3.7 Need Category: Need for Bicycle Access to Activity Centers

Measure: Activity Centers Bike-sheds

What it means: Areas within biking distance of VTrans Activity Centers. VTrans Activity Centers are identified as "areas of regional importance that have a high density of economic and social activity" and are associated with the Regional Networks Travel Market. Activity Centers have been identified through stakeholder input.

Applicable VTrans Travel Market: RN

Identification of Needs

- Data Sources:
  - OIPI, Shapefile of Activity Centers by category (Knowledge-based, Industrial, Local-serving) (See Appendix C)
  - Existing, Planned and Under-Construction Fixed-Guideway and BRT lines: Northern Virginia and Fredericksburg Regional Networks, Dulles Corridor Metrorail Project, Hampton Roads Regional Network, Greater Richmond Transit Company, Washington Metropolitan Area Transit Authority
  - U.S. Census Bureau, American Community Survey (ACS) Five-year Estimates:
    i. Table B08534: Means of Transportation to Work by Travel Time to Work
  - U.S. Census Bureau, Shapefile of MPO boundaries in Virginia, 2014
  - U.S. Census Bureau (2014). *American Community Survey Reports, "Modes Less Traveled— Bicycling and Walking to Work in the United States: 2008-2012."* (Bike Commute Time)
  - Virginia DRPT, Shapefile of transit stops in Virginia, 2019

- Year of analysis: 2017

- Period of analysis: n/a

- Calculations:
  1. Retain only knowledge-based and local-serving Activity Centers inside of MPO boundaries.
  2. Create a shapefile of all fixed-guideway transit and commuter rail stations, and BRT lines inside of MPO boundaries
  3. Extract bike speed by averaging researched sources[1] (2019 sources noted under Secondary Data Sources. 2019 bike speed equal to 9.9 mph)
  4. Extract mean bike commute time (using the U.S. Census Modes Less Traveled Survey Report) and impute bike commute time that is equivalent to the walk commute using the following equation. 2019 figures resulted in a 42-minute bike commute time using the following equation:

     $$\left[\left(\frac{\textit{Mean bike commute-mean walk commute}}{\textit{mean walk commute}} + 1\right) * \textit{90th percentile walk commute}\right]$$

  5. Calculate bike needs radius by multiplying the bike speed (9.9 mph) by the bike commute time (42 minutes) and rounding the result (6.9) to the nearest integer.
  6. Generate bike needs buffers of 7 miles around the Activity Centers, fixed-guideway transit stations, and BRT lines.
  7. Identify applicable roadway segments as those within the 7-mile buffer that are characterized as a non-limited access facility and are functionally classified above Local Streets.
  8. **Threshold for Need for Bicycle Access to Activity Centers:** Roadway segments within 7 miles of Activity Centers, fixed-guideway transit stations, and BRT lines are identified as those with a Need for Bicycle Access to Activity Centers.

[1] Multiple sources
- McLeish, M. (2017). "How far is too far to bike to work?" Mobility Lab. Available at https://mobilitylab.org/2017/02/27/how-far-bike-work/
- Average cycling speed for new and experienced cyclists" Road Bike. Available at https://www.road-bike.co.uk/articles/average-speed.php.
- Tejvan (2017). Average speeds cycling. Available at https://cyclinguphill.com/average-speeds-cycling/
- "How fast does the average person ride a bike?" Reference. Available at https://www.reference.com/world-view/fast-average-person-ride-bike-cf053029272716e0

4.2.7 Prioritization within Bicycle Access to Activity Centers Need Category

Applicable VTrans Travel Market: RN

Utilized for: Establishing Construction District Priority Locations

Two criteria, Severity and Magnitude, are utilized to categorize VTrans Mid-term Need for Bicycle Access to Activity Centers as *Very High, High, Medium,* and *Low* in the following manner.

Severity of VTrans Mid-term Need for Bicycle Access to Activity Centers

- Source data:
  - Virginia Department of Rail and Public Transportation's Route and Stop shapefiles, used to identify BRT lines, fixed-guideway transit stops, and all other transit stops.
  - VDOT Transportation Mobility Planning Division, Virginia Bicycle Facility Inventory; Existing documented bicycle infrastructure on the VDOT LRS, which includes shared use paths, bicycle lanes, shared lanes designated with signs or pavement markings, and four-foot paved shoulders.[1]
- Calculations
  - Draw 3-, 5-, and 7-mile buffers around VTrans Activity Centers. Repeat the same for BRT lines and fixed-guideway transit stops.
  - Intersect the buffers with road segment centroids and assign a road segment the smallest intersecting bike buffer.
  - Assign the following bike Severity values to segments:
    - 3.0 points: Bike buffer of 3 miles and within 200-ft of a transit stop
    - 2.5 points: Bike buffer of 3 miles and outside of 200-ft of a transit stop
    - 2.0 points: Bike buffer of 5 miles and within 200-ft of a transit stop
    - 1.5 points: Bike buffer of 5 miles and outside of 200-ft of a transit stop
    - 1.0 point: Bike buffer of 7 miles and within 200-ft of a transit stop
    - 0.5 points: Bike buffer of 7 miles and outside of 200-ft of a transit stop

[1] https://www.virginiaroads.org/datasets/bicycle-facility-inventory-view

Magnitude of VTrans Mid-term Need for Bicycle Access to Activity Centers

- Source data:
  - U.S. Census Bureau, American Community Survey 2018 5-Year Estimates, "Total Population" by Block Group
  - U.S. Census Bureau, LEHD Origin-Destination Employment Statistics (LODES) Workplace Area Characteristics (WAC) employment data by Census Block
  - VDOT, Roadway Functional Classification
- Calculations
  - Aggregate Census Block-level employment data to the Block Group level.
  - Calculate employment and population densities using each Census Block Group's total employment, population, and area in square miles.
  - Sum the resulting employment and population densities.
  - Assign a road segment the summed density value of the Block Group that its centroid intersects.
  - For roadway functional classification, assign the following values:
    - 7 points: Other Principal Arterial
    - 3 points: Minor Arterial
    - 1 point: All other functional classes

Consideration of Severity and Magnitude Criteria

- For roadway segments with no documented bicycle infrastructure, multiply Severity (proximity to VTrans Activity Centers) and Magnitude (population and employment densities, roadway functional classification) to develop a score.

Prioritizing within Bicycle Access to Activity Centers Need Category

Prioritization within this VTrans Mid-term Needs Category occurs in the following manner:

- For each VDOT Construction District, sort the score in descending order and assign the following values based on mileage[1] to develop VDOT Construction District-specific *Very High, High, Medium,* and *Low* categorizations for VTrans Mid-term Need for Bicycle Access to Activity Centers.
  - *Very High* (Score 7): Top 5% of the total mileage
  - *High* (Score 6): 5.001%–10%
  - *High* (Score 5): 10.001%–15%
  - *Medium* (Score 4): 15.001%–20%
  - *Medium* (Score 3): 20.001%–25%
  - *Low* (Score 2): 25.001%–50%
  - *Low* (Score 1): Bottom 50.001%–100%
  - Assign other roadway segments with VTrans Mid-term Needs for Bicycle Access to Activity Centers a priority score of 1 *(Low)*.

[1] Where prioritization values do not break exactly at the percentile categories, assign all values to the higher category until there is a new prioritization value. For example, if the top 7% of roadway miles all have the same score, then 7% of miles would be classified as *Very High*.