CE361 Introduction to Transportation Engineering — Posted: Monday 20 September 2004
Homework 4 — Due: Friday 1 October 2004

TRANSPORTATION PLANNING AND DEMAND MODELING

Dear Consultant:

The steady (and sometimes rapid) growth in Mythaca County makes it important that you can demonstrate basic travel demand modeling capabilities. Please complete the exercises below completely and clearly. You may work in a group of CE361 students not to exceed three on size. If the HW is submitted by more than one student, the signatures of those students must appear at the top of the front page of the materials submitted.

1. **HH-Based Regression for Trip Generation.** The Mythaca Regional Planning Commission (MRPC) wants to try the following zonal equations:

   P(i) = 53 + 6.1 HHs/zone + 4.5 vehs/zone + 3.4 jobs/zone

   A(j) = 58 + 4.3 HHs/zone + 5.2 jobs/zone

   A. (15 points) Using the socioeconomic data in Table 4.1 below, calculate the productions and attractions for each zone and present your results in a table with the format of FTE Table 4.6. If you use a spreadsheet to produce your results table, show one P and one A calculation done by hand.

Table 4.1 Middleville T/G data

TAZ	pop	HH	vehs	empl
1	0	0	0	1000
2	0	0	0	1500
3	3000	1100	1400	0
4	2000	900	1600	0
Totals	5000	2000	3000	2500

TAZ = traffic analysis zone
pop = population in zone
HH = households in zone
vehs = vehicles owned by HHs in zone
empl = employment = jobs in zone

   B. (5 points) Balance the P and A values for each zone as described at the start of FTE Section 4.3.3. Show the revised values in a new column in the table you created in Part A.

2. (20 points) **Trip Distribution by Gravity Model.** Regardless of your results in Problem 1, use A(1)=8500, A(2)=12000, A(3)=7500, and A(4)=6000 in this problem. Using the Tanner Function, the format of FTE Table 4.11, and the auto travel times in the upper left quadrant of Table 4.12, determine how many trips produced in Zone 3 will be attracted to each of the four zones if P(3) = 16,850. Use a = 1.0, b = 3.8, and c = -0.25 in the Tanner Function.

3. (20 points) **Mode Choice**. The MRPC paid a lot of money to a consulting firm last year to develop a mode choice model to explain how commuters choose between bus and driving alone. The consultants surveyed hundreds of commuters, asking them (a) what mode they chose and (b) what factors affected their choice of travel mode. The consultants claim that the only measurable factor that mattered to commuters was total travel time (TTT). The proposed utility function was $V_m = a*TTT_m$. In one travel corridor, auto TTT = 33.6 minutes and bus TTT = 57.5 minutes. Despite the clear auto advantage in total travel time, 20 percent of the commuters in the corridor chose bus. The consultant said that other, unmeasurable factors caused some commuters to choose bus. The MRPC wants you to check the consulting firm's calculations. What value of **a** (to the nearest 0.001) in the utility function will cause $p_{bus} = 0.20$ and $p_{auto} = 0.80$?

4. **Trip Assignment**. Saturday midday traffic flow is 5850 vph from Mythaca to Econoly. There are two "reasonable" routes from Mythaca to Econoly. The route using the limited access highway A has a free-flow travel time of 47 minutes, C(A) = 3260, a = 0.15, and b = 4.7. The standard highway route B has a free-flow travel time of 21 minutes, C(B) = 1440, a = 0.40, and b = 5.5. Consider the capacity values to be at LOS "C".

A. (15 points) **Equilibrium condition.** Using Equation 4.13, determine the flows V(A) and V(B) -- to the nearest 5 vph -- that occur when the 5850 vph are assigned to routes A and B so that user equilibrium occurs.
B. (5 points) **Equilibrium travel time.** Show that the travel times on the two routes are equal.