CSTDM09 – California Statewide Travel Demand Model

Model Development

Short Distance Personal Travel Model: Part 3 of 3

Final System Documentation: Technical Note

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1. Introduction

This technical note is the Part 3 of a series of three Technical Notes that describe the Short Distance Personal Travel Model (SDPTM) component of the California Statewide Travel Demand Model (CSTDM). The documentation is split into three parts to keep each individual document and computer file size to a manageable level. Together they describe the complete model features, calibration and implementation of the SDPTM. The original estimations of the models are mainly described in separate Technical Notes.

Technical Note Part 1 contains details of:

- Model Overview;
- Long Term Decision Models:
    - Person Driving License Models;
    - Household Auto Ownership Models;
    - Person Work Location Models;
        - "Simplified" Work Tour Mode Choice Models;
    - Person School Location Models;
        - "Simplified" School Tour Mode Choice Models;
- Calibration of Long Term Decision Models.

Technical Note Part 2 contains details of:

- Day Pattern Choice Models
- Main Tour Mode Models:
    - Work Tour Mode Models;
    - School Tour Mode Models;
    - "Other" Tour Mode Models.
- Calibration of Day Pattern and Main Tour Mode Models.

Technical Note Part 3 (this document) contains details of:

- Primary Destination Choice Models for "Other" Tours

- Sub-Tour Mode Choice Models;
- Secondary Destination Choice Models;
- Trip Mode Choice Models;
- Calibration of Primary and Secondary Destination / Sub-Tour and Trip Mode Choice Models;
- Implementation in the CSTDM Model Framework.

2. Primary Destination Choice Models: Other Tours

The primary destination choice model for Other tours forecast the primary destination of a tour made for an "Other" purpose. This condition differs from the Work or School tours: as described in the previous documents, the primary destination for Work and School tours are determined using the Long Term Decision Work and School Location models.

Figure 1 shows a typical "Other Purpose" tour:

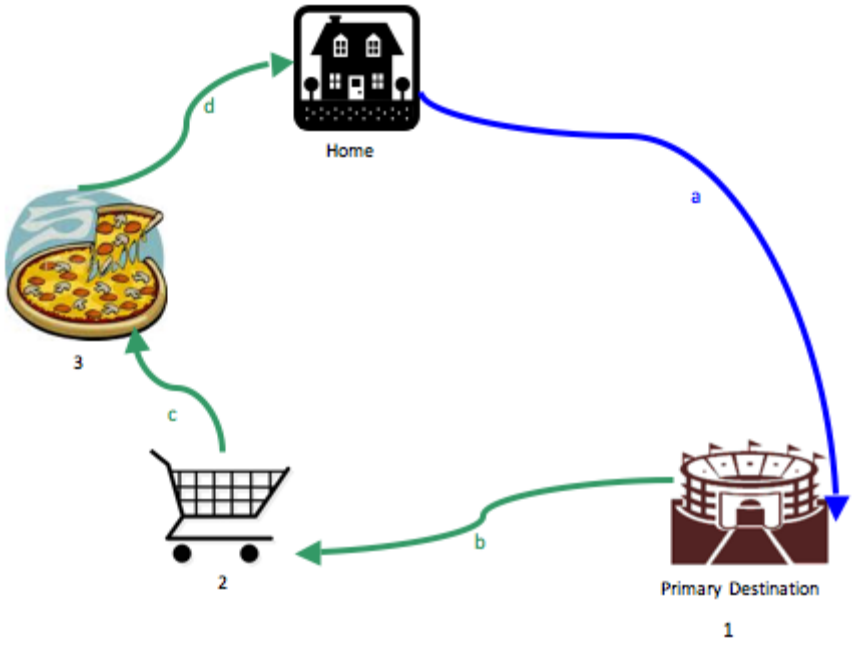

Figure 1: "Other Purpose" Tour

The tour shown in Figure 1 consists of four trips. The tour maker goes from home to a first stop, i.e. location “1”, for recreation; then goes to location “2” to shop; then goes to location “3” to eat; and then returns home. For “Other Purpose” tours, the first stop location (location “1” in the example) is considered as the primary destination (here with a recreation purpose), and all other stop locations are considered as secondary destinations.

Figure 2 illustrates the sequence of operation of the primary destination model for “Other Purpose” tours.

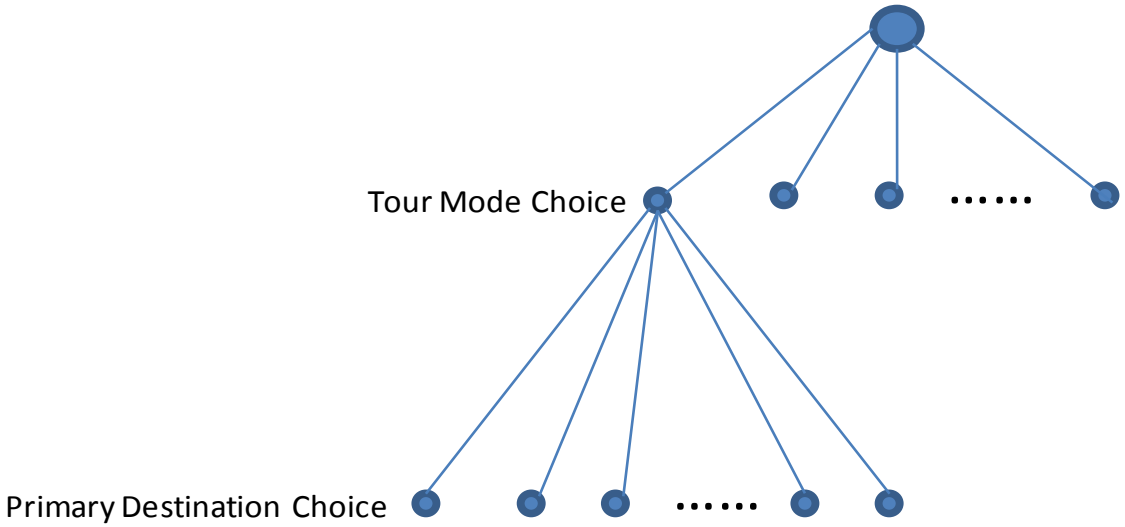

Figure 2: Model Structure for Primary Destination for Other Purposes

The tour mode has already been estimated in the CSTDM process for each purpose.

Seven modes are specified:

1. Single Occupant Auto (SOV) (not available for persons with no driving license or from a 0-auto owning household);
2. High Occupant Auto with 2-persons in the auto (HOV2);
3. High Occupant Auto with 3+persons in the auto (HOV3):

4. Walk Access Local Transit: bus, light rail, heavy rail, with walk access and egress (not available for origin-destination pairs with no transit service);
5. Drive Access Local Transit: access to or egress from a rail station is by auto (not available for origin-destination pairs with no transit service);
6. Walk (not available for a round trip tour distance > 10 miles);
7. Bicycle.

The primary destination choice models estimate the primary destination TAZ for a tour made from the tour origin TAZ, for six purposes:

1. Recreation;
2. Eat;
3. Social;
4. Personal Business;
5. Shop;
6. Escort.

Each model considers the components of travel for each mode (in-vehicle time, out-of-vehicle time and direct travel cost), summed for the outbound and return time periods given in the tour pattern and known from the day pattern model), together with a size term reflecting the attractiveness of the destination zone for the particular purpose.

The time period of the trip from home to the primary destination is the *outbound* time period of the tour. The time period of the trip from the last stop on the tour before home (here intermediate stop “3”) to home is the *return* time period of the tour.

The utility of choosing a particular destination zone is:

$$V_{im} = \beta_m (IVT_{inm} + \alpha_m \times OVT_{inm} + \gamma_m \times MC_{inm}) + \mu \ln \sum_{k=1}^{K^s} \exp(\beta_k) x_{ink} z_{ink}$$

+ distance function

where:

V_{in} is the utility of destination TAZ alternative *i* for tour *n*

β_m is the coefficient of travel deterrence for mode m

K^V is the number of utility parameters

K^S is the number of size parameters

B_k are the size term parameters (*k=1 to* K^S includes explanatory SIZE variables)

x_{ink} is the size attribute value for the TAZ alternative *i* for tour n

z_{nk} is a characteristic of tour n

μ is the size term scale parameter

IVT_i is the total in-vehicle time from home to primary destination and from primary destination back to home, in the outbound and inbound time periods.

OVT_i is the total out-of-vehicle time from home to primary destination and from primary destination back to home, in the outbound and inbound time periods.

MC_i is the total monetary cost from home to primary destination and from primary destination back to home, in the outbound and inbound time periods.

Coefficients α_m and Υ_m are used to calculate the composite travel cost of mode “m” in equivalent in-vehicle travel time.

α_m= The ratio of out-of-vehicle time and in-vehicle time used to convert out-of-vehicle time to equivalent in-vehicle time for mode m. α_m *=2.8 for* transit mode

Υ_m= The ratio of monetary cost and in-vehicle-time used to convert monetary cost to equivalent in-vehicle time for mode m. Υm= 5 for all modes..

The additional distance function was developed during the calibration process. The additional distance disutility is in the quadratic form to the minima of the function, and then floored thereafter. Free flow HOV3 network distance from home to the destination is used as the distance. The parameters are provided in table 3, with figure 2 showing the function.

For other tours, the appropriate parking cost is chosen based on the tour start and end time period, as shown in Table 1.

Table 1: Parking Costs Used in Primary Destination Other Tours

		Starting time period				
Ending time period		Offpeak Early	AM Peak	Midday	PM Peak	Offpeak Late
	Offpeak Early	1 Hour				
	AM Peak	2 Hours	1 Hour			
	Midday	Daily	3 Hours	2 Hours		
	PM Peak	Daily	Daily	3 Hours	1 Hour	
	Offpeak Late	Daily	Daily	Daily	2 Hours	1 Hour

When the models are applied by purpose and mode:

- For each purpose, the same size terms are applied across all modes;
- For each mode, the same composite travel costs are applied across all purposes.

Table 2 gives the primary destination choice model for "Other" tour purpose.

Table 2: Primary Destination Choice Model for "Other" Tour Purpose

Parameter	***Parameter Value***
Bicycle travel time	-0.052145
Walk travel time	-0.037147
Transit Composite Travel Cost	-0.016779
HOV3+ Composite Travel Cost	-0.061635
HOV2 Composite Travel Cost	-0.055621
SOV Composite Travel Cost	-0.042874
Size Term Multiplier (***μ***)	0.911768
SIZE *Function ALL*	
Size: Total Employment	1.0
SIZE *Function PERSONAL BUSINESS*	
Other Service Employment	2.613249
Education and Medical Employment	1.237931

Retail Employment	1.635965
SIZE *Function ESCORT (HH with Children)*	
Student enrollment from *K to 12*	1.542031
SIZE *Function ESCORT (HH no Children)*	
Office Employment	0.783484
Other Service Employment	2.842215
Leisure and Hospitality Employment	3.055537
Education and Medical Employment	1.279533
Retail Employment	0.052725
SIZE *Function EAT*	
Leisure and Hospitality Employment	5.367186
SIZE *Function RECREATION*	
Retail Employment	1.170141
Leisure and Hospitality Employment	4.311320
SIZE *Function SOCIAL*	
Retail Employment	-0.527702
Number of HH	0.423897
SIZE *Function SHOP*	
Retail Employment	1.602267

Table 3: Other Tour Primary Destination Distance function parameters

Tour mode	**Distance**	**Distance^2**
SOV	-0.5154	0.0220
HOV2	-0.4404	0.0228
HOV3+	-0.3649	0.0196
Transit	-0.7089	0.0410
Walk	-0.6972	0.1408
Bicycle	-0.7100	0.0486

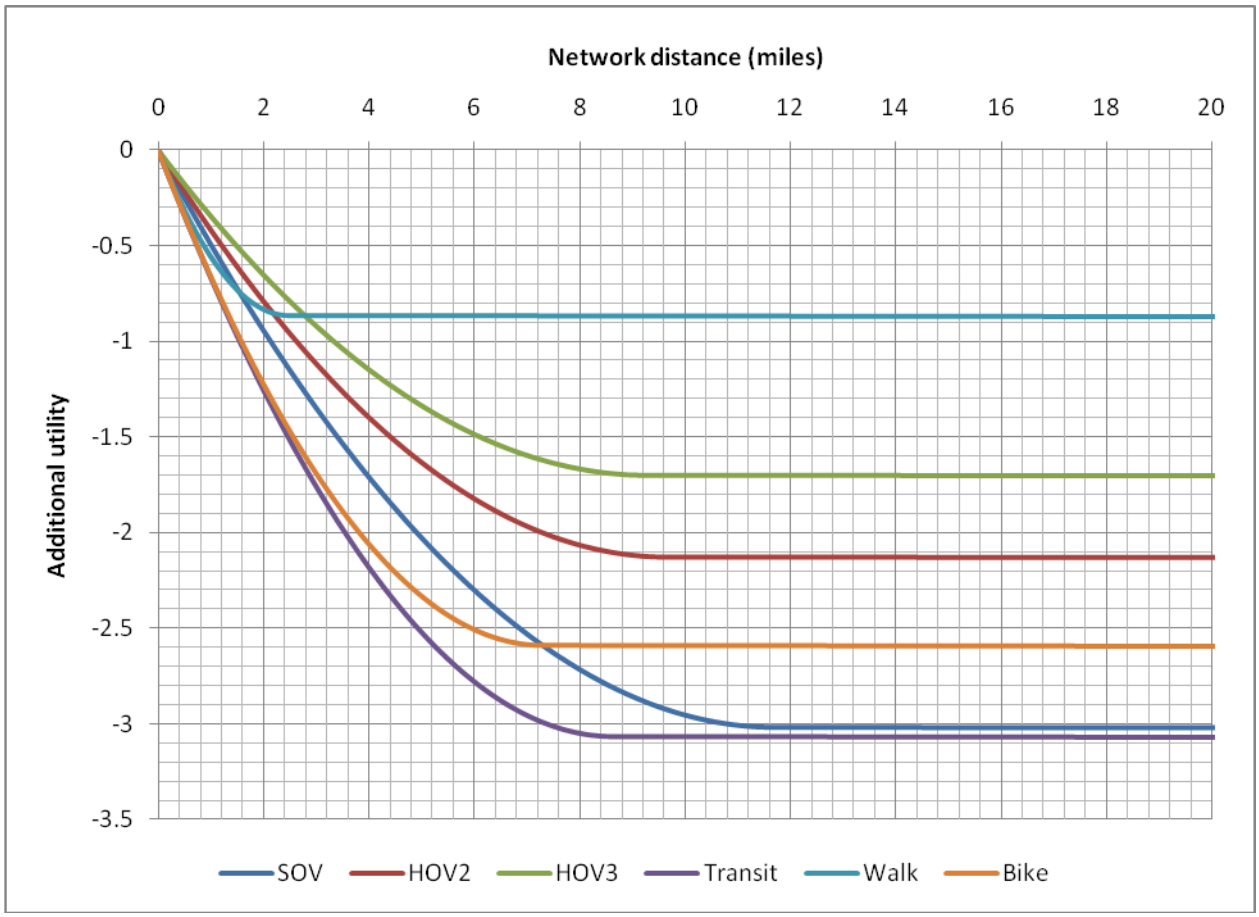

Figure 3: Other Tour Primary Destination Distance Functions

3. Sub-Tour Mode Choice Models (Work and School)

A “sub-tour” is a tour, which starts from the primary destination and ends at the primary destination. Because the person is returning to their primary destination, the walk mode is a reasonable alternative even if they have driven to the primary destination -- the auto can remain parked at work or school and used on the trip away from work or school. In practice, the majority of these subtours are made from primary work locations, for the work-related, eat or personal business purpose during the Midday time period,.

Figure 3 shows the three types of secondary destination stops that can be made as part of a tour to / from the primary destination, color coded with labels a, b, c.

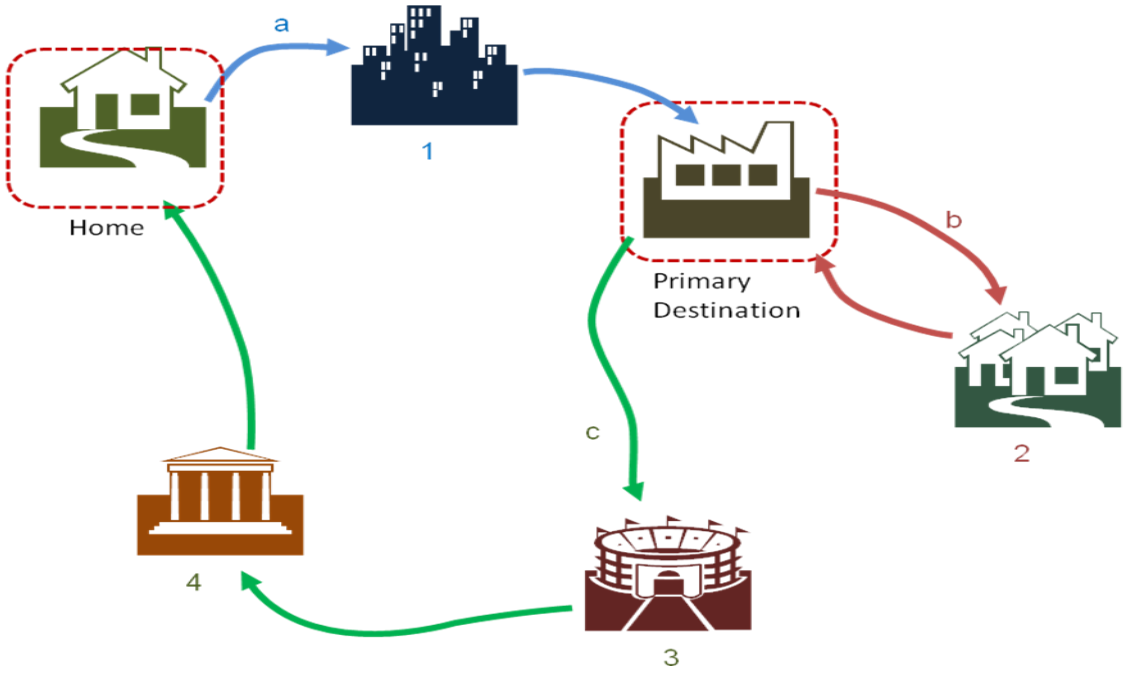

Figure 4: Types of Secondary Destination Stops in Tour, including a Sub-Tour

In Figure 3 the sub-tour is shown by the “segment b” tour made from the primary destination (to destination “2”) and returning to the primary destination.

By the definitions used to define tours for this model, a sub-tour can only take place for a Work or School tour (because for Other tours the first stop on the tour is the primary destination, and all other destinations on that tour other than home are secondary destinations).

For sub-tours the choice of mode is limited to a binary choice between the main tour mode and the walk mode. This encompasses the vast majority of observations. If the main tour mode is walk, then the sub-tour mode must be walk by definition. If the main tour mode is school bus, then the sub-tour must be walk, as there were no examples of a sub-tour by school bus. If the main tour mode is drive access transit, then the sub-tour mode choice model considers walk access transit as the main tour mode -- the auto used to drive to the rail station for the journey to work is parked at the rail station and therefore unavailable for a sub-tour.

The sub-tour mode choice model was estimated in ALOGIT on the MTC survey sample only. The purpose of the sub-tour is the purpose of the first stop; this is consistent with home based Other purpose tours. The model form is shown in table 4.

Table 4: Sub-Tour Mode Choice Model

Parameters	**Parameter value**
Main tour mode	
Constant; main tour mode SOV	9.5006
Constant; main tour mode HOV2	9.0238
Constant; main tour mode HOV3+	8.6973
Constant; main tour mode transit	6.9208
Constant; main tour mode bicycle	6.4848
Walk	
Population + employment density at primary destination	3.485×10^{-6}
Ln(population + employment density) at primary destination	0.4860
Subtour purpose is Eat	1.5627

Subtour purpose is Recreation	0.9736
Subtour purpose is Shop	0.5627
Subtour purpose is Personal Business	0.5202
Subtour is during midday time period	0.4419
Number of trips on subtour	0.2529

Walk sub-tours are thus more common in denser urban areas where more opportunities are available, when the main tour mode is not a driving mode, and in particular for lunch sub-tours.

4. Secondary Destination Choice Models

According to the secondary destination shown in Figure 4, the stop made at destination ”1”, shown as part of “segment a” of the tour, is made **before** the primary destination. By the definitions used to define tours for this model, this type of secondary stop can only take place for a WORK or SCHOOL tour (because for OTHER tours the first stop on the tour is always the primary destination).

A sub-tour, shown by the “segment b” tour, is made from the primary destination (in Figure 4 to destination “2”) and returns to the primary destination. By the definitions used to define tours for this model, a sub-tour can only take place for a WORK or SCHOOL tour (because for OTHER tours the first stop on the tour is the primary destination; all other destinations on that tour other than to home are secondary destinations).
All stops made on the tour **after** the primary destination (other than a sub-tour) are secondary stops. They can occur as part of Work, School or Other Purpose tours. In Figure 4 they are shown as destinations “3” and “4” as part of tour segment “c”.

A single secondary destination choice model is applied for all these secondary stop types. The secondary destination choice model determines the locations of all

secondary destinations on the tour (the primary destination has already been chosen). The main mode used for the tour, or sub-tour, has already been determined.

The form of the secondary destination choice model is similar to that for the Primary Destination model.

Seven modes are specified:

1. Single Occupant Auto (SOV) (not available for persons with no driving license or from a 0-auto owning household);
2. High Occupant Auto with 2-persons in the auto (HOV2);
3. High Occupant Auto with 3+persons in the auto (HOV3):
4. Walk Access Local Transit: bus, light rail, heavy rail, with walk access and egress (not available for origin-destination pairs with no transit service);
5. Drive Access Local Transit: access to or egress from a rail station is by auto (not available for origin-destination pairs with no transit service);
6. Walk (not available for a round trip tour distance > 10 miles);
7. Bicycle.

The secondary destination choice models estimates the secondary destination TAZ for a tour made for each secondary tour type (i.e. whether the trip is a diversion of a direct trip from home to primary destination and vice versa; or a sub tour) for the six purposes in the Primary Destination model, plus Work and School, which are both eligible stop purposes for a secondary stop:

1. Recreation;
2. Eat;
3. Social;
4. Personal Business;
5. Shop
6. Work;
7. School.

Each model considers the components of travel for each mode (in-vehicle time, out-of-vehicle time, and cost), together with a size term reflecting the attractiveness of the destination zone for the particular purpose. The coefficients of the size terms are kept to the same values that were established for the primary destination choice model.

The travel “costs” considered depend upon the tour type.

As shown above, Figure 4 shows three types of secondary destination stop that can be made as part of a tour to/from the primary destination:

- An intermediate stop between home and the primary destination (*segment a*)
- A stop on a sub-tour starting from the primary destination - (segment *b*)
- An intermediate stop between the primary destination and home - (*segment c*)

The calculation of travel deterrence attributes for these three segments types is;

- For *segment a*, the cost of travel considered in the secondary destination choice model is the cost from home to the secondary destination “1” and then the cost from the secondary destination “1” to the primary destination.
- For *segment b*, the sub-tour, the cost of travel considered in the secondary destination choice model is the cost from the primary destination to the secondary destination 2 and then the cost from the secondary 2 to the primary destination.
- *Segment c* has two intermediate stops on the return from the primary destination to the home. For this case, the travel cost considered in the secondary destination choice, is the cost from the current location to the secondary destination and from the secondary destination to the tour end (home). For example, In the case of secondary stop “3” (Figure 2), the current location is the primary, so the cost of travel is the cost from primary destination to secondary destination “3” and then the cost from secondary destination “3” to the tour end.

The time periods of the trips to and from the secondary destination are known from the day pattern.

The utility of choosing a particular secondary destination zone is:

$$V_{im} = \beta_{mp}\left(IVT_{inmp} + \alpha_m \times OVT_{inmp} + \gamma_m \times MC_{inmp}\right) + \mu\, ln \sum_{k=1}^{K^S} \exp(\beta_k)\, x_{inkp} z_{inkp}$$

Where:

V_{in} is the utility of TAZ alternative *i* for tour *n*

p is the trip type i.e. whether the trip is a diversion type for a tour from home to primary destination or sub tour type

β_{mp} is the coefficient of travel deterrence for mode m for trip type p

K^S is the number of size parameters

β_k is a utility parameter (*k=1 to* K^S includes explanatory SIZE variables)

x_{inkp} is the attribute value for the TAZ alternative *i* for tour n and trip type p

z_{inkp} is the characteristic of the end of a trip for tour n and trip type p

μ is a size term scale parameter

Table 5 presents the results of the estimation of the secondary destination choice model.

Table 5: Secondary Destination Choice Model

Parameter	***Parameter Value***
Bicycle travel time for Sub tour	-0.072914
Bicycle travel time for diversion	-0.089627
Walk travel time for Sub tour	-0.055045
Walk travel time for diversion	-0.044508
Transit Composite Travel Cost	-0.024345
HOV3+ Composite Travel Cost for Sub tour	-0.106029
HOV3+ Composite Travel Cost for diversion	-0.129078
HOV2 Composite Travel Cost for Sub tour	-0.088442

HOV2 Composite Travel Cost for diversion	-0.112282
SOV Composite Travel Cost for Sub tour	-0.065356
SOV Composite Travel Cost for diversion	-0.0810761
Size Term Multiplier (μ)	1.0
SIZE *Function ALL*	
Total Employment	1.0
SIZE *Function SCHOOL*	
Student enrollment in Post Secondary Education	1.931476
Student enrollment in K – g.12	1.234340
SIZE *Function PERSONAL BUSINESS*	
Other Service Employment	2.613249
Education and Medical Employment	1.237931
Retail Employment	1.635965
SIZE *Function ESCORT HOUSEHOLDS WITH CHILDREN*	
Student enrollment from *K to g.12*	1.542031
SIZE *Function ESCORT HOUSEHOLDS NO CHILDREN*	
Office Employment	0.783484
Other Service Employment	2.842215
Leisure and Hospitality Employment	3.055537
Education and Medical Employment	1.279533
Retail Employment	0.052725
SIZE *Function EAT*	
Leisure and Hospitality Employment	5.367186
SIZE *Function RECREATION*	
Retail Employment	1.170141
Leisure and Hospitality Employment	4.311320
SIZE *Function SOCIAL*	
Retail Employment	-0.527702
Number of HH	0.423897
SIZE *Function SHOP*	
Retail Employment	1.602267

5. Trip Mode Choice Models

The trip mode choice models determine the mode for an individual trip, conditional on the tour mode and the trip destination.

In general, this is the same mode as the tour mode (86.4% of the trips in the MTC data set were made by the same mode as the tour mode).

Five general groups of exceptions (to the general rule that the trip mode is the main tour mode) were observed in the travel survey data:

1. Sub-tours by walk mode. In this case, the tour is made by a mode other than walk, but the person walks when making a sub-tour from the primary destination; this is the classic case of walking to get some lunch from work. This comprises about 0.8% of trips, however these do occur the most frequently in crowded CBD areas. The Sub-Tour Mode Choice models specified in Section 3 above deal with this trip type.
2. Walk and transit tours. In this case, the tour is made by a transit mode, but the trip is by walk (outside of the sub-tours mentioned above), or the tour is made by auto access transit, but the trip is made by walk access transit. This occurs for short trips on transit tours, where transit is inefficient, as well as on auto access transit tours where only the first and last trips can reasonably be made by auto access; a person can't park and ride on their first trip to work, then park and ride on the way to shopping, then ride and drive on the way back home. These comprise about 0.7% of trips.
3. Walk on auto. In this case, the tour is made by one of the auto modes, but the trip is by walk (again, outside of the sub-tours mentioned in point one). This occurs when someone is dropped off or picked up and still travels by foot for a leg of the tour, or in implicit sub-tours not derived from the primary destination (for instance, if someone drives to a theatre, then walks to a cafe afterwards). This comprises about 1.8% of trips.
4. HOV on SOV. In this case, a tour by SOV has trips made by HOV2 or HOV3+, or a HOV2 tour has trips made by the HOV3+ mode. This is the case when

someone is picked up or dropped off in the course of a tour. The trip is still made by an auto mode, and still has very similar costs, but the occupancy is different. This is the largest of the exceptions, and comprises 9.0% of trips (6.0% being HOV on an SOV tour).

5. All other exceptions. The various other possibilities not described here, which comprise 2.0% of trips.

These exceptions are shown in Figure 5.

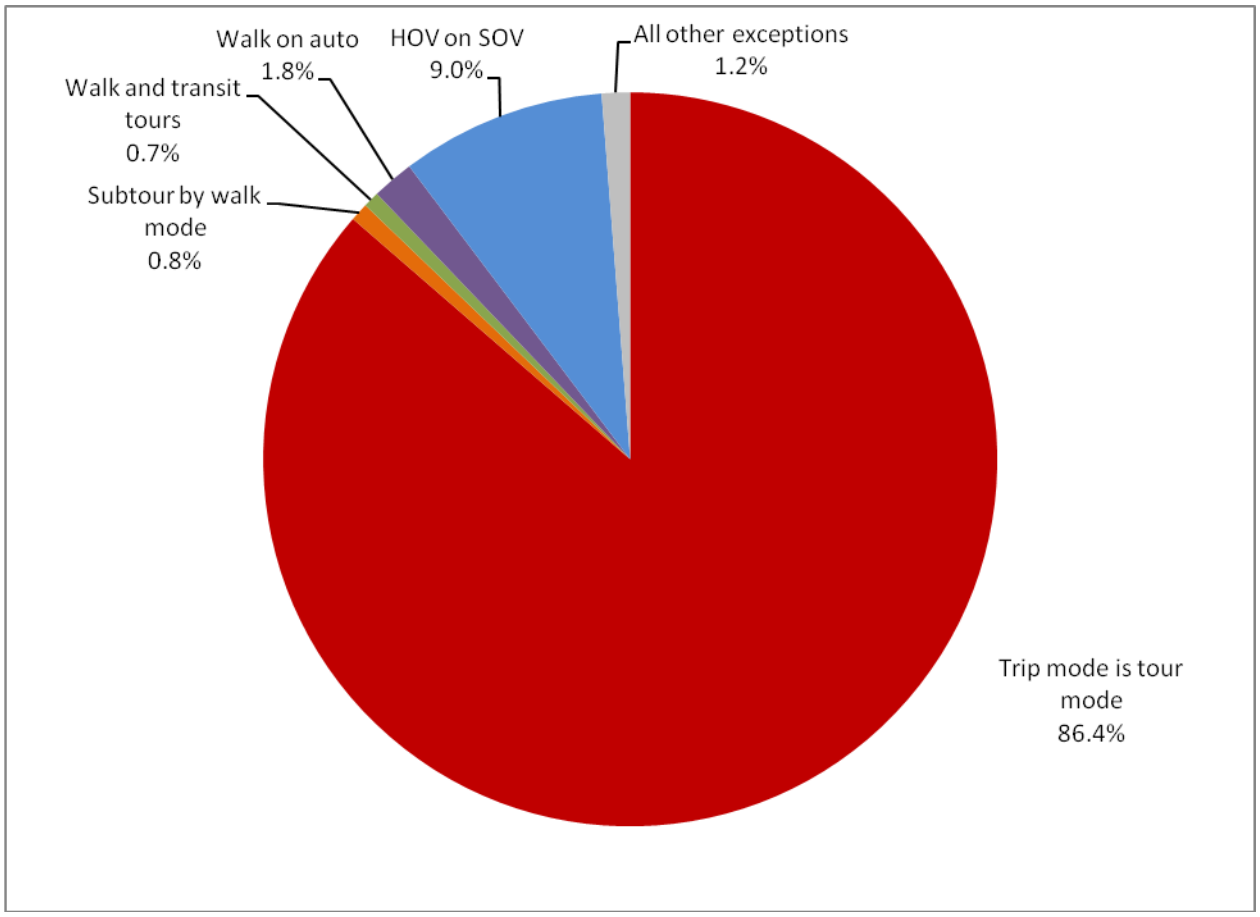

Figure 5: Observed Distribution of Trip Mode Types

For the CSTDM, two simple trip mode choice models are applied:

A. For transit tours, a rule-based model with the first and last trip of auto access transit being defined as auto access, and with the remainder (as well as all trips on a walk access transit tour) defined as walk access. This handles the fact that

drive access transit tours have a car parked at a rail station, and it must be picked up at the end of the tour, but is otherwise unavailable during the tour. Because of the mode hierarchy used to define tour modes in the dataset, a tour with both drive access transit and SOV or HOV trips is defined as SOV or HOV. Therefore, a drive access transit tour cannot contain any "pure drive" mode trips, and the first and last trips must be auto access transit.

B. For SOV and HOV tours, a logit model determines if the tour mode is SOV, HOV2 or HOV3+. This model is described below.

The SOV/HOV mode choice model considers the possibility of a trip on an SOV tour being made by SOV, HOV2 or HOV3+, and also the possibility of a trip on an HOV2 tour being made by either of the HOV2 or HOV3+ modes. By definition, SOV trips cannot be made on HOV tours, and HOV2 trips cannot be made on HOV3 tours.

The SOV/HOV tour mode choice model is a multinomial logit model estimated using the ALOGIT software package. The parameters are described in Table 6.

Table 6: SOV/HOV Trip Mode Choice Model

Parameters	Parameter value
SOV	
Constant; tour purpose is Work	3.0877
Constant; tour purpose is School	2.7341
Constant; tour purpose is Escort	3.0802
Constant; tour purpose is Shop	4.3644
Constant; tour purpose is Personal Business	4.2052
Constant; tour purpose is Recreation	4.0114
Constant; tour purpose is Eat	3.6465
Constant; tour purpose is Social	3.7349
Trip is Home to Work, AM peak period	2.5992
Trip is Home to Work, all other time periods	3.6809
Trip is Work to Home, PM peak period	2.7015

Trip is Work to Home, all other time periods	3.0860
Trip is Home to School	2.0975
Trip is School to Home	2.6769
Trip is Home to Escort	-1.8712
Trip is Escort to Home	-1.1674
Trip is Home to Other (excluding Escort)	1.5211
Trip is Other (excluding Escort) to Home	1.3760
Trip is Work or School based (non home based, with at least one end at place of work or school)	2.1850
Trip is non home based, Offpeak Early or AM Peak period	0.0000
Trip is non home based, Midday period	0.2921
Trip is non home based, PM Peak period	-0.1327
Trip is non home based, Offpeak Late period	-0.4931
One person household	0.6584
Income <$25K	-0.1116
HOV2	
Constant; tour mode SOV	2.3430
Constant; tour mode HOV2	3.0070
Female	0.2016
Postsecondary student	-0.1793
Number of children in household aged 0-15	0.1051
Fewer cars than drivers (including no car households)	0.2186
HOV3+	
Tour purpose is Work	0.8604
Tour purpose is School	0.7199
Tour purpose is Escort	1.0130
Tour purpose is Eat	0.2920
Tour purpose is Social	0.5236
Trip leaving home	-0.3750

Trip returning to home	-0.2701
Person is under 18	0.4607
Female	0.4470
Postsecondary student	-0.2895
Number of children in household aged 0-15	0.5915
Fewer cars than drivers (including no car households)	0.1895

6. Calibration of Trip Mode and Destination Choice Models

The main calibration exercise for the models described in this document was for the Other Primary Destination Choice model. The additional distance function added during calibration is described in section 2, with the resulting trip length distributions described below. The methodology for developing the trip length figures is described in the calibration of Work tour primary destinations, in the calibrations section of part 1 of this document. The model fit to the observed data appears to be quite good. The following figures show the trip length distributions for Other modes (the mode-specific graphs are used because the modes all have very similar curves, and it was difficult to evaluate model results within the overlapping curves, so the four motorized modes are presented on individual figures 6 to 9, with figure 10 showing the non-motorized mode calibration. The fits with observed trip lengths are very good, particularly for SOV and Walk.

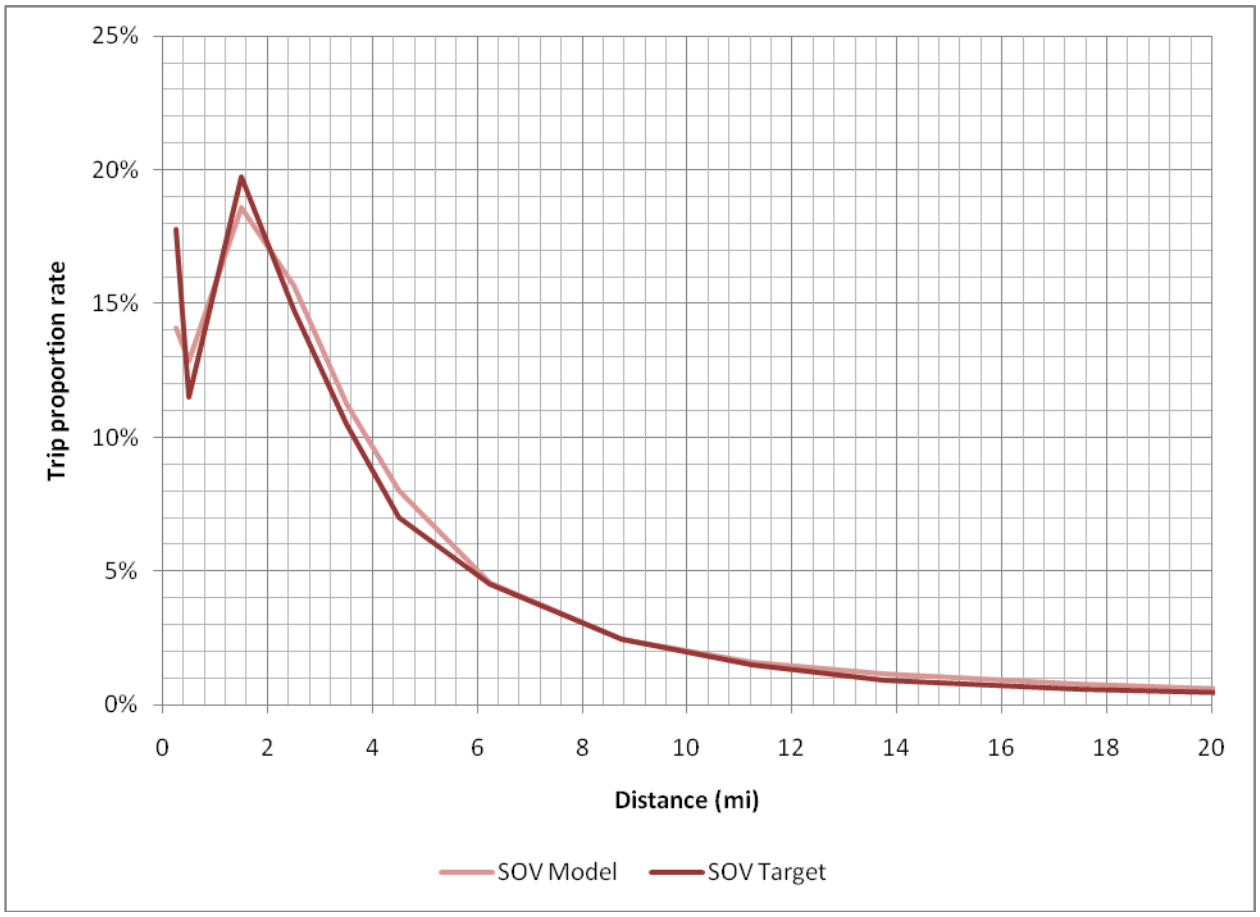

Figure 6: Other Location Model - Trip Length Distribution - SOV

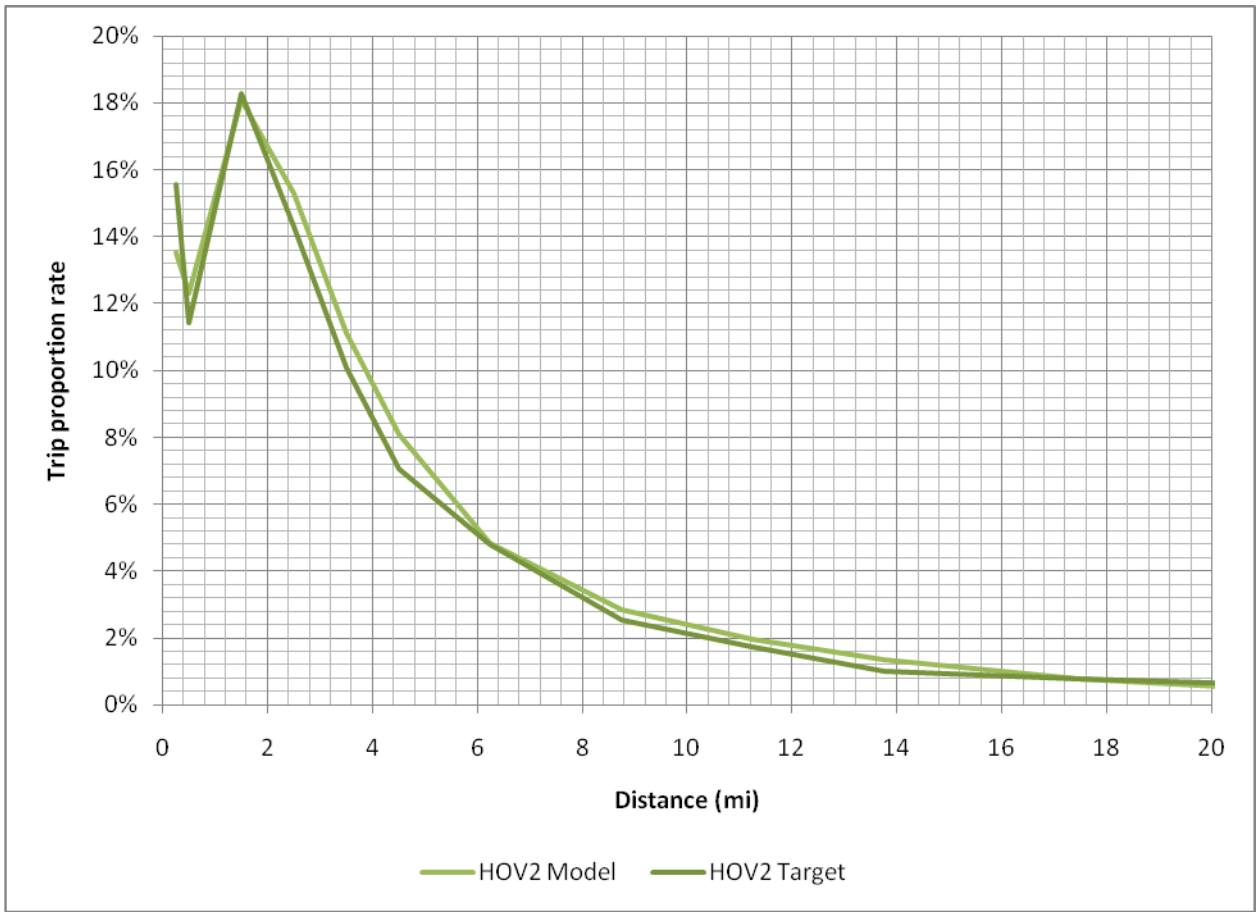

Figure 7: Other Location Model - Trip Length Distribution - HOV2

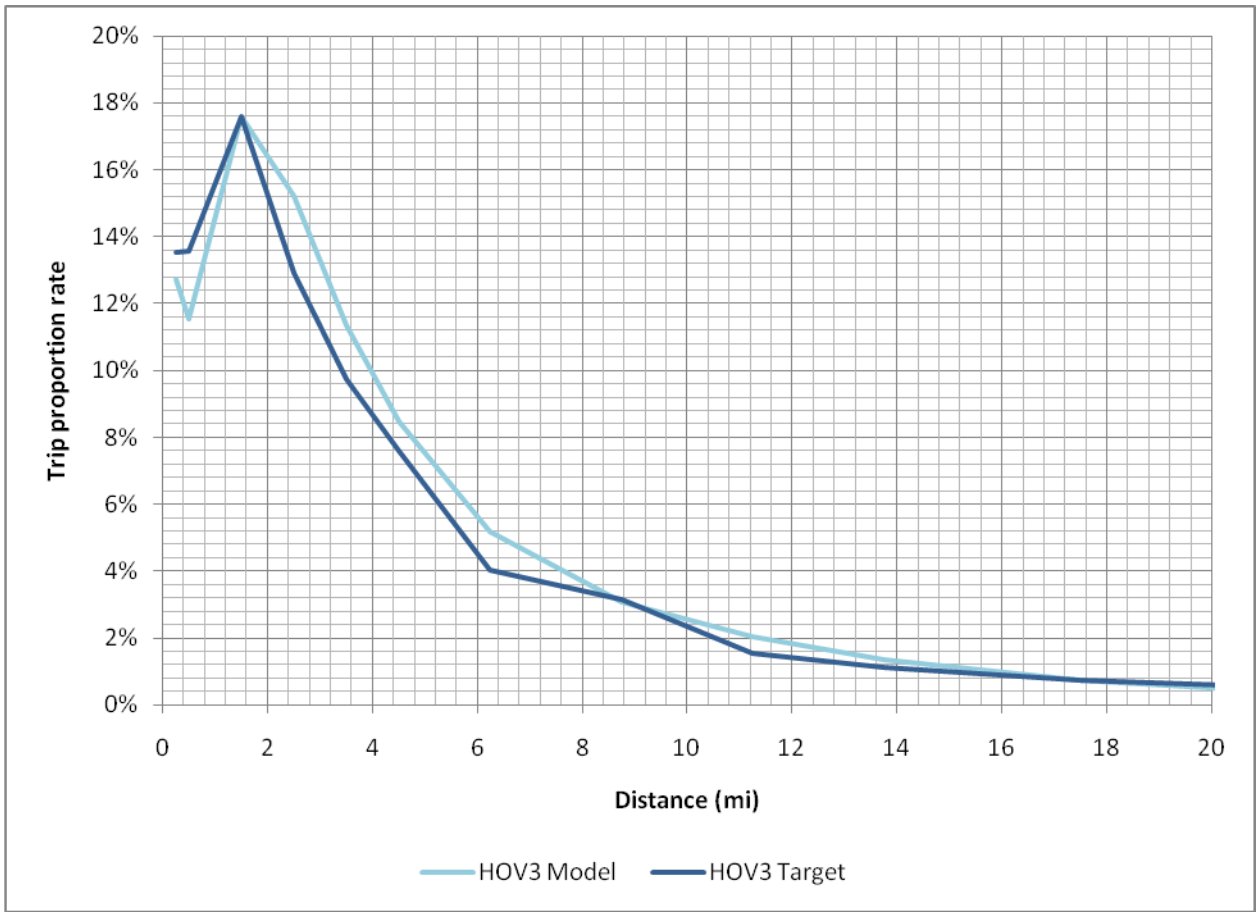

Figure 8: Other Location Model - Trip Length Distribution - HOV3

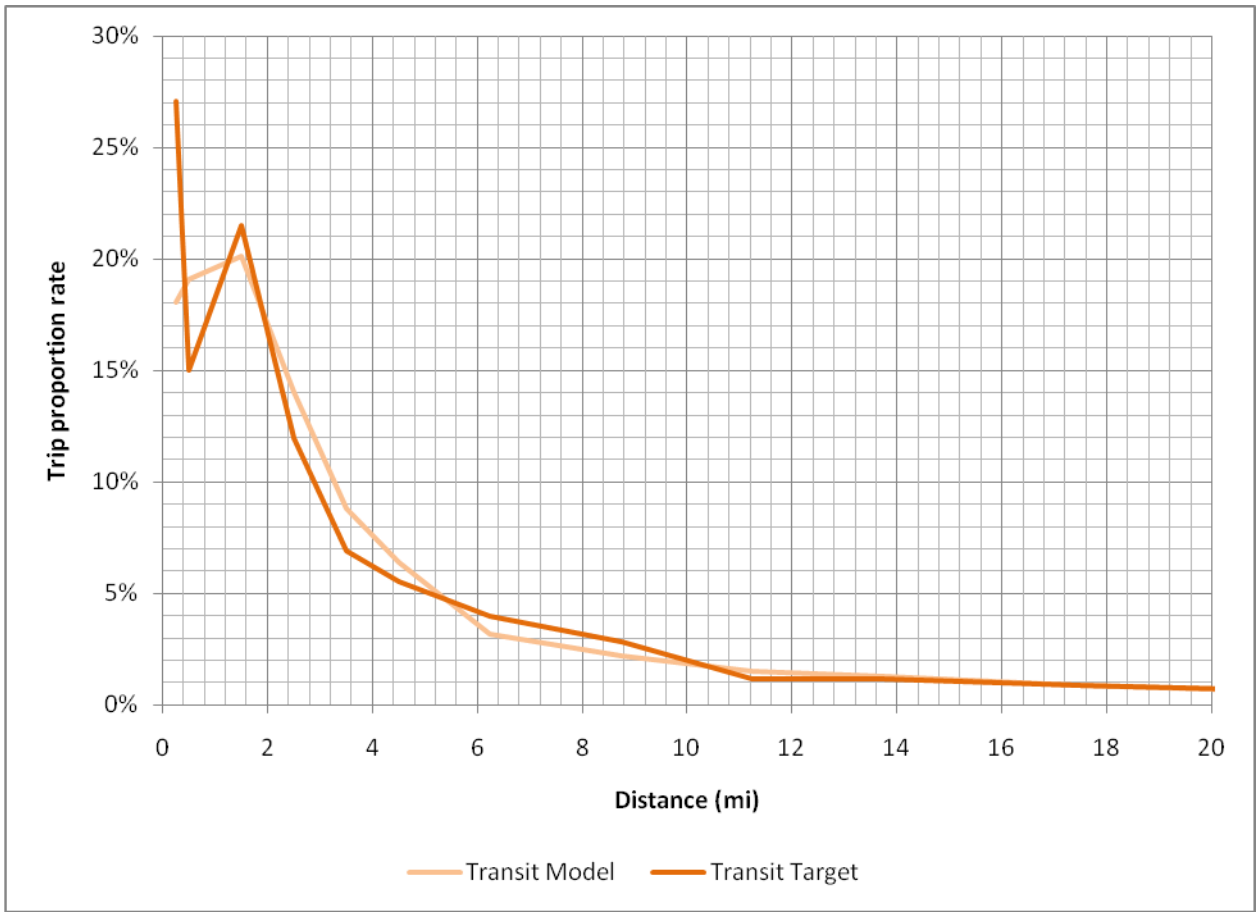

Figure 9: Other Location Model - Trip Length Distribution - Transit

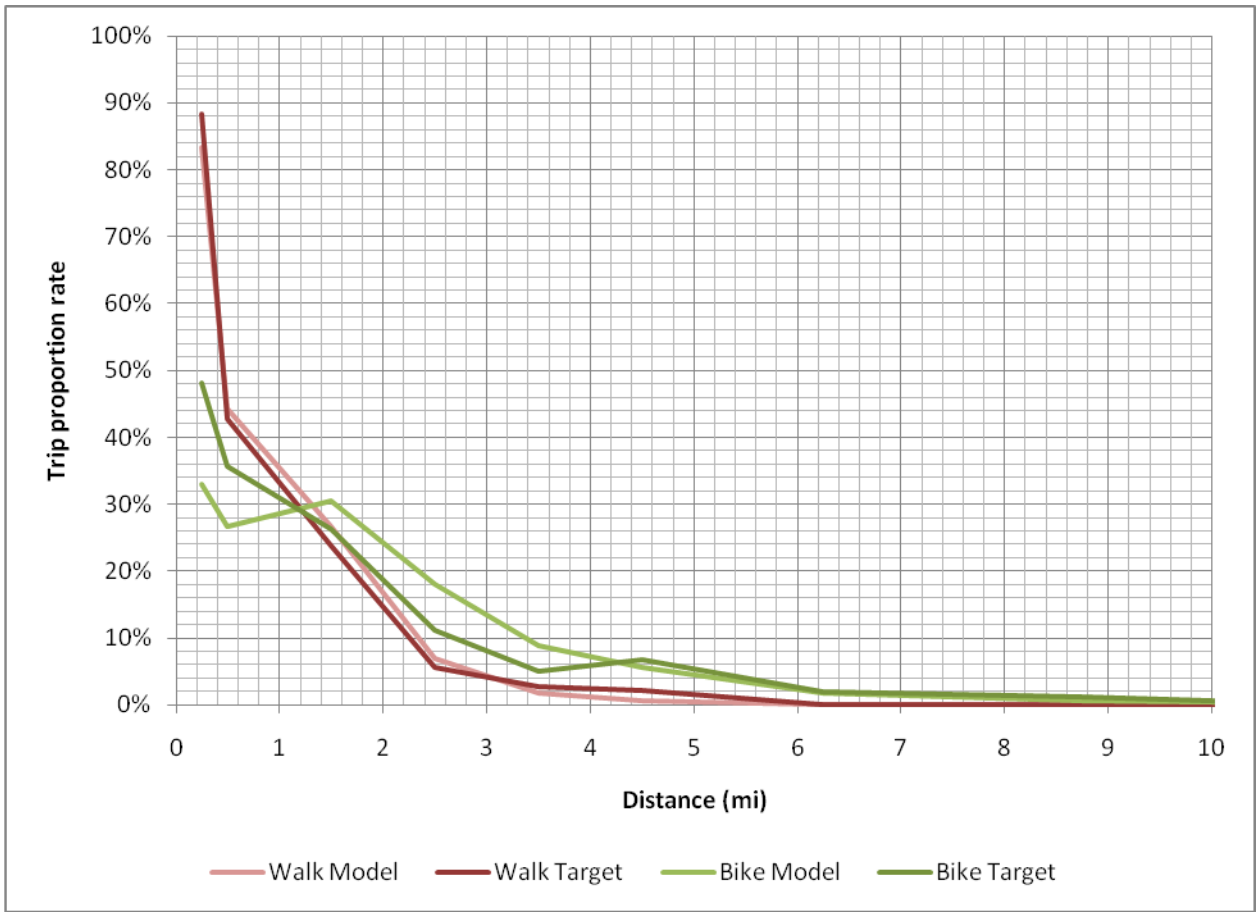

Figure 10: Other Location Model - Trip Length Distribution - Walk and Bicycle

7. Model Implementation

The SDPTM model operation is fully integrated with the other components of the CSTDM, and run as part of the overall model run within the CUBE installation.

The SDPTM model is implemented using a specially-written Python program, spread across several "modules" or files. It requires the following inputs:

- A **TAZ file** that specifies which TAZs are in each "run district". This is a CSV file that determines which parts of the state will be modelled in a group; regardless of the run district composition, each TAZ will have access to all the TAZ within 100 straight-line miles.
- A **paths file** that specifies the directories and files where the other inputs can be found, the output directory and filenames, and other run parameters. The paths file is a text file in the form of a Python program.
- A **zone properties** file in CSV format containing the employment and other properties of the TAZs.
- A **synthetic population** in a SQLite database file containing the PUMS records, including several additional fields for model operation, as well as the synthetic population list and "views" or saved queries joining these tables together.
- **Travel time and cost "skim"** files for each mode, in the HDF5 format.

The CSTDM User Guide gives specific details of the data required in the paths file. The CSTDM operation has a defined system of file directory names for input and output data, which have to be used. Many of the input fields in the paths file will stay the same for every run.

The final form of the model as described in this Technical Paper is entered directly in the model code.

The zonal properties file is automatically generated in each run from the other zonal properties and population synthesizer data input for the overall model run, as specified in the User Guide.

The skim files are automatically generated by the CUBE program as part of the model run.

The synthetic population is prepared as a separate step from running model scenarios.

The primary output for the SDPTM consists of a series of trip lists, one per "run district" in the CSTDM standard format; each record is a single trip. The fields used for the trip list are consistent with the other components of the CSTDM. These trip records can contain additional information about the synthetic population member generating the trip, and can be linked to the synthetic population for highly detailed demographic analysis. This data may be analyzed to examine trip patterns by origin-destination, mode, by demographic groups.

Additional output for the SDPTM includes a set of driver's license files and auto ownership files, one per "run district" which record the results of these two models for every person and household respectively in the synthetic population. A summary file is created at a later stage in the CUBE script that combines the trip list files and aggregates them in a number of ways to produce a somewhat more manageable file.