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TO:	Rye Baerg, Southern California Association of Governments (SCAG)
FROM:	Sasha Jovanovic and Aaron Galinis, Chen Ryan Associates
DATE:	7/27/2017
RE:	SCAG Regional Active Transportation Model – Automated Counter Sampling Strata Development

Overview

This memo describes the process of developing sampling strata to assist SCAG for automated counter siting within Los Angeles County. It will describe the process of choosing the participating segments of roadway, development of strata indicators and their respective category breaks, and the technical steps of determining the strata values of each participating segment of roadway. An Excel file which accompanies this memo shows the frequency distribution of segments by facility type and strata categories.

Segment Development

To develop strata segments along bicycle facilities, Class 1, 2 and 4 bicycle facility segments with lengths of 0.5 miles or greater were extracted from the countywide bicycle facility shapefile. To increase the population and variability of segments for strata development, the extracted segments of 0.5 miles or greater were intersected by municipal boundaries. Segments with lengths which fell below 0.5 miles as result of the intersect but remained at least 0.25 miles long were also kept in the population of segments. Any intersected segments with a length below 0.25 miles were excluded. This minimum length of sustained distance was sought to ensure that no short-length or isolated bicycle facilities, which are of lower utility to riders than continuous/connected segments of facility, end up being used as a part of this data collection.

To develop a population of strata segments on roadways without a bicycle facility, proposed Class 2 and Class 4 bicycle facility segments with lengths of 0.5 miles or greater were extracted from the countywide bicycle facility shapefile. Proposed facilities on streets with existing Class 2 facilities were excluded. Proposed facilities on yet-to-be existing rights-of-way (proposed Class 1 and proposed Class 2 facilities on unbuilt roadways) were also excluded. To increase the population of segments for strata development, segments of 0.5 miles or greater were intersected by municipal boundaries. Segments with lengths below 0.5 miles but above 0.25 miles were also included.

This process yielded 1,551 segments totaling 2,551 miles of roadway or bike path.

Strata Category Development

Three indicator types were used to develop strata categories: combined population and employment density, median household income, and comfort along roadway.

Combined Population and Employment Density

The latest (2015) American Community Survey 5-Year data was obtained for census block groups (CBG) countywide. The latest (2014) employment data was obtained from US Census LEHD *OntheMap*. *OnTheMap* assigns employment to the census block level. A spatial join was used to aggregate upward to the CBG level of geography.

The combined population and employment total from those two datasets for Los Angeles County is 14,409,937. To develop high, medium and low density strata, the population/employment density for each CBG was calculated. The density was obtained by dividing the population and employment sum of each CBG by its acreage. The densities were sorted from highest to lowest and breaks were determined at the densities which assign roughly one-third of the total population and employment (4,803,312) into each of the three categories. Those breaks were determined to be at approximately 33.7 persons per acre and 17.2 persons per acre.

- High = >33.7 persons per acre
- Medium = 17.2-33.7 persons per acre
- Low = <17.2 persons per acre

Median Household Income

The latest (2015) American Community Survey 5-Year data for median household income and number of households was obtained for CBGs countywide. The category breaks chosen were those preferred by SCAG.

- Very High = >$150,000 household income per year
- High = $75,000-$150,000 household income per year
- Medium = $35,000-$75,000 household income per year
- Low = <$35,000 household income per year

Comfort Along Roadway

SCAG provided a TomTom roadway centerline shapefile, which included number of travel lanes and average travel speed attributes along each roadway feature. The countywide bicycle facilities shapefile, which was used to create the shapefile of segment strata, was initially snapped to the TomTom roadway shapefile, which enabled the attributes from the TomTom data to be transferred spatially to the segment strata shapefile. An index roughly similar to Bicycle Level of Traffic Stress (LTS) was developed using the aforementioned data. The concept behind this indicator is to provide an index that combines number of travel lanes and speed. However, since LTS uses posted speed limits and TomTom only provides average speed, this is not an exact replication of LTS. Average roadway speed values are depressed in comparison to posted speed limit due to friction and delay along the roadway. Therefore, using the same category

breaks for speed as LTS was avoided. The category breaks were determined in an iterative fashion after combining the data with the strata segments (unlike the predetermined density and income indicators) so that the results made sense and a relatively even distribution could be ensured.

Due to the high number of features in the TomTom data where major roads contain two carriageway centerlines (each centerline attributed as one-way), all one-way road features in the shapefile had their lane values multiplied by two. When number of lanes in the TomTom shapefile equaled zero in the attributes, those features were treated as having 2-Lanes or fewer.

The category breaks were assigned as follows:

- Very High Comfort = off-roadway facility
- High Comfort = 3-Lanes or fewer and average speed of less than 35 kph
- Medium Comfort = 4 to 5-Lanes and average speed of less than 35 kph; or 2 to 3-Lanes and average speed between 35 kph and 39.9 kph
- Low Comfort = 6-Lanes or greater; or average speed 40 kph or greater

Assigning the Strata to the Segments

To extrapolate the census indicators of population/employment density and median household income, each strata segment was buffered by 500 feet. The buffers were intersected with the CBG shapefile containing the density and median household incomes by census block group. A technique known as apportioning, which recalculates split polygons based on proportional percentage of intersected area, was used to determine density for the area surrounding the segments. Each split polygon area received a proportionally-adjusted population value based on its size relative to the entire CBG. The recalculated population totals for all split polygons are then summed by the common feature identification, in order to obtain the total for each strata segment feature. Segments were assigned to the density strata categories based on the break values previously described.

For median household income strata assignment, the same apportioning method was used to calculate an estimate of the number of households within the area surrounding the segment. The apportioned number of households in each split polygon area was multiplied by the intersecting CBG's median household income. The sum of that number (apportioned number of households * CBG median income) was divided by the apportioned sum of households for the segment to determine a weighted median household income for each segment. Segments were assigned to the median household income strata categories based on the break values previously described.

For the Comfort Along Roadway indicator, the segments were intersected to the TomTom roadway shapefile. Average weighted speed was calculated by multiplying the length of each split feature by its average speed. The sum of that number (length of split feature * average speed) was divided by the sum of the lengths of all split features per segment to determine an average weighted speed per segment. The same technique was used for number of travel lanes (length of split feature * number of travel lanes) divided by the sum of lengths of all split features. This process yielded a 'typical' number of travel lanes for each strata segment.