REF- CBC/0046/2/2

Colchester Local Plan Modelling Support

Transport Planning

04/04/2016

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Essex County Council

Document Control Sheet

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Report Title	Colchester Local Plan Modelling Support
Project Number	B3553R0Q
Status	Final Draft
Revision	Rev4
Control Date	15/09/16

Record of Issue

Issue	Status	Author	Date	Check	Date	Review	Date
1	Draft	TW/AG	06/01/16	PK	07/01/16	AC	08/01/16
2	Final Draft	HB	31/03/16	AG	04/04/16	TW	04/04/16
3	Amended Version	YS	31/08/16	DH	01/09/16	TW	01/09/16
4	Final	AD	14/09/16	TW	15/09/16	TW	15/09/16

Approved for Issue By	Date
Tom Withey	15/09/2016

Distribution

Organisation	Contact	Number of Copies
ECC	Alan Lindsay	Electronic

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Executive Summary

The transport impacts of different options for development arising out of Colchester's emerging Local Plan were tested in a strategic model. The model used was based on the existing Colchester Area SATURN (CAS) model. New forecast scenarios were created reflecting the different scenario options for the Local Plan.

A variable demand model was also built which assessed the potential for mode shift to occur due to changes in the highway and public transport supply in the future. The trip matrices for each scenario resulting from the variable demand model were assigned to an updated future year network.

Taking the results from the variable demand model, junction models were built to test, at a detailed level, the impacts of reassignment. The junction model was also used to test the new development trip generation on the junctions of a proposed new link road between the A120 and A133.

This report solely focusses on the background and the methodology of the Local Plan Modelling project. The results of the modelling are covered in a separate technical note.

1 Introduction

1.1 Background

Colchester Borough Council (CBC) has asked Essex County Council (ECC) to provide transport modelling evidence to support the emerging Local Plan and the Tendring/Colchester border development known as the Eastern Garden Suburb, the Marks Tey Garden Community on the Colchester/Braintree border and a Northern Garden Suburb in the Langham area. Essex County Council through Essex Highways has subsequently asked Jacobs, as their framework consultants, to carry out this work.

1.2 Scope of work

CBC has identified a number of different scenarios for future year development growth within the emerging Local Plan, which covers the period 2017-2032 . Each scenario will be assessed to identify its likely transport impact. The modelling outputs of each scenario will be compared, in order to aid CBC's understanding of the varying scale of impact, both overall and localised, within Colchester Borough.

The objectives of the project can be summarised as thus:

- To model the impact of development in Colchester and the surrounding authorities on the transport network, including highway and public transport
- To compare the impacts of a number of different scenarios to identify the varying scale of impacts on the highway and public transport network.
- To make best use of existing available model tools for the assessment including the existing Colchester Area SATURN (CAS) model.
- To produce a report summarising the results of the modelling which describes the impact of the scenarios. The report will not identify a "preferred" scenario; this is for CBC and ECC to do on the basis of the evidence in the report.

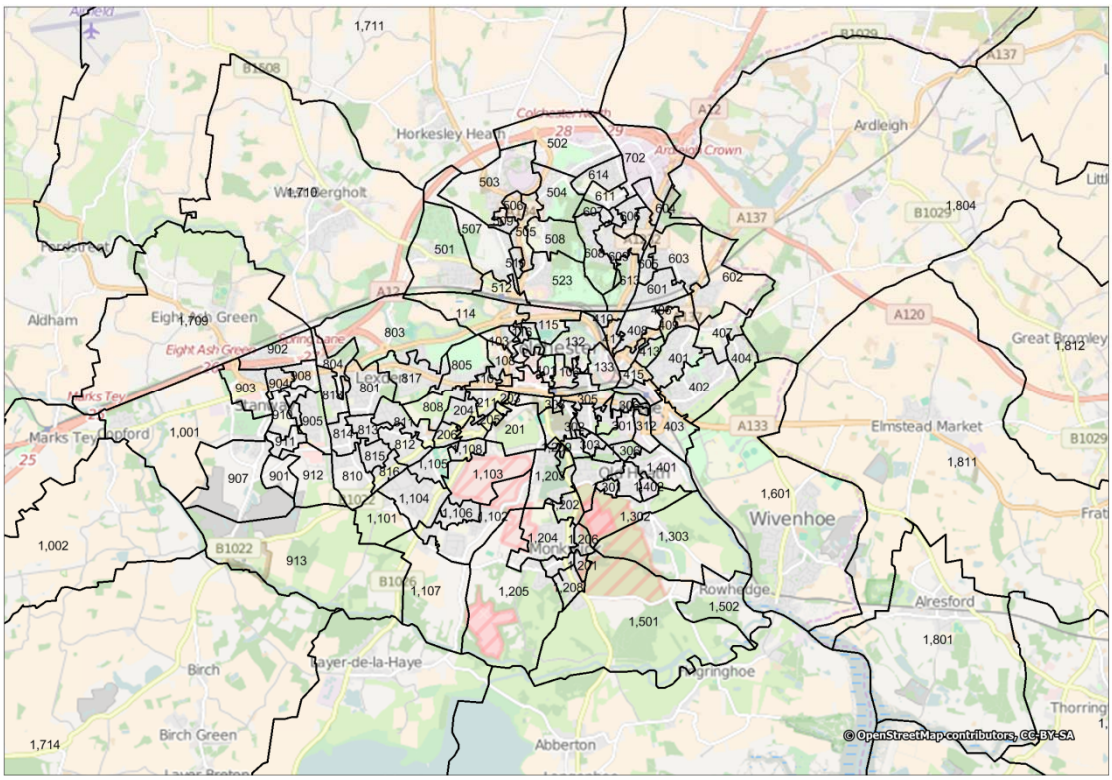
The CAS model is an existing model developed by ECC's prior framework consultant in 2009 and has a 2007 base year. The technical detail of the model is provided in the Local Model Validation Report[1] and the Forecasting Report[2].

This report will solely focus on the background and the methodology used in the Local Plan Modelling project. The modelling results are separately set out in a technical report published in July 2016.

1.3 Zoning System

The zoning system used for the strategic modelling for this project is shown below in Figure 1. The zoning system is based on the existing Colchester Saturn model, developed by Mouchel for ECC. This SATURN model was developed in 2009 and the zones below are those included in the base year.

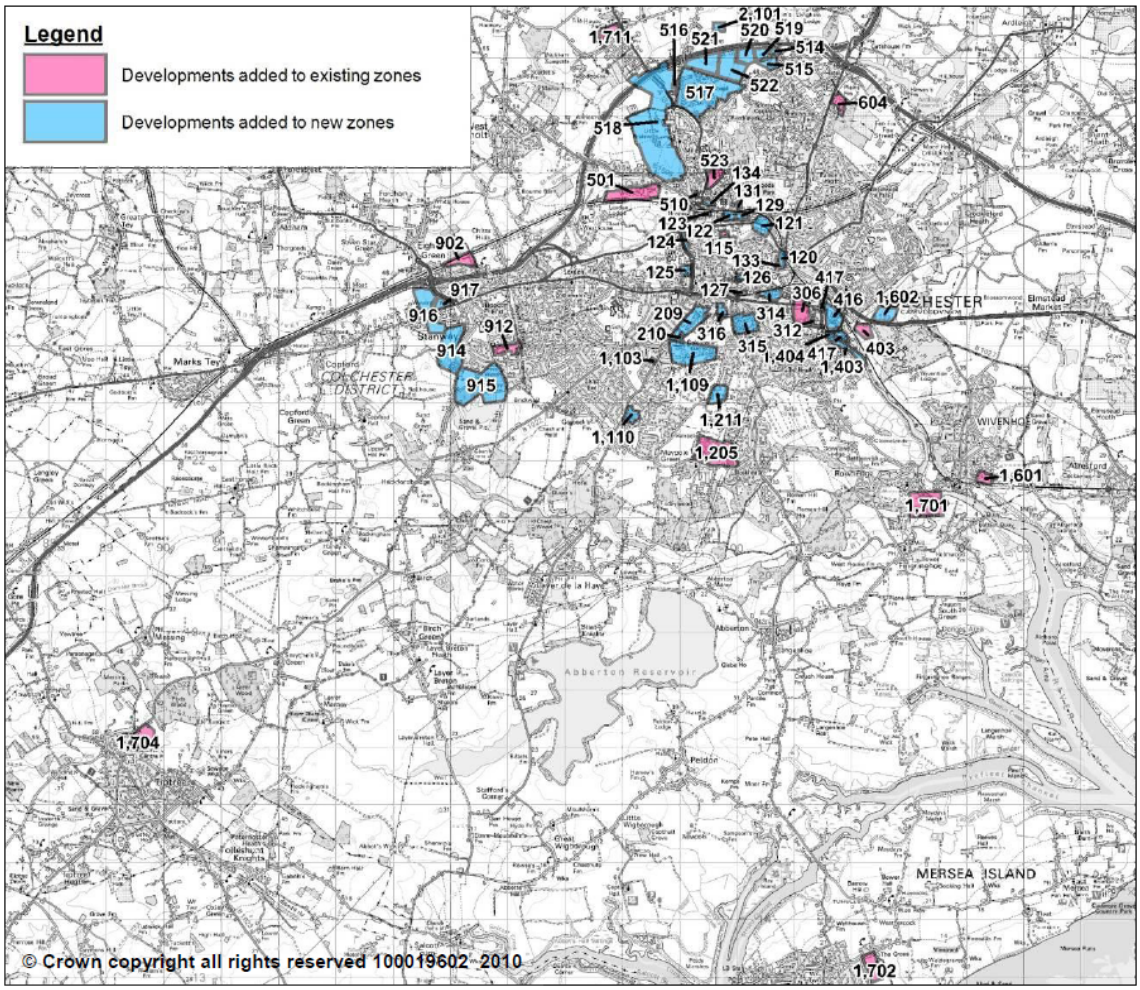
Figure 1: Zoning System in Colchester



[1] Colchester Area SATURN Model – Local Model Validation Report, AM Peak Hour, Inter-Peak Hour and PM peak hour, November 2009.
[2] Colchester Areas SATURN (CAS) Model – AM and PM Peak Forecasting Report, 8 August 2011.

In the forecast year, additional zones have been added to accommodate committed development. These additional zones are illustrated below (note that these figures have been extracted from the original model forecast report by Mouchel, produced in 2011):

Figure 2: Additional forecast zones



2 Development Scenarios

2.1 Overview

The impacts of potential Local Plan development in and around Colchester were assessed using a scenario based approach, in which three different development scenarios were tested. In each of these, development was focussed around a different part of the borough, whilst each maintained approximately the same level of development overall. Three scenarios, representing a 2032 forecast year, were tested:

- Scenario 1; with development focussed to the east and west
- Scenario 2; with development focussed to the west
- Scenario 3; with development focussed to the east and north

In addition, a 'maximum growth' scenario (Full development) was developed, which encapsulated the total amount of growth that could possibly be expected to come forward. This scenario was devised without a clear idea of the forecast year, as the timeline over which the amount of development could be delivered was not known. However, for the purposes of modelling, a nominal 2047 forecast year was assumed, as a potential horizon year for the completion of development.

For comparison purposes a "current allocated growth" scenario, with a 2032 forecast year but none of the Local Plan development, tested in scenarios 1-3, was also modelled. This forecast, as with all scenarios, did include committed and current Local Plan development (as contained in the Colchester Core Strategy and Site Allocations Plan), as detailed in the original model's forecasting report and was updated to take account of changes in proposals since the original forecast model was developed.

2.2 Current allocated development scenario

A scenario which did not include any of the Emerging Local Plan development was modelled to provide a reference case for all the 'with development' scenarios.

This included only committed development as outlined in the current Local Plan, and detailed in the forecast report for the original modelling. Given that the assumptions used in the original forecast model are now over four years old, the detail of this report was reviewed by CBC to check that if it was still reflective of the current view of the future. As a result of this review, a number of

changes were made to the assumptions of committed development. A full list of development assumed for this scenario, with any changes to the original modelling highlighted, is contained in Appendix A.

A total of 12,263 dwellings, 164,600sqm GFA employment and 49,400sqm retail have been included in the ‘current allocated development’ scenario.

3 Modelling Methodology

3.1 Models used

To make best use of available data, the existing Colchester Saturn model, developed by Mouchel for ECC was used. The SATURN model was developed in 2009 and has a base year of 2007 and two specific peak hour time periods:

- AM peak hour (08:00 - 09:00),
- PM peak hour (17:00 - 18:00)

The model originally had a 2023 forecast year, hence the model has been updated to a 2032 forecast year, encapsulating all of the required development.

A description of the methodology is provided below; where the methodology deviates from that of the original forecast modelling, it is made explicit.

A new variable demand model has also been developed in order to capture the effects of mode choice. This has been developed using a completely new methodology, not previously used for the original model, and is described in more detail in section 3.4.

3.2 Demand calculation

The calculation of the initial demand model for each scenario used almost exactly the same methodology as the original forecast modelling work. Demand was calculated by applying appropriate trip rates from TRICS to the identified development data for each scenario. The rates are the same as used in the original forecasting work.

Trips are distributed in a manner which is again, consistent with the original forecast modelling work. For housing developments, trips are distributed by using ‘donor’ zones from the base year. For employment and retail developments, the trip distribution is derived from the 2001 census journey to work dataset. The 2011 census data was not available at the time the original forecast year matrices were created. The calculated demand from the forecast development is added on top of the base year trip matrix. Further information on this methodology is available in the original model’s forecast report.

Once the trip generation and trip distribution has been calculated, background growth from Tempro is applied. For scenarios 1-3 the total demand will be capped to Tempro levels as agreed with Colchester Borough Council. In this methodology, there is a change from the original forecast modelling. Originally,

NTEM v5.4 was used as the dataset, and growth was capped to Tempro by capping the trip ends, as was appropriate at the time. Since the model was originally created, there has been an update to NTEM v6.2, and the methodology for capping trips, as mandated in WebTAG, has changed so that for the purposes of the local plan modelling, the capping of trips is applied by adjusting the underlying NTEM planning data, rather than the outturn trip generation. As with the original methodology however, growth in Colchester is calculated by aggregating NTEM zones at the district level (rather than maintaining the NTEM zones separately).

Therefore, the total development increase in terms of jobs and households is discounted from Tempro using the alternative planning assumptions facility. The employment and retail land uses are converted from gross floor area to jobs using employment densities taken from the Homes and Communities guide[3] which is widely used and accepted as a reliable indicator of employment densities, or values used in the original modelling work, where available. The specific densities used, and their source, are summarised below:

Table 1 Assumed employment densities

Land use	Employment density (m^2 per FTE)	Source data
A1	50	Original model
A1S	14	Original model
A3	18	HCA guide, table 3
A4	18	HCA guide, table 3
B1	12	HCA guide, table 3, general office
B2	36	HCA guide, table 3
B8	70	HCA guide, table 3, general warehouse and distribution
D2	90	HCA guide table 3, cinema

The adjustments are used to produce revised growth factors, which are then applied to the base year trips ends, onto which the forecast trip generation is

[3] https://www.gov.uk/government/publications/employment-densities-guide

added. This provides a new trip end total, to which the 'base year plus forecast development' is factored using a furness process.

The 'current allocated development' scenario is not capped to Tempro; it represents a lower level of development than scenarios 1-3 so should not be capped. The growth factors used are the same as those calculated for scenario 1, i.e. with Local Plan development from that scenario discounted from the background growth calculation, but without the development being explicitly modelled. The total assumed development, either modelled explicitly or through Tempro, is therefore lower than that assumed in scenarios 1-3.

Committed sites with fewer than 50 dwellings were not modelled explicitly as they were assumed to be covered by background TEMPRO growth. Similarly, wider growth outside of Colchester district (e.g. in Braintree and Tendring) is also accounted for through Tempro growth, and in some instances, with specific development as well.

3.3 Network modelling

The forecast network was based on the original modelling work, however a number of committed schemes expected to come forward by 2032 and not included in the original modelling, were added. These include the following:

- Ipswich Road to Harwich Road Highway Improvements (double mini roundabouts converted into single large roundabout)
- Colne Bank Roundabout Improvements
- Stanway Western Bypass Extension
- Brook Street Roundabout Improvements (existing roundabout at Brook Street / East Street converted to signalised junction)
- Priory Street One Way System Reversal
- Essex Hall Roundabout Signal Scheme
- Realignment of A134
- Boxted Link Road
- A134 NAR3 / Boxted Road Improvements
- Toucan Crossing at Bergholt Road / Tufnell Way

These are schemes which are already in place since the creation of the base year model, are coming forwards as part of a new land development, or already have funding in place.

In addition, the A120-A133 link road, which comes forward with development in East Colchester, was included in the networks for scenarios 1, 3 and the full

development scenario, but not for scenario 2, which focuses development to the west. The form of the link road is not yet known but for the purposes of this assessment, a 40mph road, with a relatively high capacity was modelled.

3.4 Variable demand model

To reflect the potential increase in public transport trips that could arise due to the new development, the modelling architecture was supplemented with a variable demand model. The model was designed as an own cost elasticity model, which typically uses the change in generalised cost (i.e. travel time and distance) from a reference case to calculate the likely number of trips that would switch to non-car modes. The model uses different elasticity parameters depending on the relative accessibility of public transport.

The demand model is described in detail in Appendix B.

Appendices

Appendix A List of development

Committed and LDF development – housing

SATURN Zone	Site Description	Houses
115	Jarmin Road Former Cbc Depot	57
120	Ipswich Road	3
121	Cowdray Avenue	38
121	Bypass Nursery, Cowdray Avenue	81
122	Cowdray Centre, Cowdray Avenue	200
123	Clarendon Way	88
126	St Botolphs	121
127	Britannia Car Park	200
133	Bay Mill	54
209	Garrison Development - J	501
209	Garrison Development - H	41
209	Garrison Development - K1/2	14
306	Paxmans Former Club, Hythe Hill	40
306	Paxmans Main Site, Port Lane	184
312	Gas Works Site, Hythe Quay	84
314	Brook Street	80
314	Land Rear Of Brook Street	30
315	Garrison Central 2	537
316	Garrison Central 3 - B1b	116
316	Garrison Central 3 - B1a	11
316	Garrison Central 3 - C2	30
403	University, Salary Brook Meadows	200
403	Land West Of Boundary Road, U of E	5
416	Hawkins Road	46
416	Hawkins Road	175
416	Hawkins Road	57
416	Hawkins Road	303
417	Hythe Quays	142
501	Flakt Woods Site, Braiswick	342
514	Cuckoo Point, Severalls Lane	173
515	Royal London Mill Road	163

517	Severalls Hospital	1167
518	NGAUE SW (Golf Course Site)	200
518	NGAUE Core Strategy Allocation	1600
523	Turner Village	472
604	Betts Factory, Ipswich Road	128
902	Railway Sidings Site, Halstead Road	123
912	Winstree Road, Stanway	111
914	Church Lane	400
915	West Colchester	700
1001	Land Between A12/London Road, Stanway (Wyvern Farm)	358
1103	Layer Road Football Stadium	80
1109	Garrison Central 4 - L/N	266
1109	Garrison Central 4 - P1	203
1109	Garrison Central 4 - O	38
1110	Breachfield	261
1205	Garrison Development - s1	212
1205	Garrison Development - s2n	163
1205	Garrison Development - s2nw	48
1205	Garrison Development - s2sw	21
1205	Garrison Development - s2s	146
1211	Garrison Development - Q	46
1601	Cooks Shipyard, Wivenhoe	77
1701	East Road, West Mersea	37
1702	Rowhedge Port At End Of High St.	170
1704	Core Strategy Allocation Tiptree	103
1704	Petrol Station, Maypole Road, Tip	28
1704	Jam Factory Site, Tiptree	244
1711	Tile House Farm, Gt. Horkesley	145

Committed and LDF development – retail and employment

Zone	Site Name	Total Area (sqm)	Land use class
519	Flakt Woods	18000	B2
520	Easter Group	18000	B2
521	Cuckoo Farm (A)	28000	A3,A4,B1,D2,B2,B8

522	Cuckoo Farm (B)	20000	B1,D2,D2,A4
1603	University Research Park	37000	B1,B1
418	Hawkins Road	2600	B1
916	Stane Park, Tollgate and London Road	27000	B1,B2,B8
917	Sainsburys Site	9000	B1
210	Butt Road Supermarket	3200	A1S
1404	Hythe Quay and King Edward Key	500	A1
128	Vineyard Gate	30000	A1,A3
TCCP	Cultural Quarter (St Botolphs)	5700	A1,A3,D2
TCCP	Town Centre	5000	A1
518	Mile End Greenfield	5000	A1

Appendix B Demand Model Methodology

Converting to person trips by purpose

The propensity to switch modes will vary according to trip purpose however the Colchester model only has a single demand segment, representing all trip purposes and modes. Therefore, to run the variable demand model, it was necessary to convert the single trip matrix into multiple matrices representing commute, business and other trip purposes, for people in cars (for which there is the potential to switch modes) and goods vehicles (for which there is not).

Trip purpose proportions for car trips, and also vehicle occupancies for each trip purpose, were estimated using the TAG data book, November 2014[4], table A1.3.4, which is the latest update of the data. The proportion of trips that were goods vehicles is derived from data used in the base year when creating trip matrices, factored to a 2032 forecast year using growth data from the National Road Traffic Forecasts data set (scenario 1)[5].

The calculated trip purpose proportions and percentage of car trips is summarised in Table B-1:

Table B-1 Trip purpose and car occupancy values

Input	Business	Commute	Other	Goods vehicle
Trip purpose – AM 2032	5.51%	32.87%	42.67%	19.04%
Vehicle occupancy – AM 2032	1.22	1.13	1.58	n/a
Trip purpose – AM 2047	5.42%	32.37%	42.02%	20.27%
Vehicle occupancy – AM 2047	1.22	1.13	1.57	n/a
Trip purpose – PM 2032	4.78%	28.09%	54.09%	13.04%
Vehicle occupancy – PM 2032	1.16	1.12	1.64	n/a
Trip purpose – PM 2047	4.72%	22.75%	53.43%	14.09%

[4] https://www.gov.uk/government/publications/webtag-tag-data-book-november-2014
[5] https://www.gov.uk/government/publications/road-traffic-forecasts-2015

Vehicle occupancy – PM 2047	1.16	1.12	1.63	n/a

Model formulation

The elasticity model used the exponential formulation; demand is calculated according to the following formula:

$$T_1 = T_0 e^{B(G_0 - G_{ref})}$$

Where: T_1 is the post elasticity demand, T_0 is the initial demand, G_0 is the generalised cost from assignment of the initial demand, G_{ref} is the generalised cost from the reference case, and B is the elasticity.

The equation above is applied for each cell in the matrix.

The resulting demand T_1 was then assigned to the network, to thereby create a new generalised cost G_1, which were then used in the next iteration of the elasticity model, to produce demand T_2. The process was repeated until convergence was achieved, as described in section 0 below.

Calibration of elasticity parameters

The starting point for the elasticity parameter *B* was the guidance in TAG Unit M2[6] Appendix A. Table A1 in that document specifies time elasticities by trip purpose for high and low modal competition. These were converted to generalised cost elasticities by dividing by the proportion of the total generalised cost made up of journey time. Since an exponential formulation was used, these elasticities were then further converted by dividing by the mean generalised cost. An elasticity for medium modal competition was derived by averaging the high and low elasticities.

For each zone to zone movement in the Colchester model, the determination of whether there was high, medium or low modal competition was based on the amount of public transport provision available for the trip. The original forecast network included bus routes and timetable frequencies within the Saturn network coding. These were exported from Saturn into EMME, a modelling suite which includes public transport, and public transport travel times were skimmed from the EMME network. These were compared against the highway travel

[6] https://www.gov.uk/government/publications/webtag-tag-unit-m2-variable-demand-modelling

times skimmed from Saturn, and depending on the ratio of PT to highway travel time, the trip was determined to have either a high, medium or low modal competition. Additionally, any zone to zone movements for which both ends to the trip were within 1km of a railway station were considered to have high modal competition.

A parallel study was being conducted by Jacobs into a rapid transit system to the east of the town, linking the developments at East Colchester with the town centre. Outputs from that project were not available in time for inclusion in this work, however, the potential effects of a rapid transit system in that area have been simulated by assuming that any trips along the corridor of the proposed system would also have high modal competition.

Realism testing using the base year model was employed to verify the selection of the elasticity values. In this, the assumed fuel cost in the base year was increased by 10%, and the elasticity parameters were modified slightly to ensure that the out-turn demand elasticity (with respect to fuel cost) was close to -0.3.

The elasticity parameters used in the model are given in Table B-2:

Table B-2 Demand model elasticity parameters

Elasticity by PT accessibility	Business	Commute	Other
Low	-0.0278	-0.0111	-0.0248
Medium	-0.0377	-0.0143	-0.0348
High	-0.0476	-0.0175	-0.0448

Model convergence

The elasticity model was run until convergence was achieved, that is, until the %Gap value, as calculated according to the equation below, falls below 0.2:

$$\frac{100 \sum_a G_{n-1} |T_n - T_{n-1}|}{\sum_a G_{n-1} T_{n-1}}$$

Where: *n* represents the iteration number, T_n is the demand calculated after iteration n, T_{n-1} is the demand from the previous iteration, G_{n-1} is the generalised cost from the previous iteration and *a* represents all combinations of origin zone, destination zone and demand segment.

In general, it was found that the demand model reached convergence within ten iterations for the AM peak, and 15 for the PM peak.