



Zenith Transport Model

Technical Note 6 The Period Allocation Model

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Technical Note 6: The Period Allocation Model

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1 Introduction

This Technical Note is one of a series of papers that collectively describe the Zenith Transport Model. Zenith is a four step transport model, implemented in the OmniTRANS software package for a range of Australian cities and regions.

This Technical Note details the Period Allocation model.

1.1 Objectives and Scope of This Document

The primary objective of this document is to detail the method used to allocate trips to periods within Zenith.

This scope of this document does not extend to include the definition or validation of model parameters for specific regions. Refer to Section 3 for links to this information.

The remainder of this technical note is structured as follows:

- Section **Error! Reference source not found.** describes the Period Allocation model, its objectives, its functional form, the data sources and procedures used for parameter estimation, and a summary of the model's limitations,
- Section 3 lists further sources of information relating to the Period Allocation model.



2 The Period Allocation Model

2.1 Context and Objectives

The Period Allocation model is the fifth step in the Zenith Model Run process, and follows the Destination Choice model, as illustrated in Figure 1 below.

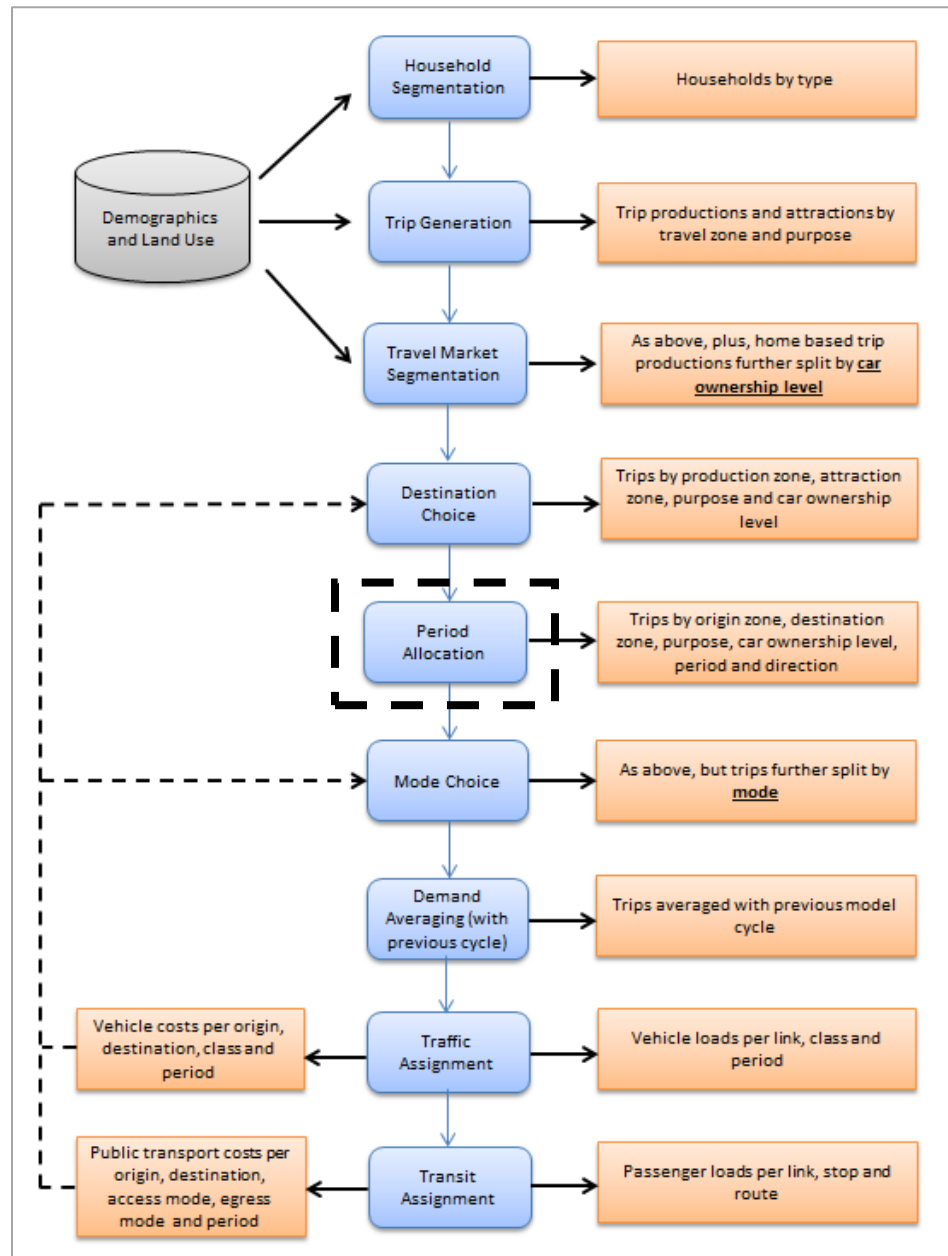


Figure 1 - Zenith Model Run Process



The Period Allocation model takes as input *trips by OD by travel market segment* which are output from the destination choice model. These trips do not yet have an assigned period, and they are all assumed to occur in the Outward (production to attraction) direction (e.g. home to work).

The aim of the period allocation model is to assign both a period and a direction to each trip.



2.2 Periods and Directions

Most Zenith models divide the 24 hour day into three mutually exclusive periods, defined as follows:

- AM Peak: 7 to 9am
- PM Peak: 4 to 6pm
- Off Peak: The remainder of the day

The single exception is the Victorian model, which divides the day into four periods:

- AM Peak: 7 to 9am
- PM Peak: 4 to 6pm
- Inter Peak: 9am to 4pm
- Off Peak: 6pm to 7am

All Zenith models also assign travel to one of two directions:

- Outward
- Return

The concept of directionality is detailed in the following sub-section.

The aim of the Period Allocation model, as discussed in the previous section, is to assign each trip both a period and a direction.

For a model with 3 periods, this leads to the assignment of trips to 6 period / direction combinations:

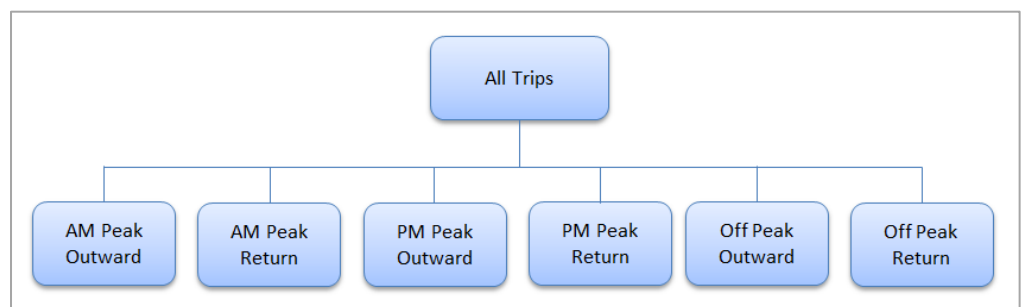


Table 1 - Allocation of Trips to Period / Direction Pairs



2.3 The Concept of Outward and Return Trips

The Zenith Period Allocation model is responsible for assigning all trips a *direction*, either 'Outward' or 'Return'. The meaning of each direction is related directly to the definition of production and attraction activities.

Strictly, the directions are defined as follows:

- Outward: *Production Activity to Attraction Activity*
- Return: *Attraction Activity to Production Activity*

For example, in the case of home based work (which includes both home to work, and work to home trips), we have:

- Outward: *Home to Work*
- Return: *Work to Home*

Home is the production activity; work is the attraction activity. Conceptually, the trip was produced at the home, and attracted to the place of work.

For all trips involving the home (either as the origin or destination), the Home is defined as the production activity. Therefore, all trips leaving the home are defined Outward; all trips returning home are defined Return.

For trips not involving the home (non-home based trips), work becomes the default production activity.

Therefore, all trips leaving work are defined "Outward"; all trips returning to work are defined "Return".

For example, in the case of work based shopping (which includes work to shopping, and shopping to work trips), we have:

- Outward: *Work to Shopping*
- Return: *Shopping to Work*

For trips which don't involve the home or work, shopping becomes the default production activity, and so on.

Given the name of a trip purpose, one can easily infer the production and attraction activities by recalling the convention by which trip purposes are named:

Trip Purpose Naming Convention:



Production Activity- Based - Attraction Activity

The concept of outward and return travel is fundamental to the achievement of the correct balance between peak direction and counter peak direction travel flows in each period.

For example, in the morning peak, a large proportion of Home Based Work trips are made in the Outward direction (home to work), while in the evening peak, the directionality tends to be reversed.



2.4 Functional Form of the Period Allocation Model

Standard Zenith Model Approach

The Zenith model uses fixed proportions to allocate total demand (all trips) to the various period / direction combinations. For example, the South East Queensland model uses the following factors for home based work (white collar):

- AM Peak / Outward: 0.2806
- Off Peak / Outward: 0.2055
- PM Peak / Outward: 0.0139
- AM Peak / Return: 0.0028
- Off Peak / Return: 0.2213
- PM Peak / Return: 0.2759

The proportions sum to 1, with 0.5 in the outward direction and 0.5 in the return. The most dominant period / direction combinations are AM Peak Outward (home to work in the morning peak), and PM Peak Return (work to home in the evening peak). This pattern is intuitive, and leads to formation of a "peak direction".

Each trip purpose has its own temporal characteristics, and its own set of period allocation factors. In some cases, period allocation factors are also defined spatially; especially travel to the CBD which often exhibits unique temporal characteristics.

Victorian Zenith Model Approach

The Zenith Model of Victoria employs a more sophisticated approach, which will soon be rolled out in other Zenith models.

This approach involves linking together outward and return journeys into a limited form of tour. Rather than independently model outward and return journeys, the Victorian model considers outward and return journeys jointly.

To facilitate this approach, period factors are defined for each outward and return period combination. For example, Table 2 lists the factors used for home based (white collar) to the CBD. The rows in the table correspond to Outward periods, while the columns correspond to the Return. Of all two-way journeys, over 53% involve travelling to work in the AM Peak and returning home in the PM Peak.



		Return Period			
		AM Peak	Inter Peak	PM Peak	Off Peak
Outward Period	AM Peak		0.0351	0.5336	0.1558
	Inter Peak		0.0229	0.0968	0.1137
	PM Peak				
	Off Peak				0.0421

Table 2 - Period Allocation Factors - Victorian Model



2.5 Data Sources and Parameter Estimation

The parameters of the Period Allocation model are estimated using Household Travel Surveys.

Surveyed trips are grouped by trip purpose, and allocated to periods. If a trip spans multiple periods (e.g. 6:30am to 7:30am) then the trip is allocated proportionally to each period, in proportion to the amount of time spent travelling during each period.

Spatial variations in the period factors are explored, and in some cases lead to parameters that vary according to the origin / destination of the journey.

2.6 Model Limitations

This section outlines the key limitations of the Period Allocation model:

Inability to Predict Changes in Departure Time Choice

The Zenith Period Allocation model assigns fixed proportions of demand to each period / direction. As such, the model cannot currently be used to predict how the demands in each period might respond to changes in travel cost (e.g. peak spreading in response to increased traffic congestion), or pricing policies (e.g. time-differentiated road user charging).

Periods are not Perfectly Homogeneous

The periods used in the Zenith model are not entirely homogeneous. For example, the off peak period (6pm – 7am) includes the shoulder of each peak, as well as the true off peak where demands are very low.

The inter-peak includes the shoulders of each peak, the school peak (3–4pm), as well as the middle of the day (e.g. lunch time).

Further division of periods to achieve a greater level of homogeneity would be desirable, but would also come at a cost: increased model run times, and larger storage requirements.



3 Sources of Further Information

This technical note has described the objectives and methodology underpinning the Zenith Period Allocation model.

The note has not, however, listed the actual parameters estimated and applied for each modelled region. These can be found in the *model specific* technical notes relating to period allocation. Simply go to: <http://zenith.veitchlister.com.au>, and go the tab which reflects your region of interest.

For further information, please contact Tim Veitch as per the contact details below.

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