CIVE461

Table 1 contains an observed (year 2023) morning peak-period work trip matrix for a hypothetical two-zone system. Table 2 provides road travel times for this system. Given these data, please answer the following questions.

Table 1 Observed 2019 O-D Trips 5-Zone System (Thousands of Trips)

Origin/Destination	1	2	Total
1	20.2	1	21.2
2	23.9	3.8	27.7
Total	44.1	4.8	48.9

Table 2 Auto Travel Times (min.)

Origin/Destination	1	2
1	8.4	13.2
2	15.8	8.4

1. Table 3 contains the projected future year (2035) morning peak-period work trip ends for this system. Use the biproportional updating procedure to project the corresponding future year trip matrix, given the base year matrix provided in Table 1. Stop when the maximum row or column sum error is 5% or less.

Table 3 2031 Projected Trip Generation by Zone (Thousands of Trips)

Zone	Destination Totals	Origin Totals
1	52	28
2	6	30
Total	58	58

2. A conventional gravity model has been estimated using base year trip data. The impedance function for this gravity model is:

$$f = \exp(-0.064 * a)$$

where a is the auto travel time from zone i to zone j.

Use this gravity model along with the data from Tables 2 and 3 to generate a second estimate of the future trip table. Iterate until the matrix is balanced to within ±5% for every column sum.

3. Use the same impedance function of question 2 and data from Table 2 and 3, but use the entropy-based method to estimate future trip table. Iterate until the matrix is balanced to within ±5% for every column sum. Compare the results of question 1, 2 and 3 and explain which one is the most reliable.

4. Table 4 provides a predicted 2019 O-D trip table generated by a trip distribution model. Compute R^2, χ^2, and MABSERR statistics for the gravity model's goodness of fit to the observed Table 1 trip matrix.

Table 4 Predicted 2023 O-D Matrix 2-Zone System (Thousands of Trips)

Origin/Destination	1	2	Total
1	23	1	24
2	25.5	4.7	30.2
Total	48.5	5.7	54.2

5. Suppose a third zone has been developed between the base and forecast years. What options exist for predicting flows to/from this new zone? Which would you choose? Explain.