TRIP DISTRIBUTION

The purpose of trip distribution is to produce a trip table of the estimated number of trips from each TAZ to every other TAZ within the study area. Trip distribution for this study was estimated using the TransCAD Gravity Model program. The Gravity Model assumes that the number of trips between two zones is 1) directly proportional to the trips produced and attracted to both zones, and 2) inversely proportional to the travel time between the zones.

The Gravity Model formulation states that the number of trips between each zone is equal to:

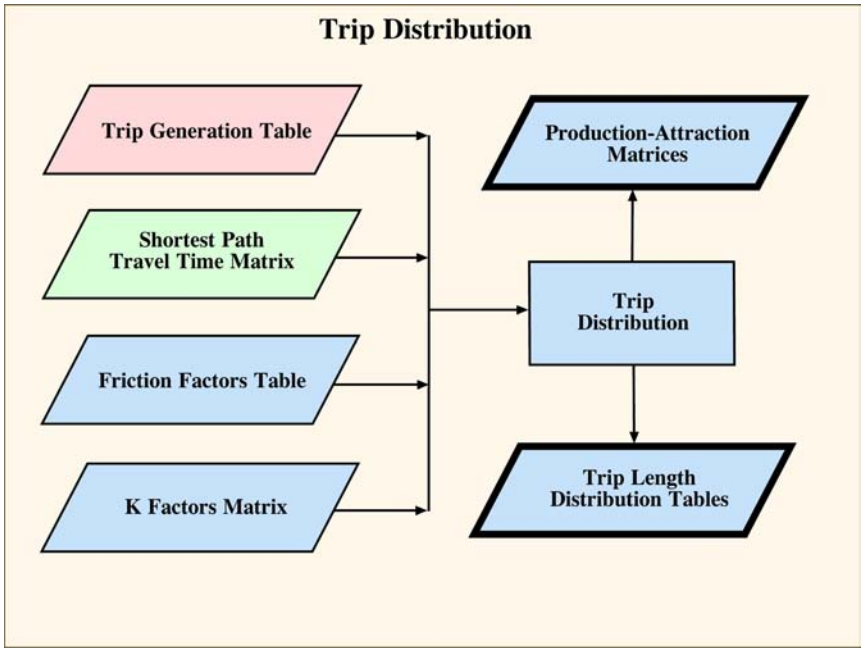
$$T_{ij} = P_i * \frac{A_j F_{ij} K_{ij}}{\sum_{j=1}^{n} (A_j F_{ij} K_{ij})}$$

Where

T_{ij}	=	Number of trips from zone i to zone j
P_i	=	Number of trip productions in zone i
A_j	=	Number of trip attractions in zone j
F_{ij}	=	Friction factor (represents the spatial separation between zone i & zone j
K_{ij}	=	Optional adjustment factor (fudge factor)-not recommended

Figure 11 shows the trip distribution process used for Lincoln MPO model.

FIGURE 11. TRIP DISTRIBUTION



The trip generation table and shortest path travel time matrix files created in previous steps serve as inputs in this process.

Friction Factors Table

Friction factors express the effect that travel time has on the number of trips traveling between two zones. Trips were distributed for the five trip purposes.

For the Lincoln MPO model, friction factors were developed using a gamma function to estimate the friction factors and application of the trip distribution model to identify the best-fit for the average trip length and trip length frequency distributions. The normalized friction factors estimated are presented in Figure 12 by trip purpose. Such plot provides a picture of the traveler's sensitivity to travel time by trip purpose; steeper curves mean more sensitivity to travel time. The gamma functions used to develop these functions used the following equation:

$$Alpha * (I^{Beta} * e^{I * Gamma})$$

Where Alpha, Beta and Gamma are coefficients and I is the impedance, or trip length in minutes.

Initial coefficients in the gamma function were obtained from the NCHRP Report 365 and the final coefficients are provided in Table 17.

FIGURE 12. ESTIMATED FRICTION FACTORS

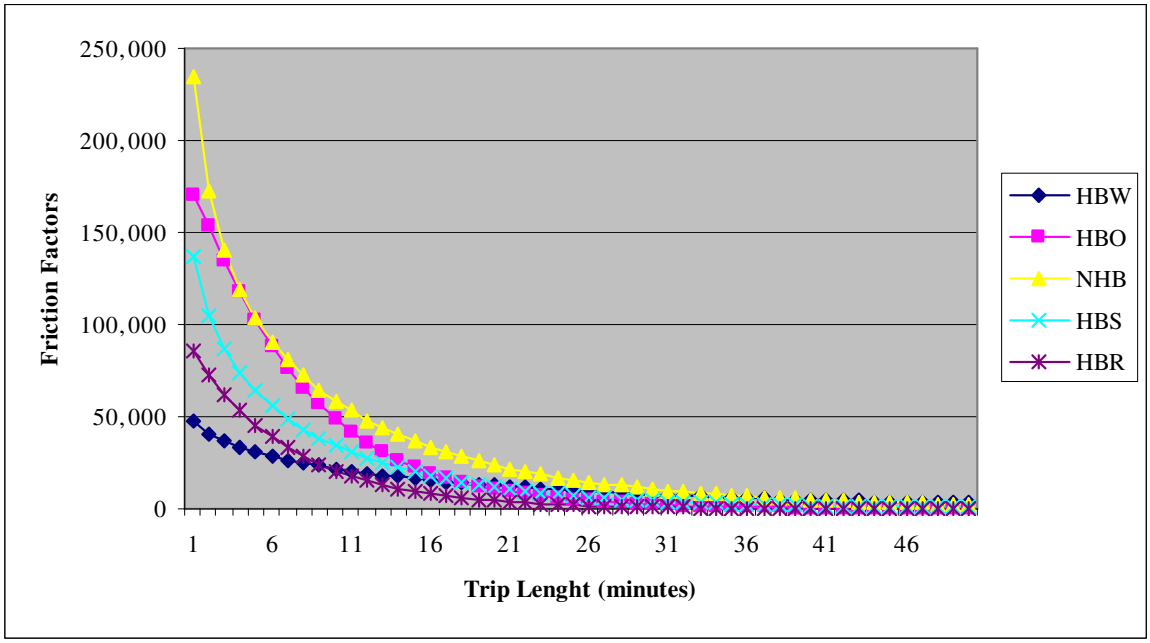


TABLE 17. COEFFICIENTS IN THE GAMMA FUNCTION TO ESTIMATE FRICTION FACTORS

Trip Purpose	Alpha	Beta	Gamma
Home Based Work	50000	-0.0174	-0.0425
Home Based Shop	200000	0.0724	-0.1578
Home Based Recreational	250000	-0.3449	-0.0658
Home Based Other	150000	-0.256	-0.0886
Non Home Based	100000	-0.0056	-0.1556

K Factors Matrix

Sometimes there are special situations where the travel patterns are different from those predicted by the gravity model. These special patterns can be replicated using K factors matrix. However, it is recommended to limit the use of these factors since the same flow patterns might not continue in the future years. For the Lincoln MPO model the K factors matrix is not used. However, it is provided as an option in the model interface for future use, if needed.

Production-Attraction Matrices

The travel time matrix from highway skims, the productions and attractions table from trip generation and the friction factors are used as input to the gravity model to produce production-attraction matrices for each trip purpose.

Trip Length Distribution Tables

The travel time matrix from highway skimming and PA matrices from the trip distribution process are used to determine the average trip length and the trip length frequency distribution for each trip purpose. Figure 13 shows the trip length distribution results for each trip purpose.

In the Lincoln MPO model, the trip length results are saved to individual matrix files for each trip purpose. TransCAD charting tools can be used to graphically display the trip length distribution results.

FIGURE 13. TRIP LENGTH DISTRIBUTION