, but it does not treat existing Park and Ride trips explicitly.

Despite this, there was a need to model the travel impacts of the proposed new station parking facilities at Beaulieu Park station and the proposed new Park and Ride facilities of Widford and Boreham. The approach taken for the station parking and Park and Ride modelling is assignmentbased. New Park and Ride trips were generated by modelling car trips to/from the facilities via special public transport connectors, which represent the car leg of these trips. The park and ride connectors are in addition to the regular public transport walk connectors. This way, mode shift from existing bus only trips and car only trips was captured, without the need to develop new demand strata for Park and Ride trips.

The model is based on calculating the travel cost savings that results from the new parking facility, relative to the previously available car only (or bus only) travel modes. These cost savings are translated into the Park and Ride demand via a simplified elasticity model. Mode-specific and time-of day specific penalties were used as a proxy for the elasticity factor. The time penalties are summarized in the following sections.

The results of the station parking model and the Park and Ride model were benchmarked against traffic counts at the Townfield Street car park, Sandon Park and Ride and Chelmer Valley Park and Ride facilities. The trips that use the parking facilities result from mode shift from car only trips or bus only trips. Once the combined Park and Ride trips are generated, the car legs of the combined trips



are assigned to the corresponding highway network. Similarly, the public transport legs of the combined trips are assigned to the corresponding public transport network.

4.3 Beaulieu Park Station Parking Model

Currently, Chelmsford railway station is the only station that serves the city of Chelmsford. Each station has a service area (catchment) which is governed by the distance within which it can attract/produce trips. Once Beaulieu Park Station comes into operation, the current station catchment area will be split between these two stations. The catchment areas were modelled using the ArcGIS software and the Thiessen polygon analysis technique⁴. The catchment areas of the stations around Chelmsford in 2021 are shown in the following figure.



Figure 20: The catchment area of the railway stations near Chelmsford in 2021 and 2036

"Car connectors" were modelled for public transport trips that will use the Beaulieu Station parking to represent the car trips between the origins/destinations and the railway station. The following figure shows these connectors to/from Beaulieu park station.

⁴ Thiessen (Voronoi) polygons define individual areas of influence around a set of points. Thiessen polygons are polygons whose boundaries define the area that is closest to each point relative to all other points. They are mathematically defined by the perpendicular bisectors of the lines between all points. They can be used to estimate service areas e.g. Station access service areas.





Figure 21: Car connectors to Beaulieu park Station in the 2021 model

As shown in the figure, trips to/from Beaulieu Park station are coming from the north-east part of Chelmsford and from the rural areas north and east of the city.

The cost of using the station parking facility includes a mode-specific and a time-of-day specific penalty. The mode penalty is a proxy for the monetary cost of parking, as well representing the fact that some people may not have access to a car. The time-of-day penalty is a proxy to further limit car park departures in the AM, car park arrivals in the PM, and all trips in the inter-peak period. This reflects the observed trip pattern of park and ride facilities throughout the day. Mode and time period specific penalties are summarised below.

Station Parking		Mode Penalty (min)	Time of Day Penalty (min)	Total Penalty (min)
4.84	Arrivals	15	0	15
AM	Departures	Ban	Ban	Ban
IP	Arrivals	Ban	Ban	Ban
	Departures	Ban	Ban	Ban
РМ	Arrivals	Ban	Ban	Ban
	Departures	15	0	15

Table 4 Park and ride penalties for station parking

Based on the Townfield Street car park survey, the Beaulieu Station car park model was set up to allow arrivals in the AM peak period only and allow departures in the PM peak period only. No trip arrivals or departure were assumed for the IP period for similar reasons. Only commute trips were permitted at the Beaulieu Station parking, as this purpose accounted for 97% of the total trips at the Townfield Street station car park. The resulting car trips to/from Beaulieu Park station in the year 2021 and 2036 are summarised in the tables below.



Beaulieu Park Train Station (Vehicles)					
2021 AM PM					
Arrival	360	0			
Departure 0 164					

Table 5 Modelled Station Parking trip arrivals and departures at Beaulieu Park Station in 2021

Beaulieu Park Train Station (Vehicles)					
2036 AM PM					
Arrival	415	0			
Departure 0 195					

Table 6 Modelled Station Parking trip arrivals and departures at Beaulieu Park Station in 2036

The AM peak arrivals at the Beaulieu Park Station (2021) have been benchmarked against AM peak arrivals in Townfield Street car park (2015). Similarly, the PM peak departures at the Beaulieu Park station (2021) have been benchmarked against PM peak departures in Townfield Street car park (2015). It is noticeable that the increase in the number of trips at the station between 2021 and 2036 is not significant. This may be attributable to Boreham Park and Ride facility becoming operational by 2036, and attracting some trips away from the Beaulieu Park station's catchment area.

4.4 Widford and Boreham Park and Ride Model

Currently, Sandon Park and Ride and Chelmer Valley Park and Ride are in operation in the city of Chelmsford. Once Widford and Boreham Park and Ride facilities come into operation, the current station catchment area will be split into four quadrants, corresponding to the four parking facilities. The catchment areas were modelled by the ArcGIS software via using the Thiessen polygon analysis technique. The catchment areas of the Park and Ride facilities around Chelmsford in 2036 are shown in the following figure.





Figure 22 The catchment area of the Park and Ride facilities in Chelmsford in 2036

Public transport trips that will switch to using Widford and Boreham Park and Ride facilities were modelled via "car connectors", which are coded in the model to represent the car trips between the corresponding catchment area zones and the Park and Ride facilities. The following figure shows the connectors to/from Widford and Boreham Park and Ride facilities.



Figure 23 Car connectors to Beaulieu park station, Widford and Boreham Park and Ride facilities in the 2036 model



As shown in the figure, trips to Widford Park and Ride facility are coming from the south-west of Chelmsford, while trips to Boreham Park and Ride facility are coming from the north-east of Chelmsford. The orientation of trips to Beaulieu Park station parking facility is the same as in 2021.

Only commute trips were permitted at the Widford and Boreham Park and Ride facility, as this purpose accounted for 90% of work trips at Sandon and Chelmer Valley P&R in the AM peak hour. During the inter-peak period, according to the surveys, other trips were in the same magnitude as work trips. However, the number of other trips in inter-peak is not significant enough to warrant their inclusion in the model.

The cost of using the Park and Ride facilities has been modelled using a mode-specific and a time-ofday specific penalty. The mode penalty is a proxy for the monetary cost of parking, as well representing the fact that some people may not have access to a car. The time-of-day penalty is a proxy to further limit car park departures in the AM, car park arrivals in the PM, and all trips in the inter-peak period. This reflects the observed trip pattern of park and ride facilities throughout the day. Mode and time period specific penalties are summarised below.

Park and Ride		Mode Penalty (min)	Time of Day Penalty (min)	Total Penalty (min)
A.8.4	Arrivals	5	0	5
AIVI	Departures	5	20	25
IP	Arrivals	5	20	25
	Departures	5	20	25
РМ	Arrivals	5	20	25
	Departures	5	0	5

Table 7 Park and ride penalties for Park and Ride facilities

In order to model the public transport trips from the Park and Ride facilities, a new Park and Ride bus route was coded in the 2036 model. Based on information received from ECC, the bus route is expected to connect Widford and Boreham parking facilities by passing through the city centre. The resulting route is shown in the following figure.





Figure 24 Park and Ride bus route between Boreham and Widford

Based on the Sandon and Chelmer Valley Park and Ride surveys, the Widford and Boreham parking model was set up to allow trip arrivals and departures in all time periods for the HBW trip purpose.

The resulting modelled car trips to/from Widford and Boreham Park and Ride facilities in the year 2036 are summarised in the tables below.

Boreham Park & Ride (Vehicles)				
2036	AM	IP	PM	
Arrival	77	6	13	
Departure	21	8	47	

Table 8 Modelled Park and Ride trip arrivals and departures to/from the Boreham Park and Ride facility in 2036

Widford Park & Ride (Vehicles)			
2036	AM	IP	PM
Arrival	224	13	27
Departure	38	27	140

Table 9 Modelled Park and Ride trip arrivals and departures to/from the Widford Park and Ride facility in 2036

The AM peak arrivals were at 77 and 224 vehicles at the Boreham and Widford Park and Ride facilities, respectively. The PM peak departures are 47 and 140 vehicles at the same facilities. These results have been benchmarked against AM peak arrivals in Sandon and Chelmer Valley Park and Ride facilities in 2011.

In the future, when all four Park and Rides are operational, the model suggests that Sandon will still attract the highest parking demand of the Park and Ride sites, followed by Widford and Chelmer Valley. Based on the model, Boreham Park and Ride will attract the lowest parking demand of the



facilities. Based on the model, Widford Park and Ride will attract more trips than Boreham Park and Ride, since on the one hand it will be the preferred facility for trips from/to London, while on the other it stands alone without a competing parking facility nearby, whilst Beaulieu Park station parking shares its catchment area with Beaulieu Park station parking.



5. Park and Ride Trip Assignments

5.1 Year 2021 Highway Assignments

Detailed methodology of the car, LGV and HGV assignments of the Chelmsford Strategic Model can be found on the LMVR Chapter 6.1. This section shows the result of the highway assignment of just the new parking and park and ride trips in the vicinity of the new parking facilities in year 2021 and 2036.

The Beaulieu station car park is assumed to become operational in the year 2021. The results of the Park and Ride trip highway assignment in the AM and PM peak hours are shown in the following figures.



Figure 25 Car trips to/from Beaulieu Park station parking in the AM peak hour in 2021





Figure 26 Car trips to/from Beaulieu Park station parking in the PM peak in 2021

The figures show that car trips to Beaulieu car park are coming from eastern part of Chelmsford as well as from north and east of the city. Trips in the AM peak travel to the station and trips in the PM peak travel from the station.

Park and Ride and Station Parking Model Technical Note



5.2 Year 2036 Highway Assignments

In addition to Beaulieu Park station car park, which is expected to be operational by 2021, the Boreham and Widford Park and Ride facilities will be operational by 2036. The results of the parking trip highway assignment by 2036 for the AM, IP and PM peak hours are shown in the following figures.



Figure 27 Car trips to/from Beaulieu station parking and Boreham Park and Ride in the AM peak in 2036



Figure 28 Car trips to/from Widford Park and Ride in the AM peak in 2036

The figures show that in the AM peak, car trips to Beaulieu Park station car park and Boreham Park and Ride are coming from the eastern part of Chelmsford as well as from north and east of the city. Trips to Widford Park and Ride are coming from south and west of the city.





Figure 29 Car trips to/from Beaulieu station parking and Boreham Park and Ride in the average IP in 2036



Figure 30 Car trips to/from Widford Park and Ride in the average IP in 2036

The figures show that in the inter-peak, car trips to Beaulieu station car park and Boreham Park and Ride are coming from the eastern part of Chelmsford as well as from north and east of the city. Trips to Widford Park and Ride are coming from south and west of the city.





Figure 31 Car trips to/from Beaulieu station parking and Boreham Park and Ride in the PM peak in 2036



Figure 32 Car trips to/from Widford Park and Ride in the average PM peak in 2036

The figures show that in the inter-peak, car trips from Beaulieu station car park and Boreham Park and Ride are going to the eastern part of Chelmsford as well as to north and east of the city. Trips from Widford Park and Ride are going to south and west of the city.

Car only, LGV and HGV highway assignment results may be found in the LMVR and TFR reports of the Chelmsford Strategic Model.



6. Public Transport Trip Assignments

6.1 Year 2021 Public Transport Assignment

The methodology of the public transport assignment can be found on the LMVR Chapter 6.3. The purpose of this section is to show the results of the Public Transport assignments in the vicinity of the new parking facilities by 2021 and 2036.

The Beaulieu Park station car park is expected to become operational by 2021. The results of the public transport assignment in the AM and PM peak hours, including Park and Ride trips, are shown in the following figures.



Figure 33 Public transport trips near Beaulieu Park station in the AM peak in 2021





Figure 34 Public transport trips near Beaulieu Park station in the PM peak in 2021

The assignment plots in 2021 show public transport trips to/from the new Beaulieu Park station.

6.2 Year 2036 Public Transport Assignment

Besides Beaulieu Park station car park, which is expected to operational by 2021, the Boreham and Widford Park and Ride facilities are assumed to be operational by 2036. The results of the public transport assignments for 2036 in the AM, IP and PM peak hours, including Park and Ride trips, are shown in the following figures.





Figure 35 Public transport trips near Beaulieu Park station and Boreham Park and Ride in the AM peak in 2036



Figure 36 Public transport trips near Widford Park and Ride in the AM peak in 2036

The assignment plots show public transport trips to/from the new Beaulieu station and the Boreham and Widford Park and Ride facilities by 2036 in the AM peak.





Figure 37 Public transport trips near Beaulieu Park station and Boreham Park and Ride in the average IP in 2036



Figure 38 Public transport trips near Widford Park and Ride in the average IP in 2036

The assignment plots show public transport trips to/from the new Beaulieu station and the Boreham and Widford Park and Ride facilities by 2036 in the inter-peak.





Figure 39 Public transport trips near Beaulieu Park station and Boreham Park and Ride in the PM peak in 2036



Figure 40 Public transport trips near Widford Park and Ride in the PM peak in 2036

The assignment plots show public transport trips to/from the new Beaulieu station and the Boreham and Widford Park and Ride facilities by 2036 in the PM peak.



7. Conclusions

The role of the Parking Model is to model the impact of the new station parking facilities at Beaulieu Park and the new Park and Ride facilities at Widford and Boreham in 2021 and 2036. The impact of these combined trips is modelled in the public transport assignment model using a simplified elasticity approach. The Parking Model is integrated into the Chelmsford Strategic Model forecasts for years 2021 and 2036, and follows the same general methodology, described in the TFR and the Variable Demand Modelling (VDM) note. The model has been developed and validated according to the WebTAG guidance.

A limitation of the Parking Model is that park and ride trips are not modelled explicitly in the base year (2014), due to due to data limitations. Nevertheless, the approach to model future station and park and ride parking provides reliable estimates of the impact of the future facilities, since the likely changes to catchment areas have been considered. Another limitation is that the Parking Model time penalty was estimated by benchmarking the model results against existing parking counts. This implies that in case of a significant change in future congestion or fares, the Parking Model will need to be revalidated. Although the model does not take parking capacity into account explicitly, this is not regarded as a limitation of this work, because the parking demand for Beaulieu Park, Widford and Boreham is expected to remain below respective car park capacities in the foreseeable future.

The model could be used in the future to model other proposed parking facilities using the methodology explained in this report. Should the location of the planned facilities change, the facilities be removed from plans, or additional facilities are proposed, the model will need to be updated. This work would be limited to revising the car connectors in the supply model, and therefore, may be done at relatively low cost.



Appendix A. Chelmsford City Centre Car Park Survey questionnaire (January 2015)

	Serial
	Integrated expertise
	Chelmsford City Centre Car Park Survey
Freepost RTEG-UKZT- KEHK Chelmsford City Centre Car Park Survey Jacobs Victoria House 101-105 Victoria Road Chelmsford, Essex CM1 1JR	On behalf of Essex County Council, Highways are carrying out a survey to build a transport model to test a variety of transport infrastructure in Chelmsford. The information you provide will assist in determining the existing travel patterns in Chelmsford so that we can then plan for the future. Thank you for taking the time to fill in this questionnaire. Your comments are appreciated. DATA WILL BE PROCESSED IN ACCORDANCE WITH THE DATA PROTECTION ACT 1998. ESSEX COUNTY COUNCIL IS THE DATA CONTROLLER.
	THANK YOU FOR YOUR CO-OPERATION. Please fold this card, seal it and post it back to us No stamp needed
_	IF YOU WOULD LIKE TO KNOW MORE ABOUT THESE SURVEYS OR WOULD LIKE THIS QUESTIONNAIRE IN A DIFFERENT FORMAT PLEASE CALL: 0845 603 7631
Q1 Where did you come from before arriving at this car park? Please circle one number.	Q8 How frequently are you making this journey? Please circle one number
Q1 Where did you come from before arriving at this car park? Please circle one number. 1 1 Home 2 Other 2 Q2 How long did this car trip take?	Q8 How frequently are you making this journey? Please circle one number 1 4-5 days a week 4 About 1-2 times a 2 2-3 days a week month 3 About 1 day a week 5 Once a month or less
Q1 Where did you come from before arriving at this car park? Please circle one number. 1 Home 2 Other Q2 How long did this car trip take? Image: Comparison of the place? Image: Comparison of the place? Q3 What was the postcode of that place? Image: Comparison of the place? Image: Comparison of the place? Q3 What was the postcode of that place? Image: Comparison of the place? Image: Comparison of the place? Q6 If not known, please give as much information as possible about the address below. Image: Comparison of the place? Image: Comparison of the place? Venetic to the out the address below. Image: Comparison of the place? Image: Comparison of the place? Image: Comparison of the place? Venetic to the out the address below. Image: Comparison of the place? Image: Comparison of the place? Image: Comparison of the place? Venetic to the out the address below. Image: Comparison of the place? Image: Comparison of the place? Image: Comparison of the place? Venetic to the out to the out the address below. Image: Comparison of the place? Image: Comparison of the place? Venetic to the out	Q8 How frequently are you making this journey? Please circle one number 1 4-5 days a week 4 About 1-2 times a 2 2-3 days a week 5 Once a month or less Q9 What time did you arrive at and leave the car park? Arrival (24 hour clock) Epidemic (24 hour clock) (24 hour clock)
Q1 Where did you come from before arriving at this car park? Please circle one number. 1 1 Home 2 Other Q2 How long did this car trip take? H H : M M Q3 What was the postcode of that place? M M Q6 What was the postcode of that place? Image: Comparison of the postcode of that place? Q6 What was the postcode of that place? Image: Comparison of the postcode of the place? Q7 M hat was the postcode of that place? Image: Comparison of the place? Q4 How many people were in the vehicle, including yourself? Image: Comparison of the place?	Q8 How frequently are you making this journey? Please circle one number 1 4-5 days a week 4 About 1-2 times a month 2 2-3 days a week 5 Once a month or less 3 About 1 day a week 5 Once a month or less Q9 What time did you arrive at and leave the car park? Arrival (24 hour clock) Departure (24 hour clock) Q10 Where did you drive to after leaving this car park? Please circle one number (2) Other
Q1 Where did you come from before arriving at this car park? Please circle one number. 1 Home 2 Other Q2 How long did this car trip take? H H : M M Q3 What was the postcode of that place? OR if not known, please give as much information as possible about the address below. Image: Comparison of the	Q8 How frequently are you making this journey? Please circle one number 1 4-5 days a week 4 About 1-2 times a month 2 2-3 days a week 9 Mattine did you arrive at and leave the car park? Final Plant Pla
Q1 Where did you come from before arriving at this car park? Please circle one number. 1 Home 2 Other Q2 How long did this car trip take? Image: Comparison of the place? Image: Comparison of the place? Q3 What was the postcode of that place? Image: Comparison of the place? Image: Comparison of the place? Q3 What was the postcode of that place? Image: Comparison of the place? Image: Comparison of the place? Q4 How many people were in the vehicle, including yourself? Image: Comparison of the place? Image: Comparison of the place? Q4 How many people were in the vehicle, including yourself? Image: Comparison of the place? Image: Comparison of the place? Q6 While your car was parked, where did you go? Please circle one number 5 Leisure activities 1 Home 5 Leisure activities 6 2 Usual place of Work 3 Other Workplace/Employer's business 5 4 Shops or local services 6 Other (please specify) 4	Q8 How frequently are you making this journey? Please circle one number 1 4-5 days a week 4 About 1-2 times a month 2 2-3 days a week 5 Once a month or less 3 About 1 day a week 5 Once a month or less Q9 What time did you arrive at and leave the car park? Arrival (24 hour clock) Departure (24 hour clock) Q10 Where did you drive to after leaving this car park? Please circle one number (24 hour clock) Q10 Q11 Home 2 Other Q11 Home log solide about the address below. Q12 What was the postcode of that place? Image: Image group? Image: Image group? Image: Image
Q1 Where did you come from before arriving at this car park? Please circle one number. 1 Home 2 Other Q2 How long did this car trip take? Image: State St	Q8 How frequently are you making this journey? Please circle one number 1 4-5 days a week 4 About 1-2 times a month 2 2-3 days a week 5 Once a month or less 3 About 1 day a week 5 Once a month or less Q9 What time did you arrive at and leave the car park? Arrival (24 hour clock) Departure (24 hour clock) Q10 Where did you drive to after leaving this car park? Please circle one number 1 Home 2 Other Q11 How long did this car trip take? Image: Street:



Appendix B. Chelmsford Park and Ride questionnaire (June 2011)

Q16 How would you rate the following aspects of the Park and Ride service? Please also rank the <i>three</i> aspects that are most important to you in order of preference, with 1 being the most important. <i>Evenlinet</i> Good Fair Poor Bank	Serial No. Essex Works.
Quality of parking facilities	Chelmsford Park and Ride Survey 2011 On behalf of Essex County Council, Mouchel are carrying out a survey to find out what you think of this Park and Ride service. The results from this survey will be used to inform Transport Planning, Public Transport and Marketing Strategies for the Park and Ride. Thank you for taking the time to fill in this questionnaire. Your comments are appreciated. Q1 Where have you travelled from today? Postcode
Q17 How did you hear about the Park and Ride service? (Tick all that apply) Passed by site Press Advert Press Story Website	Q4 Do you hold a concessionary bus pass? Yes No
Word of mouth Social Media (i.e. ECC twitter or facebook pages)	5 days or more a week 1-2 days a week First time 3-4 days a week Less frequently
Q18 Your views are important to us, please feel free, in the space provided below, to write any further comments you have with regards to the Park and Ride service.	Q6 How long do you typically tend to stay at the site? Under 1 hour 2-3 hours 1-2 hours 3-4 hours Over 9 hours
	Q7 What is your main reason for using the Park and Ride? (Tick only one) Cheaper than parking in Chelmsford More convenient Quicker than using other modes of transport Safer
Please return your completed questionnaire and pen to the survey supervisor as you exit the bus.	Can use concessionary pass Less stressful Other (please specify) Please turn over
Data Protection: Essex Countly Council handles information in accordance with the Freedom of Information Add 2000 and the Data Protection Add 1998 and is the Data Controller. Your answers are strictly voluntary and will only be used for transport planning purposes in Chelmsford. The information will be processed by a third party on behalf of Essex Countly Council. Data will be aggregated and heid until to longer needed for these purposes. If you have any concerns about the way we handle personal information or would like to see any personal information held on you by Essex Countly Council please contact Information Sharing Information Security (SIS): Essex Countly Council, PO Box 11, Chelmsford, CM1 1LX., 01245 431851, isis@essexcc.gov.uk	Essex County Council
Q8 What is your <i>main</i> purpose for travelling to Chelmsford today?	Q13 If you drove where did you previously park in Chelmsford?
Q8 What is your <u>main</u> purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer). Train Station (please state final destination).	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: Was the car park: □ Short stay or □ Long stay
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer) Train Station (please state final destination) Education (please state school/college/university) Shopping	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: Was the car park: □ Short stay <u>or</u> □ Long stay □ Private Car Park □ On Street → Was this space: □ Pay & Display <u>or</u> □ Free
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer) Train Station (please state final destination) Education (please state school/college/university) Shopping Tourism/Leisure Visiting friends and family Personal Business (Dentist, doctors, bank etc) Other (clease exact)	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: Was the car park: □ □ Private Car Park □ On Street → Was this space: □ □ Park at his space: □ □ On the map below, which route would you have previously used to travel into Chelmsford? □ Please circle the number below which represents the route into town you used to take
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer) Train Station (please state final destination) Education (please state school/college/university) Shopping Tourism/Leisure Visiting friends and family Personal Business (Dentist, doctors, bank etc) Other (please specify) Q9 How do you typically travel to the Park and Ride? Car/van → Driver	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: Was the car park: □ Short stay <u>or</u> □ Long stay □ Private Car Park □ On Street → Was this space: □ Pay & Display <u>or</u> □ Free Q14 On the map below, which route would you have previously used to travel into Chelmsford? Please circle the number below which route mould you have previously used to travel into Chelmsford? Please circle the number below which route mould you have previously used to travel into Chelmsford? Please circle the number below which route mould you have previously used to travel into Chelmsford? Please circle the number below which route mould you have previously used to travel into Chelmsford?
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer)	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: □ Was the car park: □ □ Private Car Park □ On Street → Was this space: □ □ Pay & Display <u>or</u> □ □ Free Q14 On the map below, which route would you have previously used to travel into Chelmsford? □ Please circle the number below which represents the route into town you used to take □ Image: 0 □<
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer)	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: □ Was the car park: □ Short stay <u>or</u> □ Long stay □ Private Car Park □ On Street → Was this space: □ Pay & Display <u>or</u> □ Free Q14 On the map below, which route would you have previously used to travel into Chelmsford? Please circle the number below which represents the route into town you used to take Broomfed of BRANTEE Chelmer Valley Park and Ride UNETLE PIBHOPS Broomfed Road UNETLE PIBHOPS Broomfed Road UNETLE PIBHOPS
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer)	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: □ Was the car park: □ Short stay <u>or</u> □ Long stay □ Private Car Park □ On Street → Was this space: □ Pay & Display <u>or</u> □ Free Q14 On the map below, which route would you have previously used to travel into Chelmsford? Please circle the number below which represents the route into town you used to take
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer)	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: □ Was the car park: □ Short stay <u>or</u> □ Long stay □ Private Car Park □ On Street → Was this space: □ Pay & Display <u>or</u> □ Free Q14 On the map below, which route would you have previously used to travel into Chelmsford? Please circle the number below which represents the route into town you used to taxe Was the car park → Chelmsford? Please circle the number below which represents the route into town you used to taxe Was the car park → Chelmsford? Please circle the number below which represents the route into town you used to taxe Was the car park → Chelmsford? Please circle the number below which represents the route into town you used to take Was the car park → Chelmsford 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer)	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: □ Was the car park: □ □ Private Car Park □ On Street → Was this space: □ □ Park and Ride □ On Street → Was this space: □ Park and Ride Private Car Park □ On Street → Was this space: □ Park and Ride Pree Off On the map below, which route would you have previously used to travel into Chelmsford? Please circle the number below which represents the route into town you used to take Or free On free route of the route into town you used to take If worned of the route into town you used to take On officer route of the route into town you used to take On officer route of the route into town you used to take On officer route of the route into town you used to take On officer route of the route into town you used to take On officer route of the route into town you used to take On officer route of the route into town you used to take On officer route of the route into town you used to take
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer)	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: □ Was the car park: □ Short stay <u>or</u> □ Long stay □ Private Car Park □ On Street → Was this space: □ Pay & Display <u>or</u> □ Free Q14 On the map below, which route would you have previously used to travel into Chelmsford? Please circle the number below which represents the route into town you used to take Provide to travel into Chelmsford? Please circle the number below which represents the route into town you used to take We find the find th
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer)	Q13 If you drove, where did you previously park in Chelmsford? Public Car Park → Name: Was the car park: Short stay <u>or</u> Long stay Private Car Park On Street → Was this space: Pay & Display <u>or</u> Free Q14 On the map below, which route would you have previously used to travel into Chelmsford? Please circle the number below which represents the route into town you used to taxe Was the car park to travel into Chelmsford? Please circle the number below which represents the route into town you used to taxe Was the car park to travel into Chelmsford? Please circle the number below which represents the route into town you used to taxe Was the car park to travel into Chelmsford? Please circle the number below which represents the route into town you used to take Was the car park to travel into Chelmsford? Please circle the number below which represents the route into town you used to take Was the car park to travel into Chelmsford? Please circle the number below which represents the route into town you used to take Was the car park to travel into Chelmsford? Chelmer Valley Was the car park to the proving the ration of the tax and Ride Was the car park to the proving the ration of the proving the ration of the park and Ride Was the car park to the proving the ration of the proving the
Q8 What is your main purpose for travelling to Chelmsford today? (Tick only one) Work in Chelmsford (please state employer). Train Station (please state final destination) Education (please state school/college/university) Shopping Tourism/Leisure Visiting friends and family Personal Business (Dentist, doctors, bank etc) Other (please specify) Q9 How do you typically travel to the Park and Ride? Car/van → Driver Passenger (car share) Dropped off Walk Cycle Motorcycle Motorcycle Q10 If you came by car today, how many people including yourself travelled in the car/van with you? Number of adults Number of under 16s Q11 What mode of transport did you use to access Chelmsford prior to using this Park and Ride? Car/van → Driver Passenger (car share) Dropped off Bus → Bus route Number Dropped off Station travelled from Dropped off Bus → Bus route Number Dropped off G11 What mode of transport did you use to access Chelmsford Drirt in a > Station travelled	Q13 If you drove, where did you previously park in Chelmsford? □ Public Car Park → Name: □ Was the car park: □ Short stay <u>or</u> □ Long stay □ Private Car Park On Street → Was this space: □ Pay & Display <u>or</u> □ Free Q14 On the map below, which route would you have previously used to travel into Chelmsford? Please circle the number below which represents the route into town you used to take Image: Chelmer Valley Park and Ride Chelmer Valley Image: Chelmer Valley Image: Chelmer Valley Park and Ride Image: Chelmer Valley Image: Chelmer Valley Sandon Image: Chelmer Valley Image: Chelmer Valley Image: Chelmer Valley Image: Chelmer Valley Image: Chelmer Valley Image: Chelmer Valley Image: Chelmer Valley Image: Chelmer Valley Image: Chelmer Valley Image: Chelmer Valley opened Image: Chelmer Valley opened <t< td=""></t<>



Appendix C. Link type specification

Link Type	NAME	NUMLANES
0	Blocked opposite direction	0
1	Rural dual 4 motorway	4
2	Rural dual 3 motorway	3
3	Rural dual 2 motorway	2
4	Rural dual 3 all purpose	3
5	Rural dual 5 motorway	5
6	Rural dual 6 motorway	6
7	Rural dual 1 motorway slip	1
10	Suburban dual 2 slight development	2
11	Suburban dual 2 typical development	2
12	Suburban dual 2 heavy development	2
13	Suburban single slight development	1
14	Suburban single typical development	1
15	Suburban single heavy development	1
16	Suburban dual 3 heavy development	3
17	Suburban dual 3 slight development	3
18	Suburban dual 4 slight development	4
19	Suburban single slight development HGV ban	1
20	Suburban single typical development HGV ban	1
21	Suburban single heavy development HGV ban	1
23	Rural single carriageway 10m good	1
24	Rural single carriageway 10m typical	1
25	Rural single carriageway 7.3m good	1
26	Rural single carriageway 7m typical	1
27	Rural single carriageway 6.5m bad	1
28	Rural single carriageway 5m awful	1
29	Rural single carriageway 10m typical HGV ban	1
30	Rural single carriageway 7.3m good HGV ban	1
31	Rural single carriageway 7m typical HGV ban	1
32	Rural single carriageway 6.5m bad HGV ban	1
33	Rural carriageway typical 2 lanes	2
34	Rural single carriageway 5m awful HGV ban	1
41	Urban non-central 50% development	1
42	Urban non-central 80% development	1
43	Urban non-central 100% development	1
44	Urban non-central 50% development HGV ban	1
45	Urban non-central 80% development HGV ban	1
46	Urban non-central 100% development HGV ban	1
47	Urban non-central 80% development 2 lanes	2
48	Urban non-central 80% development 2 lanes HGV ban	2



Link Type	NAME	NUMLANES
49	Urban non-central 80% development 3 lanes	3
51	Small town 35% development	1
52	Small town 60% development	1
53	Small town 90% development	1
54	Small town 35% development HGV ban	1
55	Small town 60% development HGV ban	1
56	Small town 90% development HGV ban	1
60	Urban central INT = 2	1
61	Urban central INT = 4.5	1
62	Urban central INT = 9	1
63	Urban central INT = 2 HGV ban	1
64	Urban central INT = 4.5 HGV ban	1
65	Urban central INT = 9 HGV ban	1
70	Roundabout Circulate 4	4
71	Roundabout Circulate 3	3
72	Roundabout Circulate 2	2
73	Roundabout Circulate 1	1
78	Walk Links (Cycle dismount)	1
79	Walk Links Stations Access (Cycle dismount)	1
80	Walk Links	1
81	Residential Road	1
82	Cycling Paths	1
83	(Cycling signals) Urban central INT = 4.5 HGV ban	1
84	(Cycling signals) Residential Road	1
85	(Cycling signals) Suburban single heavy development	1
86	(Cycling signals) Rural carriageway 7m typical 2 lanes	2
87	(Cycling signals) Suburban dual 2 heavy development	2
88	(Cycling signals) Urban non-central 80% development	1
89	(Cycling signals) Suburban dual 4 slight development	4
90	Single track road	1
95	Bus only	1
96	Car Park	1
97	Rail Link	1
98	LU Links	1