Appendix C - Calculation of Attractiveness Index Model

The new growth was determined by dividing the total Attractiveness Index for a TAZ by the sum of the total Attractiveness Index for all TAZs in the county. This ratio developed for each TAZ was then multiplied by the growth increment (GI_x) for the year (X) analyzed. The new growth formula is:

\[ \text{NG}_{ix} = \frac{\text{TAZ}(AI)_{ix} \times \text{GI}_x}{\sum \text{TAZ}(AJ)_{ix}} \]

This calculation was repeated for each TAZ in the county. The new growth was added to the current development checking against the maximum development, or

\[ (\text{NG}_{ix} + \text{Current Development}_{ix}) < \text{Maximum Development}_i \]

where i represents each TAZ. After the new development was allocated and the maximum development was checked, a visual inspection of the allocation process was performed to determine if any spreadsheet errors had occurred. If the current development plus new growth that was allocated to the TAZ was greater than the maximum development, then the model reallocated the new growth to other TAZs.

The variables used in the model were:

- \( i \) = TAZ number (1-780)
- \( j \) = Activity centroid (A-J)
- \( AI_{ij} \) = Attractiveness index between TAZ\( i \) and centroid\( j \)
- \( F(AI) \) = Function of attractiveness index (see below)
- \( AG_i \) = Allowable growth for TAZ\( i \) (units population)
- \( D_{ij} \) = Straight line distance from geographical center of TAZ\( i \) to centroid\( j \)
- \( Ff_{ij} \) = Friction factor based on the function e\(^{-kD}\), where D is the distance from the geographical center of the TAZ to the centroid and k is a constant

\[ \text{New growth for TAZ}_i = \sum \text{TAZ}(AI) = \sum \text{Total attractiveness for TAZ}_i (F(AI_A) + F(AI_B) + F(AI_C) + F(AI_D)...) \]

\[ \text{GI}_x = \text{Growth increment for year} \]

The attractiveness index \( (AI_{ij}) \) is a number that can start from zero and continue until it approaches infinity. An Attractiveness Index of zero has no “attractiveness.” As the index increases, the “attractiveness” of the TAZ increases as well. The function of the attractiveness index \( F(AI_{ij}) \) is the question used to develop the attractiveness index. It is defined as follows:

\[ F(AI_{ij}) = \frac{AG_{ij} \times CU_{ij} \times FF_{ij}}{D_{ij}} \]
The variable $AG_j$ is the first “mass” or maximum allowable growth in the gravity model calculations. The centroid units ($CU_j$) is the second “mass” in the gravity model and is the total sum of all the land use components under analysis (employees by category) for the particular region. The above mass components were multiplied together, divided by the distance ($D_{ij}$), and multiplied by the friction factor ($FF_{ij}$) to determine the attractiveness index.

For the function of Attractiveness Index ($F(AI_{ij})$), $i$ remains constant for each TAZ, whereas $j$ flows through each activity centroid. Starting with TAZ Number 1, the function would be $F(AI_{1A})$, $F(AI_{1B})$, $F(AI_{1C})$, $F(AI_{1D})$, $F(AI_{1E})$, $F(AI_{1F})$, ... until all TAZs were completed. Friction factors ($FF_{ij}$) further weight distances that are closer to an activity centroid. As the distance increases, its potential for development is less likely. Friction factors are determined by the function $e^{-kD}$, where $D$ is the distance from geographical center of the TAZ to the centroid. When the constant “$k$” is small, the model places less emphasis on the proximity of the TAZ to the centroids. As “$k$” increases, the importance of the proximity of the TAZ to the centroid also increases.