3.5 Need Category: Need for Transit Access to Activity Centers

Measure: Transit Access to Activity Centers for Workers

What it means: Number of people that can access a given VTrans Activity Center via public transit versus a private automobile. 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)
  - U.S. Census Bureau, LEHD Origin-Destination Employment Statistics (LODES) Resident Area Characteristics (RAC)
  - InfoUSA, Business location data aggregated at the Block Group level
  - HERE Technologies, street network database
  - VDOT Transportation Mobility Planning Division and Virginia DRPT, General Transit Feed Specification (GTFS) text files
  - VDOT Transportation Mobility Planning Division, TransCAD Transportation Accessibility Model

- Year of analysis: ~~2017~~

- Period of analysis: n/a

- Calculations

1. Calculate total employment for each VTrans Activity Center as ~~employment within a 1-mile radius of the Activity Center. (When Block centroids are within 1 mile of more than one Activity Center, they are assigned to the nearest Activity Center.)~~
2. ~~For Activity Centers with significant military and national security employment, calculate total employment within 1-mile radius, from additional Block Group-level data.~~
3. ~~Incorporate statewide street network with forecasted land use data (from VDOT TransCAD Accessibility model) by Block Group (number of workers) and decay curve for job access by car.~~
4. Incorporate statewide route system with forecasted land use data by Block Group and decay curve for job access by transit.

~~**Threshold for Need for Transit Access to Activity Centers:** Determine the number of workers who can reach an Activity Center by transit within 45 minutes as compared to by automobile.~~

6. Utilize VDOT's TransCAD Accessibility model to determine the number of workers who can reach the primary Block Group associated with an Activity Center by automobile and by transit within 45 minutes. Outputs include:
   - Automotive Accessibility: ~~Number of workers~~ that can Access an Activity Center with a 45-minute automobile ride
   - Transit Accessibility: ~~Number of workers~~ that can Access an Activity Center with a 45-minute bus, commuter rail, bus rapid transit, rail rapid transit, or light rail transit ride
7. Calculate transit access deficit: The difference between automotive accessibility and transit accessibility.
8. Normalize the transit access deficit by the total of the Activity Center's employment. Any normalized transit deficit greater than zero constitutes a Need.

9. **Threshold for Need for Transit Access to Activity Centers:** Activity Centers, where fewer ~~workers~~ can access the Activity Center within 45 minutes by transit than by automobile are identified as those with a VTrans Mid-term Need for Transit Access to Activity Centers.
10. ~~Determine the median transit commute time for each RN, spatially joining RNs to the county-level Census data on Means of Transportation to Work.~~
11. Sum the number of people in a RN taking transit and the number in each travel time category: <10 minutes, 10–14 minutes, 15–19 minutes, 20–24 minutes, 25–29 minutes, 30–44 minutes, 35–44 minutes, 45–59 minutes, 60+ minutes.

12. Identify the median transit commute time as the midpoint of the travel time bin containing the 50th percentile transit commuter.
13. Convert the value to a distance by multiplying it by the average travel speed of a bus (12 mph).[1]
14. Draw a buffer equal in radius to the median transit commute distance for each RN around Activity Centers in that RN. For Activity Centers not inside a RN, draw a buffer whose size is the distance between an RN boundary and the Activity Centers that is furthest outside it (5.4 miles).
15. ~~Assign the maximum transit deficit of any Activity Center whose buffer intersects a road segment centroid to that segment.~~

[1] American Public Transit Association (APTA), "2020 Public Transportation Fact Book", 2020."

4.2.5 Prioritization within Transit 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 Needs for Transit Access to Activity Centers as *Very High, High, Medium,* and *Low* in the following manner.

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

- Source data
  - Transit deficit (difference in number of workers who can reach an Activity Center by transit within 45 minutes as compared to by automobile) used to identify VTrans Mid-term Need for Transit Access to Activity Centers.
  - U.S. Census Bureau, Shapefile of Metropolitan Planning Organization (MPO) boundaries in Virginia, 2014

- Calculations
  - Assign node-specific VTrans Mid-term Needs to roadway segments using the following method:
  - Determine the median transit commute time for each RN, spatially joining RNs to the county-level Census data on Means of Transportation to Work.
  - Sum the number of people in a RN taking transit and the number in each travel time category: <10 minutes, 10–14 minutes, 15–19 minutes, 20–24 minutes, 25–29 minutes, 30–44 minutes, 35–44 minutes, 45–59 minutes, 60+ minutes.
  - Identify the median transit commute time as the midpoint of the travel time bin containing the 50th percentile transit commuter.
  - Convert the value to a distance by multiplying it by the average travel speed of a bus (12 mph).[1]

[1] American Public Transit Association (APTA), "2020 Public Transportation Fact Book", 2020.

- Draw a buffer equal in radius to the median transit commute distance for each RN around Activity Centers in that RN. For Activity Centers not inside a RN, draw a buffer whose size is the distance between an RN boundary and the Activity Centers that is furthest outside it (5.4 miles).
- Assign the maximum transit deficit of any Activity Center whose buffer intersects a road segment centroid to that segment.

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

- Source data:
  - U.S. Census Bureau, LEHD Origin-Destination Employment Statistics (LODES) Residence Area Characteristics (RAC) employment data by Census block
  - InfoUSA, business location data aggregated at the Census Block Group level
  - VDOT, Roadway Functional Classification
- Calculations
  - Assign the maximum Activity Center employment of any Activity Center whose buffer intersects a road segment centroid.
  - Only consider segments whose functional class is not "error", "Local", or any ramp. Assign the remaining segments a temporary functional class score ('FC Score'):
    - *7* points: Interstate, Other Freeways & Expressways, Other Principal Arterial
    - *5* points: Minor Arterial
    - 3 points: Major Collector
    - 1 point: Minor Collector

Consideration of Severity and Magnitude Criteria

- Calculate a scoring metric based on Severity and Magnitude in the following manner:

$$Score = \frac{transit\ deficit \times AC\ employment}{maximum\ AC\ employment\ indistrict} \times FC\ Score$$

Prioritizing within Transit Access to Activity Centers Need Category

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

- Needs outside MPO boundaries are automatically assigned a score of 1 and assigned to the Low Prioritization category.
- For designated MPO areas within each VDOT Construction District, sort the scores 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 Transit 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%

[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*.