CEE 123 Transport Systems 3: Planning & Forecasting

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Homework #6 -- Trip Distribution Modeling [Due: Friday 21 May 2025]

The following problems deal with a hypothetical, 4-zone region (this data will be used in a subsequent trip assignment homework). Table 1 summarizes surveyed activity system and trip generation data (productions and attractions) for 2020, and estimates of activity system variables for 2030.

Table 1. Base and Future HBW Trips and Demographic Data Summary

	HBW		HH(i)		C(i)		W(i)		E(j)		I(i)
	P(i)	A(j)	Households		Cars		Workers		Empl.		Inc.
Zone	'20	'20	'20	'30	'20	'30	'20	'30	'20	'30	both
1	825	710	321	330	447	460	390	395	300	300	Low
2	775	800	402	470	360	420	345	480	360	450	Med
3	910	970	330	300	396	375	582	570	600	690	High
4	865	895	375	420	450	465	399	450	456	455	Med
Tot	3375	3375	1428	1520	1653	1720	1716	1895	1716	1895	N/A

Problem 1. Trip Generation [10 points]

Household **HBW** trip production and attraction models for the region as a whole have been estimated and found to be significant.

$P_i = 34.8 + 0.59\ HH_i + 0.80\ C_i + 0.63\ W_i$

$A_j = 485.1 + 0.84\ E_j$

a. Using the base data, apply the models and estimate a goodness-of-fit measure for each model. For example, compute the root mean square error, RMSE=sqrt[(1/n)Σ(est-obs)^2]. Comment on the fit.

b. Use the demographic forecasts provided to predict and tabulate future trip ends for the production and attraction models. These estimates will be used in the trip distribution forecast.

Problem 2. Trip Distribution: Calibration (20 points)

By hand, calibrate a singly-constrained trip distribution model for the base year data. Show ALL calculations for three iterations. Does the model converge? Utilize attraction balancing at each iteration. Use 5-minute time categories.

Table 2. Base Travel Time and HBW Trip Distribution Matrix (2010)

From\To	1	2	3	4	From\To	1	2	3	4	P(i)
1	5	16	13	18	1	250	125	375	75	825
2	16	7	20	12	2	100	400	50	225	775
3	13	20	2	9	3	205	60	225	420	910
4	18	12	9	3	4	155	215	320	175	865
					A(j)	710	800	970	895	3375

Problem 3. Trip Distribution: Application (10 points)

In response to identified problems in the base network and to anticipated traffic volumes from future growth, a network infrastructure project has been planned that would change base travel times between some zones. In

general, infrastructure would be improved around Zone 1 (low income with little projected growth) while identified problems in Zone 4 would not be addressed by the plan.

Forecast the corresponding future total trip matrix using the trip generation forecast from Problem 1, the calibrated model from Problem 2, and the original (A0) and new (A1) skim trees given in Table 3. Utilize column/row factoring on the final trip table.

Table 3. Base and Future Transportation System Skims

BASE 2020	Travel Times				FUTURE 2030	Travel Times			
From\To	1	2	3	4	From\To	1	2	3	4
1	5	16	13	18	1	6	14	11	14
2	16	7	20	12	2	14	8	17	15
3	13	20	2	9	3	11	17	3	11
4	18	12	9	3	4	14	15	11	5

Problem 4. Trip Distribution: Performance (10 points)
Summary statistics help describe the overall flow pattern at the end of trip distribution. Using skim tree times for the base and future networks, and the base and estimated future trip distribution matrices, compute the average trip travel times for 2020 and 2030. Tabulate total trips, total time, and average travel times for each year.

Problem 5. Trip Distribution: Calibration Algorithm (5 points)
Provide the numbered algorithm steps (or flowchart) for calibrating a Single Constrained Gravity Model.

Problem 6. Travel Surveys (20 points)
The spreadsheet provides 2020 household socio-economic and travel diary data for a sub-sample of Miasma Beach households. **Use only households 4 through 6 in this exercise**.

1. **Calculate** the trip travel time, activity duration, and trip purpose classification (HBW, HBO, or NHB) for each trip and append to the table. **Compute** the mean travel time by mode and mean activity duration by purpose. Submit a hardcopy (e-copy optional) of the **updated spreadsheet**.
2. **Plot** the travel patterns on a Miasma Beach network map. Label each trip end as a production (P) or attraction (A) and label the trip type (HBW, HBO, NHB). Use color and/or line types to distinguish individuals and/or trip types. You may need to plot households on separate maps.
3. **Calculate** the associated OD trip table and the PA trip table.

Note: The results of this assignment will be needed in Homework #7.

Last Updated: 10 May 2025