Service Gap Methods

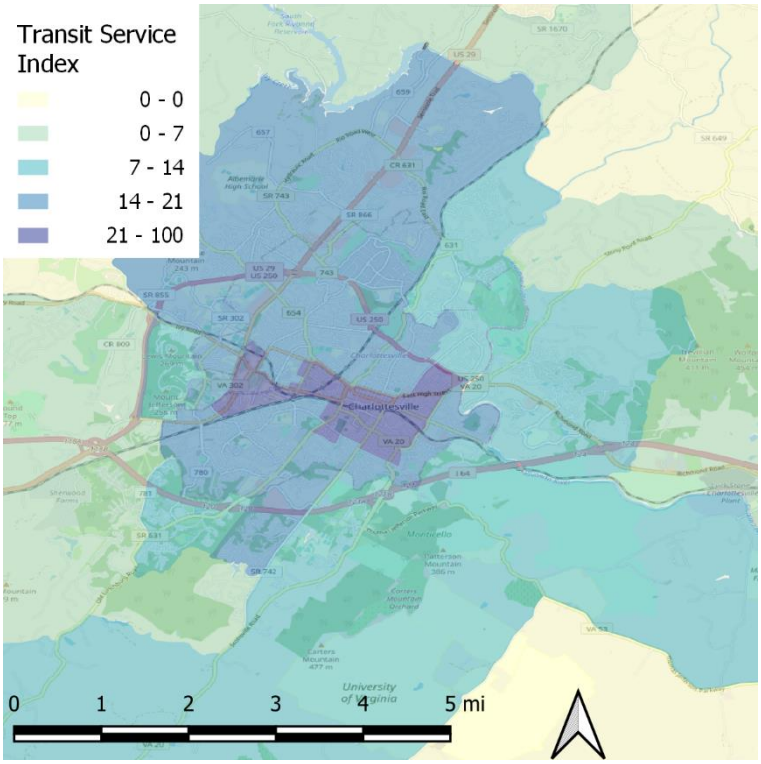
The "Transit Service Gap" feature available on the Virginia Transit Tool is identifies how the current transit service provided in a neighborhood compares to a baseline service. The baseline is defined as the average transit service provided in Virginia by all the transit agencies for the given neighborhood design. For the purposes of this analysis, a neighborhood is defined as a Census Block Group.

A Consistent Measure of Transit Service

In order to compare all the Census Block Groups in Virginia, a consistent and meaningful measure of transit service has been developed by CNT, referred to as the Transit Service Index or TSI. The TSI, which uses the weighted sum of three transit metrics: Transit Connectivity Index (TCI), the Jobs in the 30-minute Transit Access Shed (TAS) and the area covered by the 30-minute TAS. The weights use in the sum are the result of a statistical model that matches these three variables to the fraction of people in a neighborhood that use transit for their daily commute. It addresses three questions:

1. How much is the transit in a neighborhood used?
    - This is addressed by using the fraction of people who use transit for their daily commute.
2. Can neighborhood residents find a bus stop or train station and how long do they have to wait for a ride?
    - This is measured in the TCI, which uses the transit stops/stations and the frequency of service (see https://alltransit.cnt.org/methods/AllTransit-Methods.pdf pages 3-5).
3. Can neighborhood residents get to jobs and other economic activity using this transit system?
    - This is measured using the 30-minute TAS, which also allows for up to one transfer, and the Longitudinal Employment and Household Dynamics data set from 2018 (https://lehd.ces.census.gov/).

Using the variables listed above from the 24 transit agencies that are included in the tool, a range of transit quality is observed across Virginia. The TSI is scaled from 0 to 100, such that 0 means no transit service is provided, and 100 is used for the location with the most intense transit service. It is important to keep in mind that a TSI value of 0 could represent an appropriate level of transit for a given neighborhood, if that neighborhood is rural and has little demand for transit. Likewise a high TSI for a given neighborhood may have relatively good transit quality but may or may not be adequate given the local demand. The following map shows the TSI for the Charlottesville, VA area.



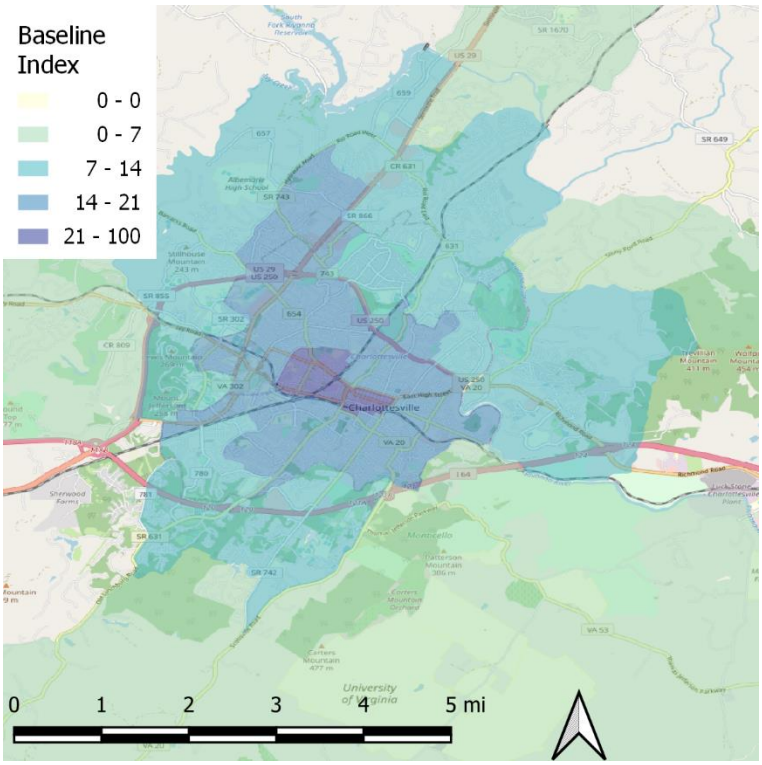
Finding the Transit Baseline

Given the TSI across Virginia, another statistical relationship is examined, this time using local built environment variables and relating them to the TSI. These local build environment variables are the neighborhood's:

- average block size,
- fraction of single family detached households,
- households per acre
- households in the surrounding vicinity
- retail jobs in the surrounding vicinity
- non-retail jobs in the surrounding vicinity[1]

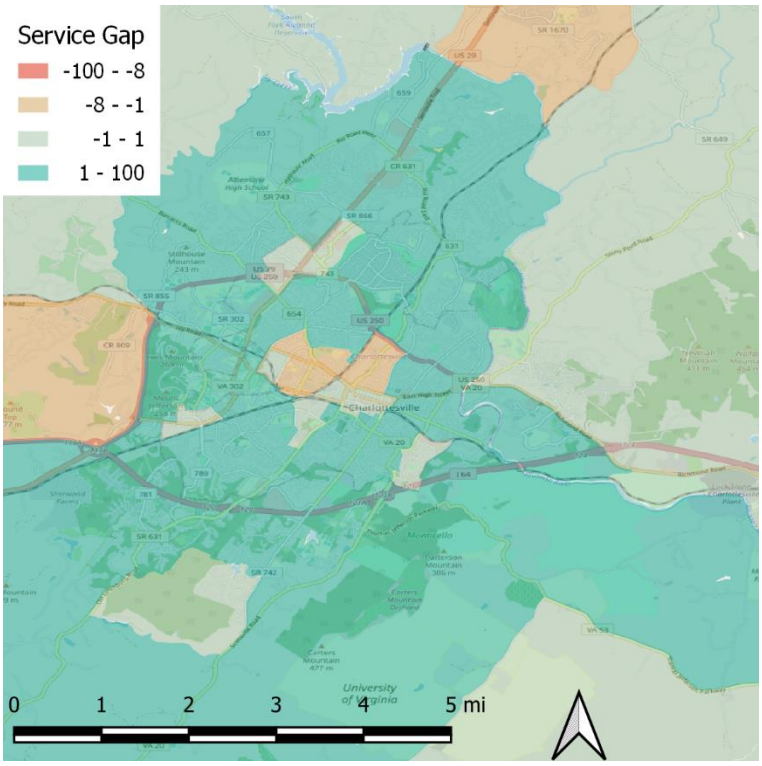
The statistical analysis reveals that these variables describe over 80% of the variation in the TSI (R^2 = 80.75%). The resulting equation is then applied to every census block group to calculate what the average TSI would be for the built environment. The following maps shows this calculated value for the Charlottesville area:

[1] By surrounding area means that the intensity variables are constructed using a gravity model which considers both the quantity of, and distance to, households and jobs, relative to any given block group. Using an inverse-square law, intensity is calculated by summing the total quantity divided by the square of the distance but does not include the households/jobs within the block group. This quantity allows us to examine the intensity of development in the area around the block group.



Finding the Service Gap

In order to find where the TSI is above or below average, the Service Gap is calculated as the difference of the TSI minus the Baseline. Thus, if this quantity is positive for a given neighborhood the transit service is above average. Likewise, when the service gap is negative, the implication is that the transit service is below the benchmark - the statewide average for similar neighborhoods. The following map shows this Service Gap.



On the tool's map, neighborhoods where either the TSI or the baseline is less 3 are shown as having "Low Transit Need." Other neighborhoods use the breakpoint used in the maps above – that is for the legend on the tool, the following is true:

- Low Transit Need – TSI or Baseline < 3.0
- Significantly Below Baseline – Transit Gap > 8.0
- Moderately Below Baseline – Transit Gap is between 1.0 and 8.0
- Baseline – Transit Gap Transit Gap is between -1.0 and 1.0
- Above Baseline – Transit Gap < -1.0