Transportation Systems Analysis

Fall 2017/18

MyCity: Assignment #3a & 3b

Land Use Plan for My City

Preliminary layout Due: Before precept: Monday, Oct. 2, 2017; Trip matrices are due before precept: Monday/Tuesday, Oct 9, 2019

The objective of this assignment is for you to confront at least a few of the issues faced in addressing the tradeoffs between urban form, land use and transportation prior to us trying to do it for real for all of all of the US. You are to work cooperatively with your partner, see sheet 2 of Enrolled Students.
It is your job to layout the land use plan of your city (please give it a name) which has the following fundamental characteristics (which you may augment ONLY if you can justify the change to me!):
1. City boundary is square with sides 10.119 miles long. (total area 102.4 square miles)
2. A river runs through the city (you locate it). There are several lakes, and planned open space areas. One lake is about 1.6 sq. mi. others are about 0.5 sq. mi. Open space is appropriately sized so that in total, about 30% of the space is totally undeveloped.
3. "Pixelate" the city into a 32x32 area of individual pixels, each covering an area of 0.1 square miles.

> *Of course you aren't expected to maintain land use data at the maximum depth throughout the entire city. In the dense urban centers (of which there exists 2 or 3 (your choice)) you do want data at the highest detail. In the outlying areas you can have a greater spatial aggregation. You may aggregate over areas that have contiguous land uses. For example, if you have large areas of open space, they can be aggregated into one zone. Similarly for large suburban residential areas, or industrial tracts. In all you should maintain about 60 individual zones covering your entire area of which about 10 should be vacant land uses that encompass your river, lakes, and undeveloped open passive space (This does not include recreational areas that attract patrons.). Each zone is Rectangular!!*

> *You will want to create homogeneous Land Use areas that comprise one and usually more than one pixel. You may do that by assigning to each Land Use zone the list of pixels that are contained in the zone. In order to be manageable your city should have about 60 homogeneous Land Use Zones. These will also be called Traffic Assignment Zones(TAZ) for which you will forecast the number of trips originating and terminating by trip type(work, school, shop, recreation, each home-based and non-home-base) and time-of-day (ToD)*

> *If you wish to be algorithmic is the definition of which pixels are contained in which Transportation Assignment-Land Use zone you may choose your zones using a Quadtree structure. This Quad tree will be up to a depth of 5 allowing for up to 1024 zones, the smallest of which is 0.316 x 0.316 miles = 0.1sq. mi. Bucket Quadtree Demo Your 60 or so developed areas will range in size depending on the depth of the Quad-tree.*

4. For each of the 60 or so TAZs you will need to specify:
    a. A reference number (which will serve as the index into an array (Excel spreadsheet)
    b. The list of pointers to the individual pixels that make up each TAZ (or the Quadtree pointer to that square area)
    c. Its area in Sq. Miles
    d. The amount of each type of land use that it contains. Include: Residential, Educational, Retail, Restaurant, Industrial, Professional Office, Recreational and Open. Zones can have more than one land use, but keep these at a minimum.
    e. x and y coordinates for the centroid of each zone (which can be computed from b above).
    f. For those having Residential land use: Residential density which you will translate into total population, number of workers, number of school aged children, number home workers)
    g. For those having Education land use: School enrollment.
    h. For those having Retail & Restaurant: floor space (to be converted into # of patrons per day)
    i. For those having Office & Industrial: floor space (to be converted into # of employees)
    j. Recreational activity space, by type (golf course, movie theater, sports stadium, etc), to be converted into # of patrons per day.

5. Your city is self sufficient! This means that there is employment for all that work, there is schooling for all children, there is restaurant space for all that eat out, there is recreational space for all recreational activity. There is a balance! Thus, you are going to have to juggle the numbers around or make one zone the balancing zone!

6. Population is 250,000, with some central zones having populations of as much as 40,000 people per square mile. Your residential zones should have populations of 4,000 – 10,000. Some 40 or so zones should include residential land use. Other land uses should be more concentrated in fewer zones, although many residential zones will also include some non-residential land use (industrial-office, shopping-dinning, education, and recreation-openSpace). Anyway, it's your design! You make the call. The city is self-sustaining and all activity takes place within the city boundaries.

7. Based on some geographic comparison, this city has an age distribution, jobs, recreation and shopping/dinning that you deem appropriate. **Assignment 3a (TAZ map and Land Use data) Due: at 7:30pm Monday Oct 2**

8. The next objective (**Assignment 3b due at 7:30pm Monday/Tuesday Oct 9**) is to estimate the number of trips, by type (and time of day) that are generated in your city (Trip Generation) and the distribution (Trip Distribution) of the morning journey to work. (the other trip distributions are due in the final report (**Assignment 4**)

   Each city will have 3 trip types (Work, School, Shop-Dine-Recreate) You will generate the travel demand for a typical work-school day (I suggest that on average there are 4 trips per day per person in your city, although you may choose use another value as long as you justify it.). You will generate Production and Attraction values for each one of your TAZs for
   a. Home-based Work
   b. Home-based School
   c. Home Based Shopping-Dinning-Recreation
   d. Non-Home-based Trips

We will assume that
   100 % of the to-work and to-school trips are home-based (and uniformly distributed across the TAZs)
   80% of the from-work and from-school trips are home-based
   50% of the to-shopping, from-shopping, are home-based
   The rest of the trips are non-home based (Shop->Shop, Work->Shop, School->Shop

   Use the gravity model to the morning journey to work distribution.
   You may assume that all workers work the daylight shift (go to work in the morning and leave work in the late afternoon; same for school. To simplify the Gravity model while retaining its fundamental essence, you may choose as the distance between zones to be 20% greater than the Cartesian distance between the centroid of the TAZ pair. For intra-zonal pairs, use the square root of the area of the TAZ).

Due: Monday/Tuesday Oct 9: Trip Production and Attraction vectors (TAZ long) for each type & base. As well as the trip array and the trip length density distribution chart (# trips < X versus X) for the morning journey to work, (Arrays and distributions for the other trip types by time-of-day as well as the total trip distribution chart will be due as part of HW#4)!)