

CEE 123 Transport Systems 3: Planning & Forecasting
Spring 2024: Michael G. McNally (mmcnally-at-uci-dot-edu) [15450]

Homework #8 -- Trip Assignment [Due: Wednesday, 5 June 2024]

Homeworks 6 and 7 utilized data pertaining to a hypothetical five zone region. The data set included surveyed production, attractions, and activity system variables for the base year (2020) as well as estimates of activity system variables for the future 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 Table

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 and forecasts completed for both generation and distribution (with specified network and activity changes). In Homework 7, trip table adjustments produced a peak period vehicle trip matrix in OD format for all purposes. The problems below continue this sequence.

Problem 8. Trip Assignment [20 points]

The study area network is shown below (Node 6 is an interchange, not a centroid). Links are labeled with length in miles. For the AM-peak period, assume average auto speeds of 30 mph. **Assign** total AM-peak vehicle demand. Use the estimated AM-peak Period HBW O-D vehicle trip matrix from Problem 7 and the HBO and NHB matrices in Table 8. Use *All-or-Nothing Assignment* based on shortest time paths (verify path results with skims provided in Table 1a). Show all work, and include a **network map** depicting link volumes.

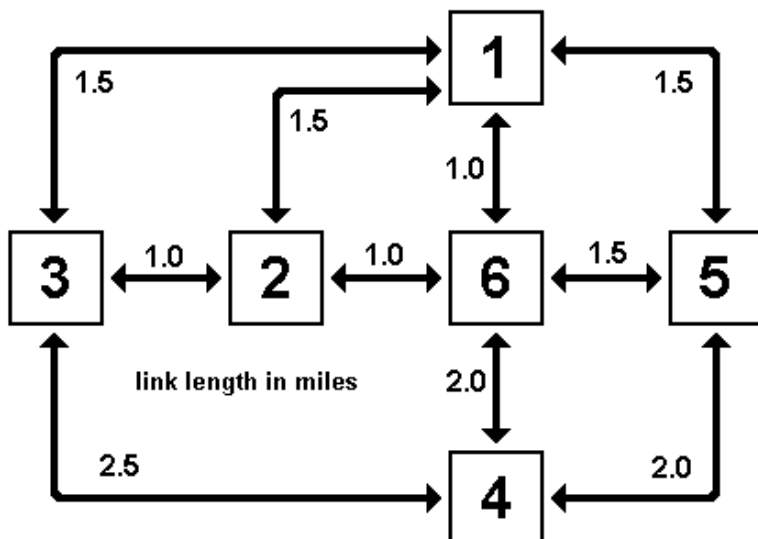


Table 8. AM-peak Period HBO and NHB Vehicle-trip O-D Matrices

Fr\To	-- HBO Vehicle-trips --						-- NHB Vehicle-trips --						
	1	2	3	4	5	Tot	Fr\To	1	2	3	4	5	Tot
1	0	0	2	0	3	5	1	5	2	1	0	1	9
2	0	0	4	0	4	8	2	2	3	1	3	1	10
3	5	11	3	2	12	33	3	1	1	1	1	1	5
4	0	0	1	0	2	3	4	0	3	1	3	1	8
5	9	11	18	7	27	72	5	1	1	1	1	1	5
Tot	14	22	28	9	48	121	Tot	9	10	5	8	5	37

Problem 9. Trip Assignment: Updating [10 points]

After network assignment, **re-compute** link travel times using the FHWA/BPR Link Performance Function. **Summarize** in tabular format. Assume the default values of alpha (0.15) and beta (4.0) and link capacities of 25 vehicles per hour (or 50 vph for the 2-hour AM-peak period). The FHWA LPF is:

$$t_a = t_a^0 [1 + \alpha(x_a/c_a)^\beta]$$

where: t_a = link travel time ;

t_a^0 = free flow link travel time ;

x_a = link volume ;

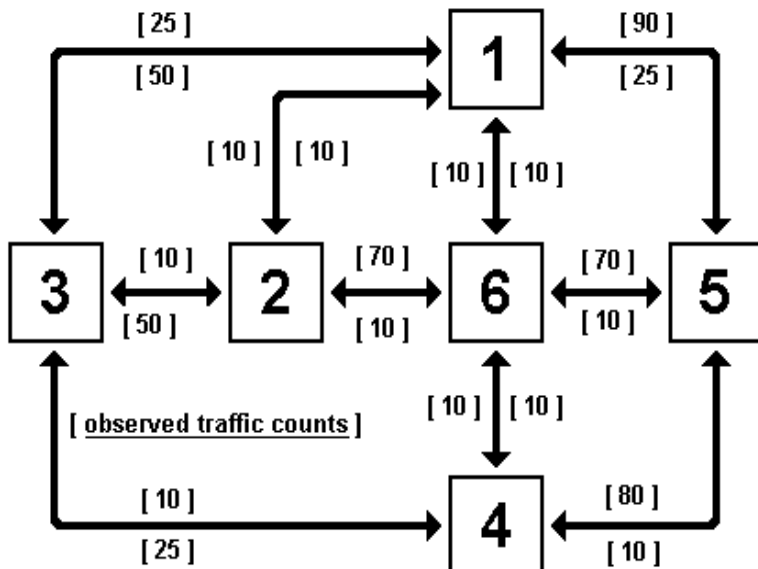
c_a = link capacity

- Explain** how these adjusted link travel times would be used to find the UE solution.
- Compute** at least one system-level performance measure (mean speed, VMT, etc.)

Problem 10. Trip Assignment: Screen Line Performance [10 points]

Observed traffic counts for the AM-peak period are provided below. Using observed and estimated volumes, **compute** the volumes associated with screen lines drawn to isolate residential (HB production) zones from employment (HB attraction) zones. The first screen line (A) will cut links (3,1), (3,2), and (3,4); the second screen line (B) will cut links (1,5), (6,5), and (4,5).

- Show your screen line results **graphically** and **tabulate** the difference between observed and estimated directional volumes across the screen lines.
- Select** a third screenline and repeat the analysis. **Describe** what types of flow are being measured.
- Compute** the directional GEH statistics for each screen line (convert to 1-hour flows).



Problem 11. Trip Assignment: Network Performance [10 points]

Summary statistics help describe the overall flow pattern at the end of the full modeling process.

- a. Using estimated link volumes and updated travel times for the base network, **compute** VHT, VMT, and the average travel speeds for the 2020 base year. Hint: Use a spreadsheet!
 - b. **Compare** these results with the Trip Distribution results in HW 6 Problem 3.
 - c. **Compute** the GEH statistic for each link (convert to 1-hour flows). **Evaluate** based on the GEH standard.
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Problem 12. Developing Alternatives [5 points]

Given observed 2020 loads on the base network, propose and justify three alternate transportation system designs for 2030:

- a. one that addresses infrastructure enhancements (e.g., new links)
- b. one that addresses operational improvements (new link characteristics), and
- c. one that addresses demand

You do **not** need to load the future demand onto any of these alternative networks.

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

Last Updated: 27 May 2024