Index Development Methodology

Federal Boulevard First/Last Mile Project

Prepared for:

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Department of Transportation

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Index Development Methodology

The following outlines the methodology used to develop the Colorado Department of Transportation (CDOT) Federal First/Last Mile (FLM) Index. The following tools can be used to create walksheds from pedestrian networks and identify the walksheds in most need of multimodal improvements through the development and analysis of an FLM index.

Example outputs of these tools for recent field visits can be found in this webmap, and the index scoring and background data can be found in this spreadsheet. If you have any questions about the methodology or how you can use these tools on your project, contact the CDOT OIM at dot_innovativemobility@state.co.us.

Walkshed Analysis

For the Federal Boulevard FLM project, GIS was used to create a half-mile walkshed around each of the 44 Bus Rapid Transit (BRT) station areas proposed by the Federal Boulevard BRT project. Pedestrian-accessible roadways and trails were used as the "walkable" network representing each station-area walkshed. If the BRT station area included a northbound and southbound station, the half-mile buffer for each corresponding station was merged and analyzed as one geometry. In addition to developing walksheds, a broader transportation network analysis of key roadway corridors, bike facilities, trails, microtransit, and micromobility data outside the half-mile walkshed was conducted.

To conduct a walkshed analysis:

1. Import proposed station points.
    - For the Federal Blvd FLM project, the analysis was run from the 86 northbound and southbound stations from the concurrent Federal BRT design project. The walksheds generated from the subsequent step were then merged into 44 station area walkshed polygons to capture the network for both the northbound and southbound stops for each station area.
2. Create a walkshed polygon for the sidewalk network around the transit stations.
    A. Use the network analyst extension in GIS to perform a walkshed analysis.
        1) Create a network dataset.
            - Inputs should include GIS layers such as roads, sidewalks, and/or trails that represent the walkable network within the study area. For the Federal Boulevard FLM project, this included the 2024 CDOT Major and Local Roads layers (as a proxy for sidewalks) and the 2024 COTREX trails layer.
            - Learn more about network datasets here.
        2) To clean up the network, perform a quality check on the network dataset to ensure that no gaps in the network exist. Gaps in the network can make parts of the study area inaccessible and lessen the size of the potential walkshed and eventual analysis area. **Note: Because even small gaps can be skipped by the network analyst tool, a detailed review is important at this step.**
        3) Import all stations as facilities in the network analyst.
        4) Create a service area layer with your desired walkshed distance (.5 mi for FLM).
        5) Save the output from this analysis as the "walkshed" polygons to use in later analysis steps.

Key data sources for the walkshed analysis include:

- 2024 CDOT Major Roads and Local Roads GIS layers
- 2024 COTREX statewide trails GIS layer
- Municipal level trail/shared-use path data
- Most recent Federal BRT stations layer from the concurrent Federal Boulevard BRT project

Site Selection Index Development

The next step involves developing a site selection index score for half-mile walksheds. For the Federal Boulevard FLM project, the overall process joined census demographic data, transit ridership data, traffic safety data, and network data from the walkshed analysis step with block group data and then intersected the data with the walksheds to calculate data for each walkshed. The min/max method was used to normalize data to a 0–100 scale to arrive at an index score for each data variable for each walkshed. The scores for each variable were grouped and averaged to get an average score for each group, and finally each group score was averaged to arrive at an overall index score for each walkshed.

1. Calculate Census demographic data for each walkshed.
   A. Import Census Block Group and Tract GIS data.
   B. Import Census demographic tables.
   C. Join tables to Census Block Groups or Tracts.
      1) Save new Block Group and Tract GIS layers with demographic attributes.
   D. Run the intersect tool, including new Block Group or Tract layer and walksheds.
      1) For resulting block group layers, calculate the area of the new intersected part in a new field.
      2) Calculate the percentage of the new area/original area of the Block Group/Tract in a new field.
      3) Multiply demographic data by percentage into new fields to proportionate values.
         a. For percentages, divide demographic population by total population.
   E. Run the dissolve tool on intersected layers for each walkshed.
      1) Doing so will combine intersected block groups into one walkshed and one value for each demographic variable.
      2) When running the dissolve tool, choose the option to sum demographic field values.
2. Calculate miles of network in each walkshed.
   A. Run the intersect tool including walksheds and pedestrian network.
   B. Calculate the length of the intersected pedestrian network for each walkshed.
3. Calculate crash data for each walkshed.
   A. Run the intersect tool or select crashes by location for each walkshed.
   B. Create new fields for total crashes, KSI crashes, and bike/ped crashes.
   C. Populate new fields with totals for each crash type in each walkshed.
4. Use the min-max analysis to assign 0-100 score to each data point.
   A. Pull all intersected data into Microsoft Excel and calculate the min/max score for each walkshed.
      1) $Scaled\ Score = \left(\frac{variable\ value - variable\ min}{variable\ range}\right) * new\ scale\ max$

2) Example for Walkshed 1 Population:
   a. **Population** for Walkshed 1 is **2,366**.
   b. **Minimum population** among all walksheds is **201**.
   c. The **range between min and max** population for all walksheds is **5,874**.
   d. **Population index score** for Walkshed 1 is **36.35** (see math below).

$$36.35 = \left(\frac{2{,}366 \ - \ 201}{5{,}874}\right) * 100$$

3) To combine index scores, calculate the mean of the scores.

Key data sources for the Site Selection Index include:

- Census 2022 American Community Survey 5-year data (in line with DRCOG Equity Index indicators)
  - Block Group Level
    - Household and Employment Density Data
    - Minority
    - Households with Limited English Proficiency (LEP)
    - Under 18/Over 65
    - Low-Income Households
    - Zero Car Households
  - Census Tract Level
    - Households with at least one person with a disability
- Transit ridership data
  - Current RTD boarding and alighting data
  - Projected 2045 transit ridership
- Safety data
  - Crash location density
  - Crash counts by severity and mode

Urban and Suburban Station Locations

Parallel to the development of the Site Selection Index for the Federal Boulevard FLM project, station area walksheds were designated as urban or suburban with the goal of selecting one urban and one suburban station area walkshed for in-depth existing conditions analysis in Task 3. Whether a station-area walkshed was defined as urban, urban edge, or suburban was developed based on current and future land use and neighborhood classifications found in Blueprint Denver, the Adams County Comprehensive Plan, and the Westminster Comprehensive Plan.