

Zenith Model Recalibration and
Validation Version 3.0.1

Destination Choice Model

June 2015

Page Intentionally Left Blank

Zenith Model Recalibration and Validation Version 3.0.1

Destination Choice Model

Project No. ZML-VIC-Year4

COPYRIGHT: The concepts and information contained in this document are the property of Veitch Lister Consulting Pty Ltd. Use or copying of this document in whole or in part without the written permission of Veitch Lister Consulting constitutes an infringement of copyright.

LIMITATION: This report has been prepared on behalf of and for the exclusive use of Veitch Lister Consulting Pty Ltd's Client, and is subject to and issued in connection with the provisions of the agreement between Veitch Lister Consulting and its Client. Veitch Lister Consulting accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Date	Revision	Prepared By	Checked By	Approved By	Description
18/02/2014	A	JP	JC	TV	Draft Report
05/06/2015	B	AA	TV	TV	Final Report



Executive Summary

The Zenith Model of Victoria is one of a family of models developed by Veitch Lister Consulting (VLC) for transport planning in Australian cities and regions. This document is one in a series of working papers that collectively describe the calibration and validation of the Zenith Model of Victoria. In particular, this document describes the Destination Choice Model.

The aim of the Destination Choice Model is to predict (for each trip produced by the Trip Generation Model) the destination of travel.

The Zenith Destination Choice Model takes account of:

- Perceived generalised cost of travel between all origin / destination pairs for all travel modes at all times of the day;
- The relative attractiveness of each destination for each trip purpose; and
- Traveller willingness to travel longer distances (to destinations with higher generalised cost) for each trip purpose (as revealed by VISTA).

This report describes the model parameters which have been estimated using the VISTA survey, and also provides detailed information regarding model validation for each travel market segment.



Contents

Executive Summary	ii
Contents	iii
List of Figures	v
List of Tables	vii
1 Introduction	1
1.1 Background	1
1.2 Report Structure	1
2 Data Sources	2
3 Methodology	3
3.1.1 Data Set Construction	3
3.1.2 Segmentation	3
3.1.3 Model Estimation Procedures	3
3.1.4 Model Validation Procedures	3
4 Model Parameters	4
5 Model Validation	6
5.1 Summary	6
5.2 Model Validation - Home Based Work - White Collar Workers	10
5.2.1 Trip Length Frequency	10
5.2.2 Sector To Sector analysis	11
5.2.3 Average Trip Length by Demographic Variable	12
5.3 Model Validation - Home Based Work - Blue Collar Workers	14
5.3.1 Trip Length Frequency	14
5.3.2 Sector To Sector analysis	15
5.3.3 Average Trip Length by Demographic Variable	16
5.4 Model Validation - Home Based Education - Secondary School	18
5.4.1 Trip Length Frequency	18
5.4.2 Sector To Sector analysis	19
5.4.3 Average Trip Length by Demographic Variable	20
5.5 Model Validation - Home Based Education - Tertiary Education	22
5.5.1 Trip Length Frequency	22
5.5.2 Sector To Sector analysis	23
5.5.3 Average Trip Length by Demographic Variable	24
5.6 Model Validation - Home Based Shopping	26
5.6.1 Trip Length Frequency	26
5.6.2 Sector To Sector analysis	27
5.6.3 Average Trip Length by Demographic Variable	28
5.7 Model Validation - Home Based Recreation	30



5.7.1	<i>Trip Length Frequency</i>	30
5.7.2	<i>Sector To Sector analysis</i>	31
5.7.3	<i>Average Trip Length by Demographic Variable</i>	32
5.8	Model Validation - Home Based Other	34
5.8.1	<i>Trip Length Frequency</i>	34
5.8.2	<i>Sector To Sector analysis</i>	35
5.8.3	<i>Average Trip Length by Demographic Variable</i>	36
5.9	Model Validation - Work Based Work	38
5.9.1	<i>Trip Length Frequency</i>	38
5.9.2	<i>Sector To Sector analysis</i>	39
5.9.3	<i>Average Trip Length by Demographic Variable</i>	40
5.10	Model Validation - Work Based Shopping	42
5.10.1	<i>Trip Length Frequency</i>	42
5.10.2	<i>Sector To Sector analysis</i>	43
5.10.3	<i>Average Trip Length by Demographic Variable</i>	44
5.11	Model Validation - Work Based Other	46
5.11.1	<i>Trip Length Frequency</i>	46
5.11.2	<i>Sector To Sector analysis</i>	47
5.11.3	<i>Average Trip Length by Demographic Variable</i>	48
5.12	Model Validation - Shopping Based Shopping	50
5.12.1	<i>Trip Length Frequency</i>	50
5.12.2	<i>Sector To Sector analysis</i>	51
5.12.3	<i>Average Trip Length by Demographic Variable</i>	52
5.13	Model Validation - Shopping Based Other	54
5.13.1	<i>Trip Length Frequency</i>	54
5.13.2	<i>Sector To Sector analysis</i>	55
5.13.3	<i>Average Trip Length by Demographic Variable</i>	56
5.14	Model Validation - Other Non-Home Based	58
5.14.1	<i>Trip Length Frequency</i>	58
5.14.2	<i>Sector To Sector analysis</i>	59
5.14.3	<i>Average Trip Length by Demographic Variable</i>	60



List of Figures

Figure 5.1: Average Trip Length by Trip Purposes	6
Figure 5.2: Trip Length Frequency, All Purposes	7
Figure 5.3: Cumulative Trip Length Frequency, All Purposes.....	7
Figure 5.4: Intra SA4 Movements, All Purposes	8
Figure 5.5: Inter SA4 Movements, All Purposes	9
Figure 5.6: Trip Length Frequency Distribution, Home Based Work - White Collar Workers	10
Figure 5.7: Cumulative Trip Length Frequency Distribution, Home Based Work - White Collar Workers	10
Figure 5.8: Intra SA4 Movements, Home Based Work - White Collar Workers.....	11
Figure 5.9: Inter SA4 Movements, Home Based Work - White Collar Workers.....	11
Figure 5.10: Average Trip Length by Household Size, Home Based Work - White Collar Workers	12
Figure 5.11: Average Trip Length by Number of Cars, Home Based Work - White Collar Workers	12
Figure 5.12: Average Trip Length by Household Income Quintile, Home Based Work - White Collar Workers	13
Figure 5.13: Trip Length Frequency Distribution, Home Based Work - Blue Collar Workers	14
Figure 5.14: Cumulative Trip Length Frequency Distribution, Home Based Work - Blue Collar Workers	14
Figure 5.15: Intra SA4 Movements, Home Based Work - Blue Collar Workers.....	15
Figure 5.16: Inter SA4 Movements, Home Based Work - Blue Collar Workers.....	15
Figure 5.17: Average Trip Length by Household Size, Home Based Work - Blue Collar Workers	16
Figure 5.18: Average Trip Length by Number of Cars, Home Based Work - Blue Collar Workers	16
Figure 5.19: Average Trip Length by Household Income Quintile, Home Based Work - Blue Collar Workers	17
Figure 5.20: Trip Length Frequency Distribution, Home Based Education - Secondary School	18
Figure 5.21: Cumulative Trip Length Frequency Distribution, Home Based Education - Secondary School.....	18
Figure 5.22: Intra SA4 Movements, Home Based Education - Secondary School.....	19
Figure 5.23: Inter SA4 Movements, Home Based Education - Secondary School.....	19
Figure 5.24: Average Trip Length by Household Size, Home Based Education - Secondary School.....	20
Figure 5.25: Average Trip Length by Number of Cars, Home Based Education - Secondary School.....	20
Figure 5.26: Average Trip Length by Household Income Quintile, Home Based Education - Secondary School.....	21
Figure 5.27: Trip Length Frequency Distribution, Home Based Education - Tertiary Education	22
Figure 5.28: Cumulative Trip Length Frequency Distribution, Home Based Education - Tertiary Education.....	22
Figure 5.29: Intra SA4 Movements, Home Based Education - Tertiary Education	23
Figure 5.30: Inter SA4 Movements, Home Based Education - Tertiary Education	23



Figure 5.31: Average Trip Length by Household Size, Home Based Education - Tertiary Education.....	24
Figure 5.32: Average Trip Length by Number of Cars, Home Based Education - Tertiary Education.....	24
Figure 5.33: Average Trip Length by Household Income Quintile, Home Based Education - Tertiary Education.....	25
Figure 5.34: Trip Length Frequency Distribution, Home Based Shopping	26
Figure 5.35: Cumulative Trip Length Frequency Distribution, Home Based Shopping.....	26
Figure 5.36: Intra SA4 Movements, Home Based Shopping.....	27
Figure 5.37: Inter SA4 Movements, Home Based Shopping.....	27
Figure 5.38: Average Trip Length by Household Size, Home Based Shopping	28
Figure 5.39: Average Trip Length by Number of Cars, Home Based Shopping	28
Figure 5.40: Average Trip Length by Household Income Quintile, Home Based Shopping ..	29
Figure 5.41: Trip Length Frequency Distribution, Home Based Recreation	30
Figure 5.42: Cumulative Trip Length Frequency Distribution, Home Based Recreation.....	30
Figure 5.43: Intra SA4 Movements, Home Based Recreation	31
Figure 5.44: Inter SA4 Movements, Home Based Recreation	31
Figure 5.45: Average Trip Length by Household Size, Home Based Recreation	32
Figure 5.46: Average Trip Length by Number of Cars, Home Based Recreation.....	32
Figure 5.47: Average Trip Length by Household Income Quintile, Home Based Recreation	33
Figure 5.48: Trip Length Frequency Distribution, Home Based Other	34
Figure 5.49: Cumulative Trip Length Frequency Distribution, Home Based Other.....	34
Figure 5.50: Intra SA4 Movements, Home Based Other.....	35
Figure 5.51: Inter SA4 Movements, Home Based Other.....	35
Figure 5.52: Average Trip Length by Household Size, Home Based Other	36
Figure 5.53: Average Trip Length by Number of Cars, Home Based Other	36
Figure 5.54: Average Trip Length by Household Income Quintile, Home Based Other.....	37
Figure 5.55: Trip Length Frequency Distribution, Work Based Work	38
Figure 5.56: Cumulative Trip Length Frequency Distribution, Work Based Work.....	38
Figure 5.57: Intra SA4 Movements, Work Based Work	39
Figure 5.58: Inter SA4 Movements, Work Based Work	39
Figure 5.59: Average Trip Length by Household Size, Work Based Work	40
Figure 5.60: Average Trip Length by Number of Cars, Work Based Work.....	40
Figure 5.61: Average Trip Length by Household Income Quintile, Work Based Work	41
Figure 5.62: Trip Length Frequency Distribution, Work Based Shopping.....	42
Figure 5.63: Cumulative Trip Length Frequency Distribution, Work Based Shopping	42
Figure 5.64: Intra SA4 Movements, Work Based Shopping.....	43
Figure 5.65: Inter SA4 Movements, Work Based Shopping.....	43
Figure 5.66: Average Trip Length by Household Size, Work Based Shopping	44
Figure 5.67: Average Trip Length by Number of Cars, Work Based Shopping	44
Figure 5.68: Average Trip Length by Household Income Quintile, Work Based Shopping...	45
Figure 5.69: Trip Length Frequency Distribution, Work Based Other.....	46
Figure 5.70: Cumulative Trip Length Frequency Distribution, Work Based Other	46
Figure 5.71: Intra SA4 Movements, Work Based Other.....	47
Figure 5.72: Inter SA4 Movements, Work Based Other.....	47
Figure 5.73: Average Trip Length by Household Size, Work Based Other	48
Figure 5.74: Average Trip Length by Number of Cars, Work Based Other	48
Figure 5.75: Average Trip Length by Household Income Quintile, Work Based Other.....	49



Figure 5.76: Trip Length Frequency Distribution, Shopping Based Shopping	50
Figure 5.77: Cumulative Trip Length Frequency Distribution, Shopping Based Shopping ...	50
Figure 5.78: Intra SA4 Movements, Shopping Based Shopping	51
Figure 5.79: Inter SA4 Movements, Shopping Based Shopping	51
Figure 5.80: Average Trip Length by Household Size, Shopping Based Shopping.....	52
Figure 5.81: Average Trip Length by Number of Cars, Shopping Based Shopping	52
Figure 5.82: Average Trip Length by Household Income Quintile, Shopping Based Shopping	53
Figure 5.83: Trip Length Frequency Distribution, Shopping Based Other	54
Figure 5.84: Cumulative Trip Length Frequency Distribution, Shopping Based Other	54
Figure 5.85: Intra SA4 Movements, Shopping Based Other	55
Figure 5.86: Inter SA4 Movements, Shopping Based Other	55
Figure 5.87: Average Trip Length by Household Size, Shopping Based Other.....	56
Figure 5.88: Average Trip Length by Number of Cars, Shopping Based Other.....	56
Figure 5.89: Average Trip Length by Household Income Quintile, Shopping Based Other ..	57
Figure 5.90: Trip Length Frequency Distribution, Other Non-Home Based.....	58
Figure 5.91: Cumulative Trip Length Frequency Distribution, Other Non-Home Based	58
Figure 5.92: Intra SA4 Movements, Other Non-Home Based	59
Figure 5.93: Inter SA4 Movements, Other Non-Home Based	59
Figure 5.94: Average Trip Length by Household Size, Other Non-Home Based.....	60
Figure 5.95: Average Trip Length by Number of Cars, Other Non-Home Based	60
Figure 5.96: Average Trip Length by Household Income Quintile, Other Non-Home Based	61

List of Tables

Table 4.1: Estimated Model Parameters	5
---	---



Page Intentionally Left Blank



1 Introduction

1.1 Background

The Zenith Model of Victoria is one of a family of models developed by Veitch Lister Consulting (VLC) for transport planning in Australian cities and regions. This document is one in a series of working papers that collectively describe the calibration and validation of the Zenith Model of Victoria.

The primary focus of this document is the Destination Choice Model, the aim of which is to predict (for each trip produced by the Trip Generation Model) the destination of travel.

The scope of this paper is limited to the estimation and validation of the Destination Choice Model developed for the Zenith Model of Victoria. Details regarding methodology (including how the model is implemented in Zenith) are contained in the associated methodology document from the Framework series “Zenith Framework – Paper E – Destination Choice Model”.

1.2 Report Structure

The balance of this report is structured as follows:

Chapter 2: Describes the data sources used to estimate and validate the Destination Choice Model;

Chapter 3: Describes the methodology by which the Destination Choice Model has been estimated and validated;

Chapter 4: Presents the parameter estimates for each segment; and

Chapter 5: Presents model validation.



2 Data Sources

Three sources of information were used to develop Destination Choice Models for the Zenith Model of Victoria:

- Data from the *Victorian Integrated Survey of Travel and Activity* (VISTA);
- Generalised cost matrices (skims) for each trip purpose, which were output from the Zenith Mode Choice Model; and
- Estimates of “Trip Attractions” for each travel zone, output from the Zenith Trip Attraction Model.

Data from the following two editions of the VISTA survey were pooled to maximise the available sample:

- VISTA07 (a sample of 17,115 Victorian households surveyed between June 2007 and June 2008); and
- VISTA09 (a sample of 16,269 Victorian households surveyed between July 2009 and July 2010).

A more recent VISTA survey began in July 2012 but is not currently available for transport modelling purposes. Therefore VISTA07 and VISTA09 represent the latest available Victorian household travel surveys.

Data collected on weekends, public holidays and during school holidays were removed to facilitate the development of average weekday models.



3 Methodology

3.1.1 Data Set Construction

A data set was constructed using each expanded VISTA0709 trip as a data point.

The response variable (i.e. the dependant variable) for each data point was the destination zone which was actually chosen by the VISTA survey respondent. The predictors (i.e. the independent variables) were:

- the cost of travel to each possible destination;
- the natural log of the cost of travel to each possible destination;
- the trip attraction of each possible destination; and
- a small set of dummy variables associated with destinations in the CBD and inner city.

3.1.2 Segmentation

Separate Destination Choice Models were estimated for each trip purpose, with home based trip purposes further segmented by household car ownership level (0, 1, 2, 3+).

3.1.3 Model Estimation Procedures

For each segment, a multinomial logit model was estimated using a Maximum Likelihood optimisation procedure.

3.1.4 Model Validation Procedures

Model validation was performed using “6-fold cross validation”. This procedure enabled a predicted destination to be generated for each trip, where that trip was not part of the training set used to estimate the model parameters. This procedure enables the predictive accuracy of the model to be realistically assessed.

Note however that the final parameter estimates were calculated using the complete set of survey data.



4 Model Parameters

Destination Choice Model parameters have been estimated for each segment, which represents a combination of trip purpose, and household car ownership level (0,1,2,3+). These parameters are used to determine the 'force of attraction', F_d , toward a potential travel zone, d , in the Zenith Gravity Model via the formula

$$F_d = \frac{A_d}{C_{od}^\alpha e^{\beta C_{od} + U_d}}$$

For each travel market segment, an α and β were estimated. Destination specific constants for each of six regions (CBD Core, CBD NonCore, CBD Frame, Outer Frame, Melb_Uni and LargeNonCBD Uni) were also estimated, and included in the model where such a parameter was significant.

The α and β values do not lend themselves to a simple numerical interpretation. However, the destination specific constants have been expressed in 2008 cents to facilitate interpretation. A negative value indicates a reduction in cost to the destination (which translates to an increase in its overall attractiveness). Therefore, a value of -100 indicates a 100 cent (\$1) boost to the attractiveness of the destination. Generally speaking, larger constants are estimated for segments associated with higher car ownership. This is because households with no car already find the CBD very attractive as a destination due to its accessibility by public transport. Indeed, the decision to not own a car is often facilitated by one's ability to take public transport or walk to work.



Sum of statistic_value								
	CBDCore	CBDNonCore	CBDFrame	OuterFrame	Melb_Uni	LargeNonCBD_Uni	alpha	beta
HWB								
0	88	83	254				1.127	-0.004
1	-564	-444	-478	-18			-0.009	-0.003
2	-834	-686	-774	167			-0.113	-0.003
3	-880	-501	-720	174			-0.169	-0.003
HWW								
0	-117	27	24	-127			0.090	-0.003
1	-620	-442	-358	-341			-0.095	-0.003
2	-877	-673	-567	-230			-0.166	-0.003
3	-793	-608	-521	-304			-0.204	-0.003
HSE								
0	1526	-106	1569				5.370	-0.023
1	88	50	24				1.787	-0.014
2	104	-32	-38				1.883	-0.013
3	52	157	2430				2.100	-0.013
HBS								
0							1.528	-0.008
1	-550	-350	-189				0.101	-0.010
2	-871	-569	-330				-0.427	-0.007
3	-942	-544	-386				-0.412	-0.007
HBR								
0	-209	-186	-117	-162			0.247	-0.007
1	-294	-148	-185	-25			0.142	-0.009
2	-319	-167	-223	25			0.124	-0.011
3	-352	-227	-280	-17			0.204	-0.012
HTE								
0	1679	-32214	-224	-29980	1415	950	-4.033	0.001
1	-63	495	169	311	-172	-268	-0.219	-0.004
2	-194	42	-273	-168	-297	-216	0.670	-0.005
3	-331	-143	-322	-224	-405	-518	-0.612	-0.004
HBO								
0	25	518	-413	595			1.615	-0.004
1	-864	-656	-362	-448			0.050	-0.006
2	-1092	-1079	-850	-737			-0.421	-0.003
3	-1021	-727	-781	-461			-0.405	-0.003
SBO								
nil	78	205	64	31	-114	-101	-0.190	-0.006
SBS								
nil	36	74	-96	-105	128	368	-0.229	-0.006
WBS								
nil	223	320	127	31	-31	195	-0.341	-0.005
WBO								
nil	316	290	253	101	279	196	-0.082	-0.004
WBW								
nil	-13	101	85	8	58	55	-0.320	-0.003
ONHB								
nil	-296	-93	-139	-77	-104	-5	-0.245	-0.006

Table 4.1: Estimated Model Parameters



5 Model Validation

5.1 Summary

This section of the report examines how well the updated Zenith Destination Choice Model replicates travel demands and patterns revealed in the VISTA household travel survey.

The validation summary includes a comparison of Zenith and VISTA:

- average trip lengths by trip purpose;
- trip length frequency distributions (all trip purposes combined) for the latest recalibration (Zenith Recal_14) and previous recalibration (Zenith Recal_11); and
- cumulative trip length frequency (all trip purposes combined); and
- sector to sector person trip movements (all trip purposes combined) using the SA4 sector system.

Average Trip Length by Purpose		
	VISTA	Zenith
HBO	4.67	5.44
HBR	6.51	6.20
HBS	4.85	4.66
HSE	5.66	5.89
HTE	14.07	16.83
HWB	13.21	13.38
HWW	12.36	12.06
ONHB	6.25	5.75
SBO	6.42	5.99
SBS	5.17	5.01
WBO	9.66	9.75
WBS	6.40	5.75
WBW	9.95	9.62
Grand Total	7.26	7.23

Figure 5.1: Average Trip Length by Trip Purposes

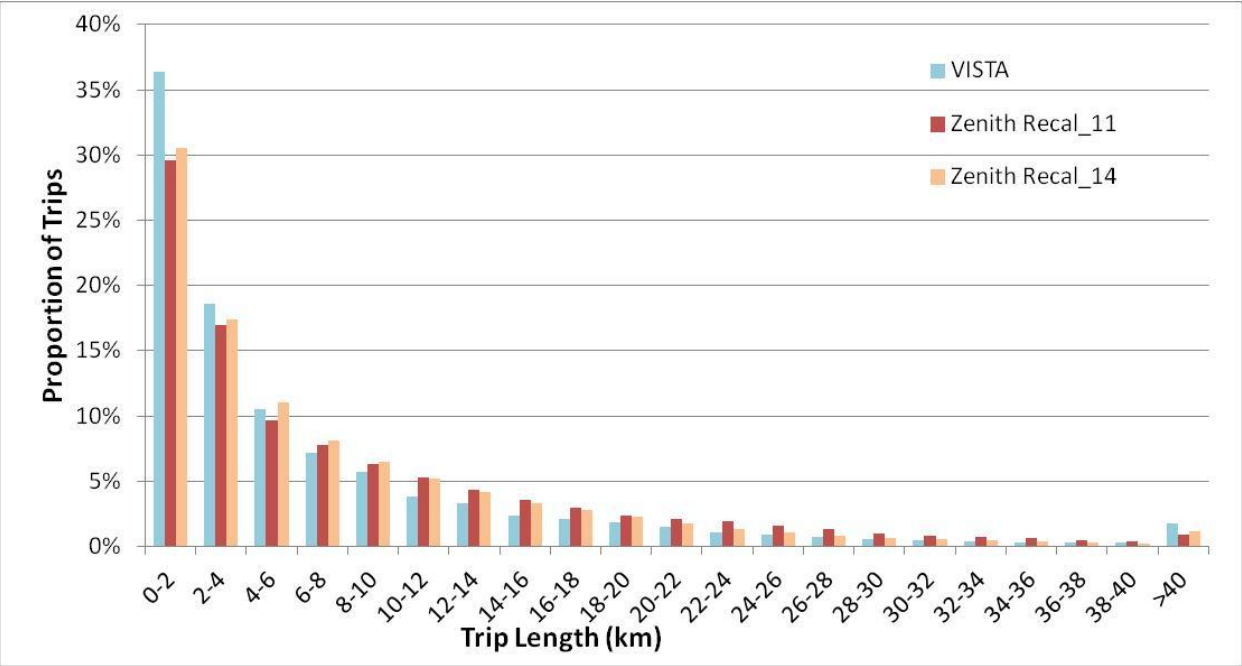


Figure 5.2: Trip Length Frequency, All Purposes

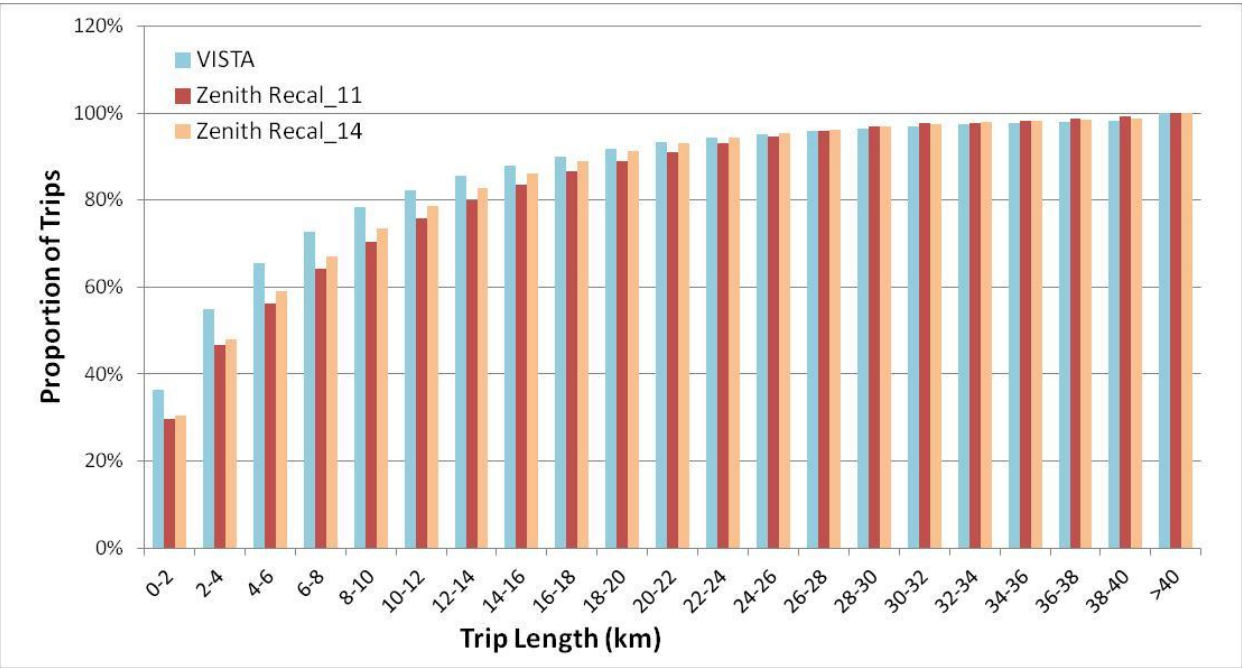


Figure 5.3: Cumulative Trip Length Frequency, All Purposes

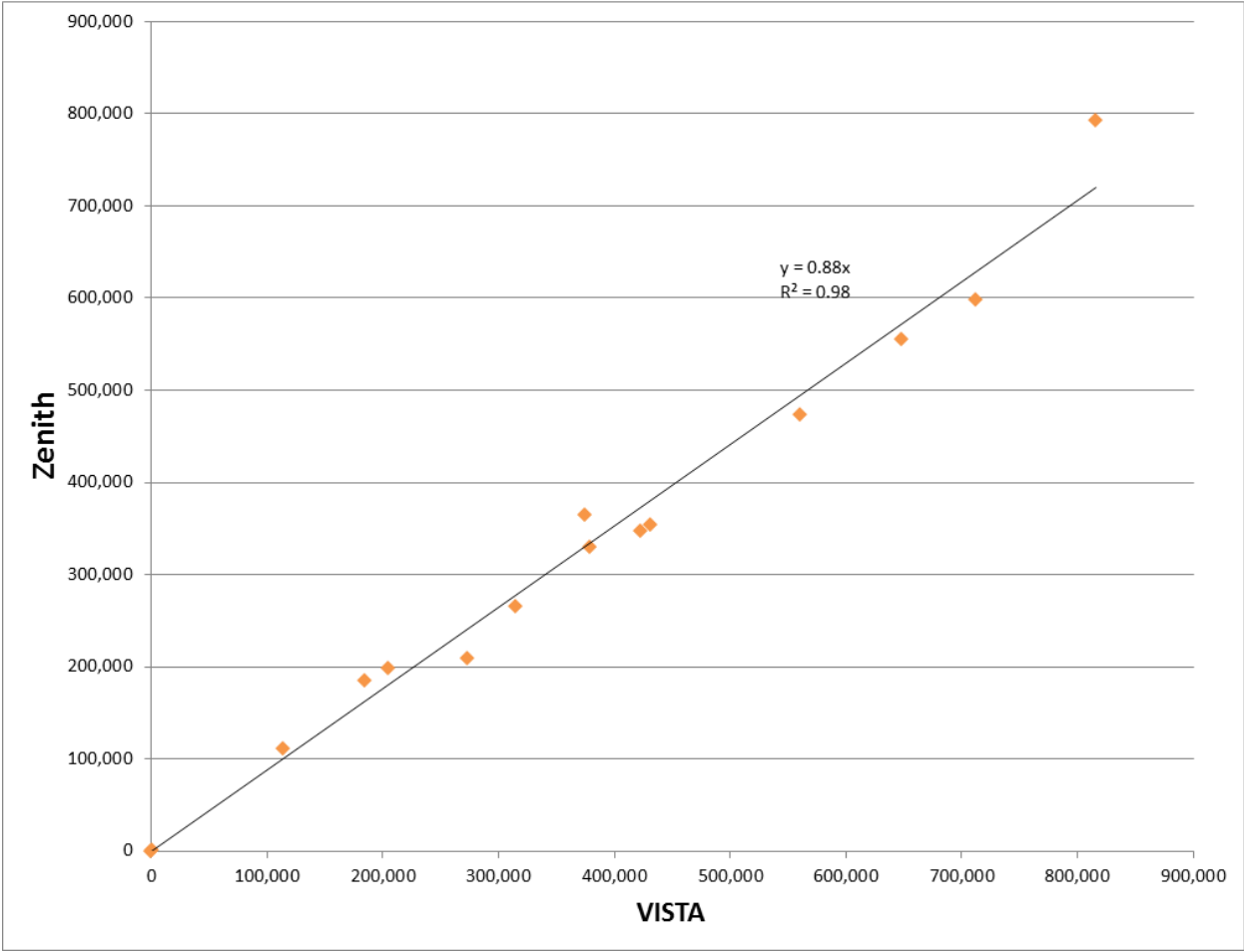


Figure 5.4: Intra SA4 Movements, All Purposes

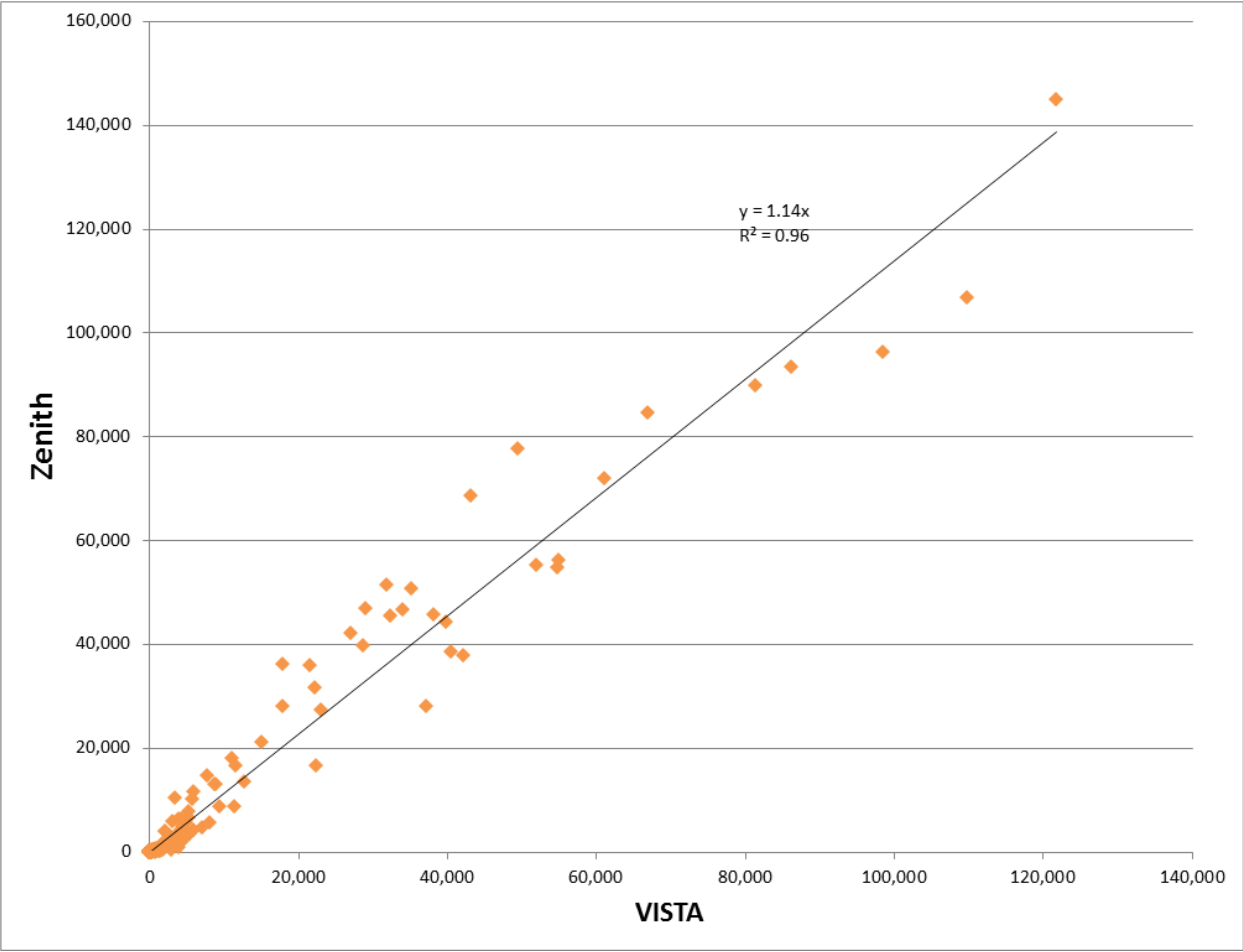


Figure 5.5: Inter SA4 Movements, All Purposes



5.2 Model Validation - Home Based Work - White Collar Workers

5.2.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Home Based Work (White Collar Workers) are compared below. Figure 5.7 presents the same data in a cumulative form.

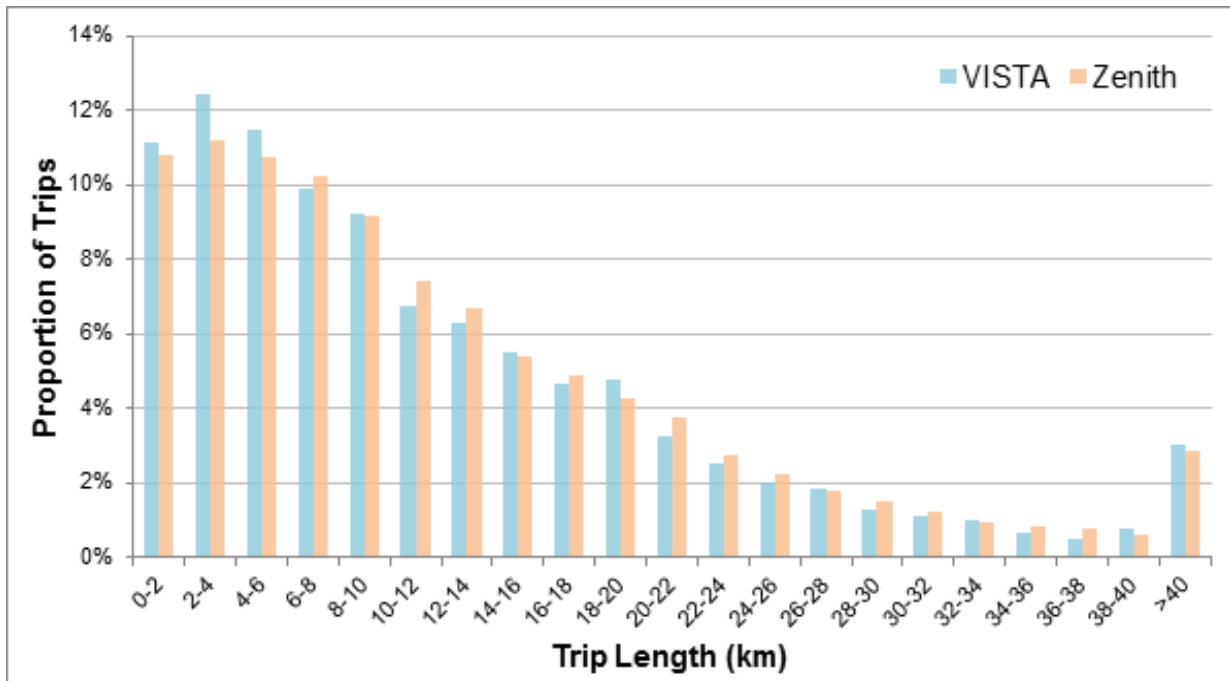


Figure 5.6: Trip Length Frequency Distribution, Home Based Work - White Collar Workers

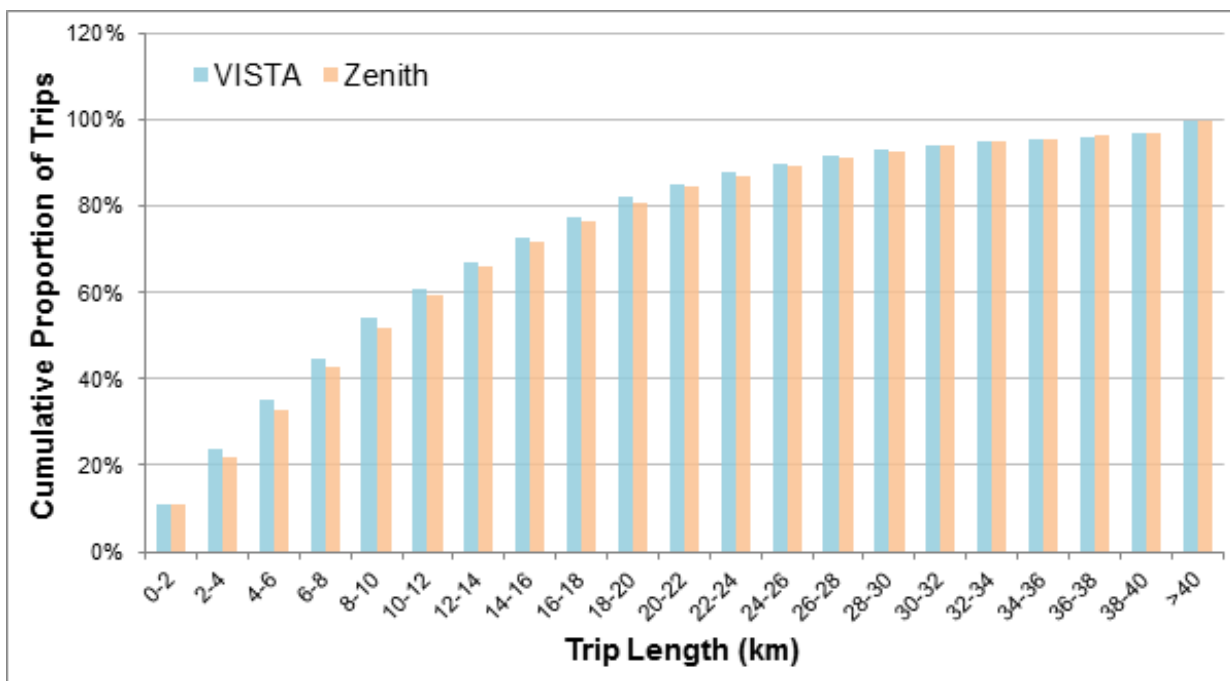


Figure 5.7: Cumulative Trip Length Frequency Distribution, Home Based Work - White Collar Workers



5.2.2 Sector To Sector analysis

Modelled and observed Home Based Work (White Collar Workers) SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

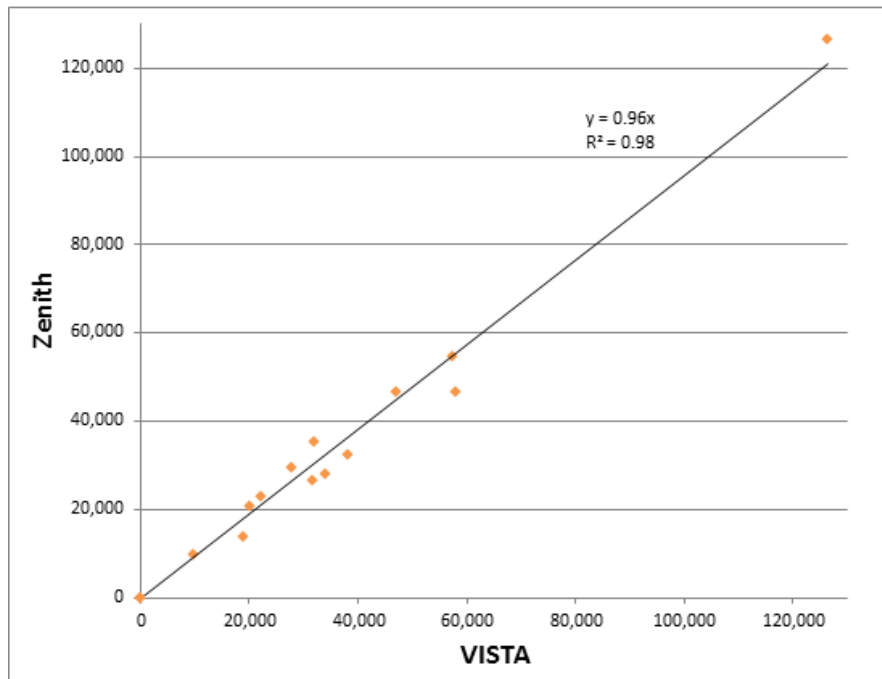


Figure 5.8: Intra SA4 Movements, Home Based Work - White Collar Workers

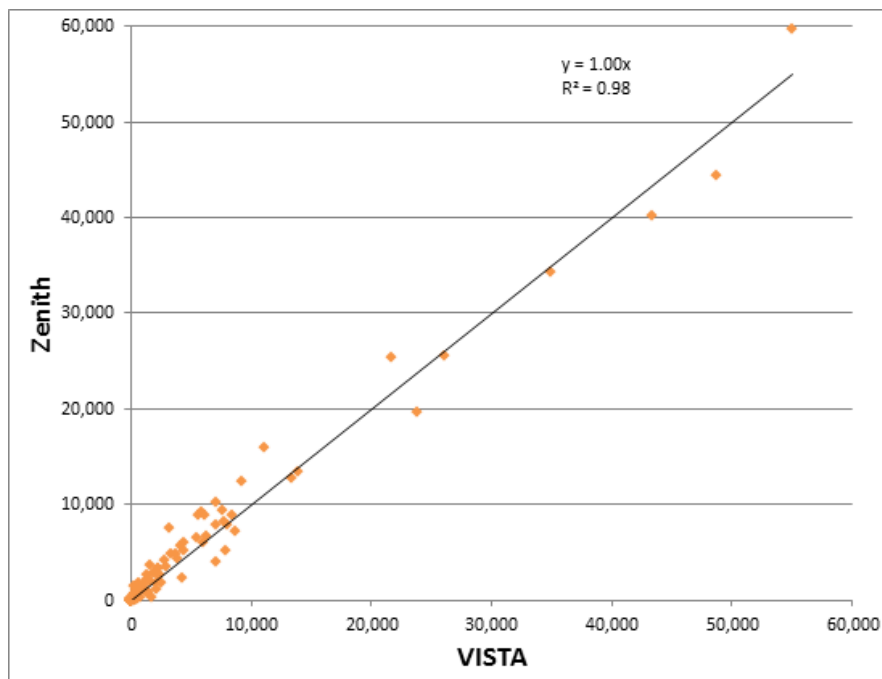


Figure 5.9: Inter SA4 Movements, Home Based Work - White Collar Workers



5.2.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

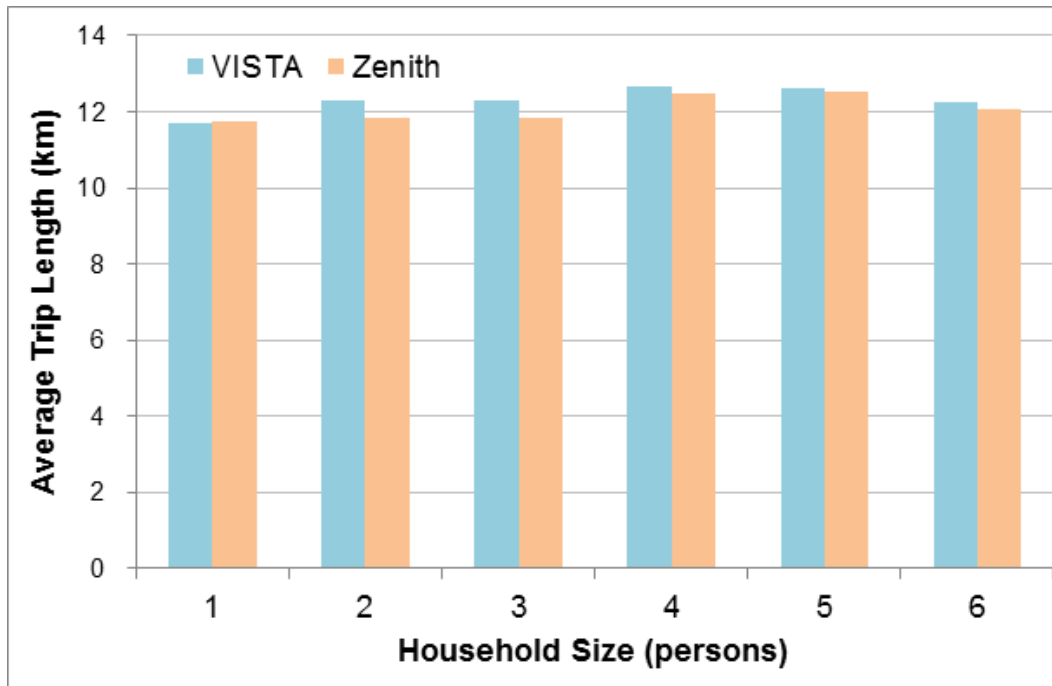


Figure 5.10: Average Trip Length by Household Size, Home Based Work - White Collar Workers

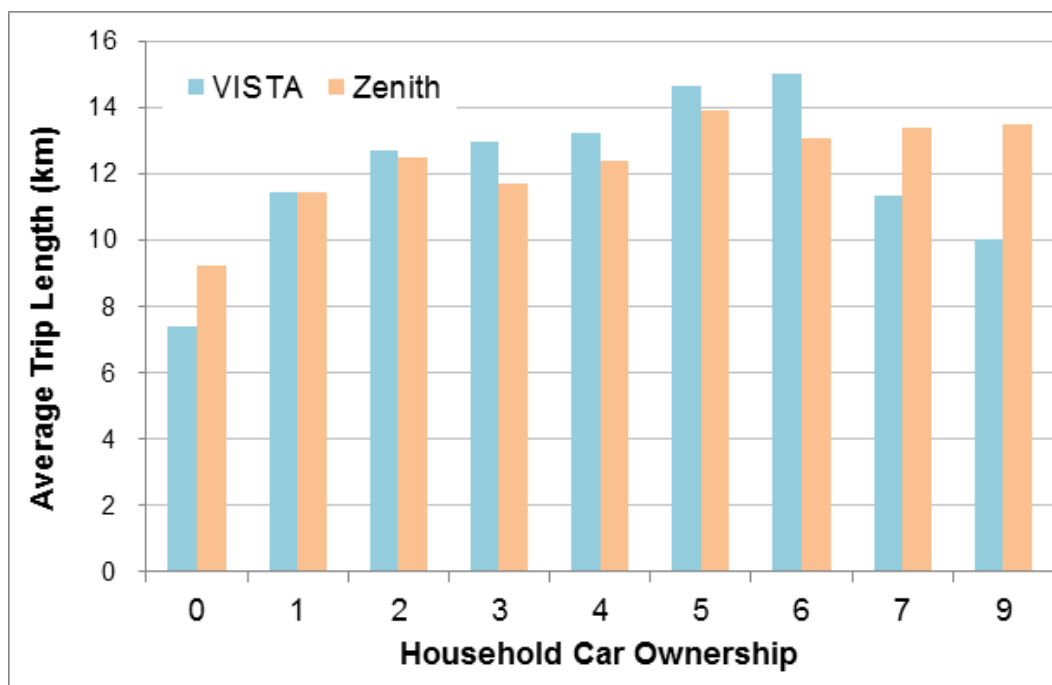


Figure 5.11: Average Trip Length by Number of Cars, Home Based Work - White Collar Workers

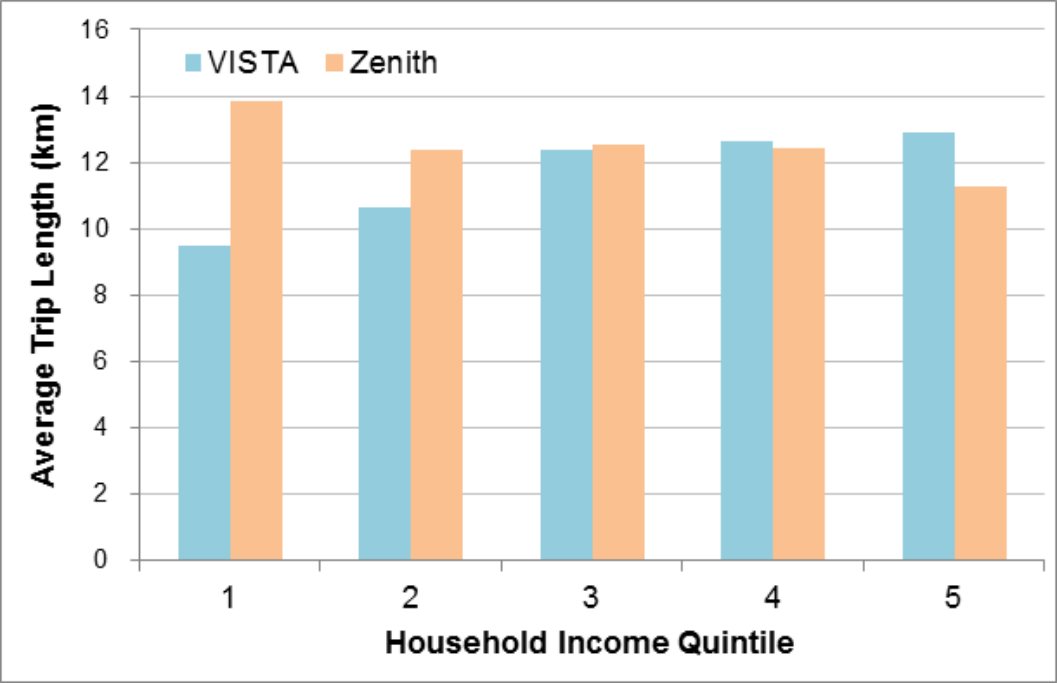


Figure 5.12: Average Trip Length by Household Income Quintile, Home Based Work - White Collar Workers



5.3 Model Validation - Home Based Work - Blue Collar Workers

5.3.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Home Based Work (Blue Collar Workers) are compared below. Figure 5.7 presents the same data in a cumulative form.

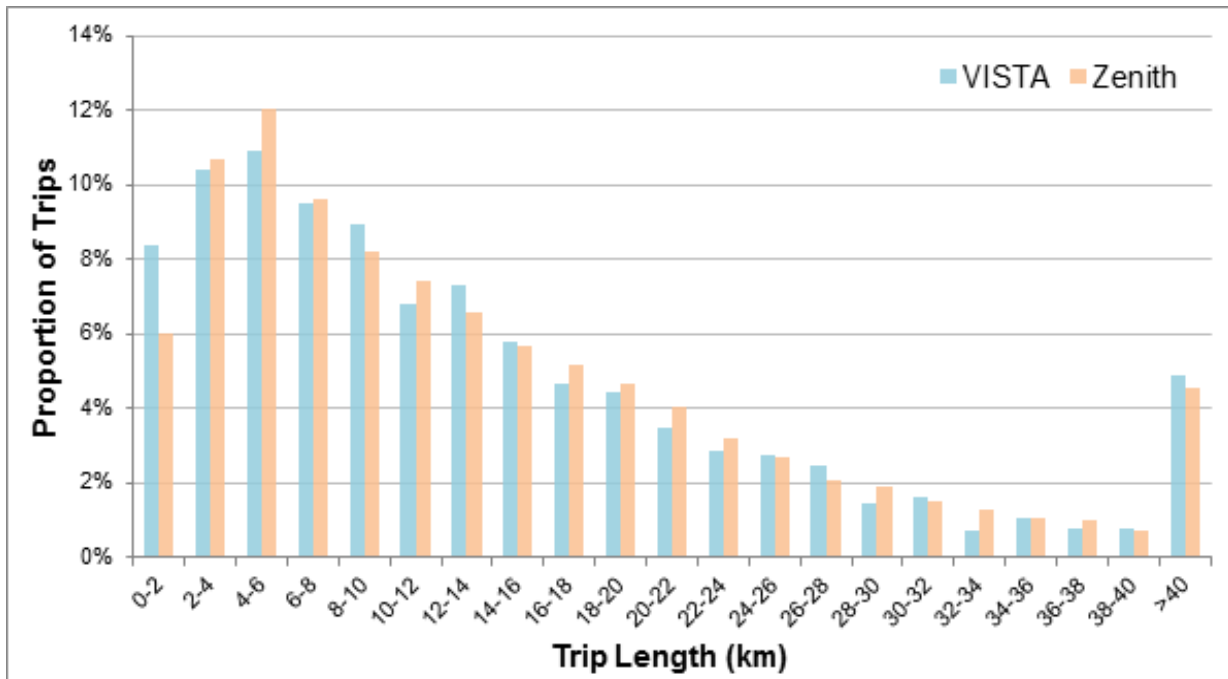


Figure 5.13: Trip Length Frequency Distribution, Home Based Work - Blue Collar Workers

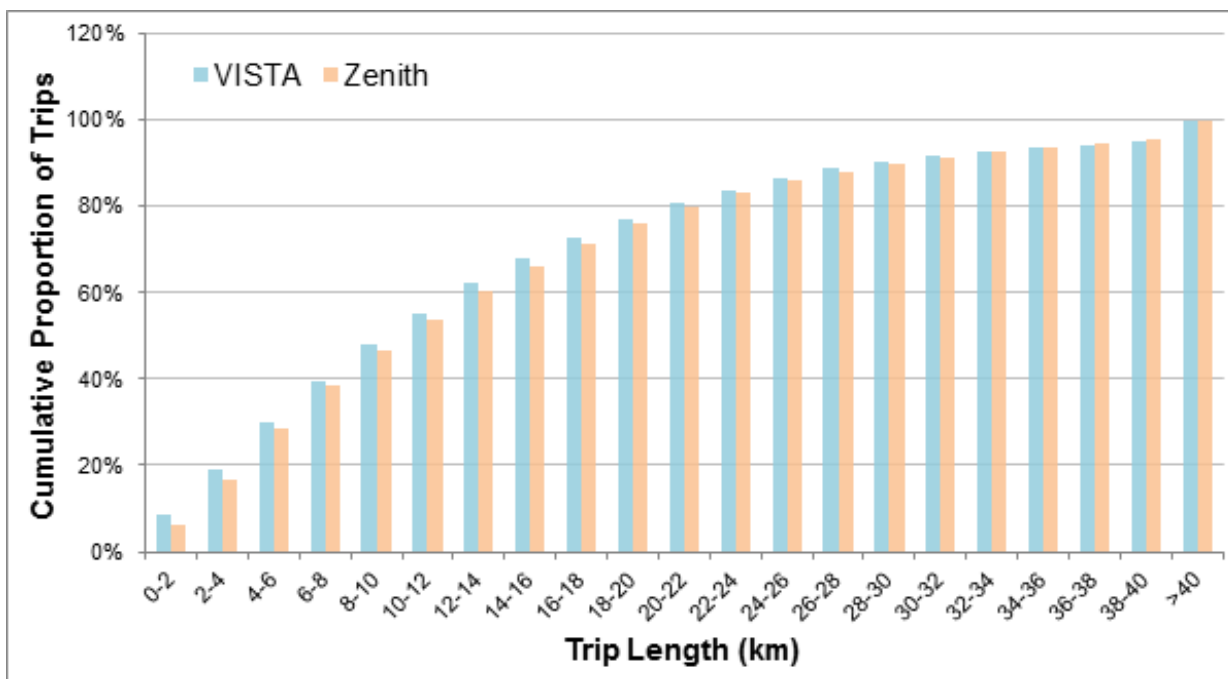


Figure 5.14: Cumulative Trip Length Frequency Distribution, Home Based Work - Blue Collar Workers



5.3.2 Sector To Sector analysis

Modelled and observed Home Based Work (Blue Collar Workers) SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

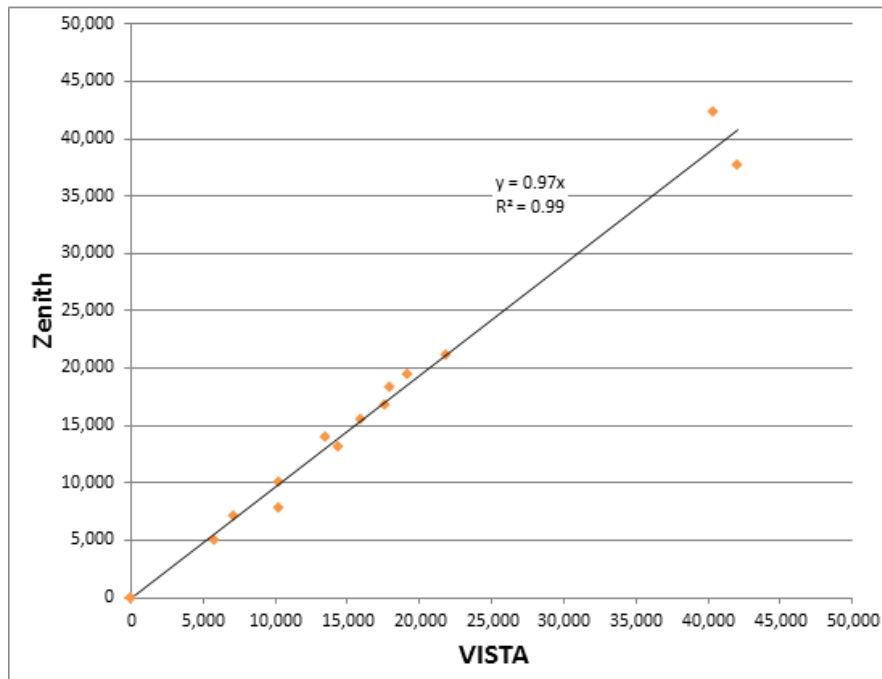


Figure 5.15: Intra SA4 Movements, Home Based Work - Blue Collar Workers

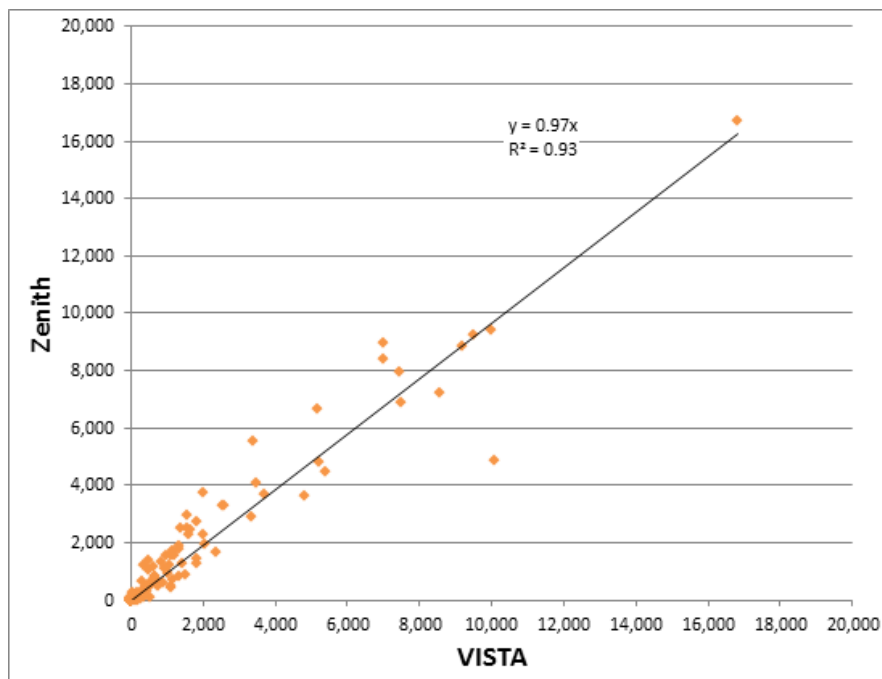


Figure 5.16: Inter SA4 Movements, Home Based Work - Blue Collar Workers



5.3.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

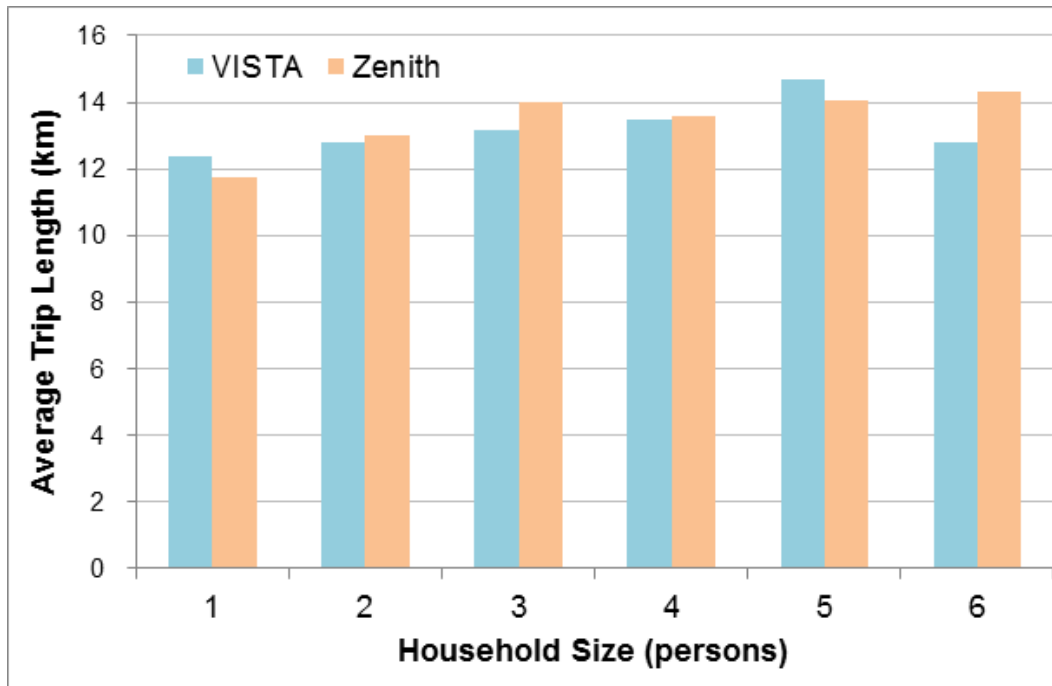


Figure 5.17: Average Trip Length by Household Size, Home Based Work - Blue Collar Workers

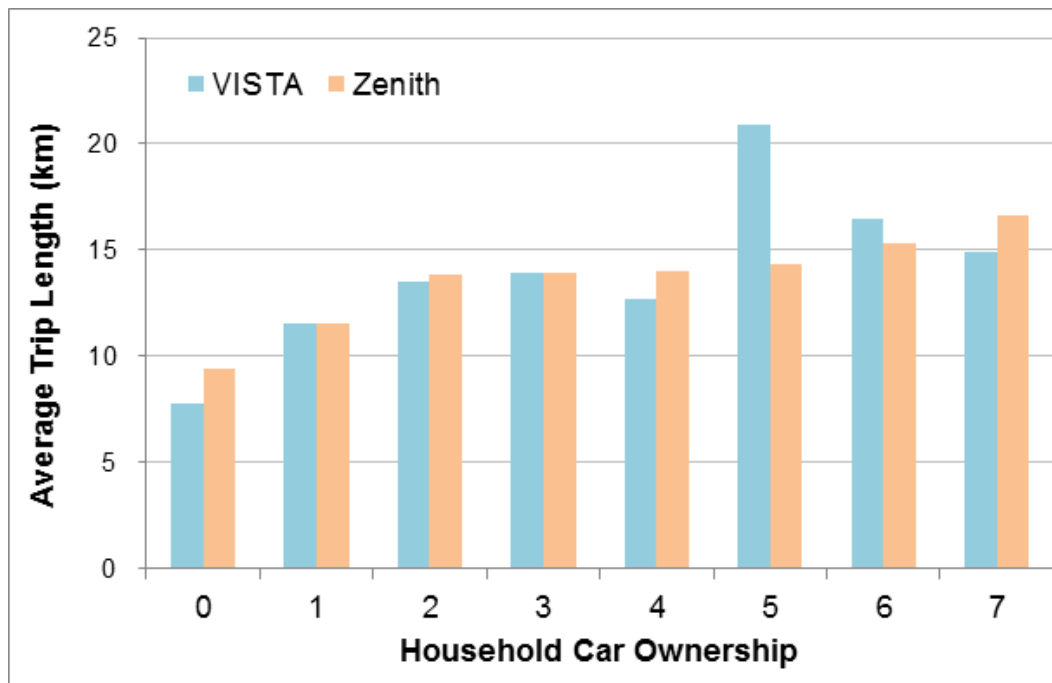


Figure 5.18: Average Trip Length by Number of Cars, Home Based Work - Blue Collar Workers

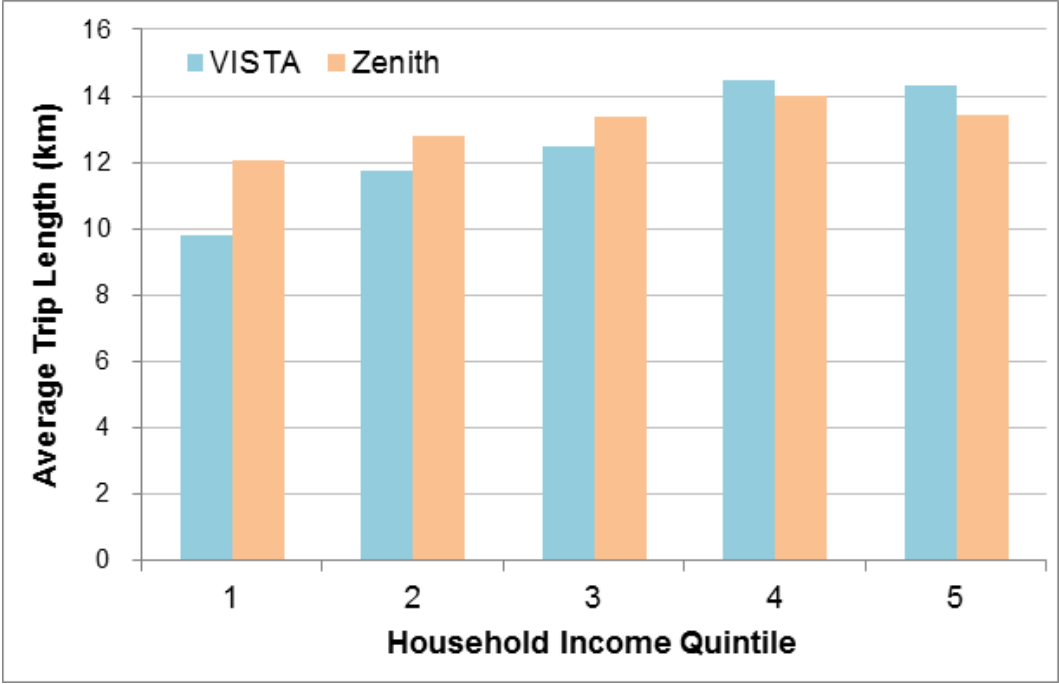


Figure 5.19: Average Trip Length by Household Income Quintile, Home Based Work - Blue Collar Workers



5.4 Model Validation - Home Based Education - Secondary School

5.4.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Home Based Education (Secondary School) are compared below. Figure 5.7 presents the same data in a cumulative form.

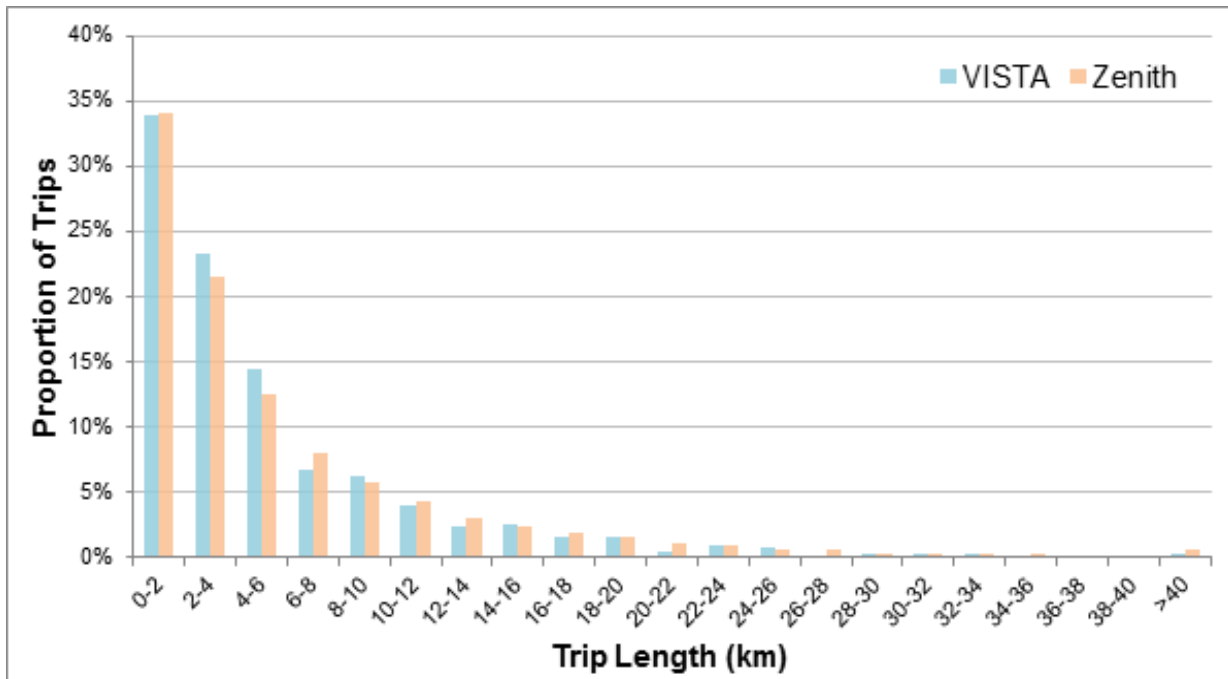


Figure 5.20: Trip Length Frequency Distribution, Home Based Education - Secondary School

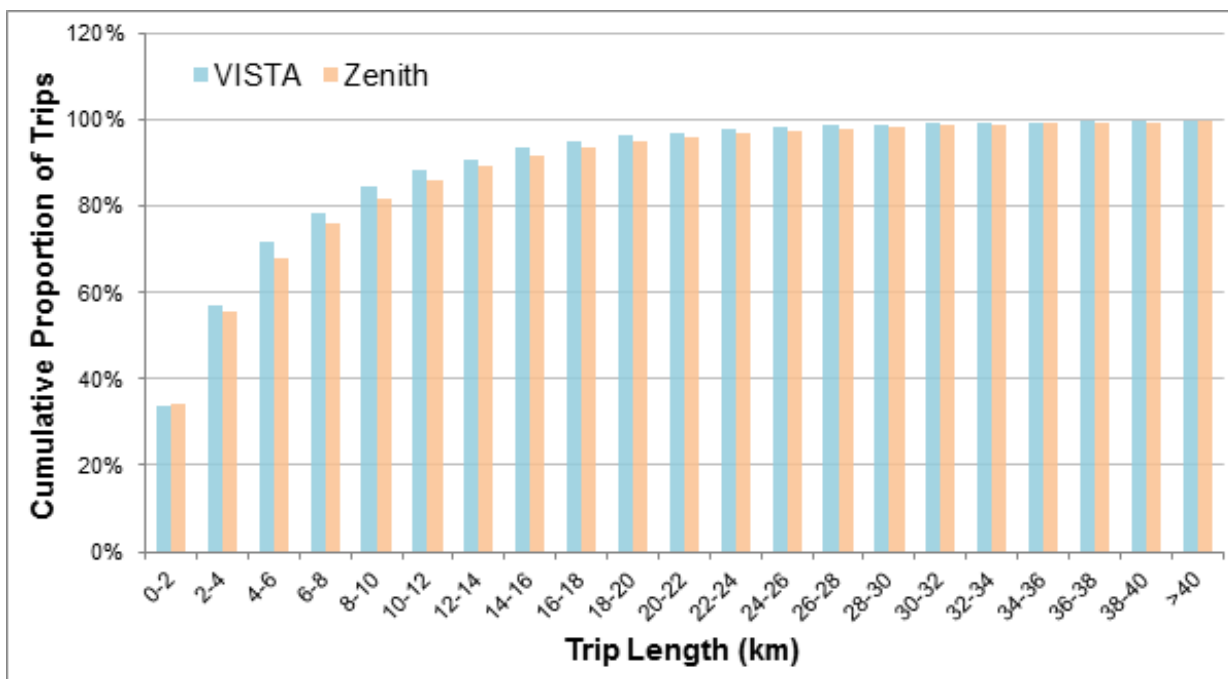


Figure 5.21: Cumulative Trip Length Frequency Distribution, Home Based Education - Secondary School



5.4.2 Sector To Sector analysis

Modelled and observed Home Based Education (Secondary School) SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

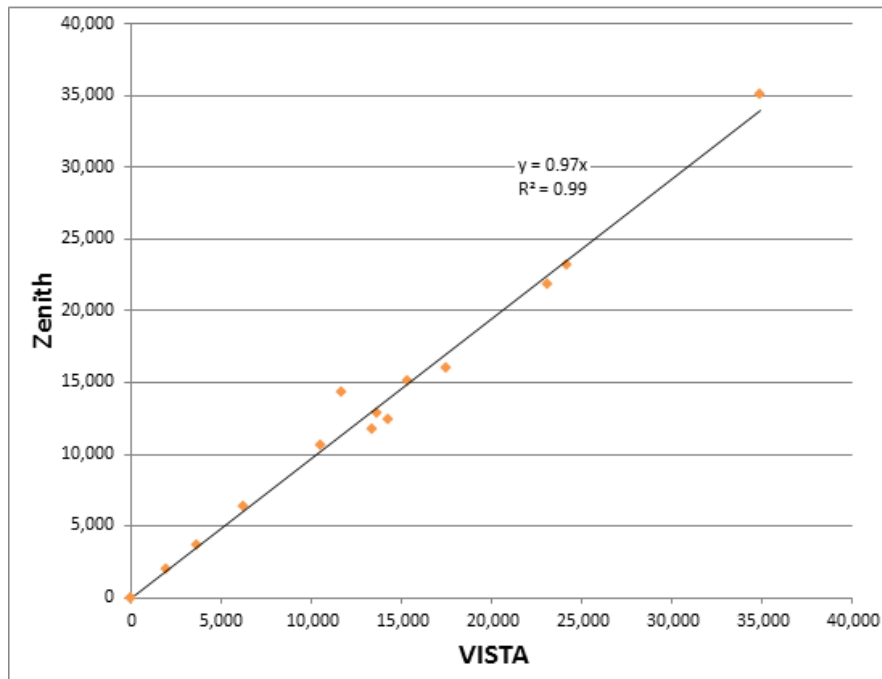


Figure 5.22: Intra SA4 Movements, Home Based Education - Secondary School

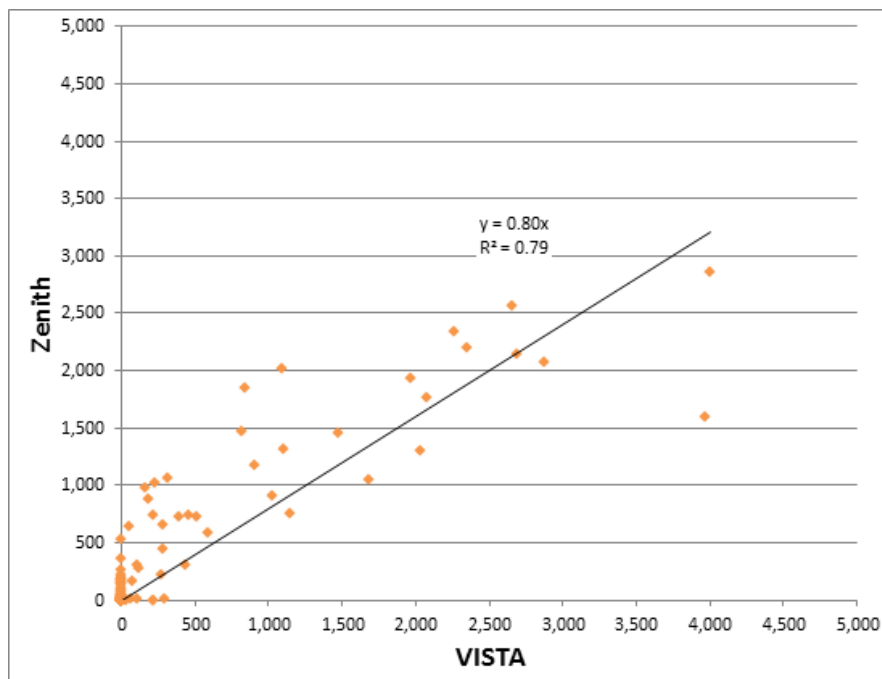


Figure 5.23: Inter SA4 Movements, Home Based Education - Secondary School



5.4.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

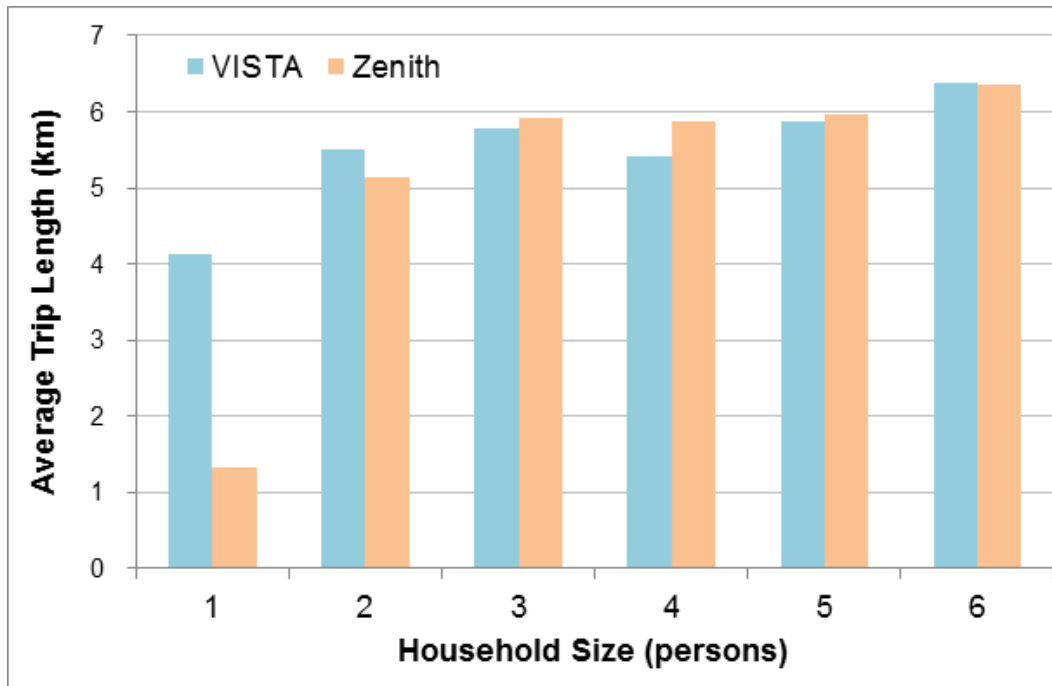


Figure 5.24: Average Trip Length by Household Size, Home Based Education - Secondary School

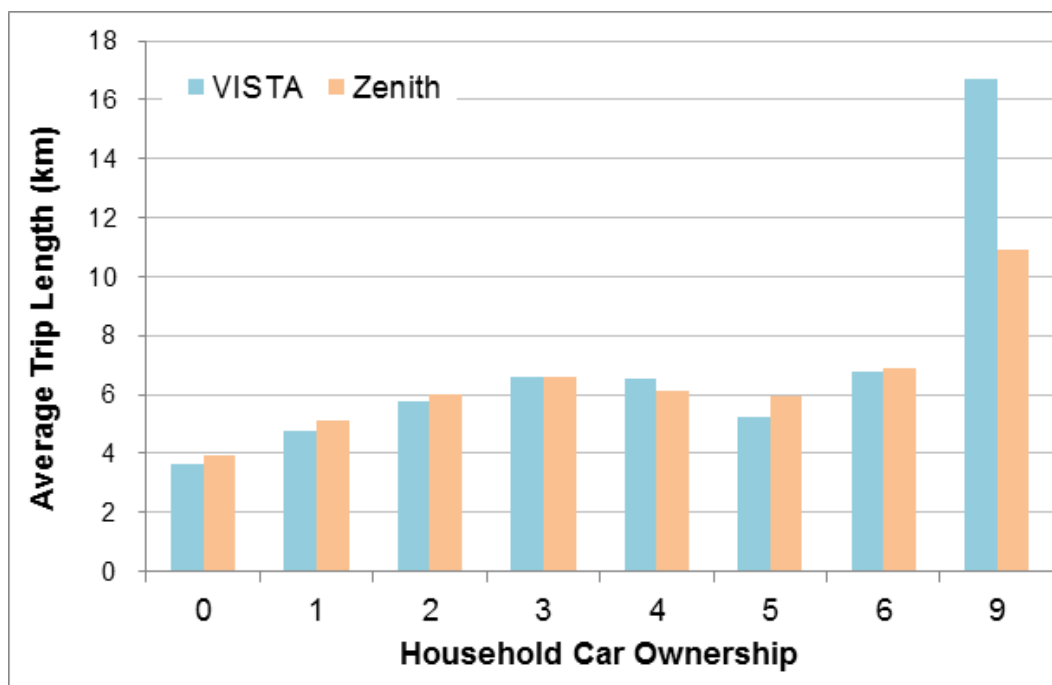


Figure 5.25: Average Trip Length by Number of Cars, Home Based Education - Secondary School

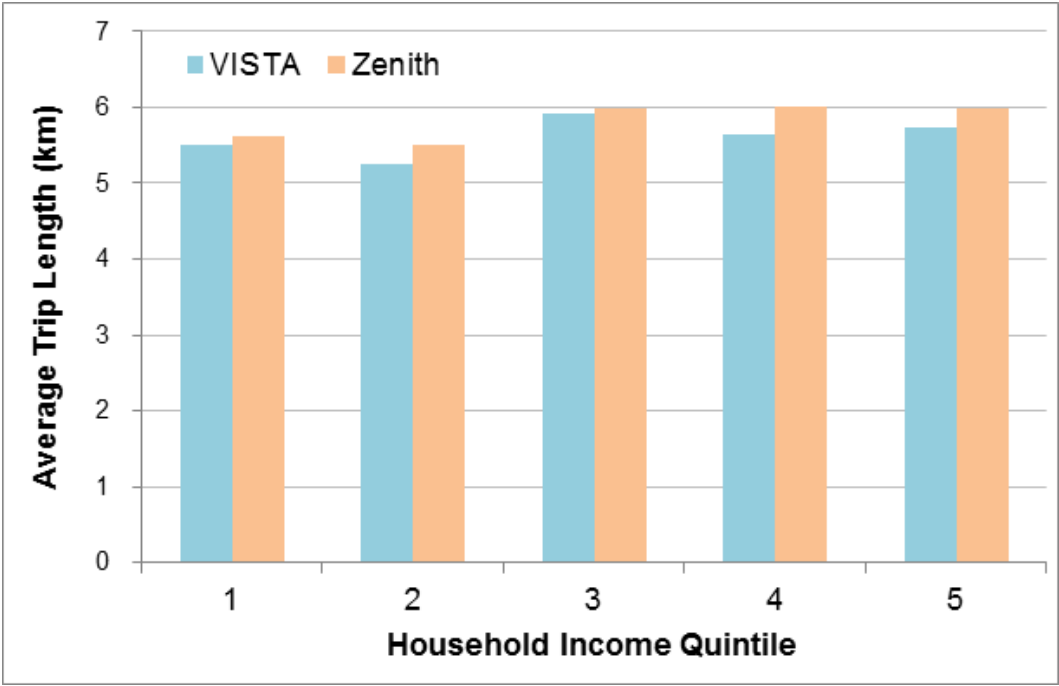


Figure 5.26: Average Trip Length by Household Income Quintile, Home Based Education - Secondary School



5.5 Model Validation - Home Based Education - Tertiary Education

5.5.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Home Based Education (Tertiary Education) are compared below. Figure 5.7 presents the same data in a cumulative form.

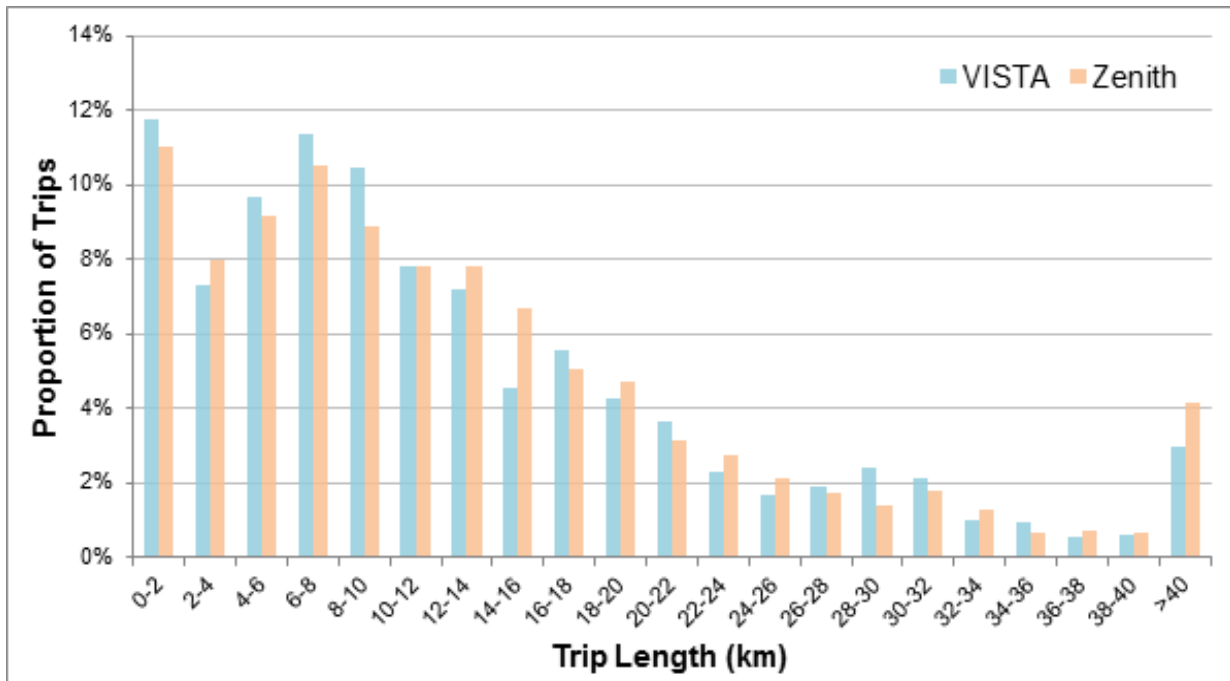


Figure 5.27: Trip Length Frequency Distribution, Home Based Education - Tertiary Education

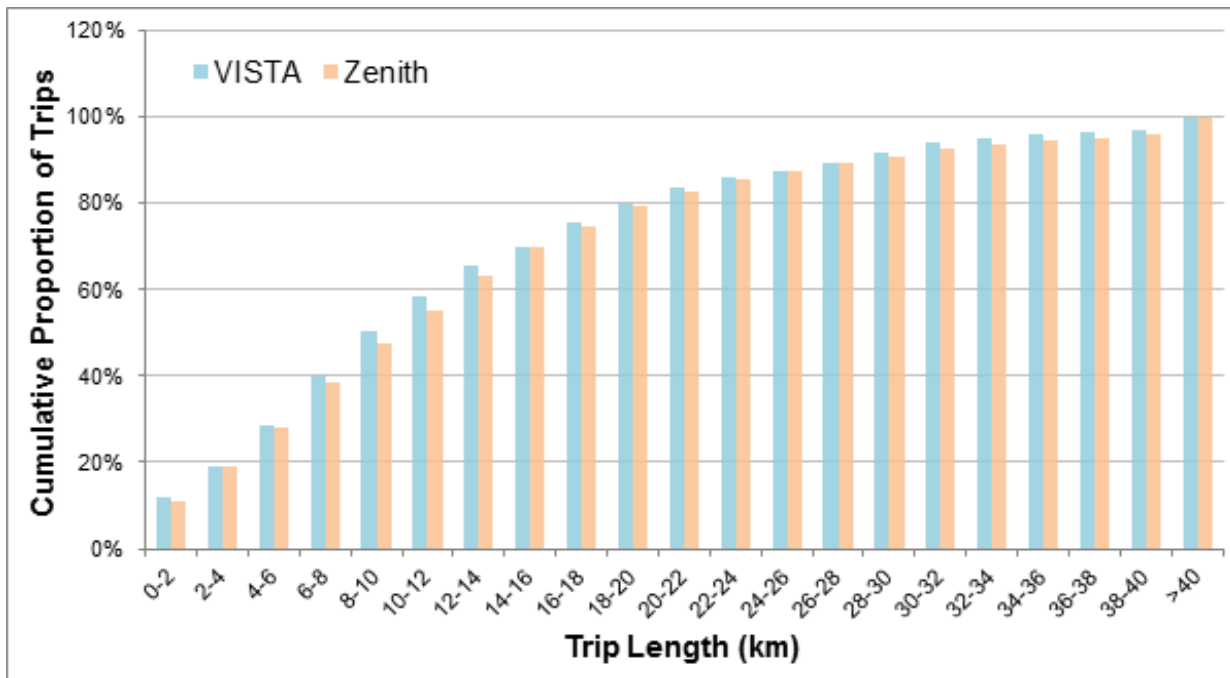


Figure 5.28: Cumulative Trip Length Frequency Distribution, Home Based Education - Tertiary Education



5.5.2 Sector To Sector analysis

Modelled and observed Home Based Education (Tertiary Education) SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

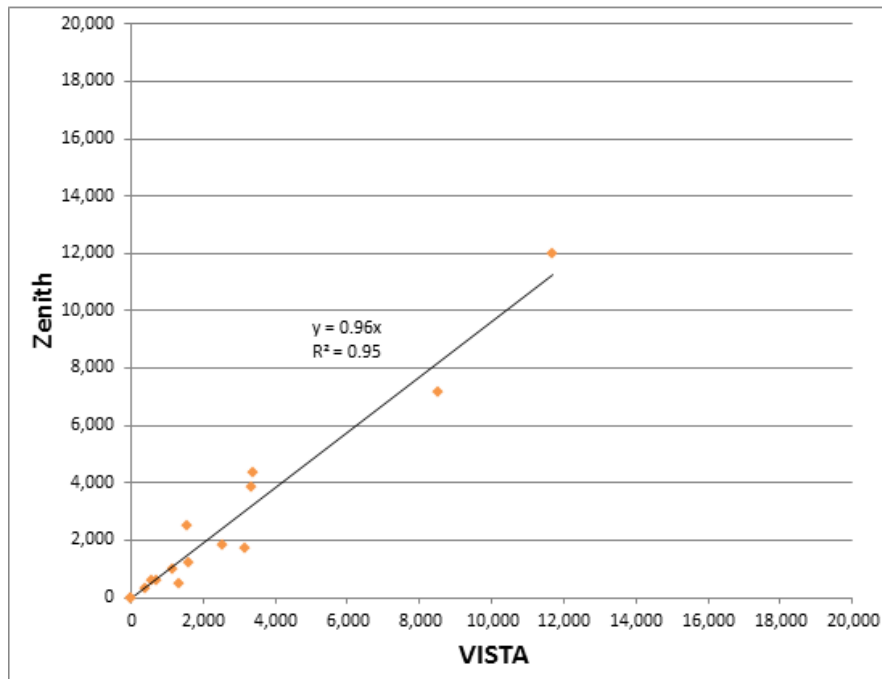


Figure 5.29: Intra SA4 Movements, Home Based Education - Tertiary Education

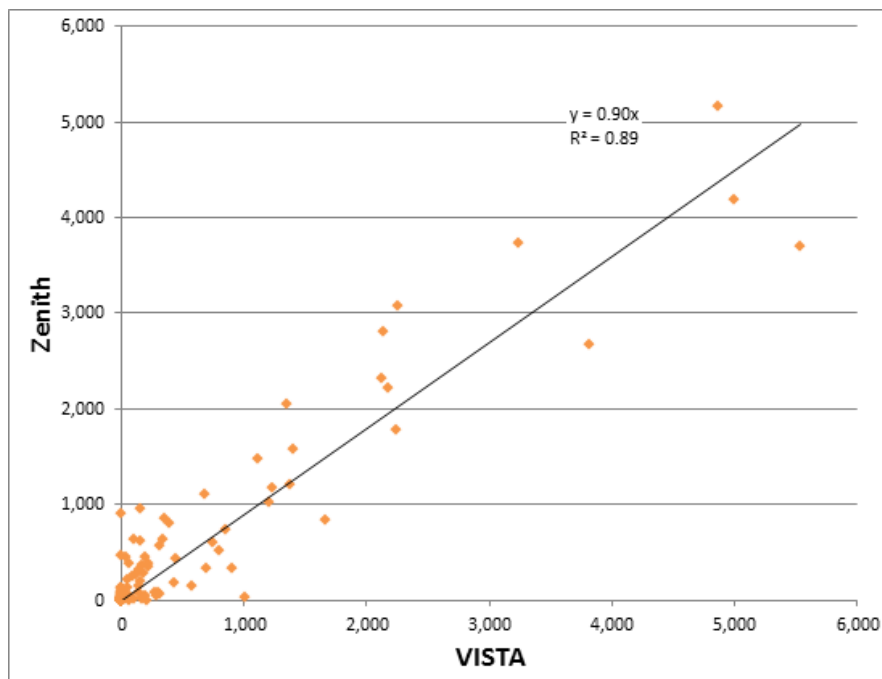


Figure 5.30: Inter SA4 Movements, Home Based Education - Tertiary Education



5.5.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

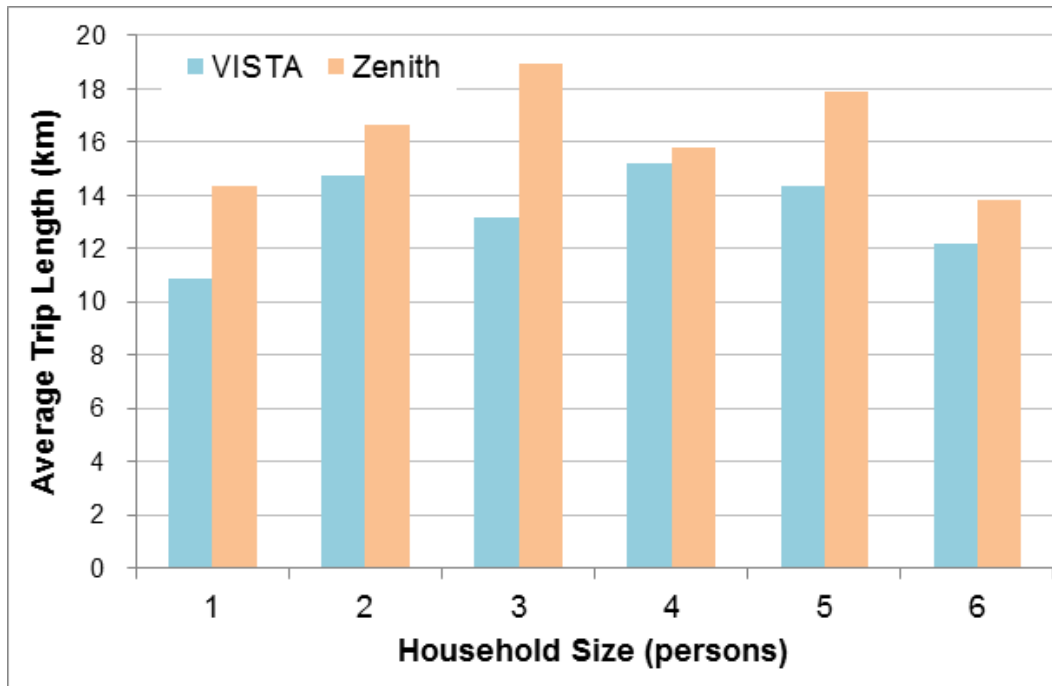


Figure 5.31: Average Trip Length by Household Size, Home Based Education - Tertiary Education

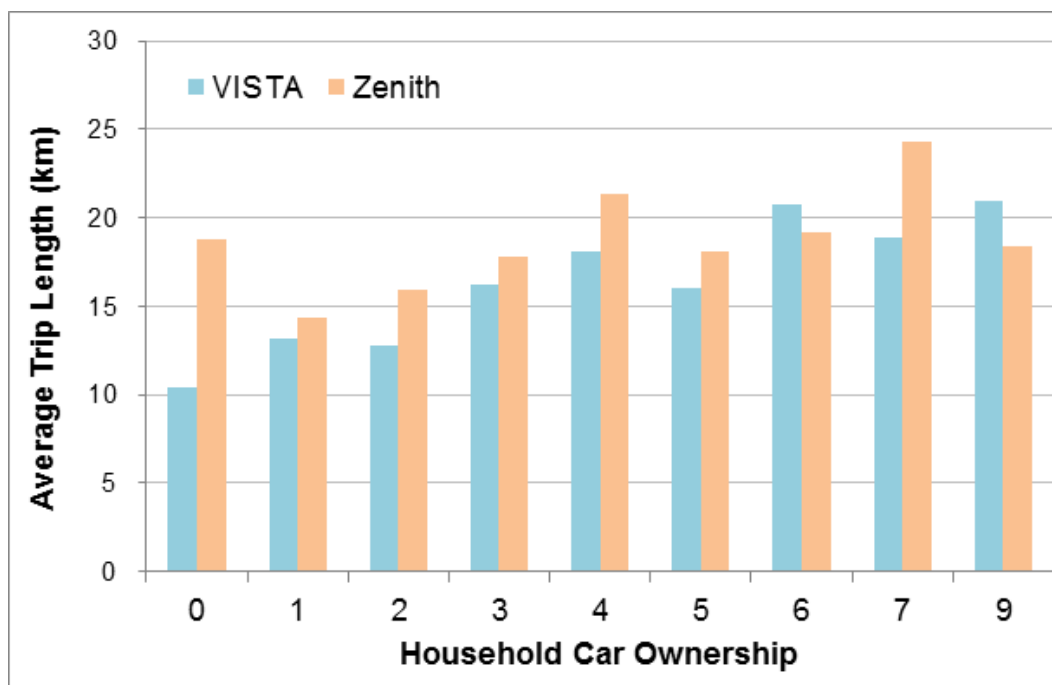


Figure 5.32: Average Trip Length by Number of Cars, Home Based Education - Tertiary Education

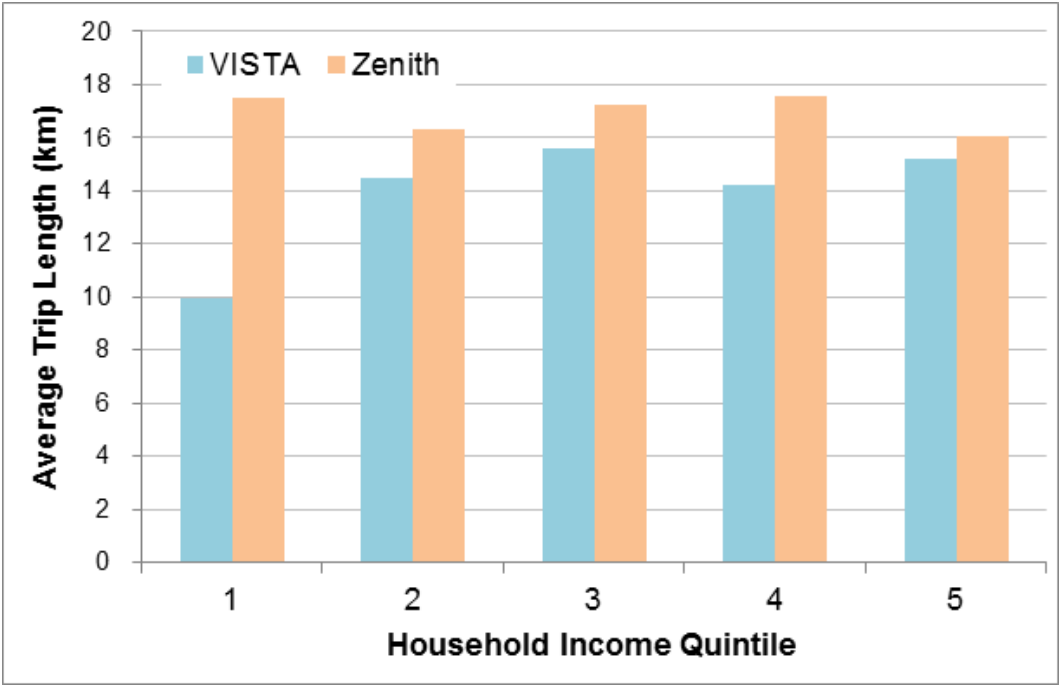


Figure 5.33: Average Trip Length by Household Income Quintile, Home Based Education - Tertiary Education



5.6 Model Validation - Home Based Shopping

5.6.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Home Based Shopping are compared below. Figure 5.7 presents the same data in a cumulative form.

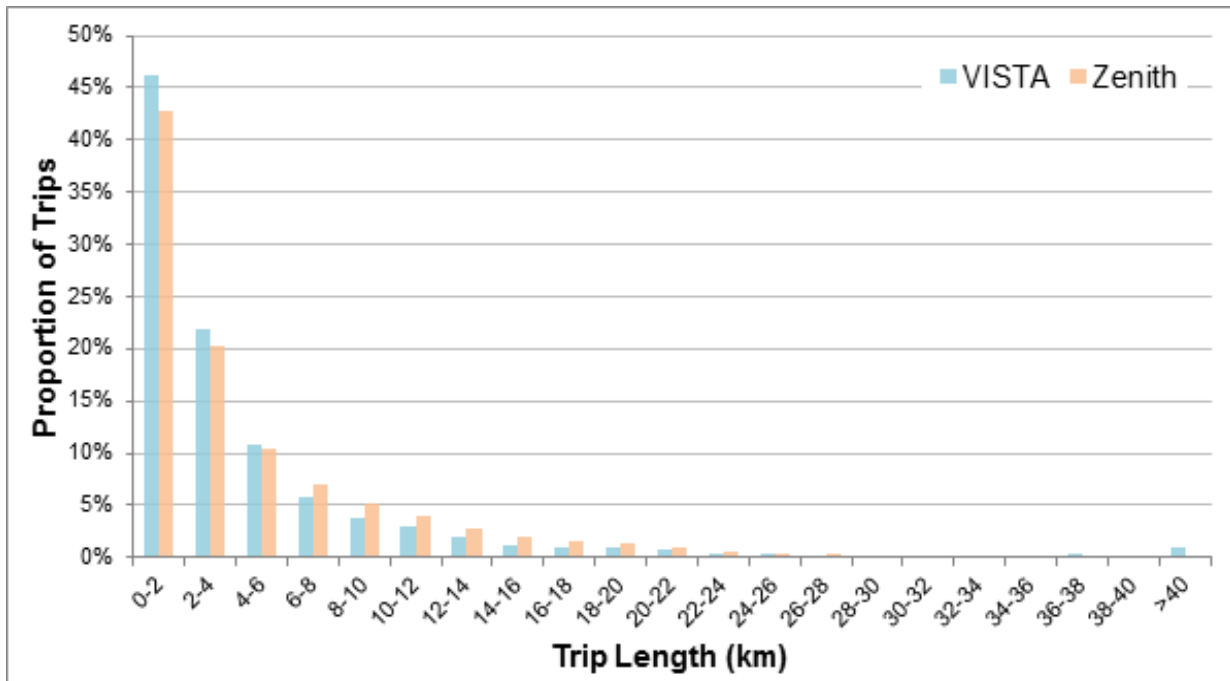


Figure 5.34: Trip Length Frequency Distribution, Home Based Shopping

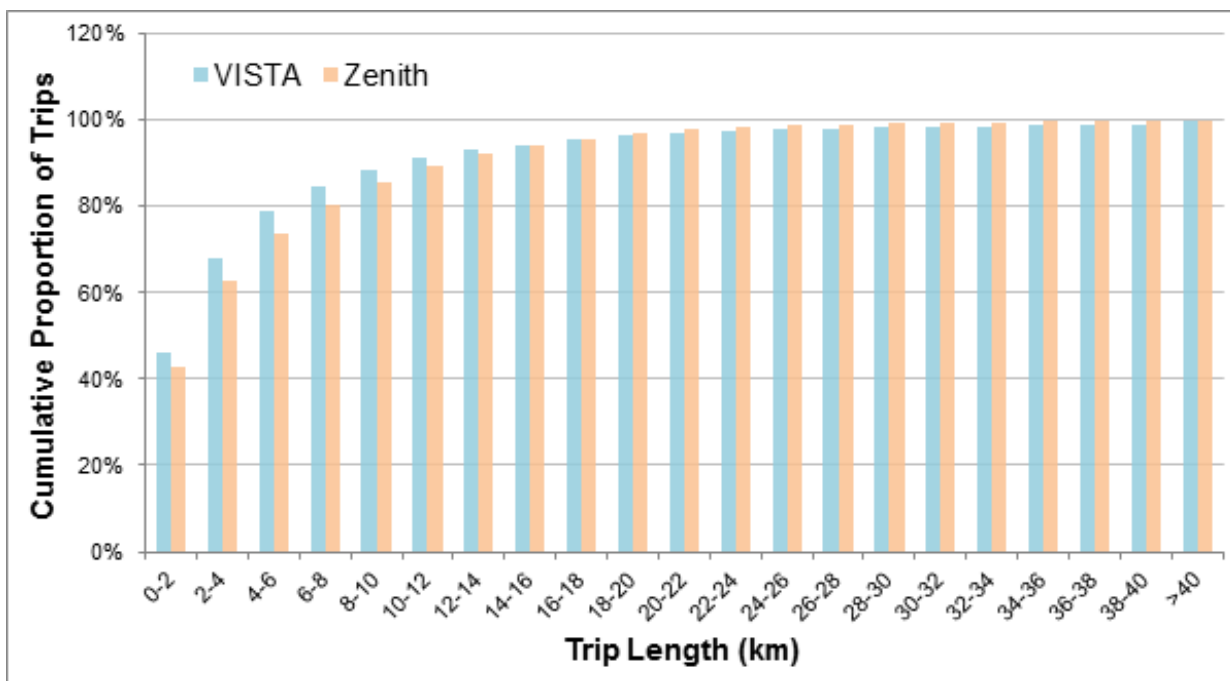


Figure 5.35: Cumulative Trip Length Frequency Distribution, Home Based Shopping



5.6.2 Sector To Sector analysis

Modelled and observed Home Based Shopping SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

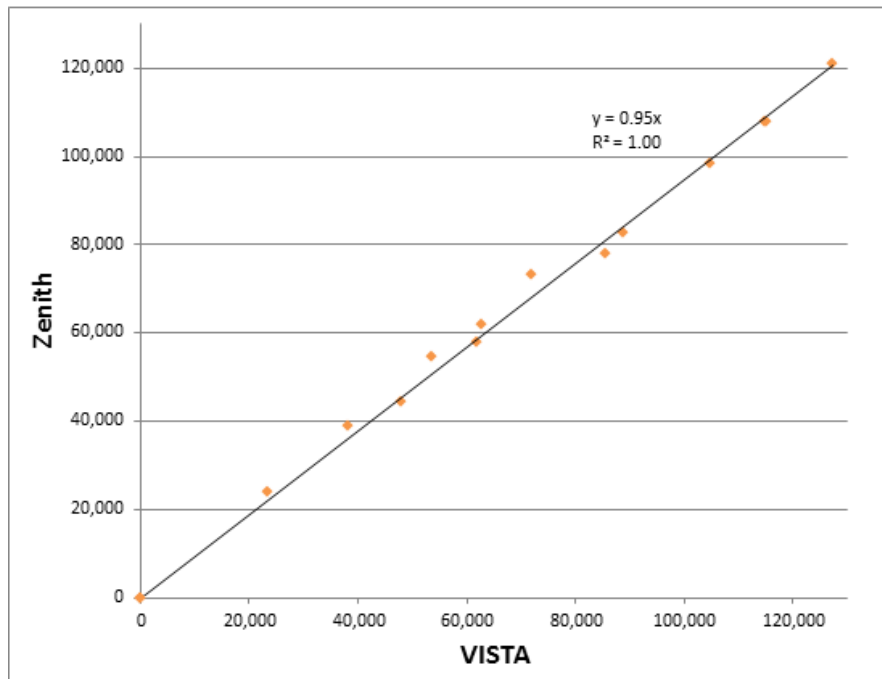


Figure 5.36: Intra SA4 Movements, Home Based Shopping

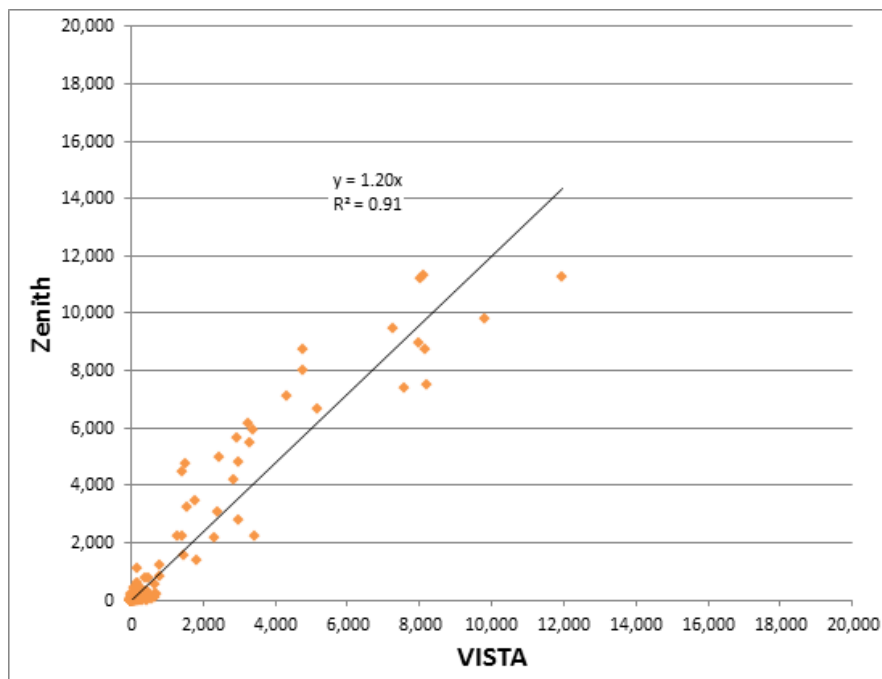


Figure 5.37: Inter SA4 Movements, Home Based Shopping



5.6.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

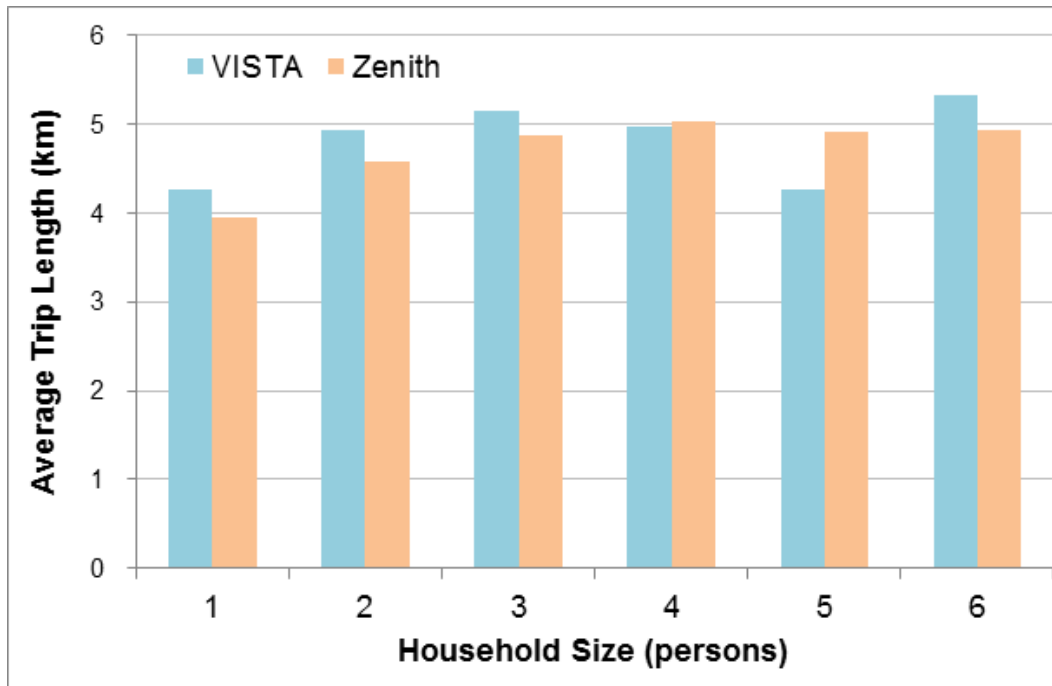


Figure 5.38: Average Trip Length by Household Size, Home Based Shopping

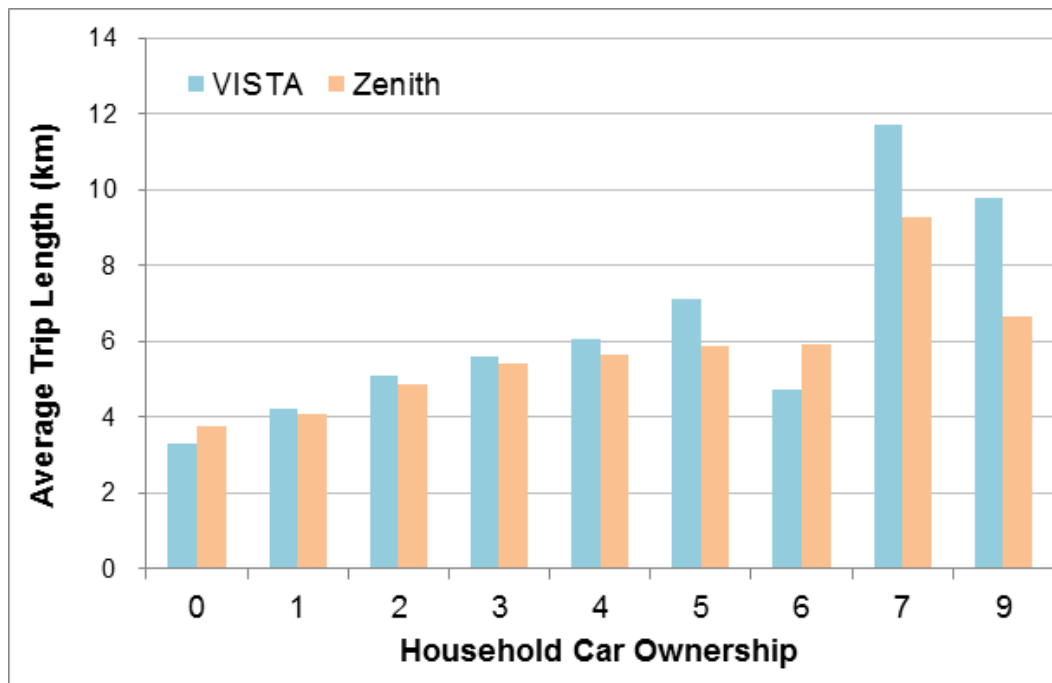


Figure 5.39: Average Trip Length by Number of Cars, Home Based Shopping

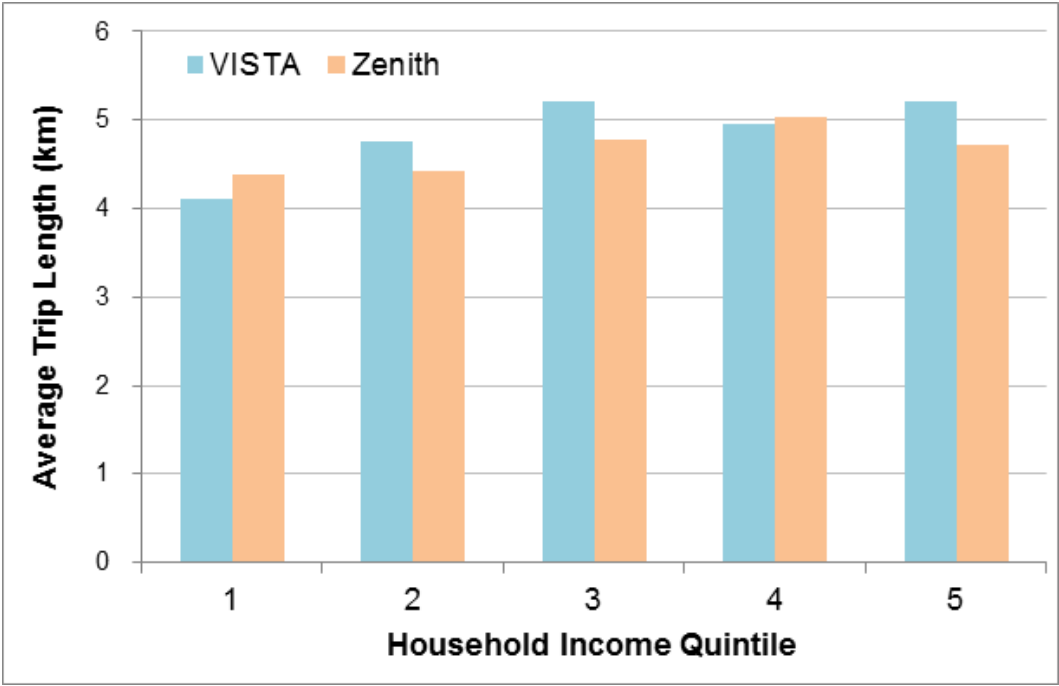


Figure 5.40: Average Trip Length by Household Income Quintile, Home Based Shopping



5.7 Model Validation - Home Based Recreation

5.7.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Home Based Recreation are compared below. Figure 5.7 presents the same data in a cumulative form.

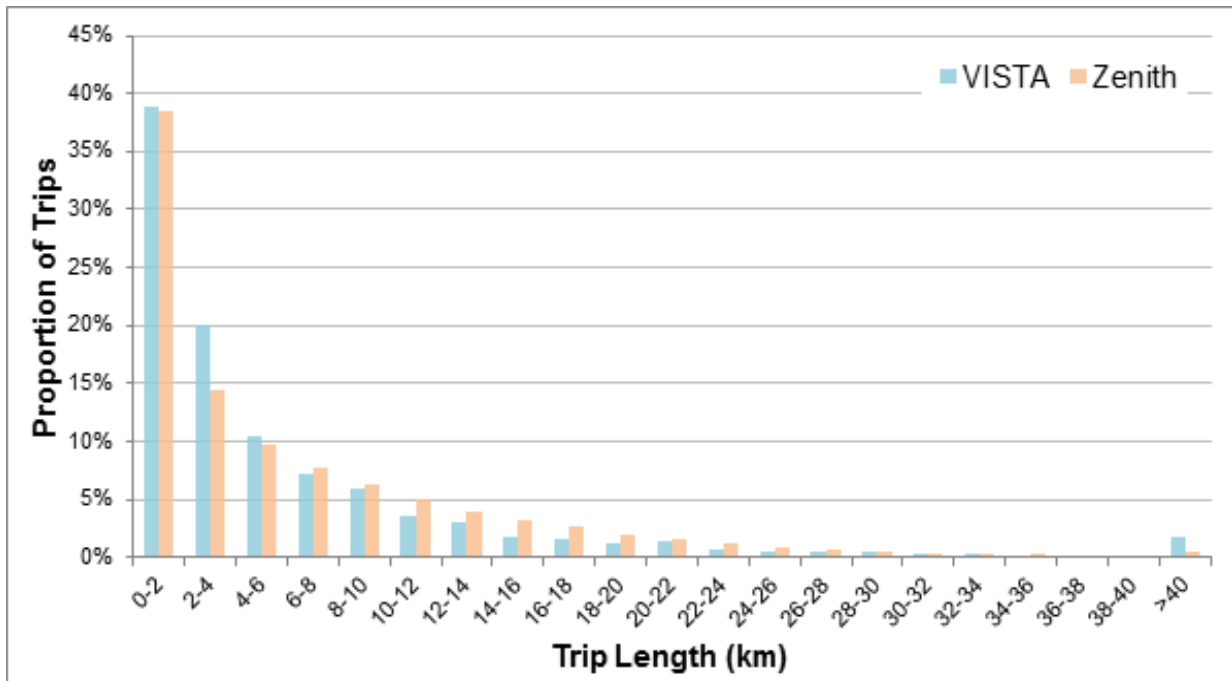


Figure 5.41: Trip Length Frequency Distribution, Home Based Recreation

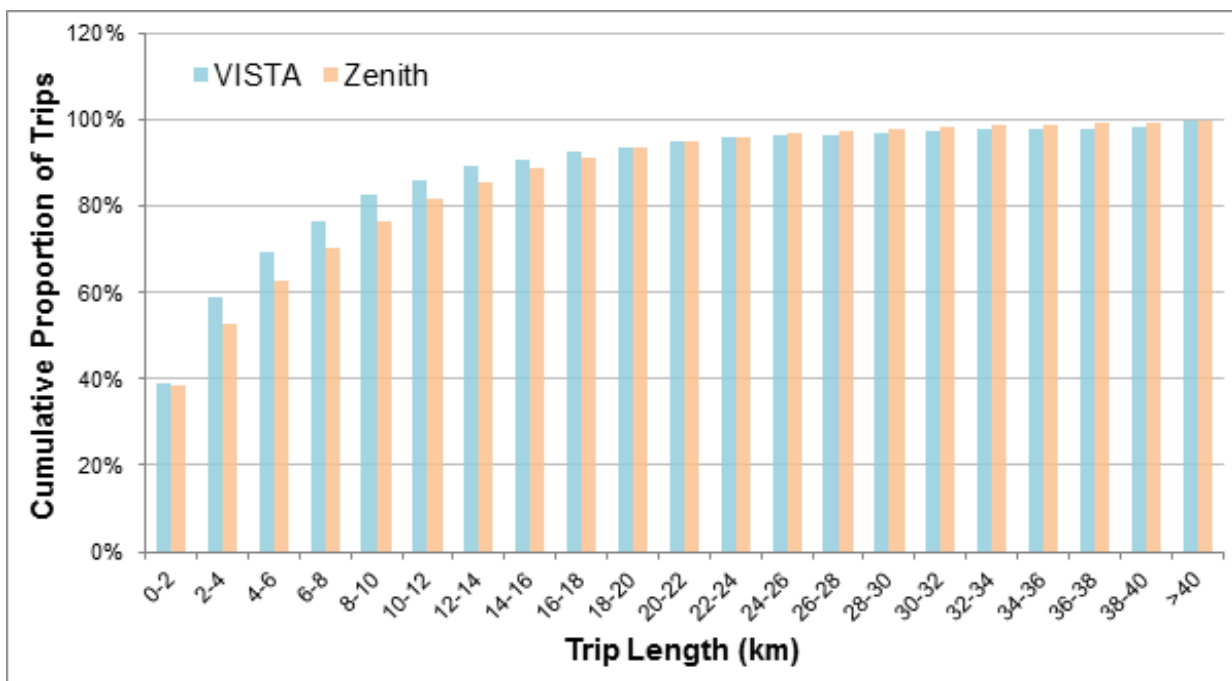


Figure 5.42: Cumulative Trip Length Frequency Distribution, Home Based Recreation



5.7.2 Sector To Sector analysis

Modelled and observed Home Based Recreation SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

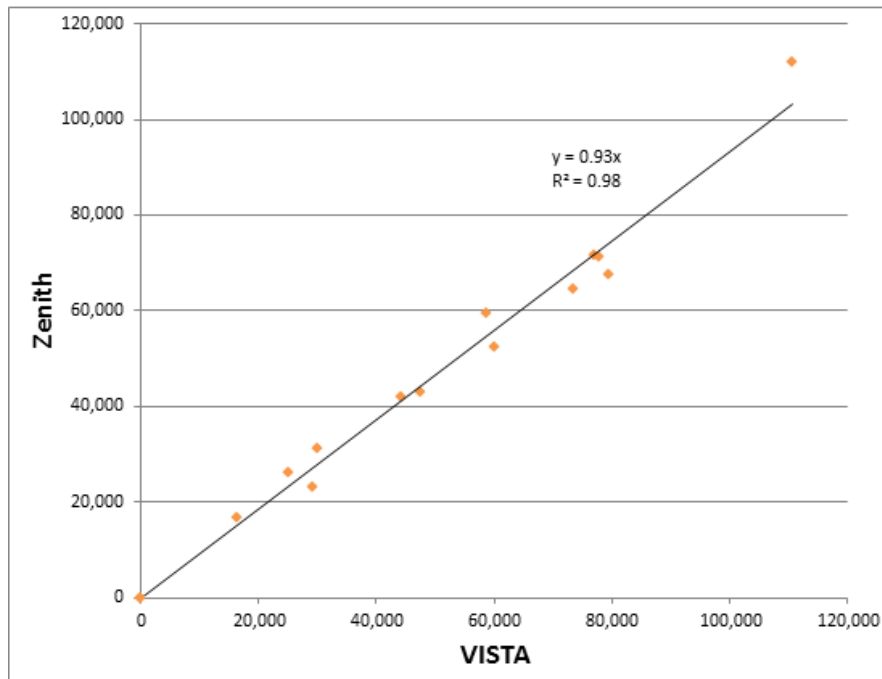


Figure 5.43: Intra SA4 Movements, Home Based Recreation

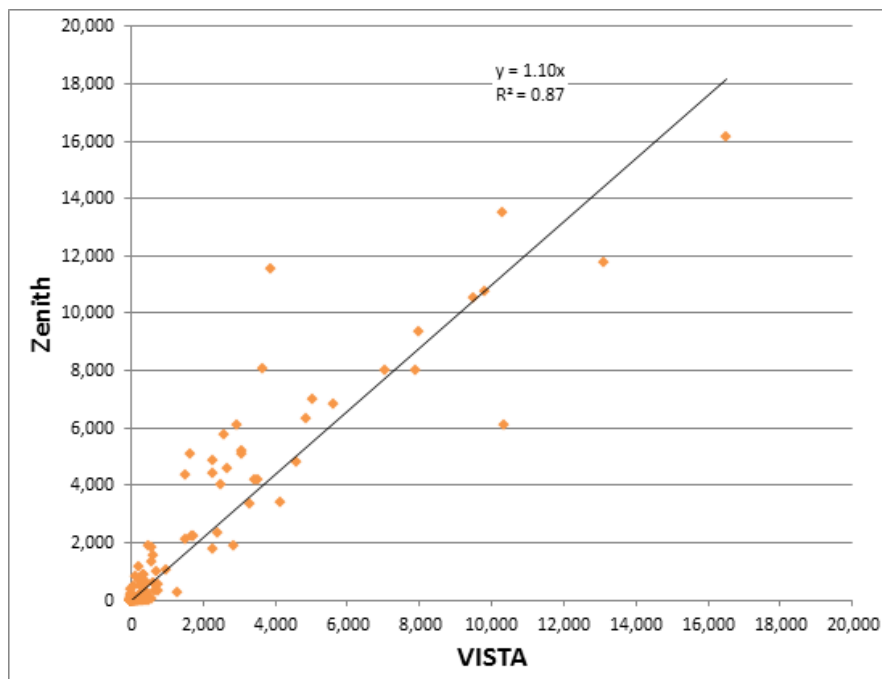


Figure 5.44: Inter SA4 Movements, Home Based Recreation



5.7.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

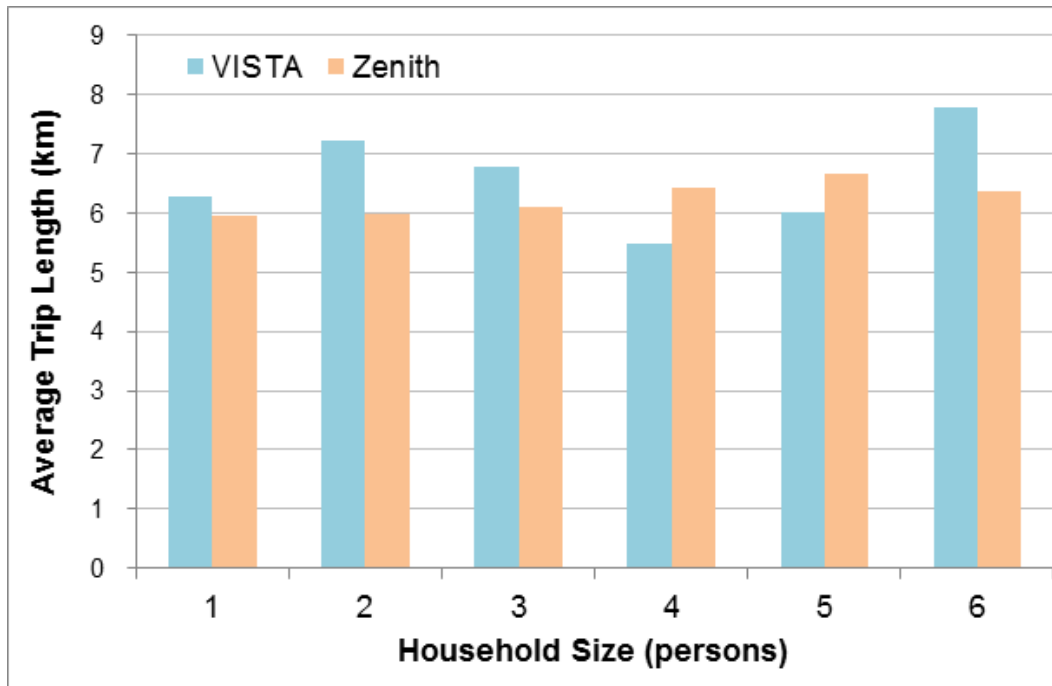


Figure 5.45: Average Trip Length by Household Size, Home Based Recreation

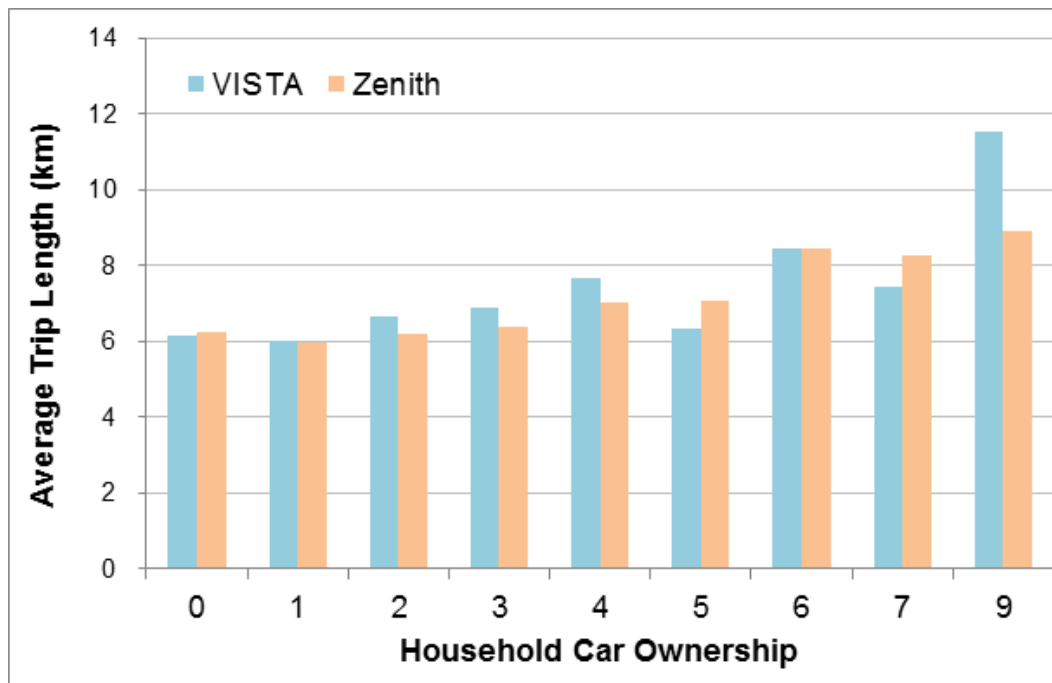


Figure 5.46: Average Trip Length by Number of Cars, Home Based Recreation

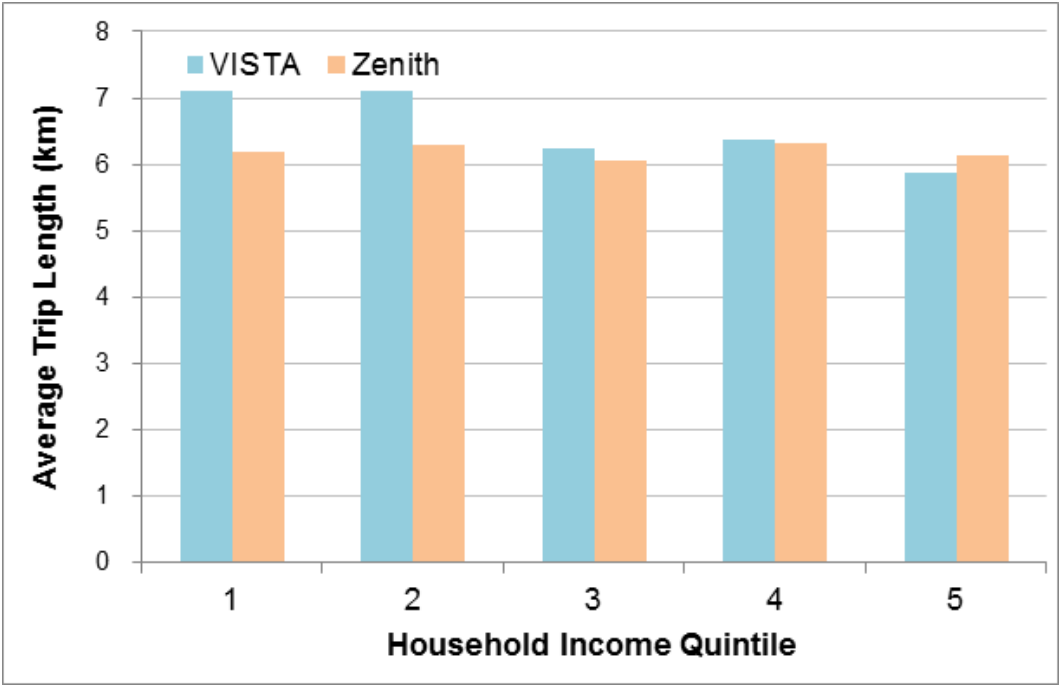


Figure 5.47: Average Trip Length by Household Income Quintile, Home Based Recreation



5.8 Model Validation - Home Based Other

5.8.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Home Based Other are compared below. Figure 5.7 presents the same data in a cumulative form.

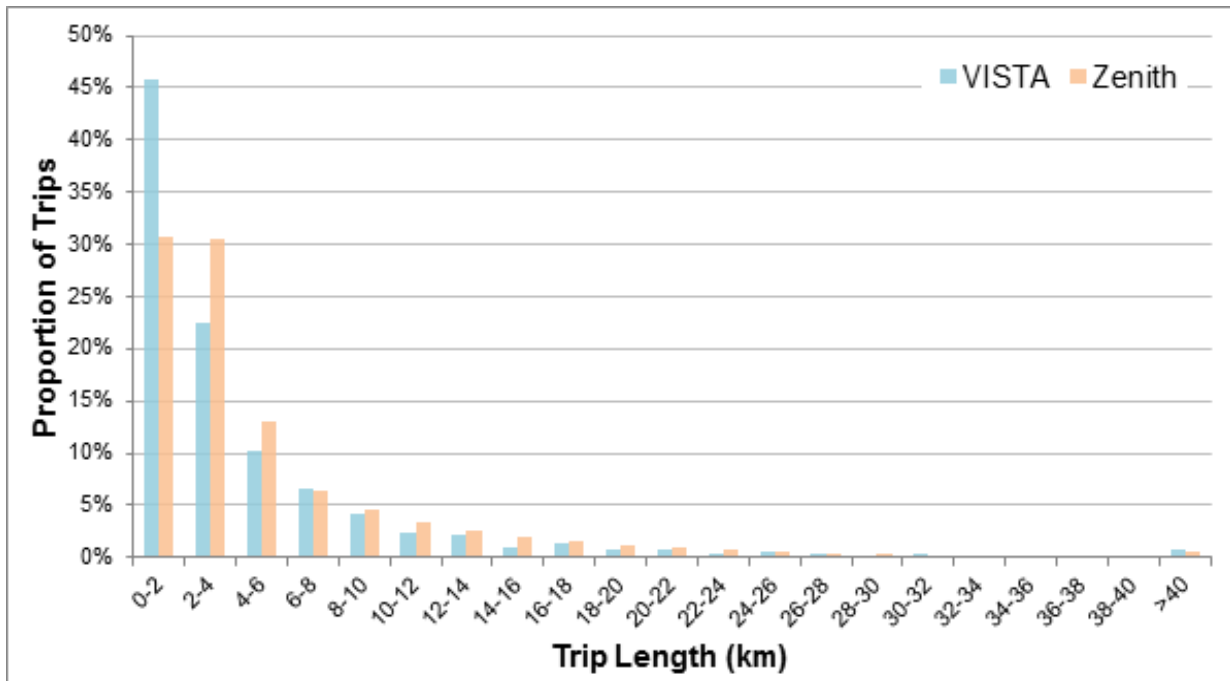


Figure 5.48: Trip Length Frequency Distribution, Home Based Other

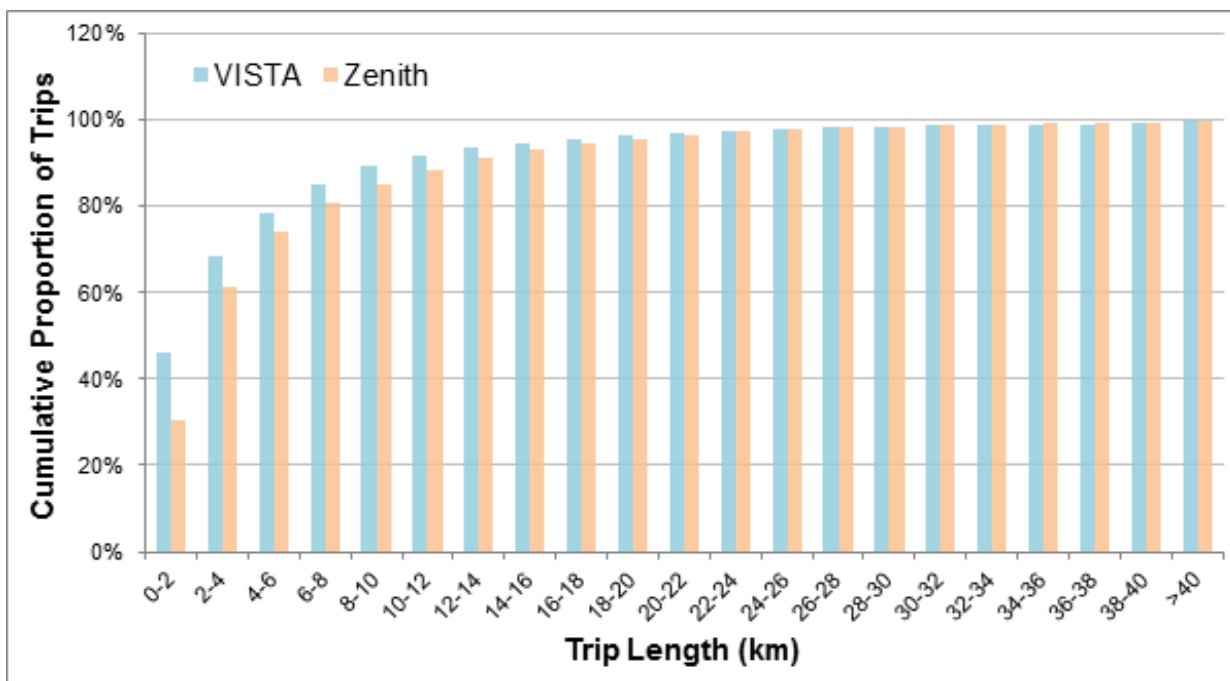


Figure 5.49: Cumulative Trip Length Frequency Distribution, Home Based Other



5.8.2 Sector To Sector analysis

Modelled and observed Home Based Other SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

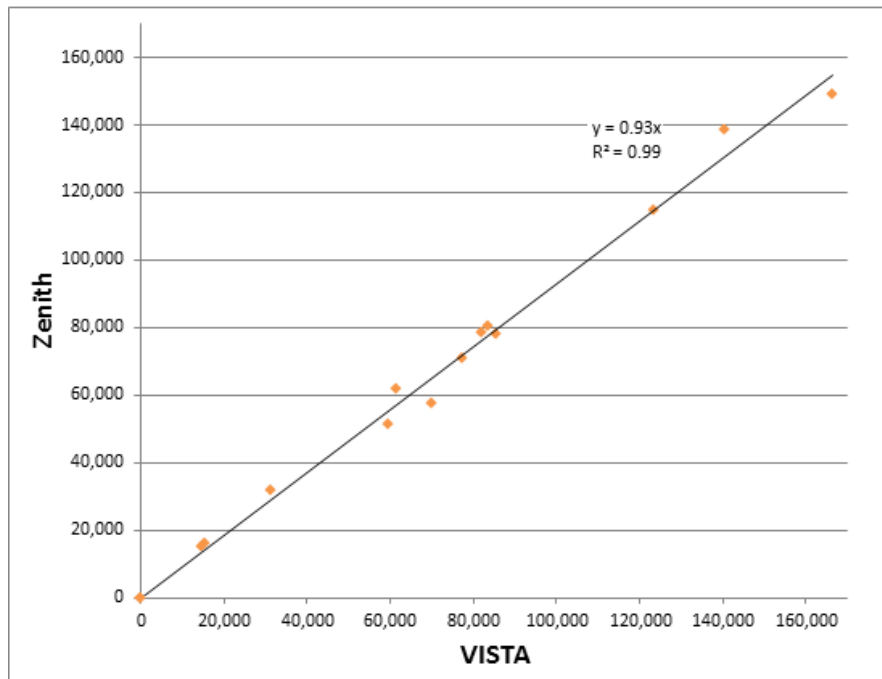


Figure 5.50: Intra SA4 Movements, Home Based Other

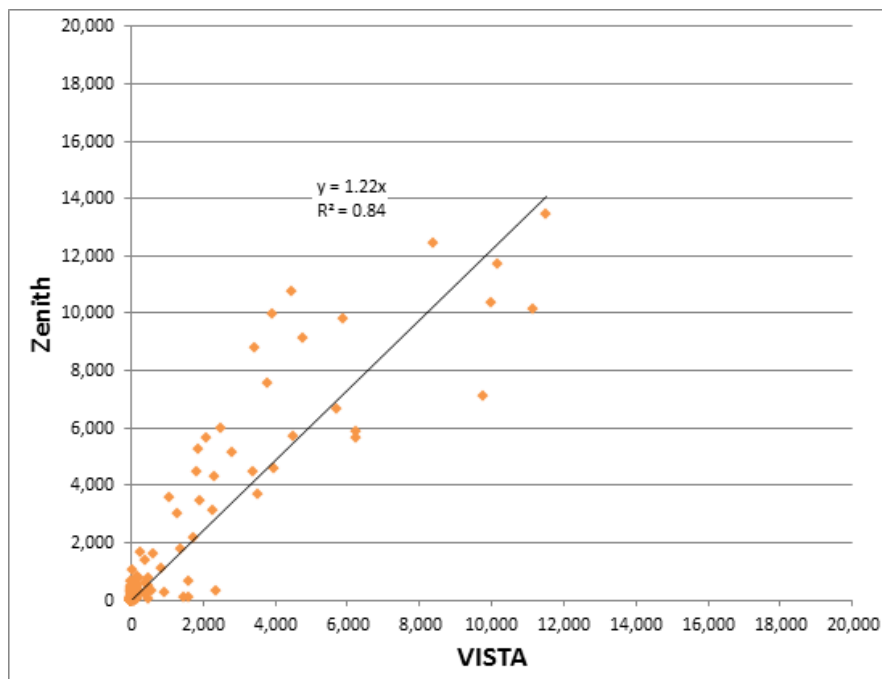


Figure 5.51: Inter SA4 Movements, Home Based Other



5.8.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

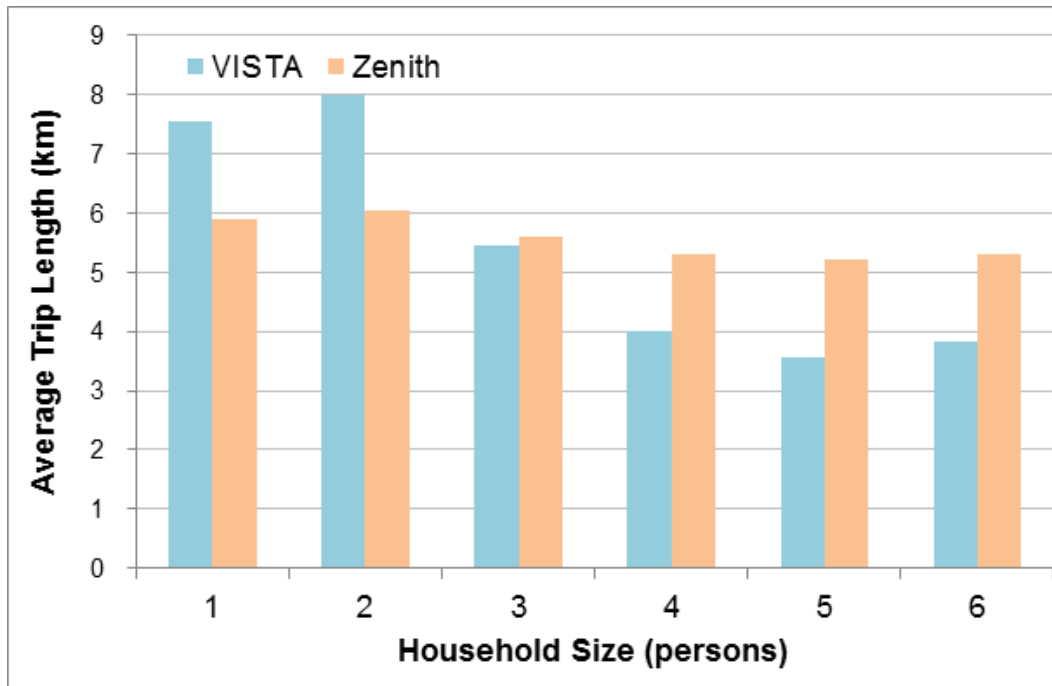


Figure 5.52: Average Trip Length by Household Size, Home Based Other

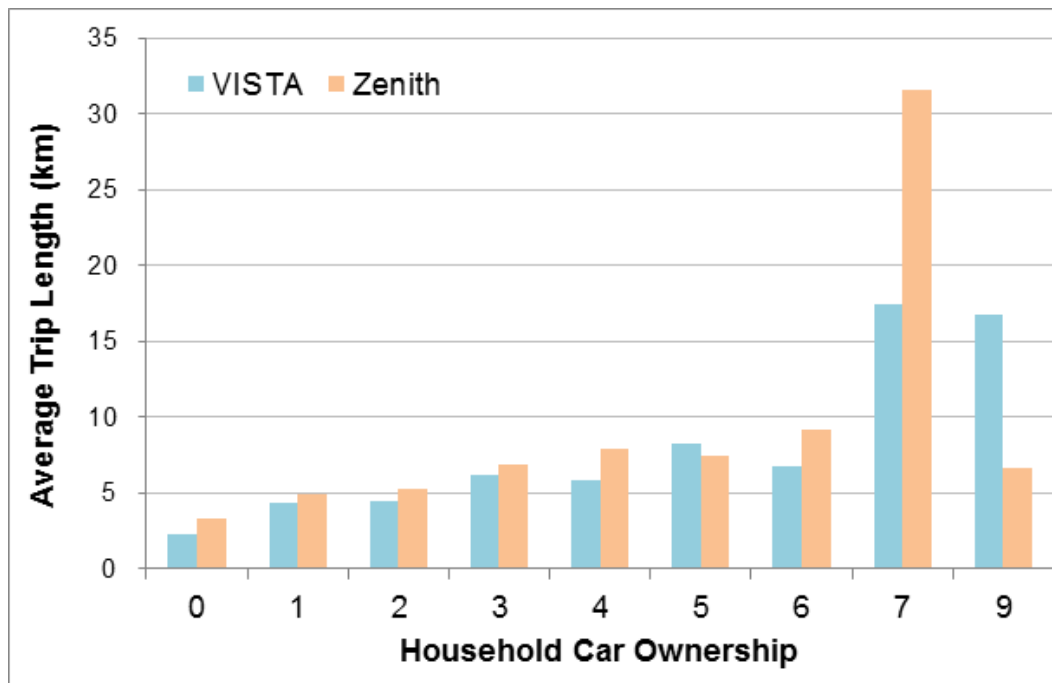


Figure 5.53: Average Trip Length by Number of Cars, Home Based Other

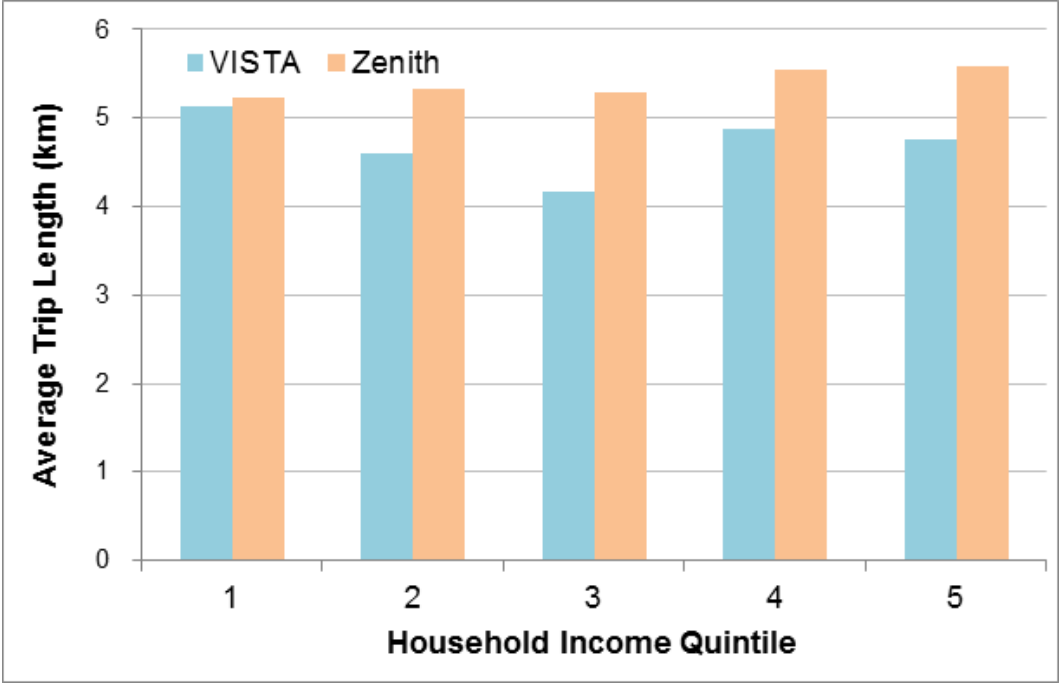


Figure 5.54: Average Trip Length by Household Income Quintile, Home Based Other



5.9 Model Validation - Work Based Work

5.9.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Work Based Work are compared below. Figure 5.7 presents the same data in a cumulative form.

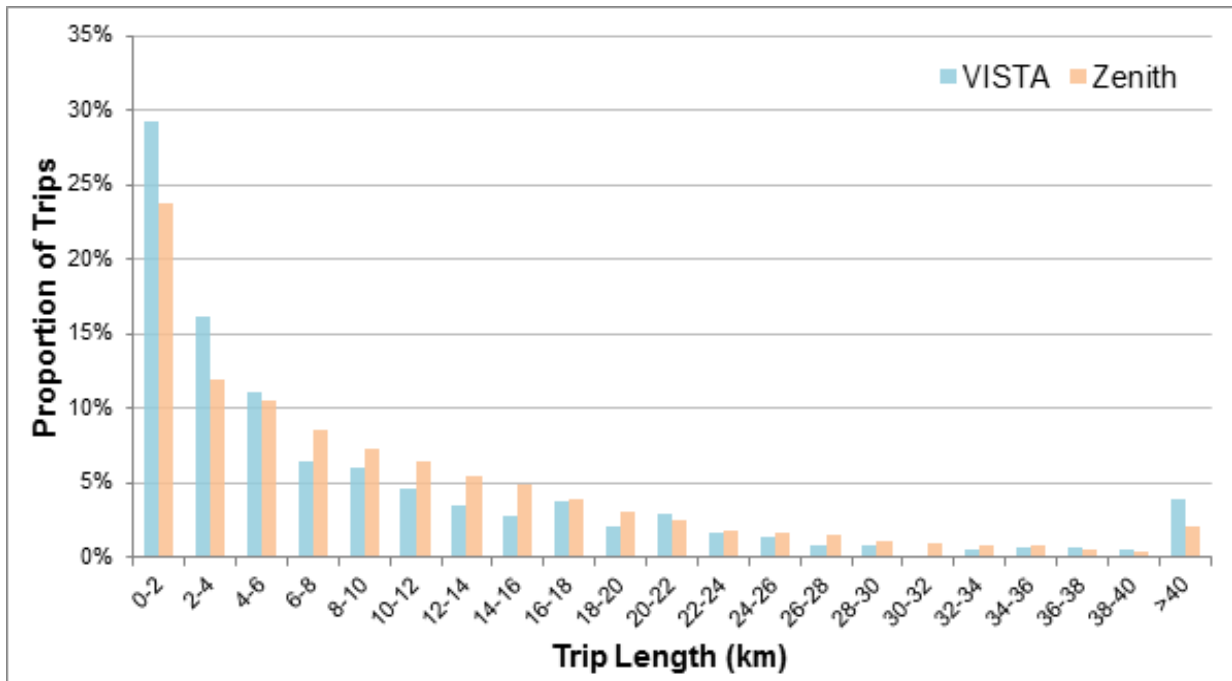


Figure 5.55: Trip Length Frequency Distribution, Work Based Work

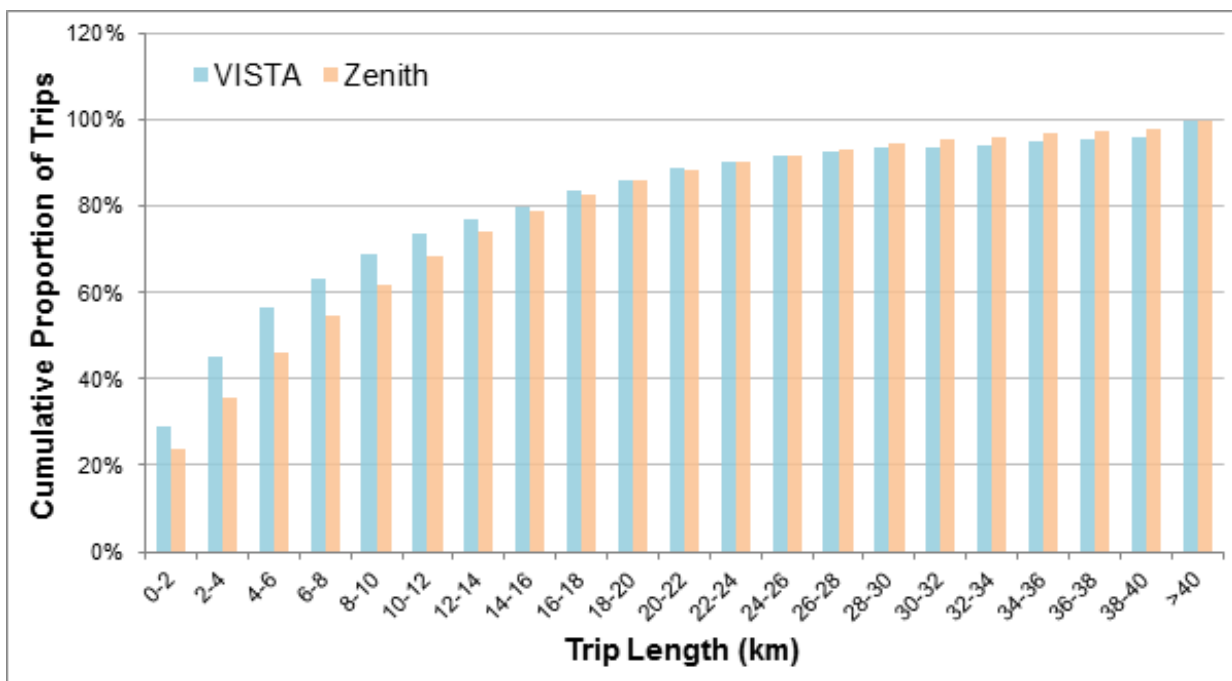


Figure 5.56: Cumulative Trip Length Frequency Distribution, Work Based Work



5.9.2 Sector To Sector analysis

Modelled and observed Work Based Work SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

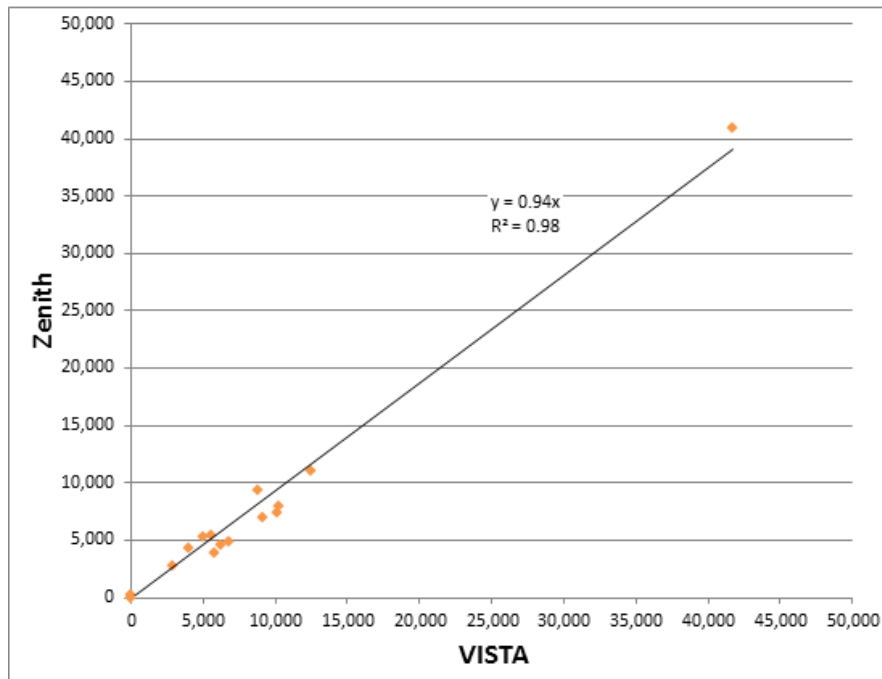


Figure 5.57: Intra SA4 Movements, Work Based Work

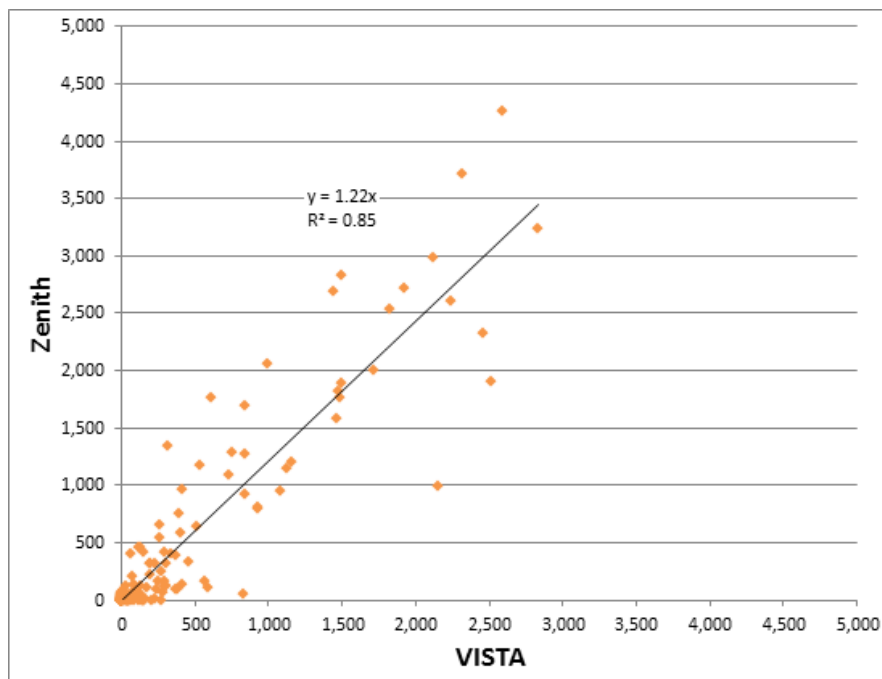


Figure 5.58: Inter SA4 Movements, Work Based Work



5.9.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

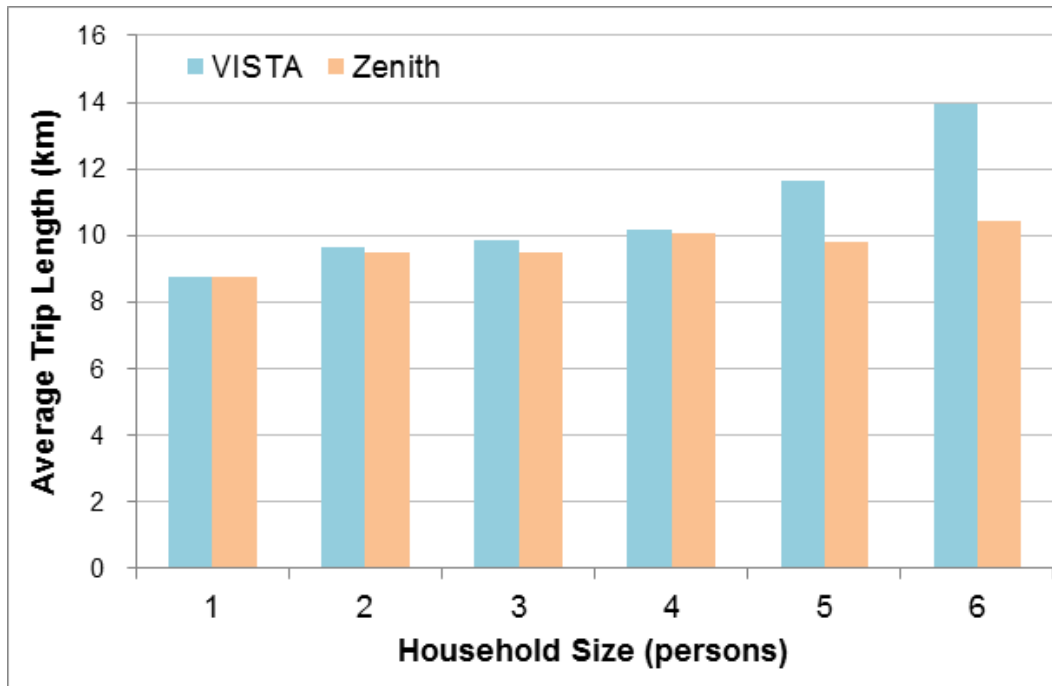


Figure 5.59: Average Trip Length by Household Size, Work Based Work

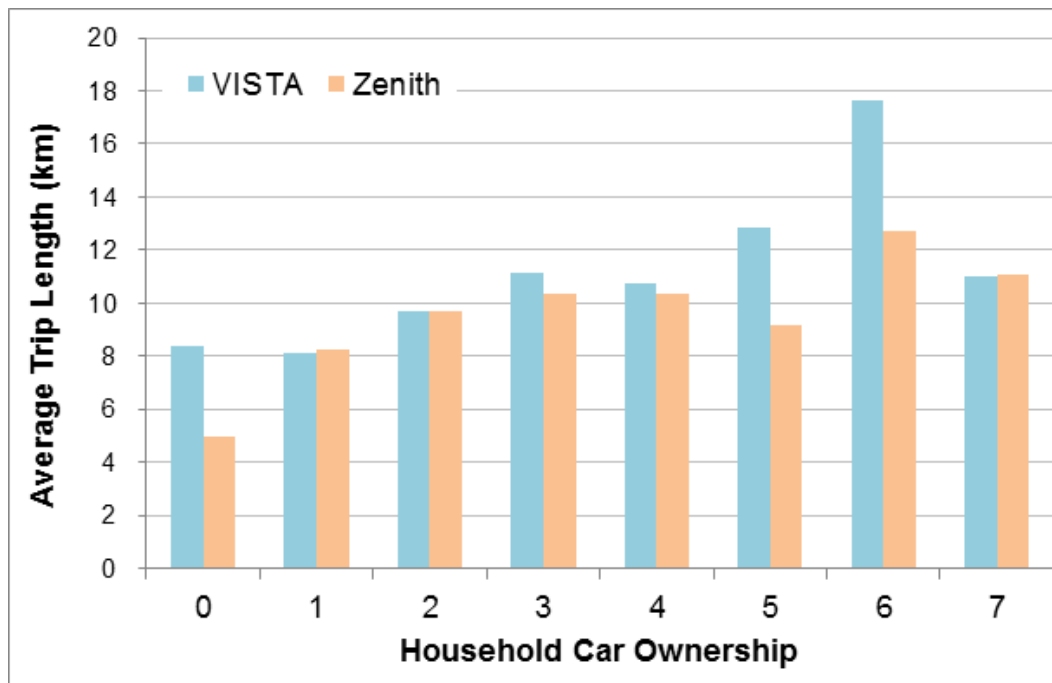


Figure 5.60: Average Trip Length by Number of Cars, Work Based Work

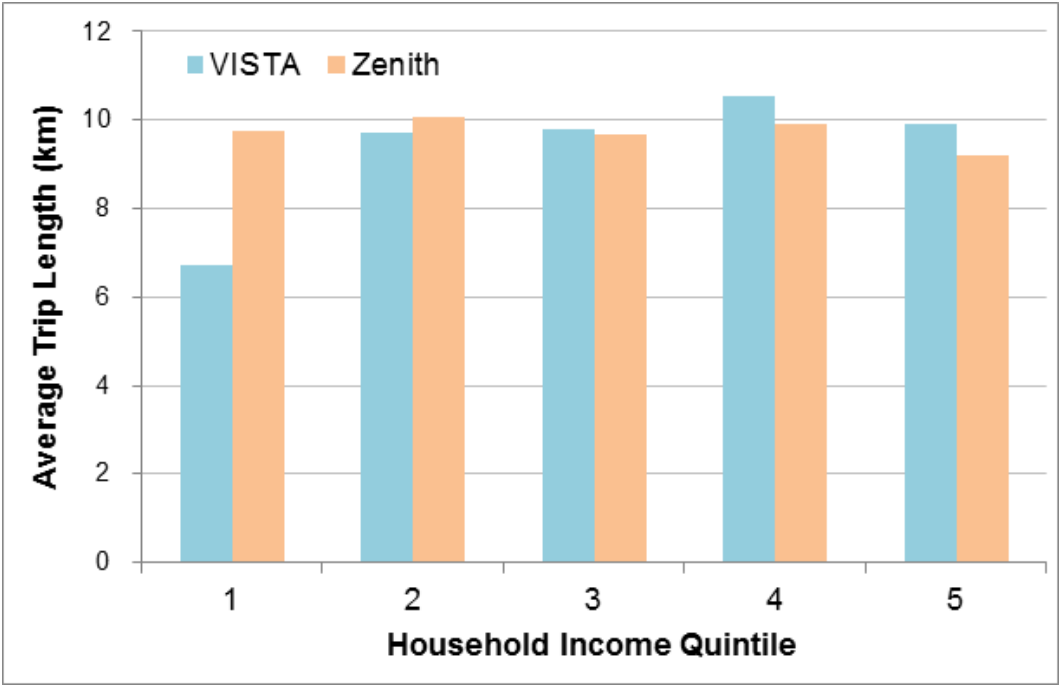


Figure 5.61: Average Trip Length by Household Income Quintile, Work Based Work



5.10 Model Validation - Work Based Shopping

5.10.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Work Based Shopping are compared below. Figure 5.7 presents the same data in a cumulative form.

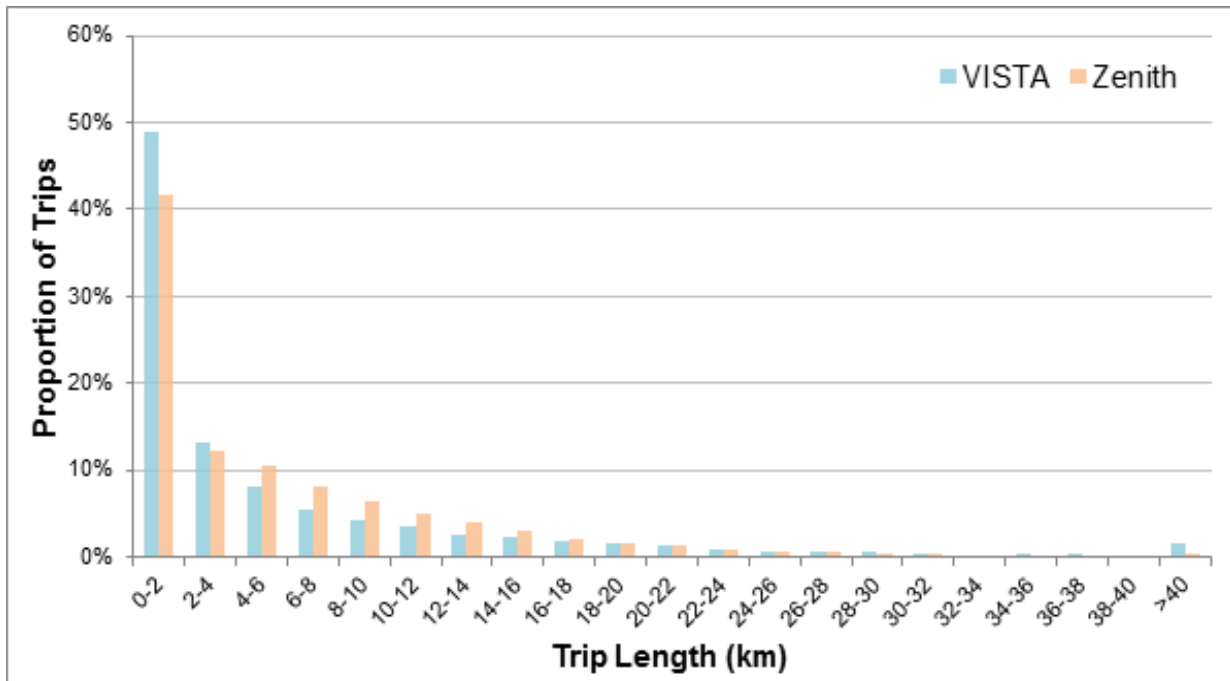


Figure 5.62: Trip Length Frequency Distribution, Work Based Shopping

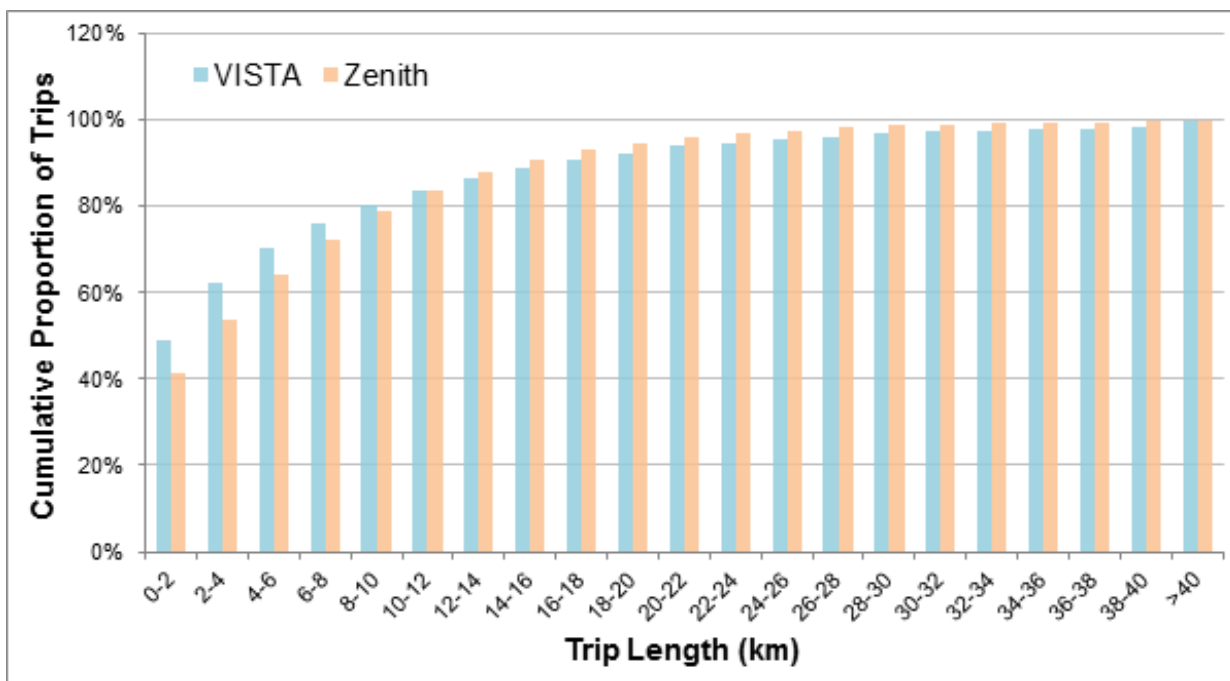


Figure 5.63: Cumulative Trip Length Frequency Distribution, Work Based Shopping



5.10.2 Sector To Sector analysis

Modelled and observed Work Based Shopping SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

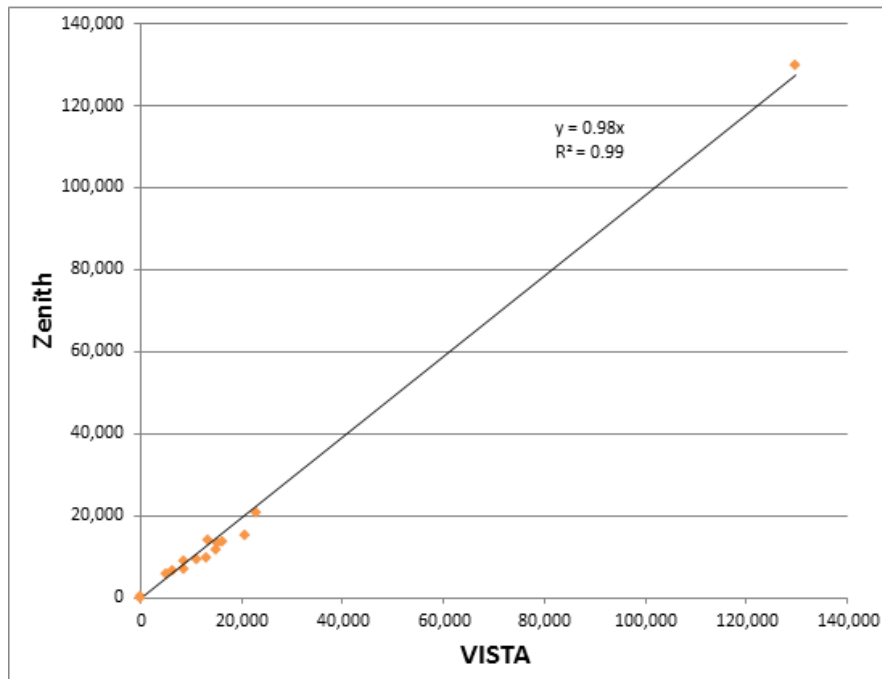


Figure 5.64: Intra SA4 Movements, Work Based Shopping

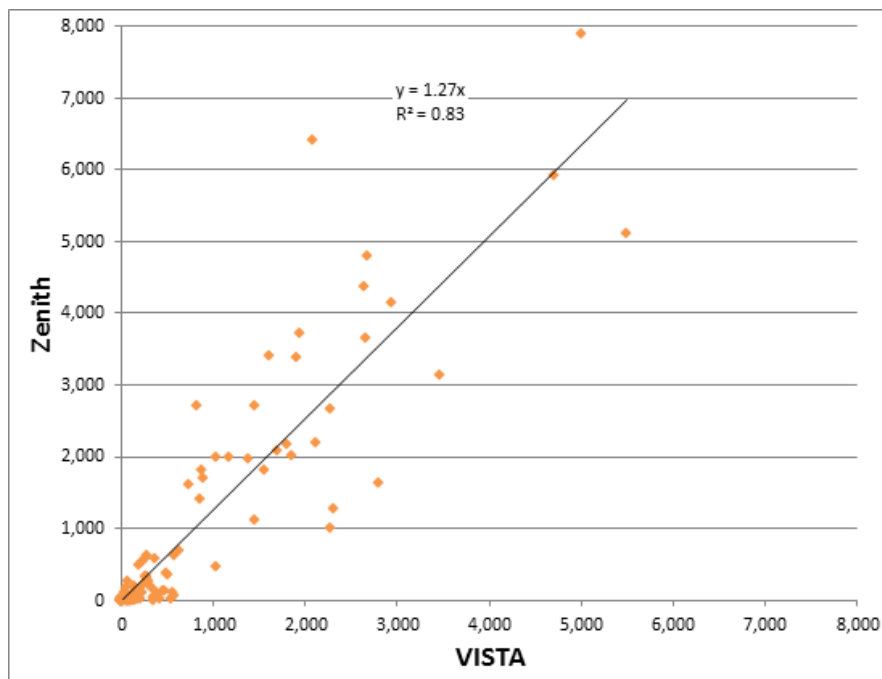


Figure 5.65: Inter SA4 Movements, Work Based Shopping



5.10.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

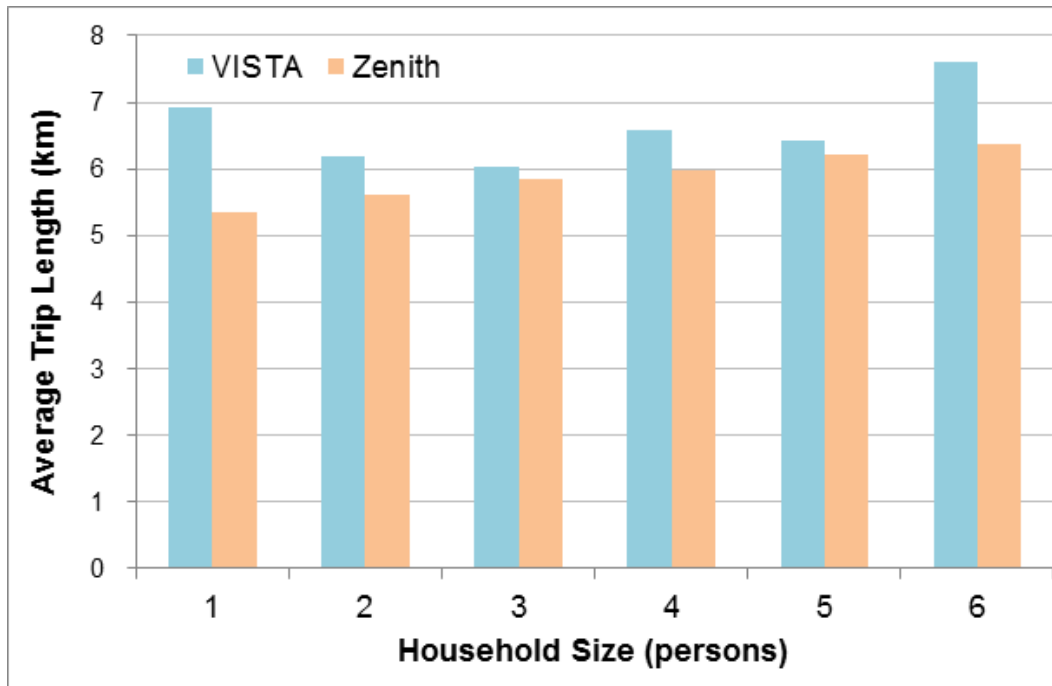


Figure 5.66: Average Trip Length by Household Size, Work Based Shopping

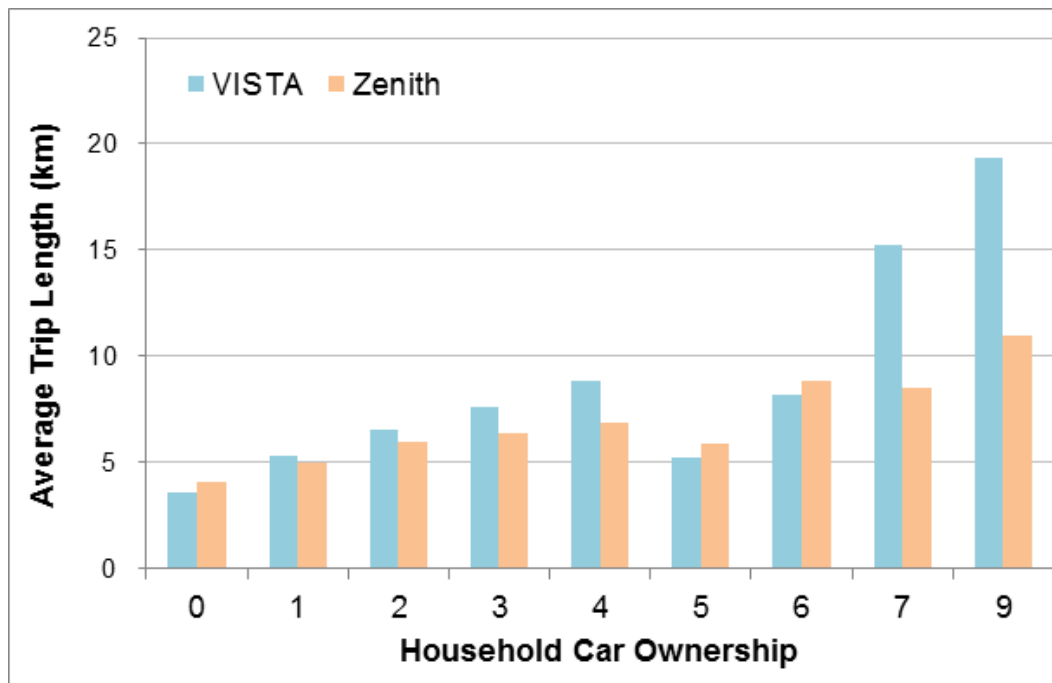


Figure 5.67: Average Trip Length by Number of Cars, Work Based Shopping

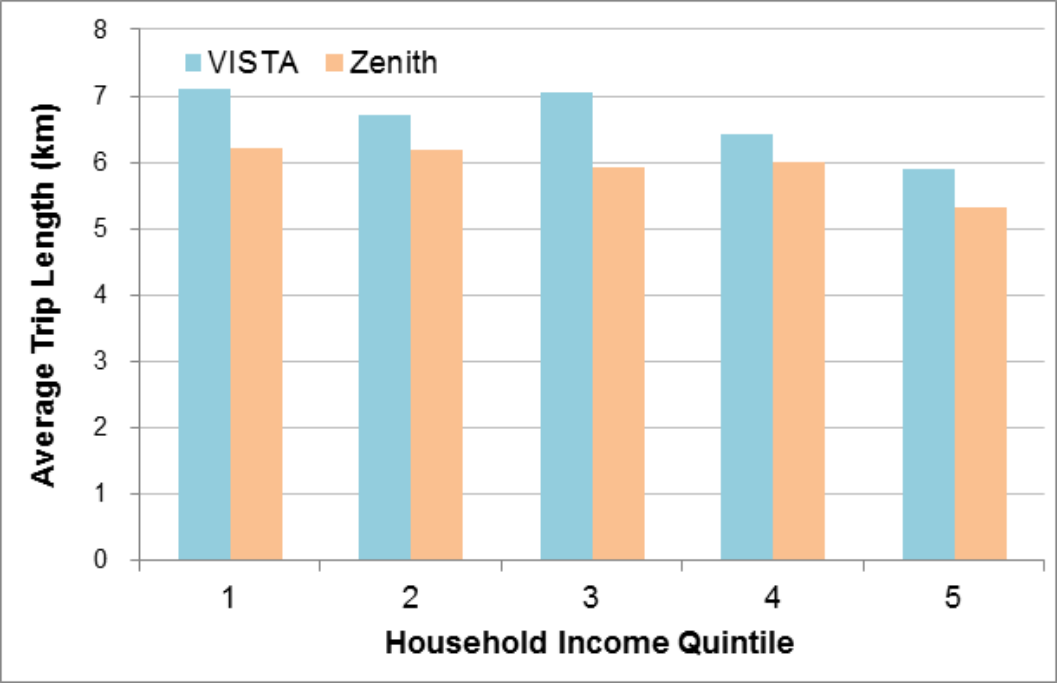


Figure 5.68: Average Trip Length by Household Income Quintile, Work Based Shopping



5.11 Model Validation - Work Based Other

5.11.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Work Based Other are compared below. Figure 5.7 presents the same data in a cumulative form.

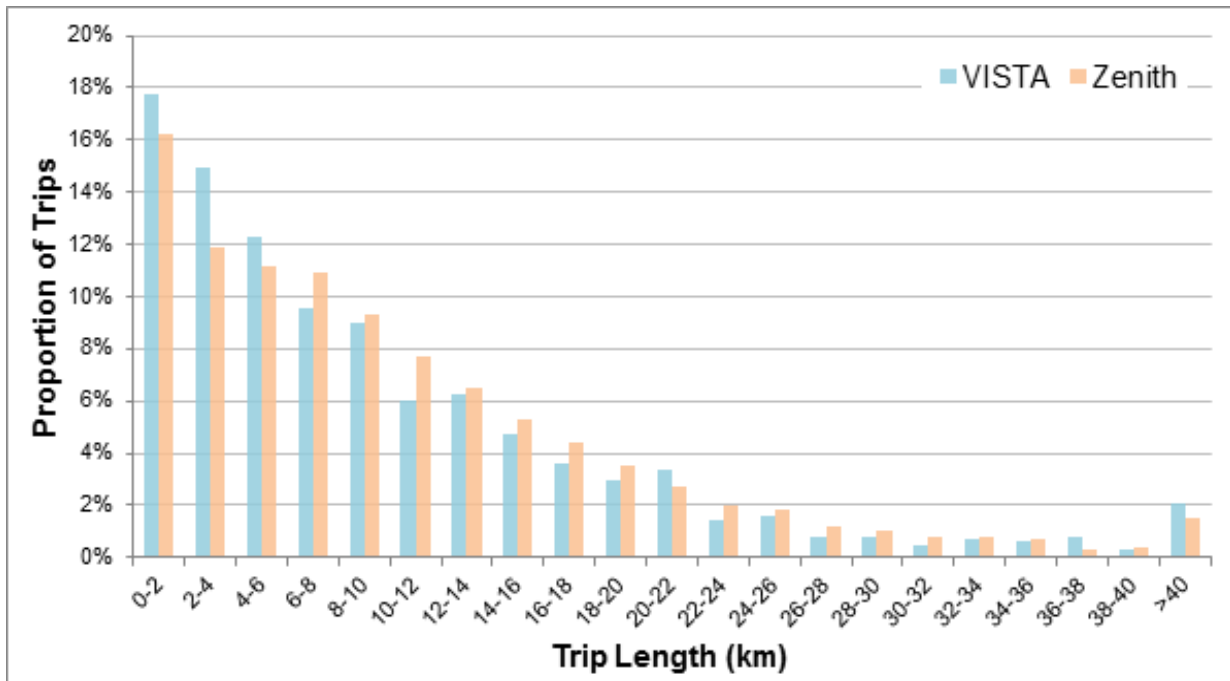


Figure 5.69: Trip Length Frequency Distribution, Work Based Other

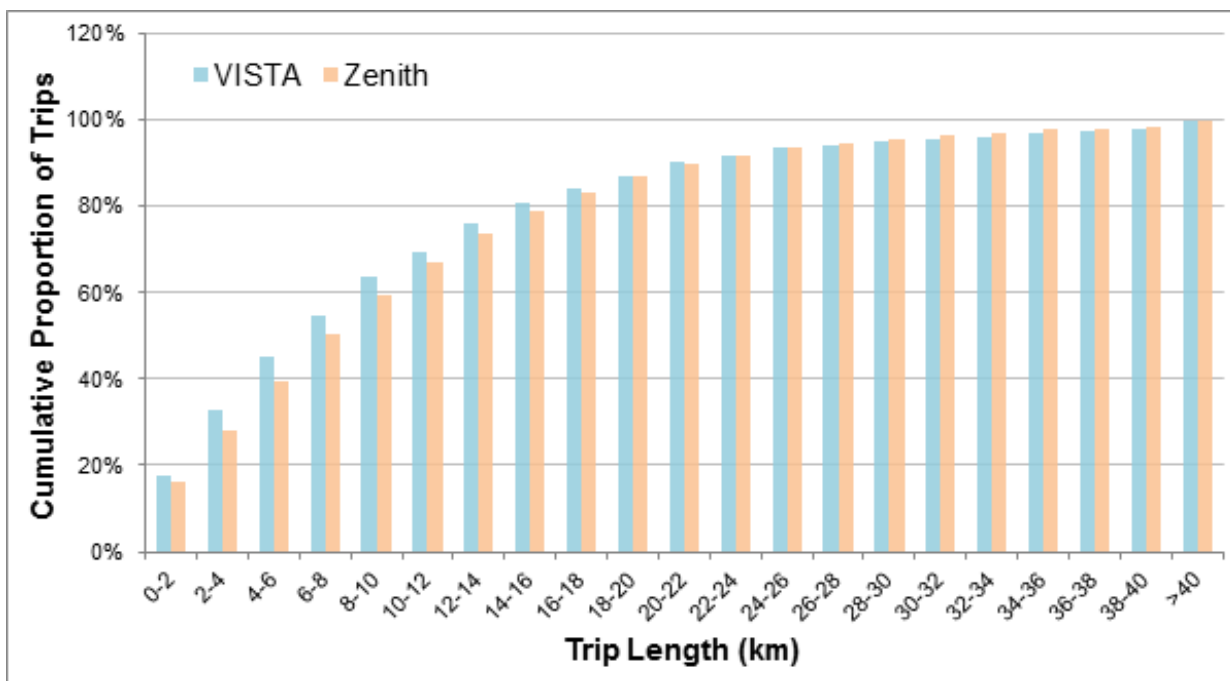


Figure 5.70: Cumulative Trip Length Frequency Distribution, Work Based Other



5.11.2 Sector To Sector analysis

Modelled and observed Work Based Other SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

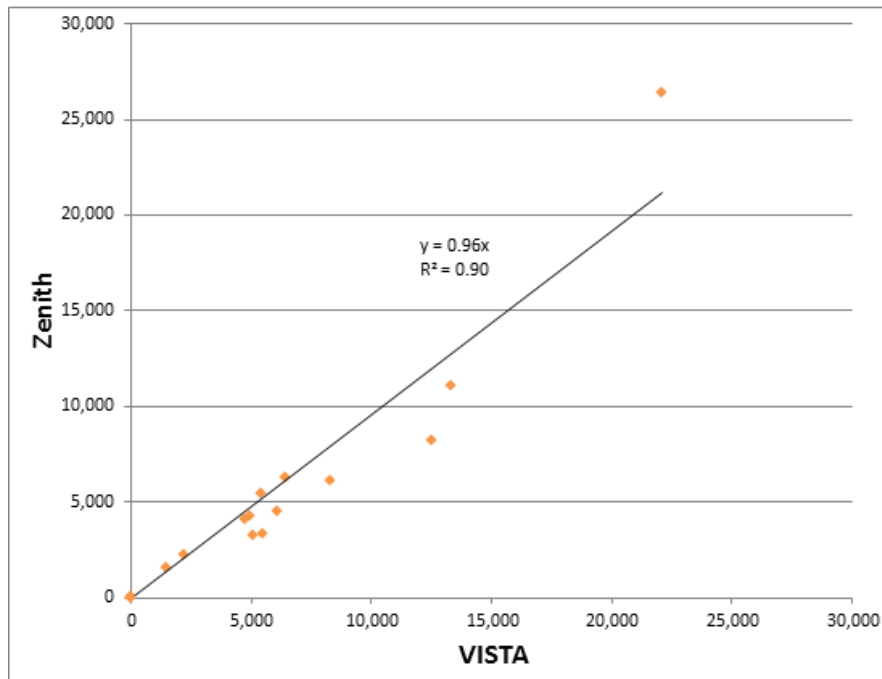


Figure 5.71: Intra SA4 Movements, Work Based Other

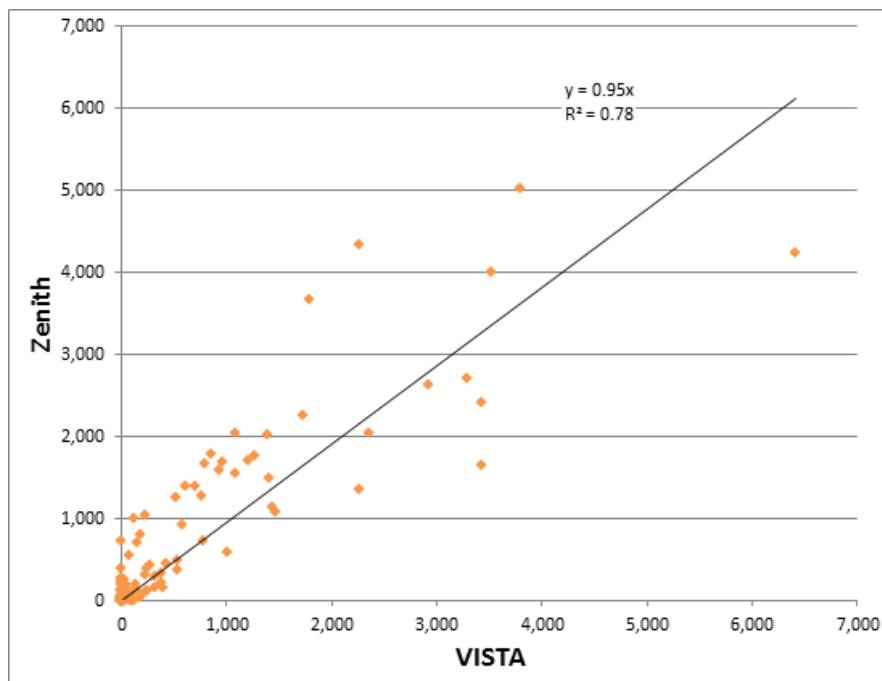


Figure 5.72: Inter SA4 Movements, Work Based Other



5.11.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

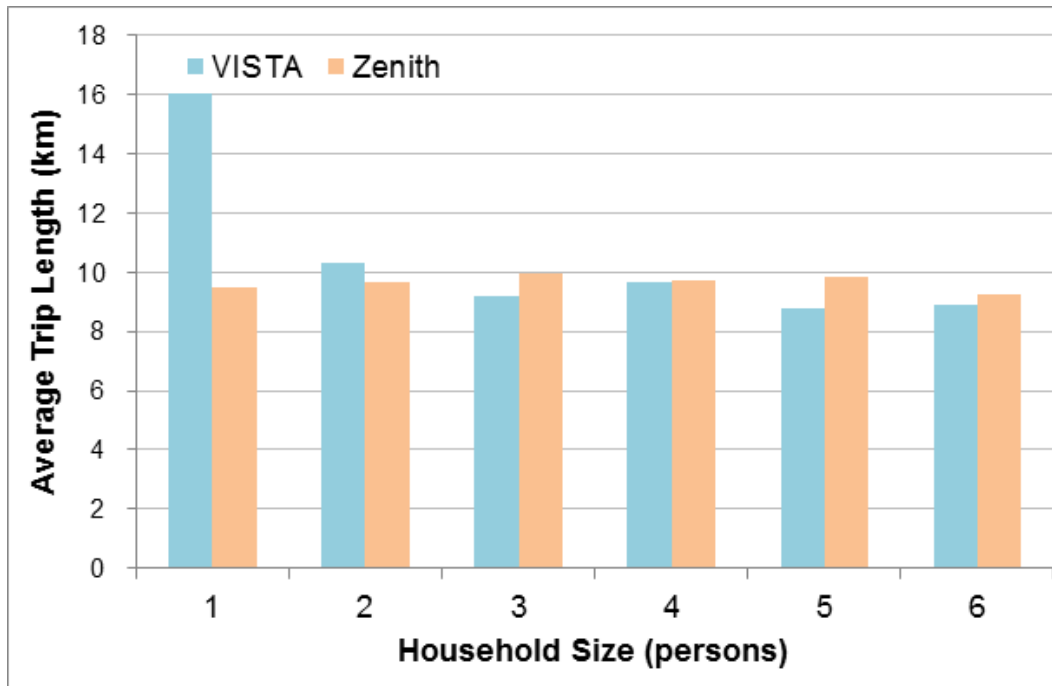


Figure 5.73: Average Trip Length by Household Size, Work Based Other

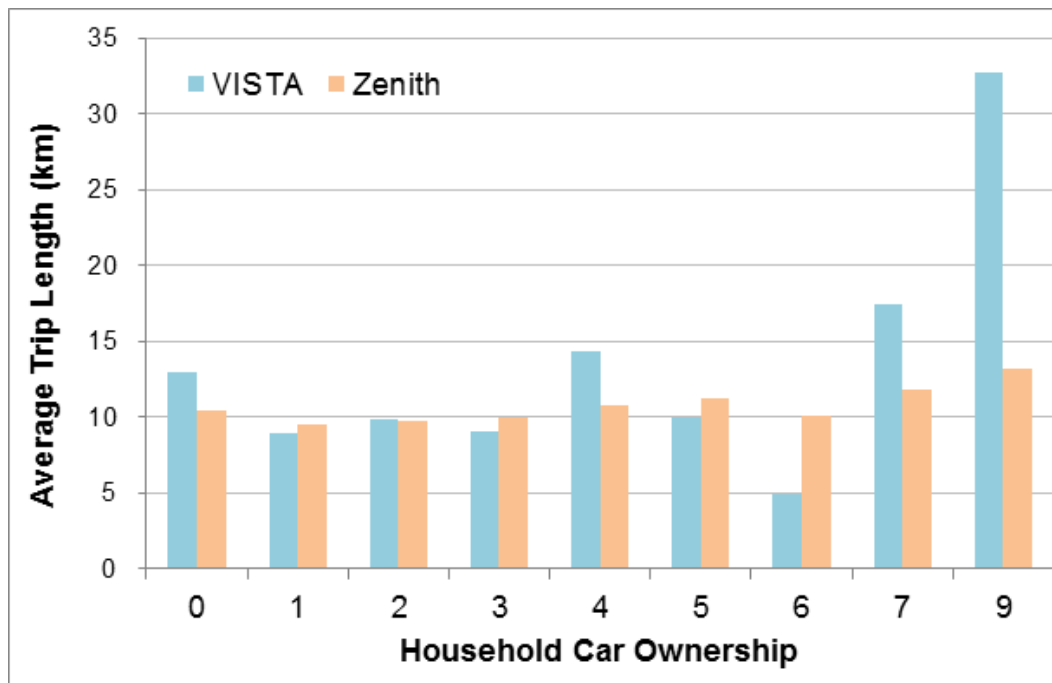


Figure 5.74: Average Trip Length by Number of Cars, Work Based Other

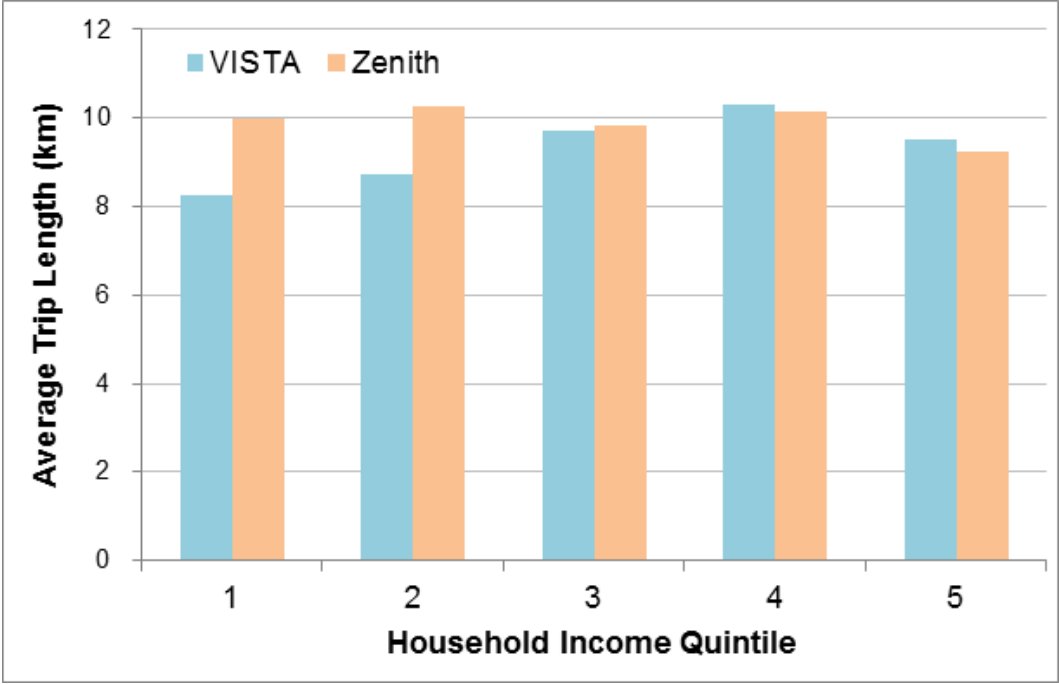


Figure 5.75: Average Trip Length by Household Income Quintile, Work Based Other



5.12 Model Validation - Shopping Based Shopping

5.12.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Shopping Based Shopping are compared below. Figure 5.7 presents the same data in a cumulative form.

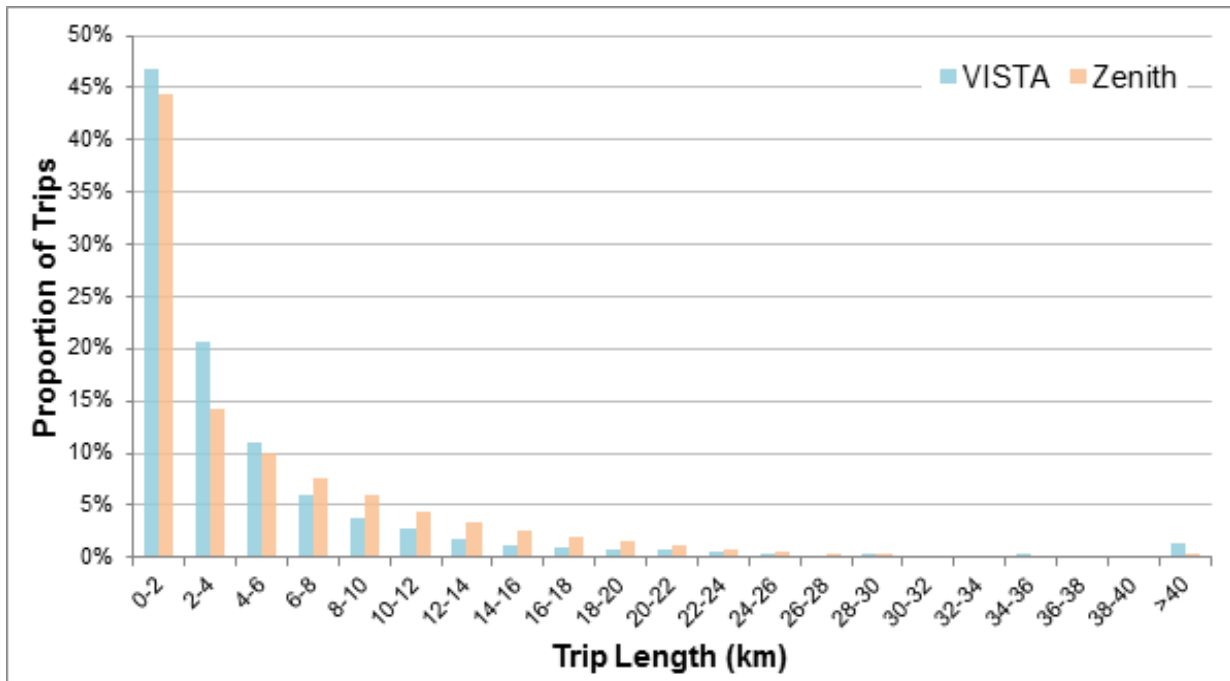


Figure 5.76: Trip Length Frequency Distribution, Shopping Based Shopping

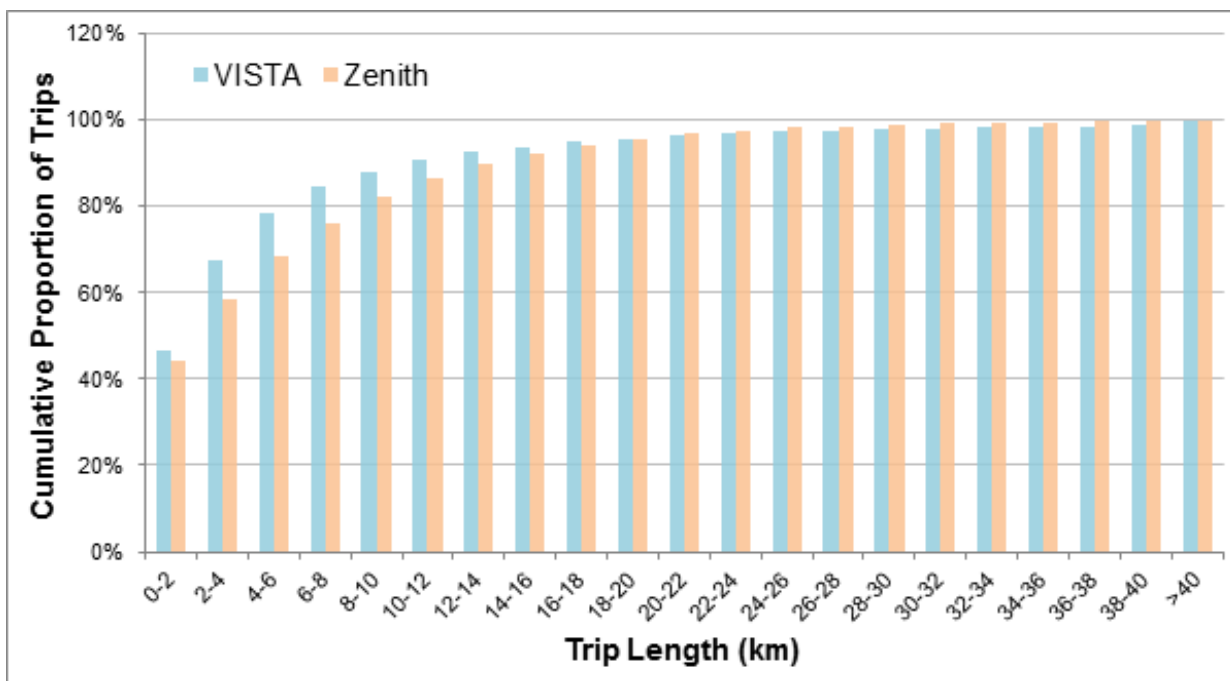


Figure 5.77: Cumulative Trip Length Frequency Distribution, Shopping Based Shopping



5.12.2 Sector To Sector analysis

Modelled and observed Shopping Based Shopping SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

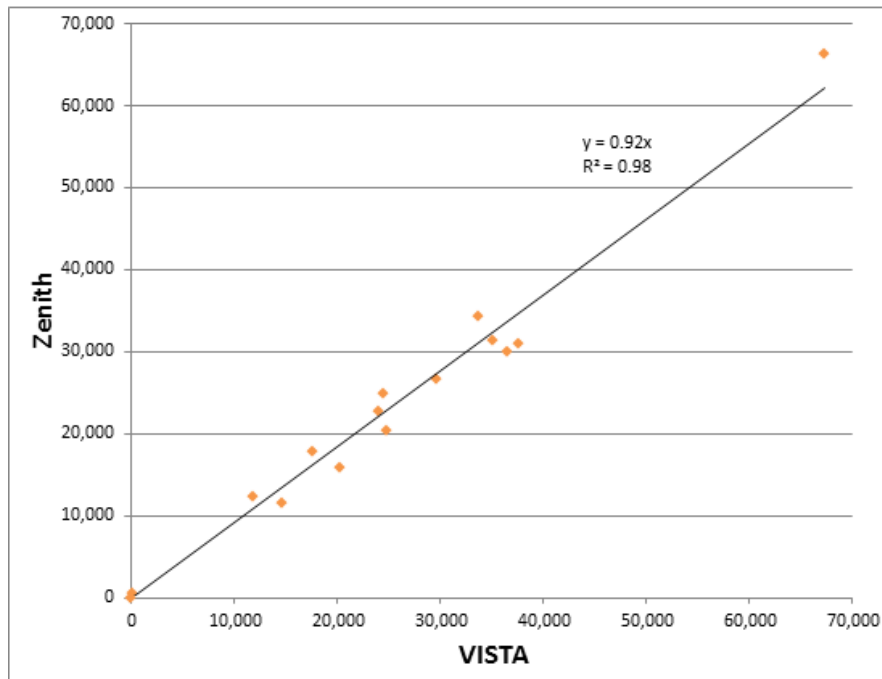


Figure 5.78: Intra SA4 Movements, Shopping Based Shopping

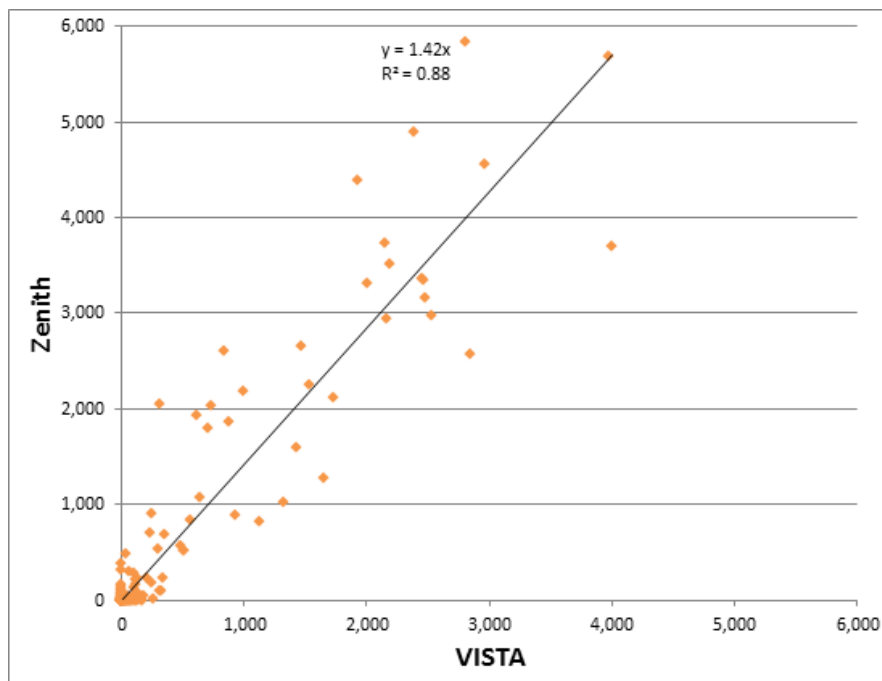


Figure 5.79: Inter SA4 Movements, Shopping Based Shopping



5.12.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

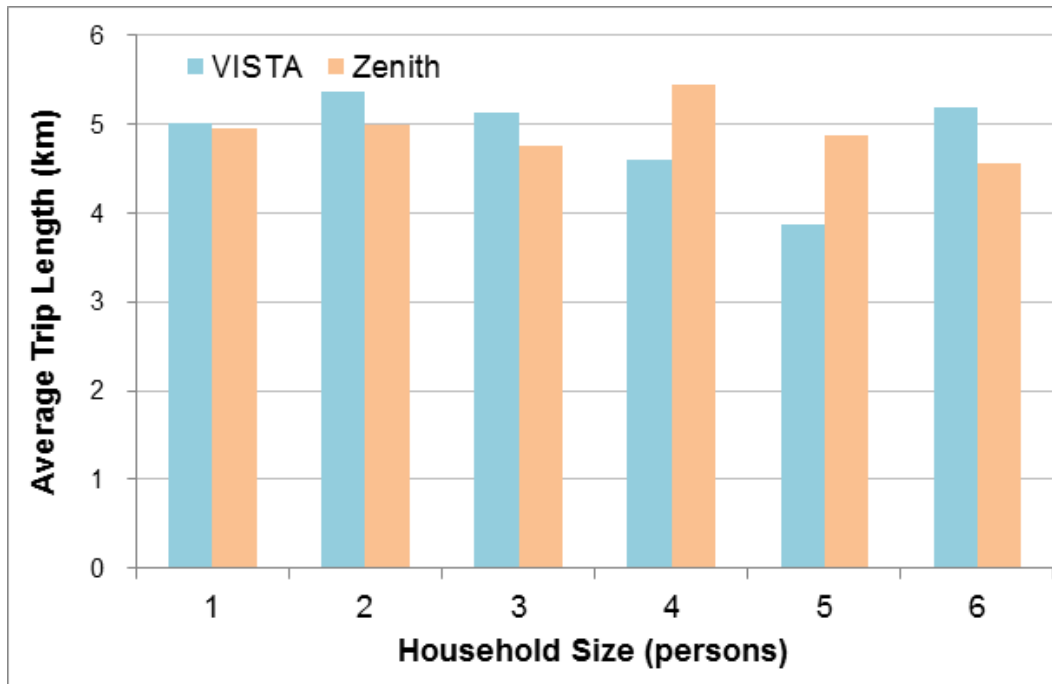


Figure 5.80: Average Trip Length by Household Size, Shopping Based Shopping

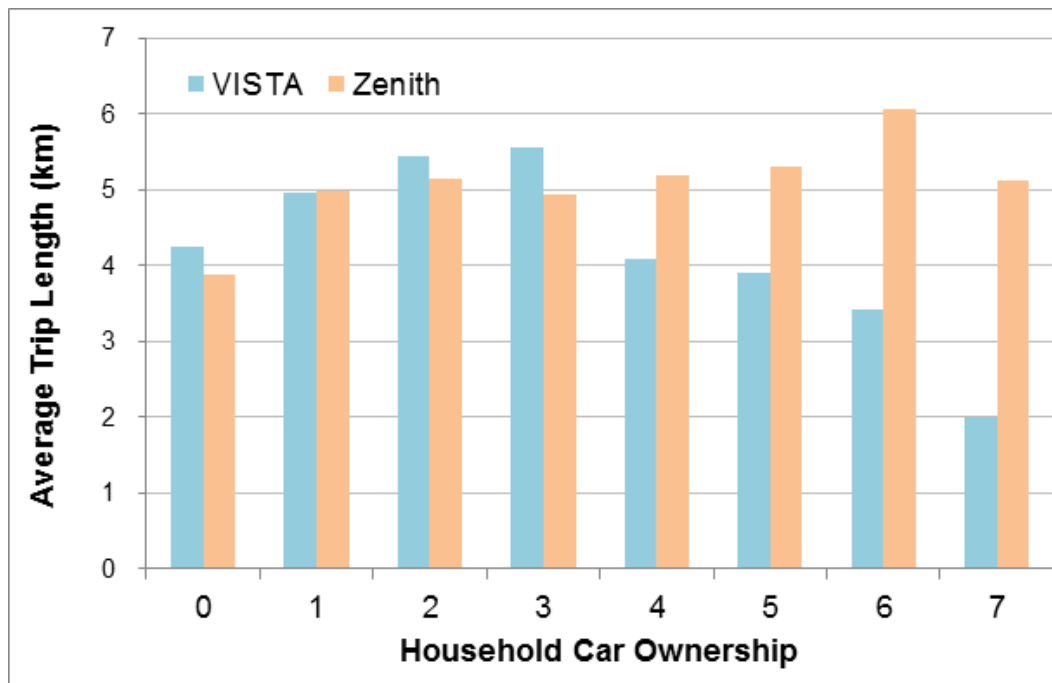


Figure 5.81: Average Trip Length by Number of Cars, Shopping Based Shopping

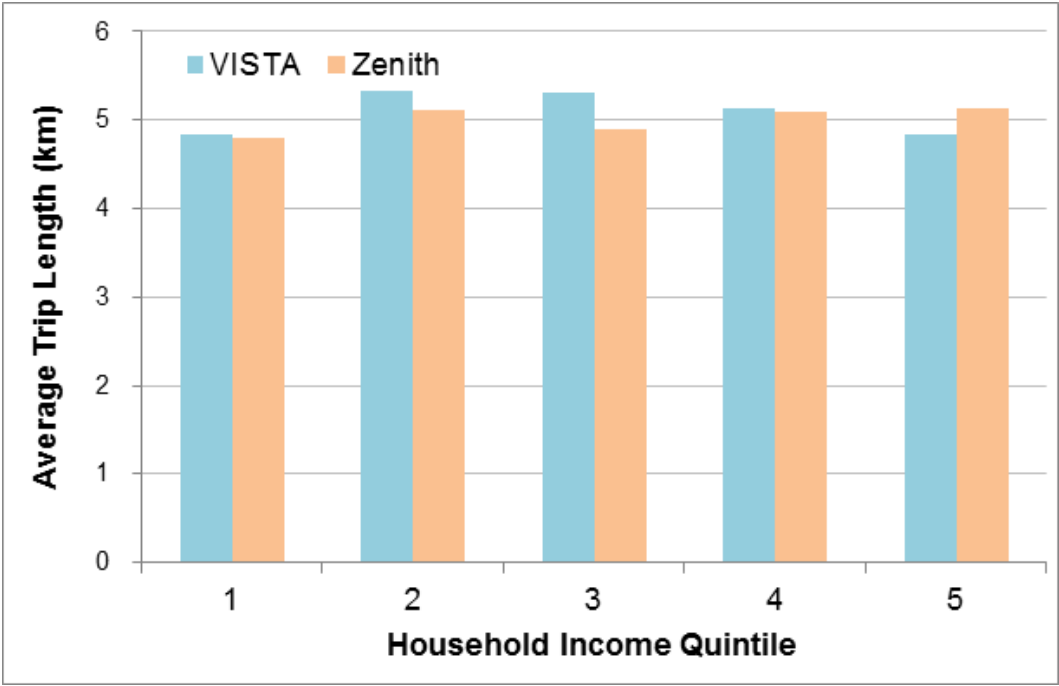


Figure 5.82: Average Trip Length by Household Income Quintile, Shopping Based Shopping



5.13 Model Validation - Shopping Based Other

5.13.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Shopping Based Other are compared below. Figure 5.7 presents the same data in a cumulative form.

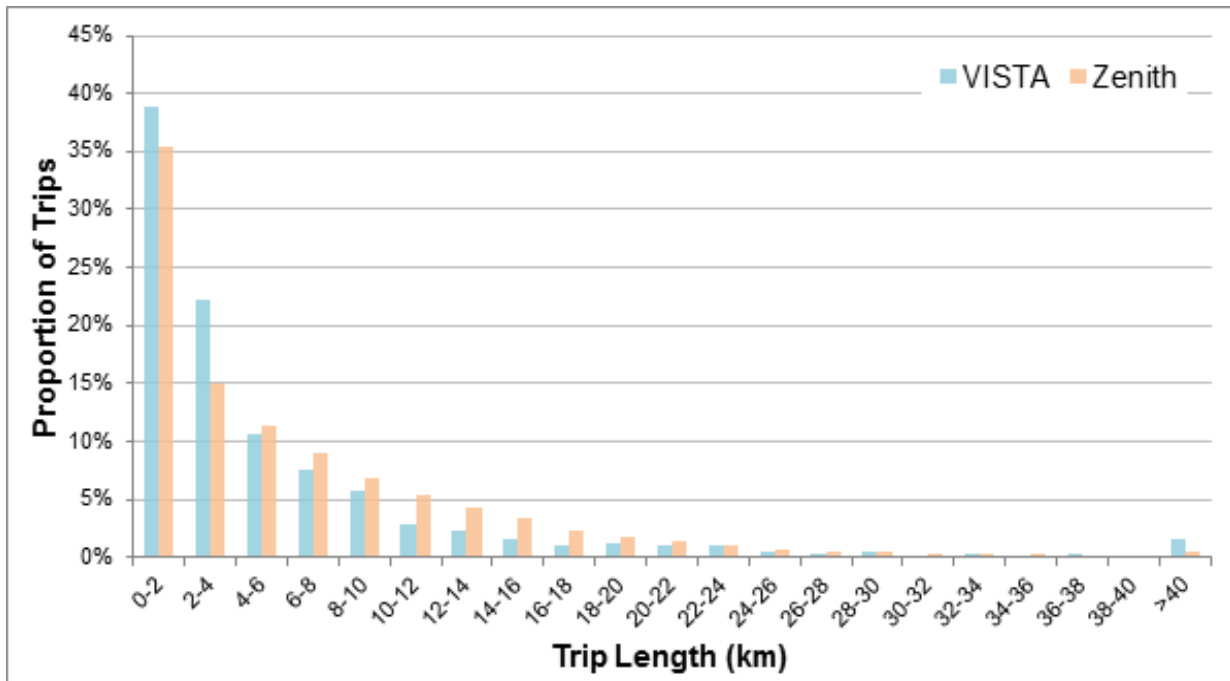


Figure 5.83: Trip Length Frequency Distribution, Shopping Based Other

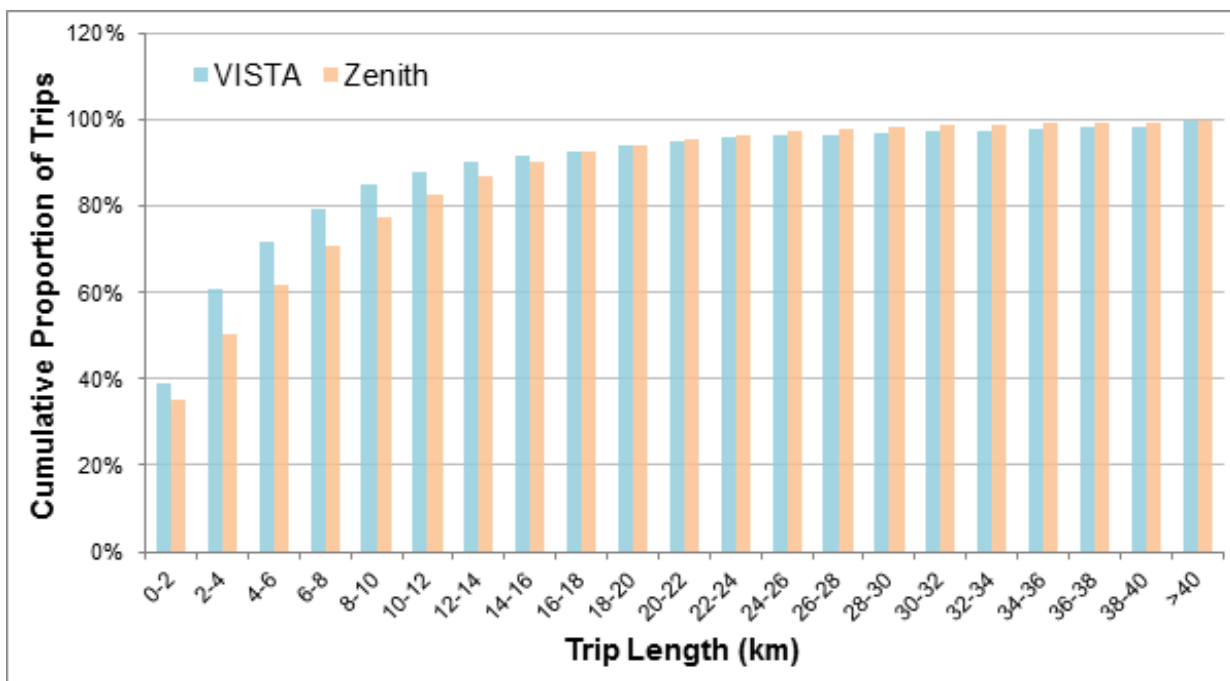


Figure 5.84: Cumulative Trip Length Frequency Distribution, Shopping Based Other



5.13.2 Sector To Sector analysis

Modelled and observed Shopping Based Other SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

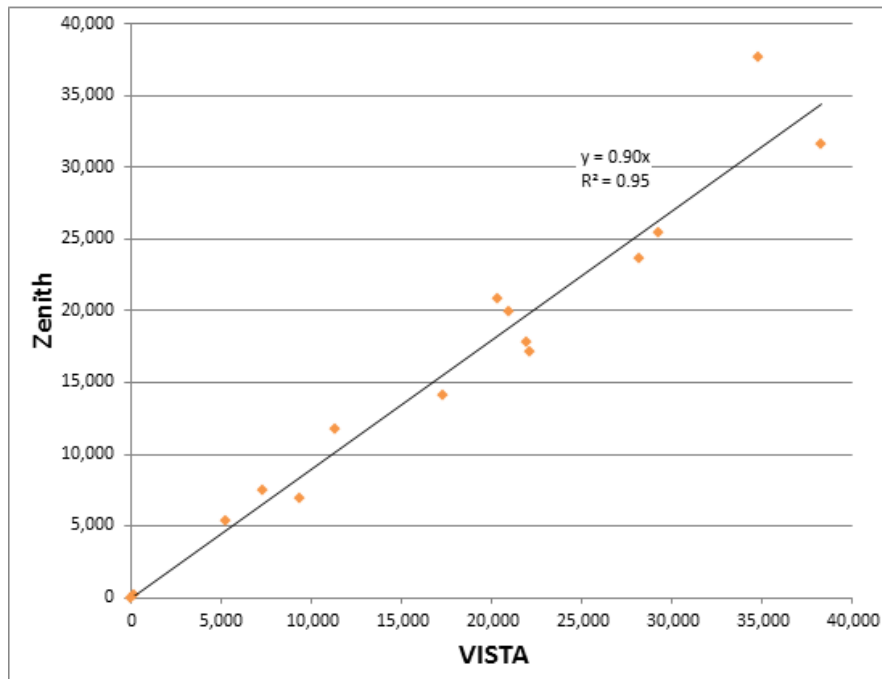


Figure 5.85: Intra SA4 Movements, Shopping Based Other

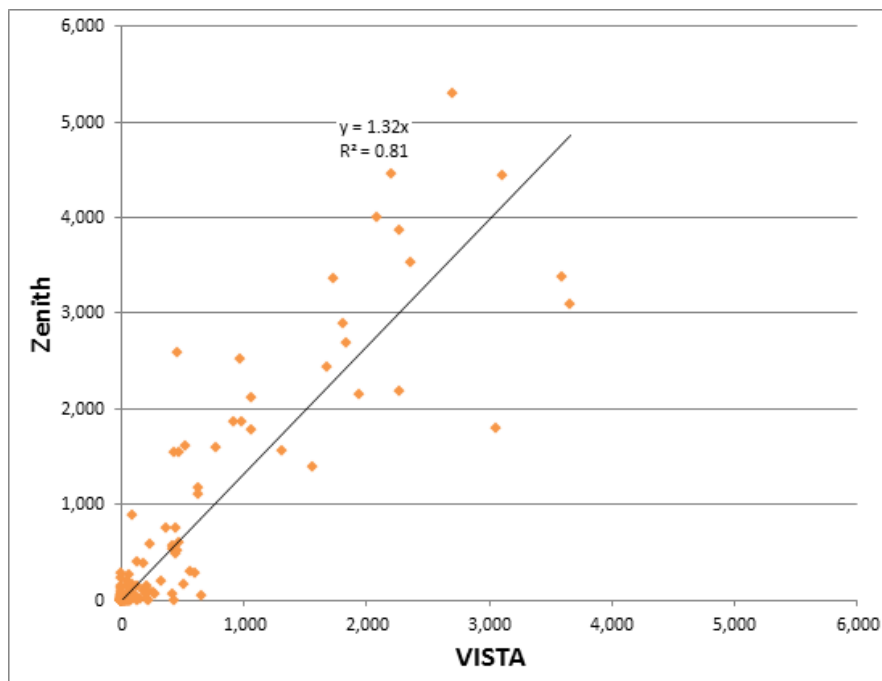


Figure 5.86: Inter SA4 Movements, Shopping Based Other



5.13.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

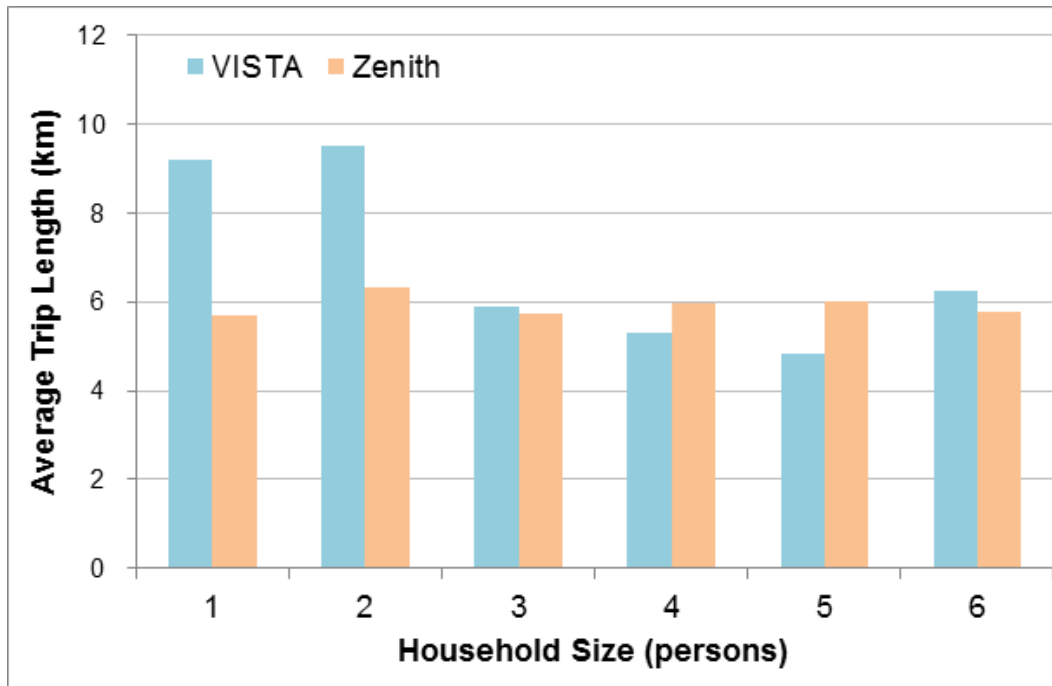


Figure 5.87: Average Trip Length by Household Size, Shopping Based Other

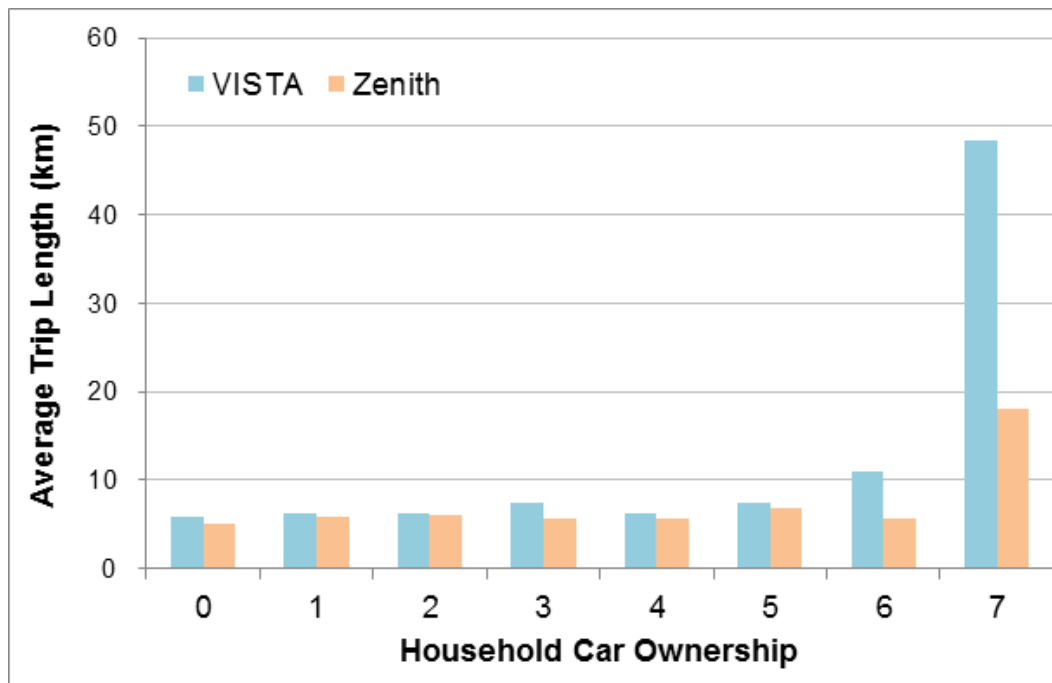


Figure 5.88: Average Trip Length by Number of Cars, Shopping Based Other

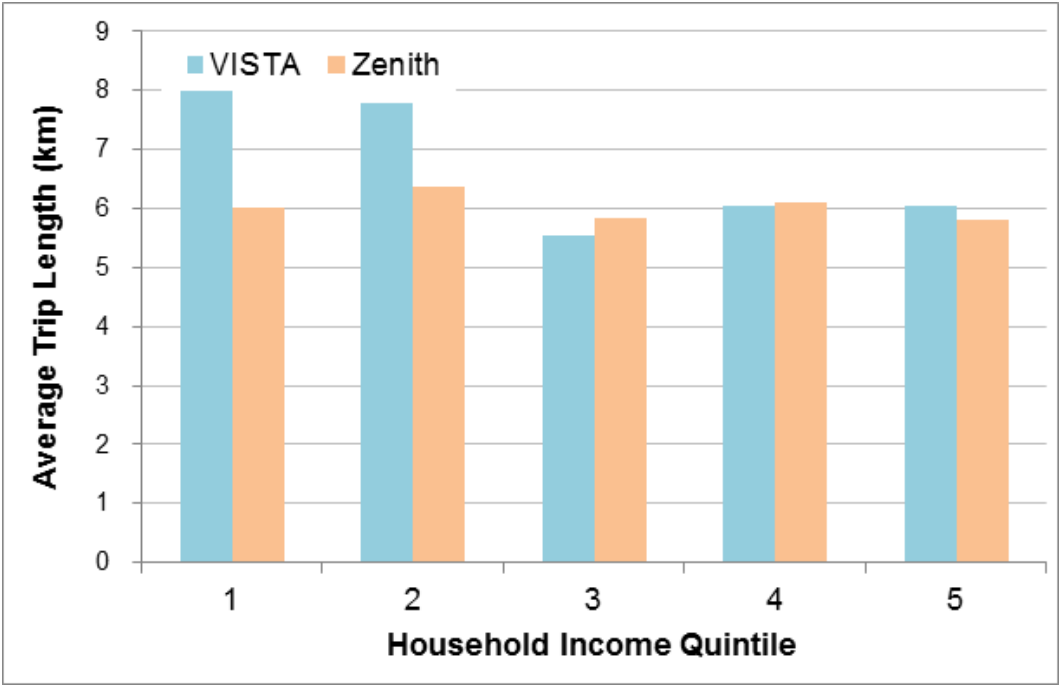


Figure 5.89: Average Trip Length by Household Income Quintile, Shopping Based Other



5.14 Model Validation - Other Non-Home Based

5.14.1 Trip Length Frequency

VISTA and Zenith trip length frequency distributions for Other Non-Home Based are compared below. Figure 5.7 presents the same data in a cumulative form.

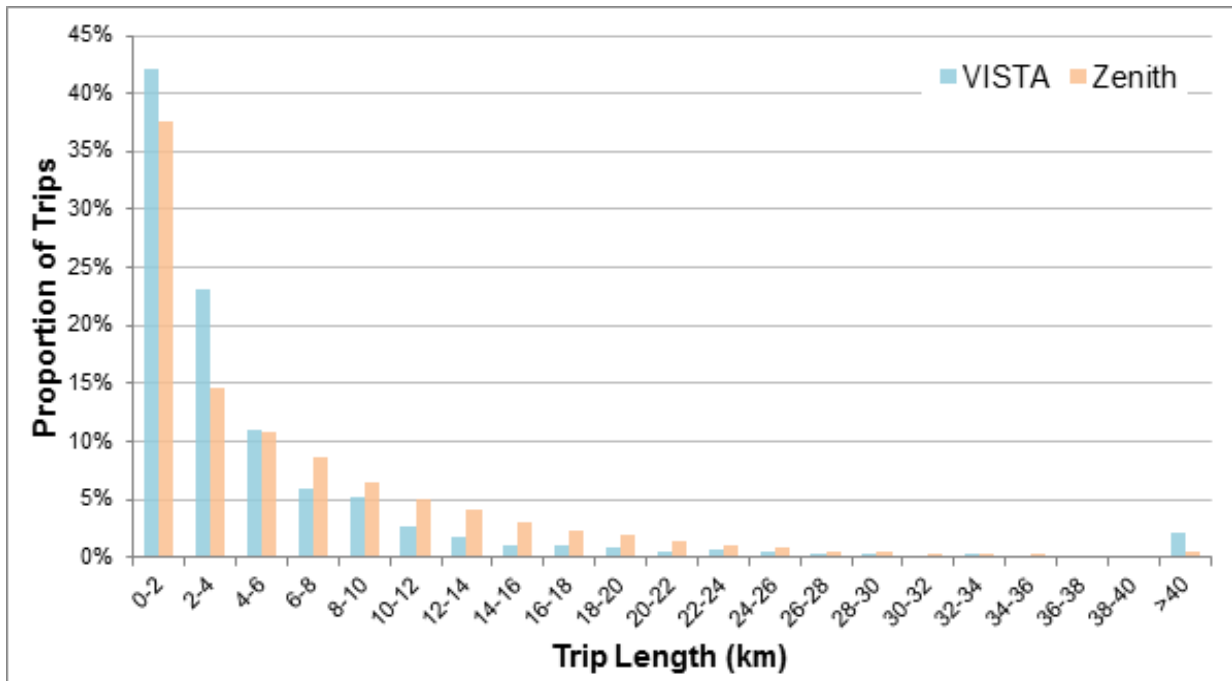


Figure 5.90: Trip Length Frequency Distribution, Other Non-Home Based

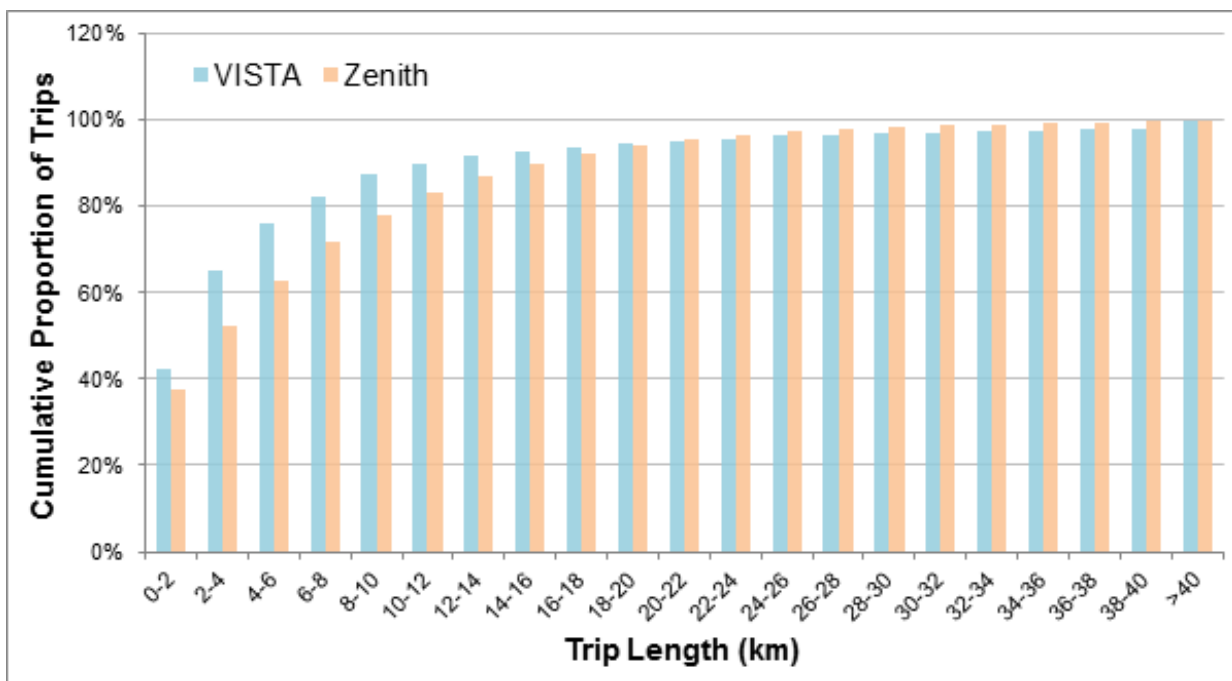


Figure 5.91: Cumulative Trip Length Frequency Distribution, Other Non-Home Based



5.14.2 Sector To Sector analysis

Modelled and observed Other Non-Home Based SA4 to SA4 movements are shown in the scatter plots below.

The performance of the model, in terms of replicating observed intra-sector and inter-sector movements by purpose, is shown in the R^2 regression coefficients and slopes in Figure 5.4 and Figure 5.9

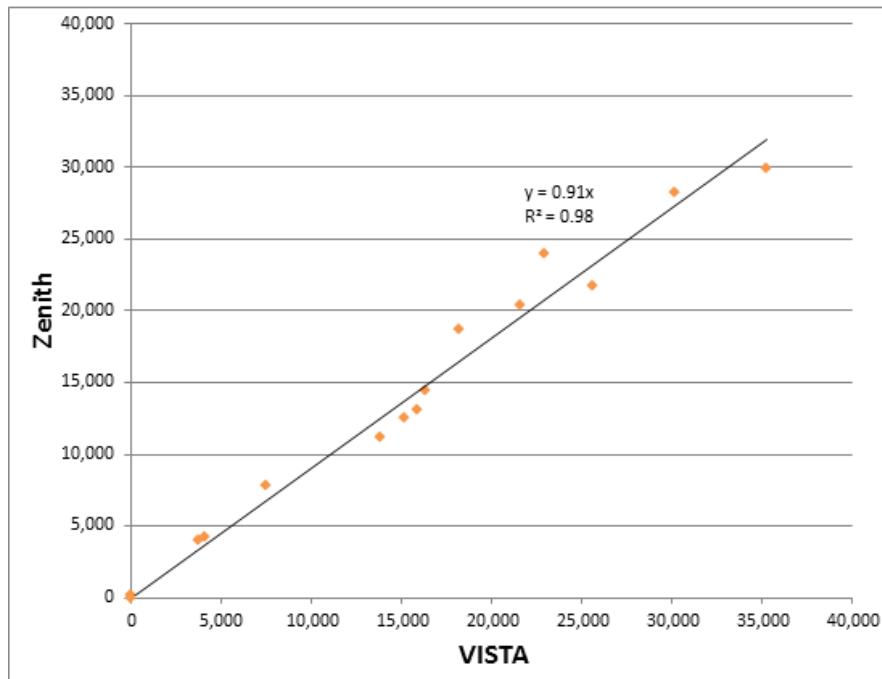


Figure 5.92: Intra SA4 Movements, Other Non-Home Based

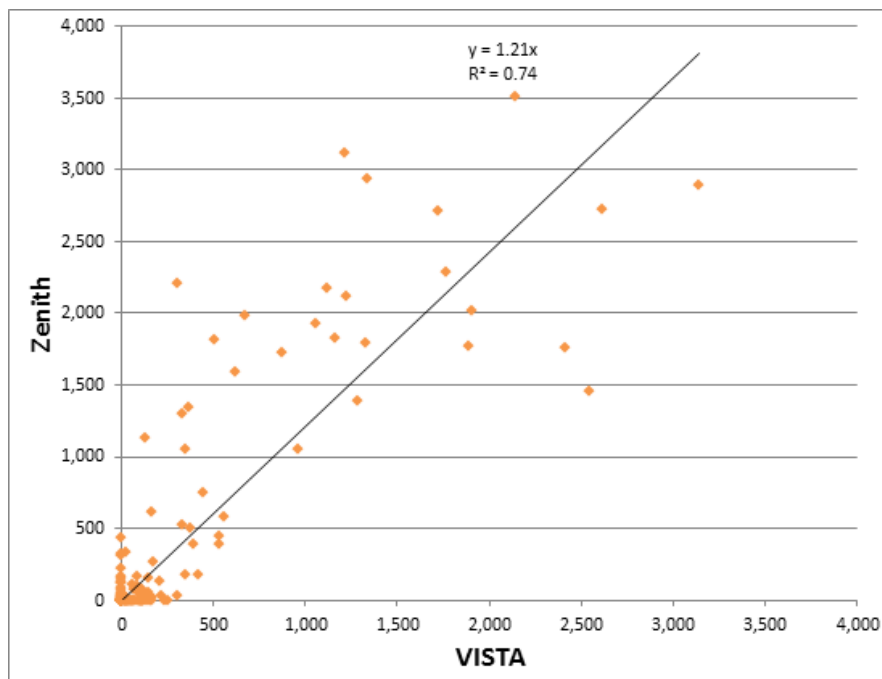


Figure 5.93: Inter SA4 Movements, Other Non-Home Based



5.14.3 Average Trip Length by Demographic Variable

Figures below show a comparison of VISTA and Zenith average trip lengths, for different demographic groups.

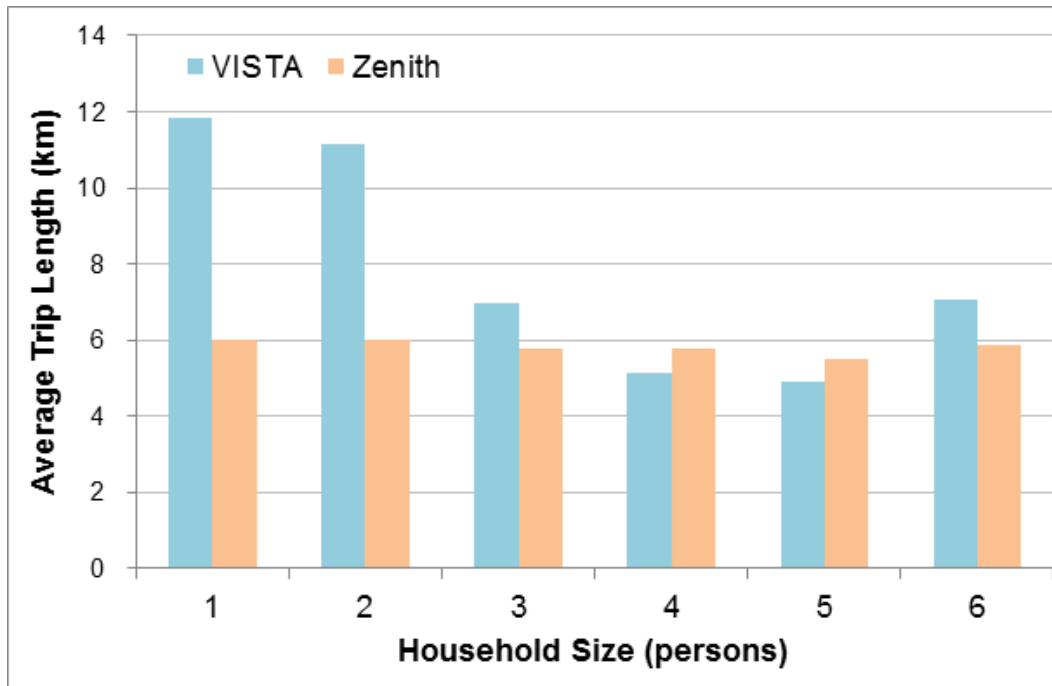


Figure 5.94: Average Trip Length by Household Size, Other Non-Home Based

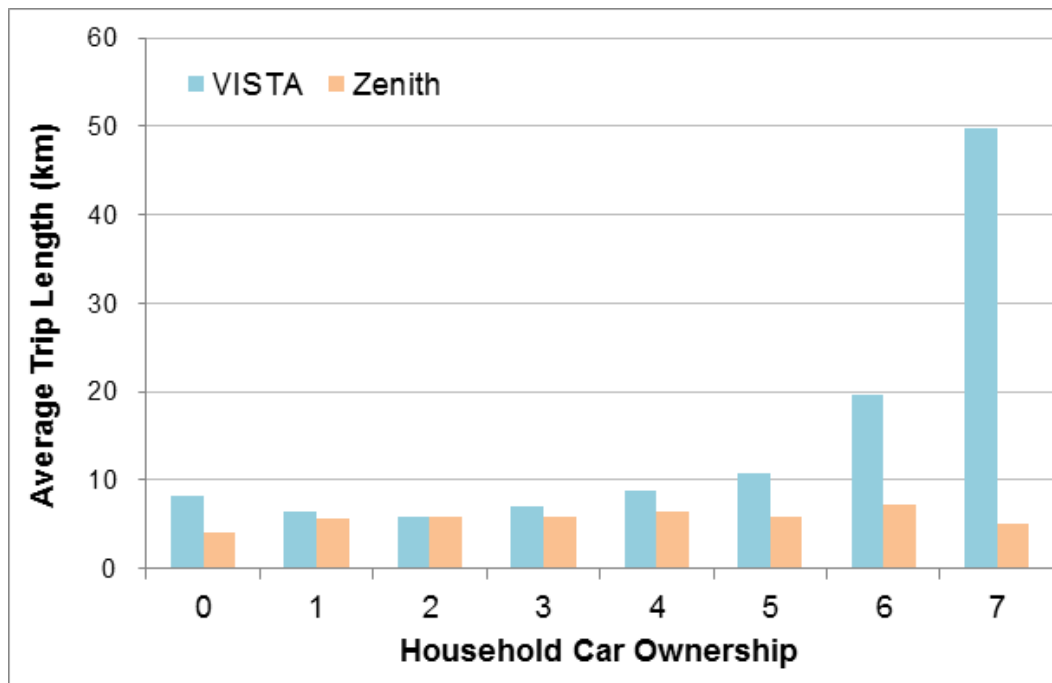


Figure 5.95: Average Trip Length by Number of Cars, Other Non-Home Based

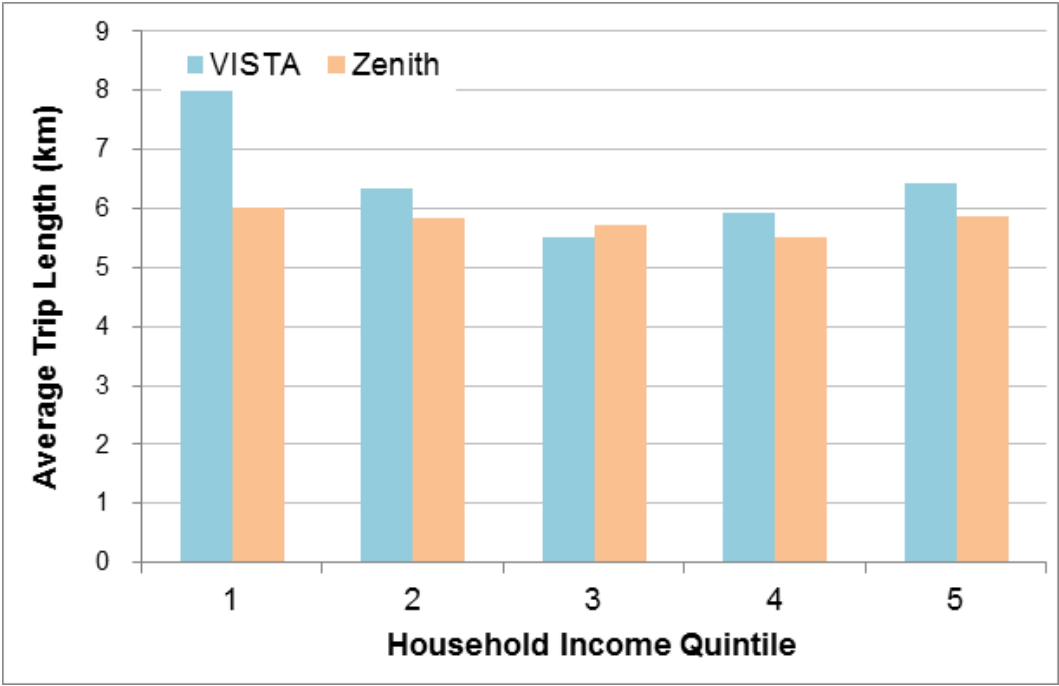


Figure 5.96: Average Trip Length by Household Income Quintile, Other Non-Home Based

