

Task 4. TRAVEL FORECASTING: TRIP DISTRIBUTION

The prior task involved the calibration of a set of trip generation models for the internal zones. This task applies a trip distribution model to obtain 2020 trip matrices for the three trip purposes of the trip generation models. Subsequent matrix adjustments will include PA to OD conversion, factoring by time-of-day, and conversion of person to vehicle trips for trip assignment. External area trips are introduced in Task 5.

4.1 Base Trip Distribution Model Application

The output of the Task 3 Trip Generation procedure serves as one of two basic inputs to the Task 4 Trip Distribution procedure. The conventional Gravity Model distributes trips from production zones to attraction zones as a function of zonal productions and zonal attractions, both outputs of trip generation, and of some function of travel impedance. This measure of spatial separation is often taken as uncongested automobile network travel times, although most applications feedback congested travel times from trip assignment (often by weighted mode travel times). The gravity model to be utilized is doubly constrained, where all productions and attractions remain balanced in the estimated trip matrix. TransCAD can either calibrate a Gravity Model (i.e., estimate the function of travel impedance, or "friction factors"), or it can validate or forecast with an existing calibrated model.

2020 Model Analysis:

A set of friction factors which were estimated for the 2000 Miasma Beach model will be used for all applications of the 2020 model system.

4.1.1 Open Input Data

To perform trip distribution analysis in TransCAD, the final Travel Impedance Matrix (skim tree) that was created in Task 2 is needed. Go to **File / Open** and select the directory where the Task 2 results were saved. Select **Matrix** as the file type; a list of matrix files created in Task 2 should appear. Select *skimtree.mtx* and click **OK**. Open the TAZ dataview by first opening the TAZ Geographic file and then click on the New Dataview button. This table contains the production and attraction values that were estimated for each TAZ in Task 3. Next, create a new table with the adjusted PA input.

Go to **File / New**, select **Table**, select **dBASE/FoxPro**, and Click OK. In the dialogue window, click **add Field** seven times. Change the first field name to ID (field type is integer, width 8). The remaining field name should match **your** balanced P-A trip table names: BFHBW_P, BFHBW_A, BFHBO_P, BFHBO_A, BNHB_P, BNHB_A (field types are Real, width 10, decimal 2). Click OK to save the table as Balanced 8 zones PA Table. Click OK and TransCAD will open the table for editing.

Go to **Edit, add records**, and enter **8** in the dialogue window. **Enter** 1 through 8 in the ID column. **Copy and paste** the balanced and reallocated Ps and As to the new table. The order of the TAZ IDs and trip purpose must match your prior table.

4.1.2 Appending Friction Factors

The trip distribution model requires not only production and attraction data, but also calibrated friction factors for the gravity model. Table 5 provides friction factors by trip purpose that were calibrated in a prior Miasma Beach modeling effort. Travel times which are greater than the table maximum utilize the F-factor for the last category.

Check for an existing friction factor look up table (matching values in Table 5) in the TransCAD dataset for Miasma Beach. If not, this file must be created. TransCAD uses the friction factor lookup table to generate friction factors for each zone pair.

HELP: Create Friction Factor Lookup Table

Check if there is a friction factor look up table; otherwise, click:

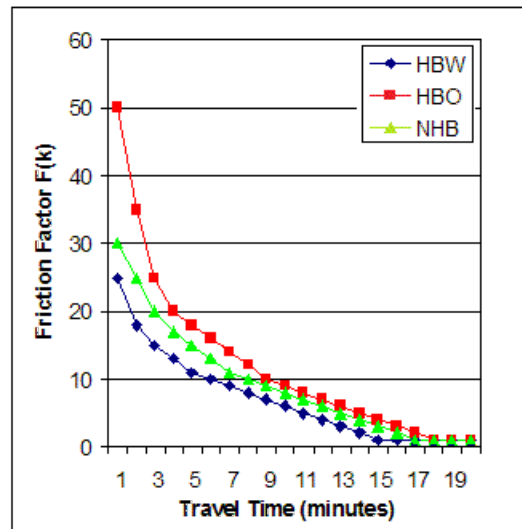
<http://www.its.uci.edu/~mmcally/cee/cee123/project/mbt4-fflu.html>

4.1.3 Utilizing K-Factors

The 2020 model analysis will not use K-factors. State this explicitly in your report.

Table 5. Miasma Beach F-Factors (2000, 2020, and 2030)

Time (minutes)	Friction Factor (F _{ij})		
	HBW	HBO	NHB
1	25	50	30
2	18	35	25
3	15	25	20
4	13	20	17
5	11	18	15
6	10	16	13
7	9	14	11
8	8	12	10
9	7	10	9
10	6	9	8
11	5	8	7
12	4	7	6
13	3	6	5
14	2	5	4
15	1	4	3
16	1	3	2
17	1	2	1
18	1	1	1
19	1	1	1
20 +	1	1	1



4.2 Applying A Gravity Model

This task utilizes the Task 4 Trip Generation results with the Task 4.1 Friction Factor Analysis to apply a Doubly-constrained Gravity Model and produce a trip table for each defined trip purpose.

HELP: Applying a Gravity Model

To specify the input data and parameters for a gravity model application, click:

<http://www.its.uci.edu/~mmcnally/cee/cee123/project/mbt4-gmapp.html>

TransCAD generates P-A flow matrices that match the productions and/or attraction vectors based on the structure of the friction factor matrix. TransCAD evaluates the 3 models, displays a Summary dialog box (with access to a Notepad file), indicates whether the three models converged, and also displays a matrix view (P-A) containing the results.

4.3 Model Output Adjustments

The trip table produced in Task 4.2 contains Production-Attraction distribution matrices for three trip purposes (see *p-a.mtx* file). These matrices represent total 24-hour person trips and must be converted to Origin-Destination vehicle trips for a defined analysis period (such as the AM-peak hour for Miasma Beach) prior to trip assignment.

4.3.1 Conversion from P/A Format to O/D Format

All trip demand analysis has thus far been expressed in terms of productions and attractions. Prior to trip assignment, the trip matrices must be converted to origin-destination format. A simple process for doing so averages the original and transposed trip matrices, an approach which is valid for 24-hour matrices where most trips are paired with an equivalent trip in the reverse direction. An appropriate time-specific trip table must be extracted for formal assignment since network capacities (as with volumes) are temporal measures. Conversion of the P/A matrices to O/D format must reflect **observed time-of-day** patterns. For example, in the PM-peak, the majority of HBW trips have an origin at the production (residential) end and a destination at the attraction (employment) end.

Using the base year Miasma Beach Origin-Destination Survey, the percentages of trips by time-of-day were computed and are displayed in **Table 6a**. An hourly breakdown of trip percentages by time-of-day is provided in Table 6B (click here:

<http://www.its.uci.edu/~mmcnally/cee/cee123/project/mb-todtable.html>. Tables 6a is (and 6b can be) used by TransCAD to extract appropriate O/D matrices from the 24-hour trip matrices and simultaneously convert person-trips to vehicle-trips.

2020 Model Analysis:

Miasma Beach is concerned with only the **PM-peak period** (defined as 5 to 6 PM). Create or modify the Hourly Look-up Table to reflect the appropriate factors in **Table 6A** for the analysis period in question, adjusting other hourly factors appropriately.

Table 6a. Temporal Distribution of Trips by Purpose

Analysis Period	-- HBW --		-- HBO --		-- NHB --	
	PA	AP	PA	AP	PA	AP
1-hr AM-peak (7-8 am)	0.15	0.00	0.04	0.01	0.03	0.03
1-hr PM-peak (5-6 pm)	0.03	0.10	0.03	0.05	0.04	0.04
Full AM-peak (7-9 am)	0.28	0.00	0.08	0.02	0.04	0.04
Full PM-peak (4-7 pm)	0.05	0.30	0.09	0.15	0.12	0.12
Off-peak (other)	0.17	0.20	0.33	0.33	0.34	0.34

HELP: Create Hourly Lookup Table

[Check](#) if an hourly look-up table is included in the base Miasma Beach data; otherwise, click:

<http://www.its.uci.edu/~mmcally/cee/cee123/project/mbt4-look.html>

4.3.2 Conversion from Person Trips to Vehicle Trips

An analysis of the household interview survey conducted previously in this study has produced estimates of vehicle occupancy by trip purpose (see Table 7).

Table 7. Base Year Vehicle Occupancy by Trip Purpose [S'26]

Type	Trip purpose	Average Vehicle Occupancy
1. HBW	Home-based Work	1.10 persons/vehicle
2. HBO	Home-based Other	1.40 persons/vehicle
3. NHB	Non-home-based	1.20 persons/vehicle

Model Adjustments:

Adjust the estimated trip matrices to reflect a PA to OD format conversion, the selected time-of-day period, and the adjustment for vehicle occupancy.

HELP: Trip Table Adjustments

To adjust trip tables for PA-OD conversion, time-of-day, and vehicle occupancy, click:

<http://www.its.uci.edu/~mmcally/cee/cee123/project/mbt4-adjust.html>

4.3.3 Creation of Total Purpose File

The last step in developing the base O/D table is the creation of a combined trip purpose file (since all trip types load on the network at the same time). This table is saved as a fourth table in the same TransCAD file.

HELP: Create Total Trip Purpose Table

To combine individual trip tables into a combined (or total) trip table file, click:

<http://www.its.uci.edu/~mmcnally/cee/cee123/project/mbt4-totl.html>

4.4 Interim Report

Prepare a **Task 4 Interim Report** documenting trip distribution model development. Include graphics and auxiliary material. Follow [Report Style Guidelines](#) in the preparation of this report. This report will be submitted as part of **Interim Report 2** with the results of Tasks 3 and 5.