

CEE 123 Transport Systems 3: Planning & Forecasting

Spring 2026: Michael G. McNally (mmcnally-at-uci-dot-edu) [15450]

Homework #7 -- Trip Table Adjustments [S O L U T I O N S]

Homework 7 utilized data pertaining to a hypothetical five zone region. The data set included surveyed production, attractions, and activity system variables for 2020, as well as estimates of activity system variables for the year 2030.

Table 1a. Travel Times ; HBW Ps & As ; Base and Future Demographics

From\To	-Base Travel Time-					-Base Trips-		-Base Demo-		-Future Demo-	
	1	2	3	4	5	PROD	ATTR	WORK	EMPL	WORK	EMPL
1	1	3	3	6	3	0	450	0	220	0	216
2	3	1	2	6	5	0	250	0	110	0	118
3	3	2	1	5	6	300	0	140	0	250	0
4	6	6	5	1	4	0	300	0	140	0	166
5	3	5	6	4	1	700	0	360	0	472	166
Totals						1000	1000	500	470	722	666

Table 1b. Base HBW Trip Distribution

FROM\TO	1	2	4	Prod
3	125	125	50	300
5	325	125	250	700
Attr	450	250	300	1000

In Homework 6, a HBW trip gravity model was calibrated for the region, and forecasts were completed for both trip generation and distribution (with assumed network and activity system changes). The following problems continue with the sequence of analysis.

Problem 6 [15 points]

Using the **base** 24-hour Home-based Work (HBW) person-trip production-attraction matrix in Table 1b and the Table 6 conversion factors, **produce** the corresponding (a) AM-peak, (b) PM-peak, and (c) off-peak period origin-destination matrices for HBW person-trips.

Table 6. Temporal Distribution of Trips by Purpose (PA-to-OD)

Analysis Period	--- HBW ---		-- HBO --		-- NHB --	
	P-A	A-P	P-A	A-P	P-A	A-P
1. AM-peak (7-9:00am)	0.30	0.00	0.06	0.02	0.04	0.04
2. PM-peak (4-7:00pm)	0.03	0.30	0.09	0.15	0.12	0.12
3. Off-peak (other)	0.17	0.20	0.33	0.33	0.34	0.34

Solution:

Table 6a shows the results for AM-peak, PM-peak, and off-peak ODs for HBW trips only (due to round-off error, row and column sums may not exactly match O/D totals). **Note:** the "2-by-3" problem in PA format is a full "5-by-5" problem in OD format in the PM-peak and the off-peak since HBW trips exist in both directions (H-W and W-H). The sum of the 3 matrices yields the original matrix converted to O-D format by using P-A and A-P factors (PAF and APF) of 0.5 and 0.5 (column sums from Table 1). To convert PA trips to OD trips, use:

$$T_{ij}^{OD} = PAFactor * T_{ij}^{PA} + APFactor * T_{ji}^{PA}$$

Table 6a. AM-peak, PM-peak, and Off-peak HBW O-D Matrices

----- AM-peak -----						----- PM-peak -----						----- Off-peak -----					
Fr\To	1	2	3	4	5	Fr\To	1	2	3	4	5	Fr\To	1	2	3	4	5
1	0	0	0	0	0	1	0	0	38	0	97	1	0	0	25	0	65
2	0	0	0	0	0	2	0	0	37	0	38	2	0	0	25	0	25
3	37	38	0	15	0	3	4	4	0	1	0	3	21	21	0	9	0
4	0	0	0	0	0	4	0	0	15	0	75	4	0	0	10	0	50
5	98	37	0	75	0	5	10	4	0	8	0	5	55	21	0	42	0
[PAF=0.30; APF=0.00]						[PAF=0.03; APF=0.30]						[PAF=0.17; APF=0.20]					

Daily HBW in OD format [PAF=0.50; APF=0.50]

O\D	1	2	3	4	5	O(i)
1	0	0	63	0	162	225
2	0	0	62	0	63	125
3	62	63	0	25	0	150
4	0	0	25	0	125	150
5	163	62	0	125	0	350
D(j)	225	125	150	150	350	1000

Problem 7 [5 points]

Convert the 2-hour AM-peak HBW O-D matrix of person-trips (see Problem 1) to vehicle trips, using Table 2 parameters. **Report** in O-D matrix format.

Table 7. Base Year Vehicle Occupancy by Trip Purpose

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

Solution: Each element of the AM-peak HBW OD-matrix is divided by the HBW average vehicle occupancy (1.1 persons/vehicle) to obtain the number of vehicle-trips.

Table 7a. AM-peak HBW Vehicle-trip O-D Matrix (AVO=1.1)

--- Person-trips ---						----- Vehicle-trips -----						
Fr\To	1	2	3	4	5	Fr\To	1	2	3	4	5	Tot
1	0	0	0	0	0	1	0	0	0	0	0	0
2	0	0	0	0	0	2	0	0	0	0	0	0
3	37	38	0	15	0	3	34	34	0	14	0	82
4	0	0	0	0	0	4	0	0	0	0	0	0
5	98	37	0	75	0	5	89	34	0	68	0	191
						Tot	123	68	0	82	0	273

NOTE: HW 6, 7, and 8 provide a useful exercise which illustrates the sequential application of the four step model and, thus, serves as excellent preparation for the final exam.

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