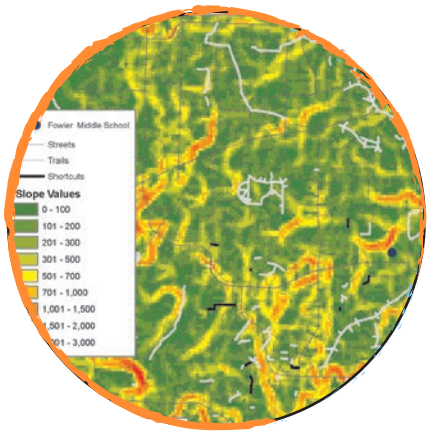
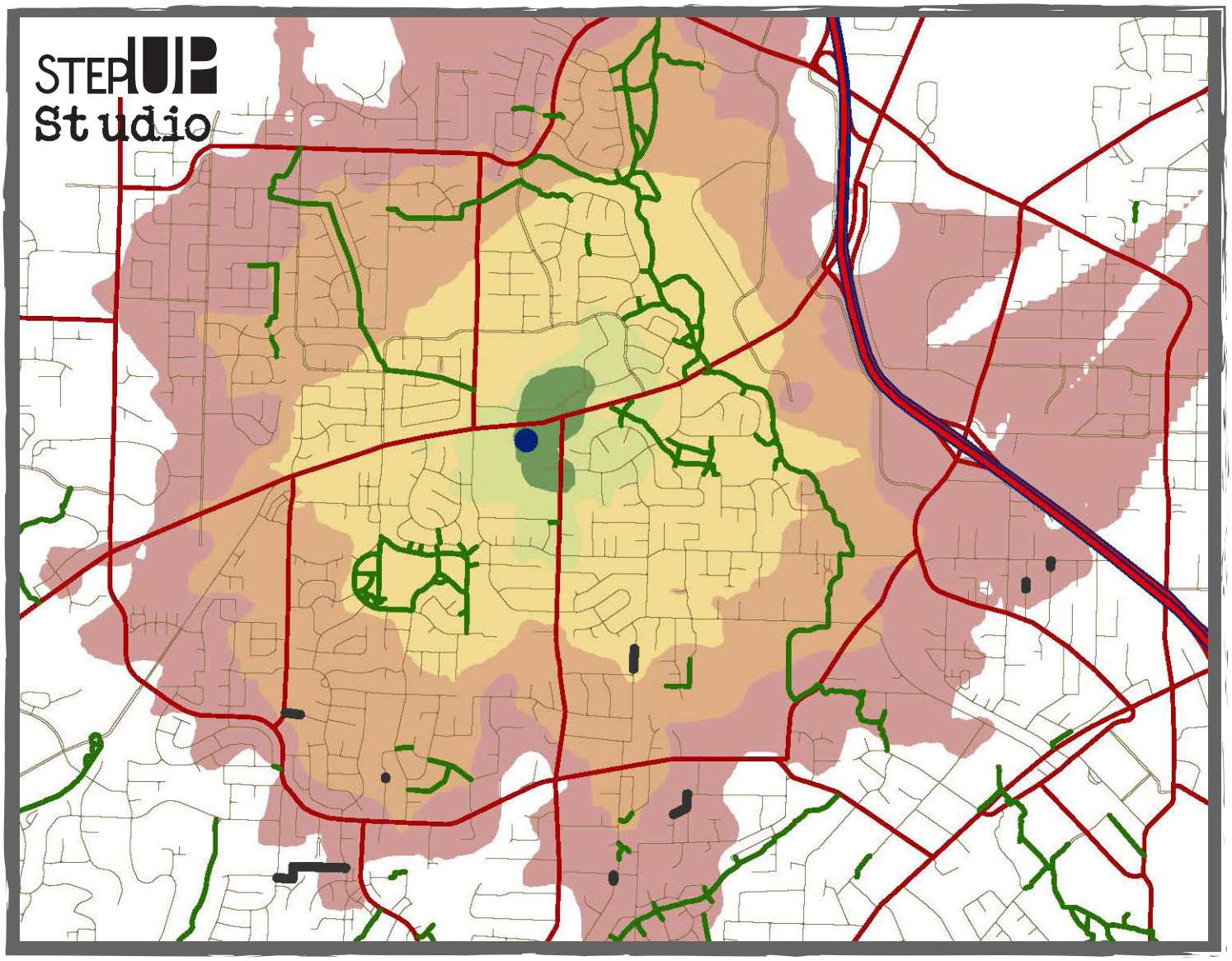
Pedestrian Network Analysis Guide



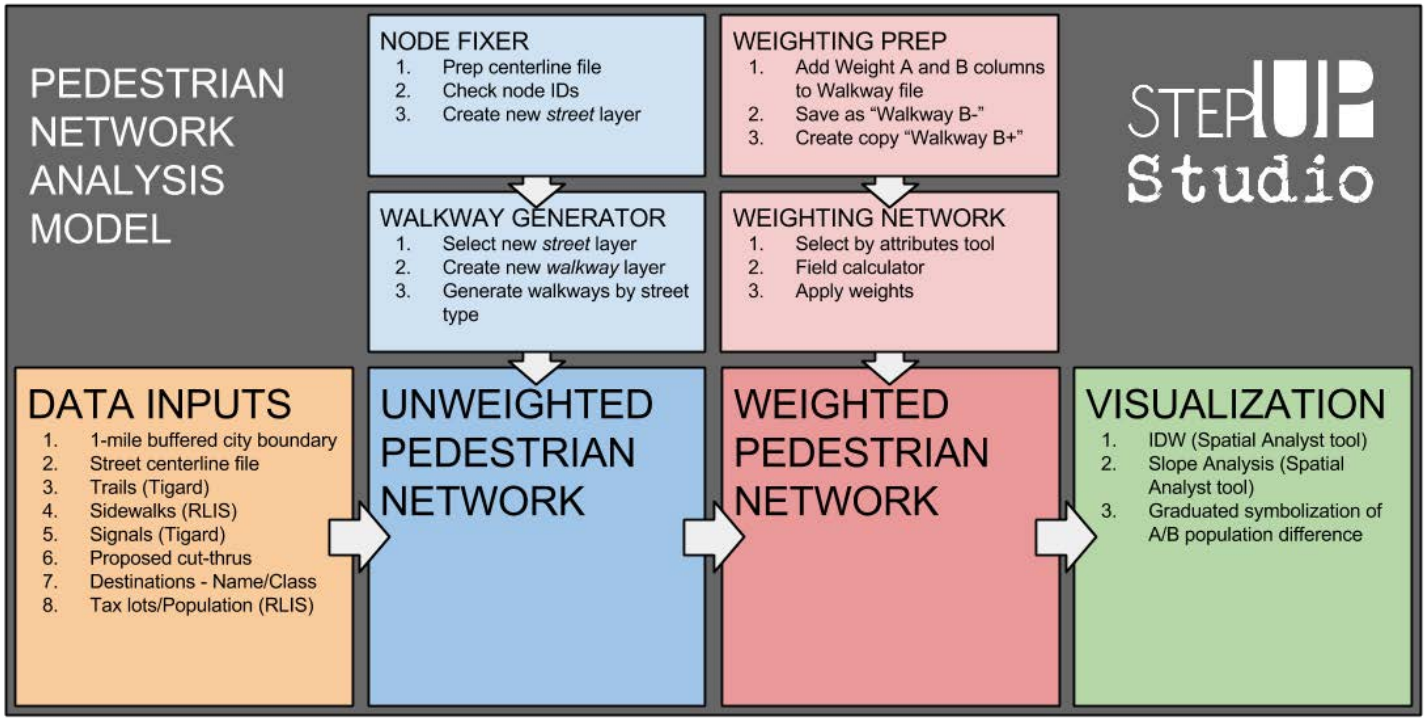


June
13th
2014

STEPUP
Studio

OVERVIEW

This guide provides background on data requirements, pedestrian network analysis and visualization for the ArcGIS Network Analyst utility created by Scott Parker and used by StepUP Studio for the Tigard Walks project. The tool can be used to look at the ped shed of a location or test the utility of a new sidewalk, regional trail extension of neighborhood trail. The guidance herein is intended for the Tigard GIS team as future reference when testing concepts or projects.



I. REQUIRED DATA

1. Use City Boundary with a 1 mile buffer (to account for fringe effects) with "Geoprocessing/Buffer" and "Geoprocessing/Merge" tools in ArcGIS to create this
2. Street centerline file
3. Trails (RLIS or City of Tigard)
4. Sidewalks (RLIS) with attributes (L/R yes/no)
5. Signals (City of Tigard) with attributes (yes/no)
6. Proposed cut throughs (self-created)
7. Create destinations (self-created) with Name (e.g. Whole Foods) and Class (e.g. Grocery)
8. Taxlots (RLIS) -> Population (dwellings) layer created using Taxlots with Feature to Points (Data Management) tool.

NOTE: All data must be eventually on one layer so the streets and trails shapefiles need to be joined together with sidewalk and signal attributes.

II. THE 'NODE FIXER'

Prepare the street centerline file (check or make node IDs)

Required:

- Create a unique segment ID fields (all official data should have this - if not FID can be used with care)
- to node ID field
- from node ID field
- street type field
- NOTE: All three ID fields must be numbers

Check node IDs

- Select the street centerline layer and ID fields
- When checking errors use "all funky ones". The program flags the following errors:
  - Street segments that are not two ended polylines
  - Street segment endpoints that are within 16 feet of each other but have different node IDs.
  - Street segments shorter than 16 feet (can be ignored)
  - Errors will be highlighted on the map
  - Repair nodes using "Node Fixer / Intersection" table.
    - Use "<prev" or "next>" to cycle through the flagged errors.
    - Use "pan to" to show the error on the map.
    - Check "auto" to show errors on the map after "<prev" or "next>"
    - Select segments in the table to highlight them on the map.
    - Use "Ctrl" key to select more than one segment.
    - Use "use majority", "use selected", or "enter" to fix errors.
    - Fix false intersections at bridges if required.
- If node IDs are not provided in the street centerline file they can be created by the 'Node Fixer' (both node ID fields must exist even if empty) using 'make node IDs.
  - Common issue: street and trail lines created by cities are generally not connected, therefore they need to be snapped to each other at the nodes manually. Edit shapefiles with the 'Edit Vertices' tool. This way there is a continuous network the way it exists in reality.

III. WALKWAY GENERATOR

Building a walkway network model

- Use the just created street layer with nodes which have unique segment IDs and to and from IDs -> select them in the Walkway Generator
- Create the Walkway layer with using the "new" button and select it (as the Walkway layer).
- Generate walkways for the different street types (using the street type in the street layer). Create the following attributes:
  - Arterials & collectors need 'Sidewalk and crosswalk'
  - For Driveways, Unimproved streets, Local streets use 'On-walks' (sidewalks or crosswalks are not necessary due to low traffic on these types of streets)
  - 'Off-walks' for trails (no sidewalks or crosswalks exist on trails)
  - 'Non-walk' for ramps (not walkable)

Note: These are just suggestions and can be changed to fit local conditions.

IV. WEIGHTING THE NETWORK

Adding information about what currently exists on the network

Weighting Preparation

- Add Weight A and Weight B columns in Walkway file.
- Save Walkway file as "B-"
- Create a second copy of Walkway file and save as "B+" (e.g.: Walkway B- and Walkway B+).
  The Weight A columns in both files refer to the network of streets & trails.
  The Weight B column in the B- file refers to the network via streets only
  The Weight B column in the B+ file refers to the whole network with proposed cut through trails.

Method

Use the 'Select by Attributes' tool in the Tables to select:

- From walktype (sidewalks and crosswalks)
- From sidewalks/crosswalks attributes (yes/no)
- For sidewalks LT and RT and "alignment" (attribute) LT and RT have to be done separately.
  Example: "st_type2" = 'Arterial' AND "walk_type" = 'sidewalk' AND "alignment" = 'left' AND "SW_LT" = 'yes'

After selection use Field Calculator to calculate Weight_A and Weight_B fields

- do this for both Walkway files: B- and B+.
  *Example: Weight_A= foot length * 1.2 (using the same example as above)*

Weights

the foot value refers to how many people are predicted to go out of the way to an impedance.

By type of street:

- For B+ and B- files: for all collectors Weight A = 1 and Weight B = 1
- For B+ file: for Trails Weight B = Length
- For file B+: for proposed 11 cut through trails and driveways Weight A = 50000 (ft)
- For file B-: for all trails Weight B = 50000 and for proposed cut through trails (11) and driveway Weight A = 50000 (ft)

For crosswalk on arterials:

- Signal YES: 250 (ft)
- Signal NO: 1000 (ft)

For sidewalks onn arterials:

- Sidewalk YES: 1.2 x Length (street of segment)
- Sidewalk NO: 10 x Length (street of segment)

For sidewalks on collectors:

- Sidewalks YES: 1 x Length (same as length)
- Sidewalks NO: 5 x Length

Note: The 'Open Weighter' tool from the model was not used for this project. Instead it was done manually as described above.

V. ANALYSIS TOOL

aka the Access Index

Perform the analysis by clicking on 'Open Analysis' using Walkway weight files (B- or B+) as 'walkway files'.

- Walkway layer that was previously created.
- Destination layer is a shapefile with point (destination) features - choose the name and class attributes and select the destination desired
- Population layer is created using Taxlots with Feature to Points (Data Management) tool
- Create 'new' origin distance layer with bottom (a new folder and file will be created)
- Choose above created file
- Click 'generate effective distances and/or traversals', and analysis is performed using above created file

Add fields that calculate (for each destination):

- Difference between A and B (if needed do B-A instead of A-B to avoid negative numbers) (use LONG INT)
  i.e. [Gro_ABDiff] field = [Grocery_A] - [Grocery_B]

- Difference X population numbers (use LONG INT)
  I.e. [GroXPopu] field = [Gro_ABDiff] X [totalPop]

VI. VISUALIZING THE RESULTS

IDW (using Spatial Analyst Tool IDW)

- Choose Analysis (either - or +) file and choose Field A (e.g. Grocery_A). -> via streets & trails.
- Choose Analysis B- file and choose Field B (e.g. Grocery_B). -> via streets only.
- Choose Analysis B+ file and choose Field B (e.g. Grocery_B). -> via existing network with proposed cut throughs.
- For symbolization use Defined intervals > set interval size to 1320 ft (1/4 mile)

Slope Analysis (using Spatial Analyst Tool Slope)

- Use IDW raster files created above.
- For Output Measurement use PERCENT_RISE instead of degrees.

Graduated symbolization of AB difference X population

- Choose Analysis B- file and choose 'xPopu field' (e.g. GroXPopu).
- Use Quantiles, Network Performance, 9 classes, take out 0s (use exclusion button and enter i.e. "GroXPopu" = 0)
- Do the same using Analysis B+ file

Visualization Examples of Model Output Destinations

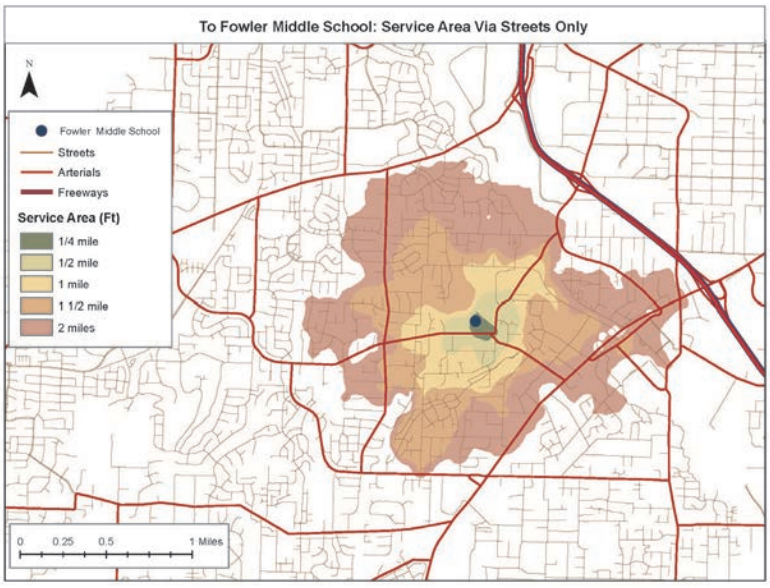
At the back of this document are maps for a handful of example destinations in West Tigard.

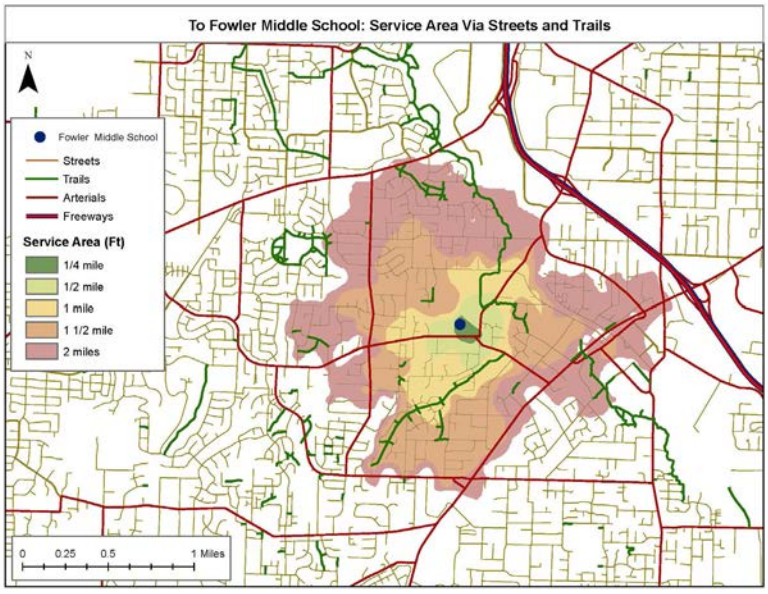
- Fowler Middle School (9 maps)
- SW 121st Avenue Bus Stop (9 maps)
- Whole Foods on Scholls Ferry Road (9 maps)
- Sample Neighborhood Commercial Node near SW Walnut and Gaarde Streets (9 maps)

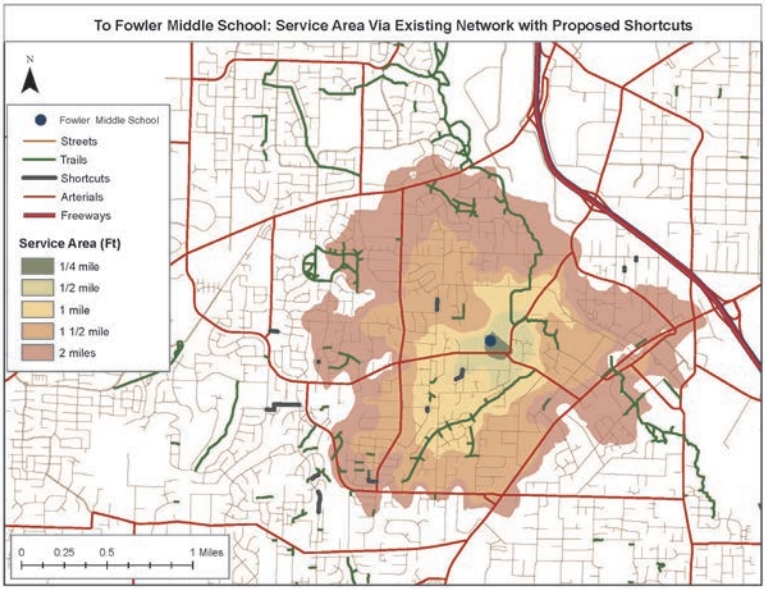
Examples

Pages 9-23 contain example output visualizations run by StepUP Studio during their analysis for the Tigard Walks project.

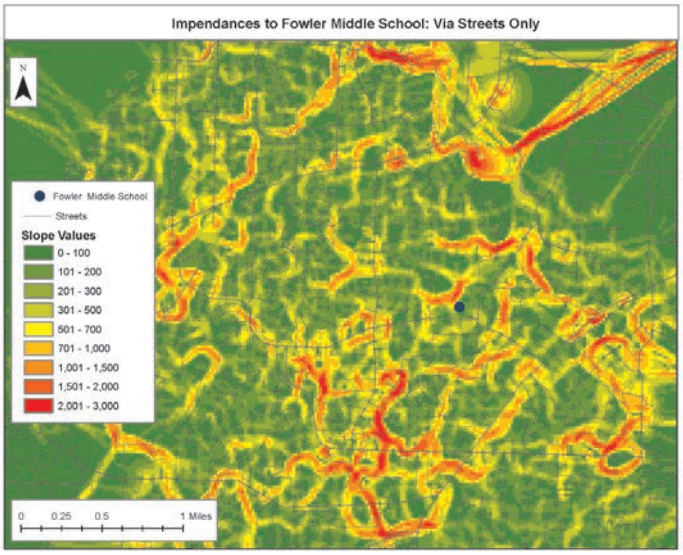
Fowler Middle School - IDW

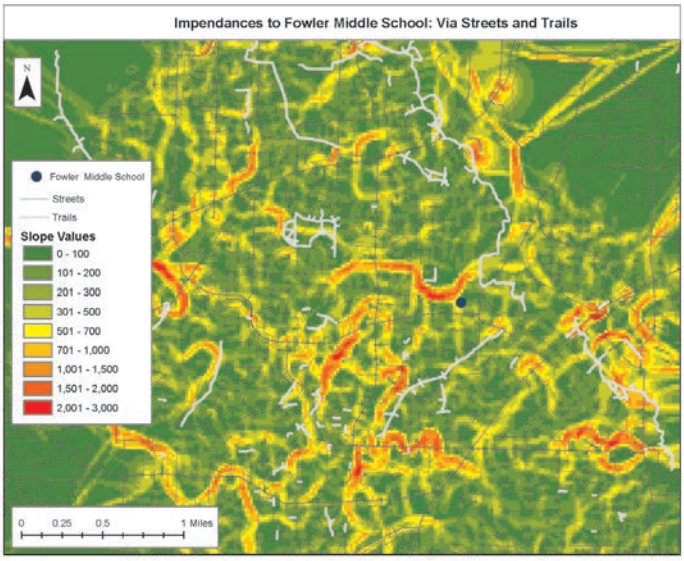


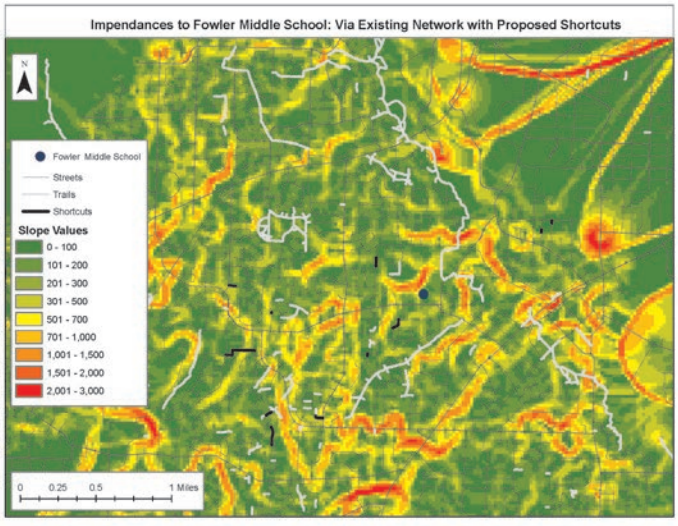




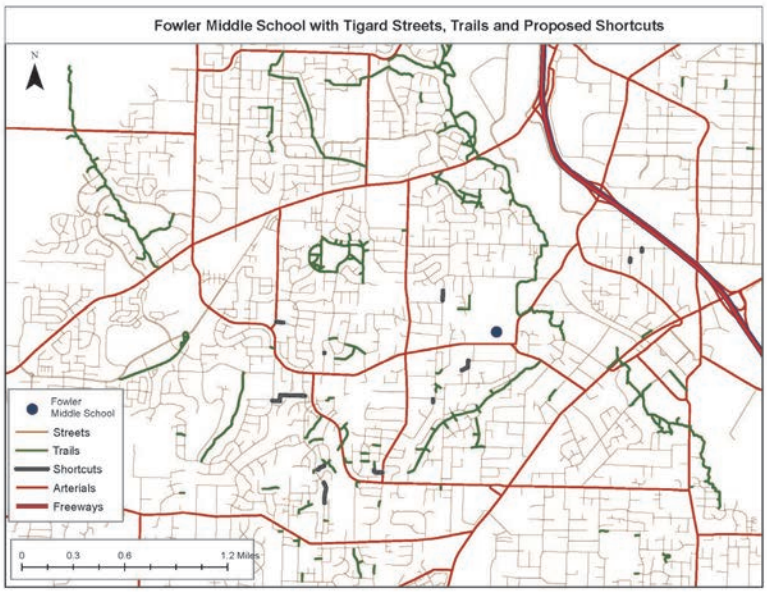
Fowler Middle School - Slope

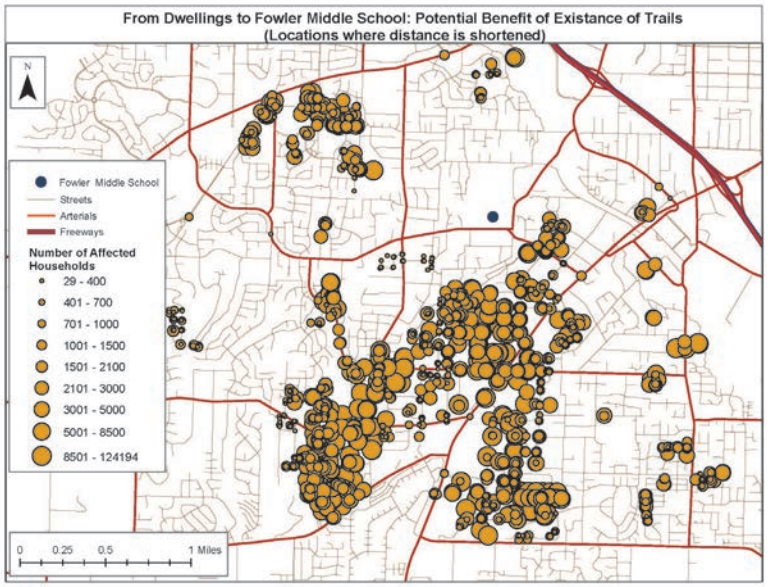


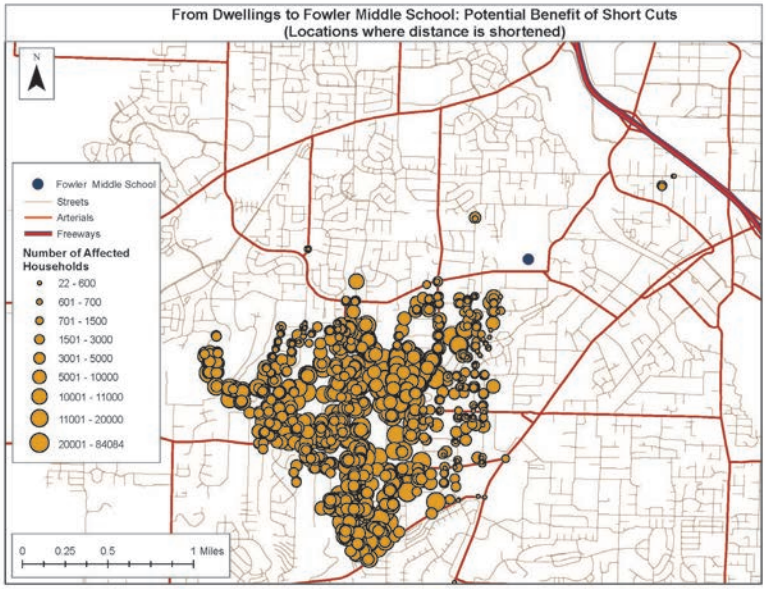




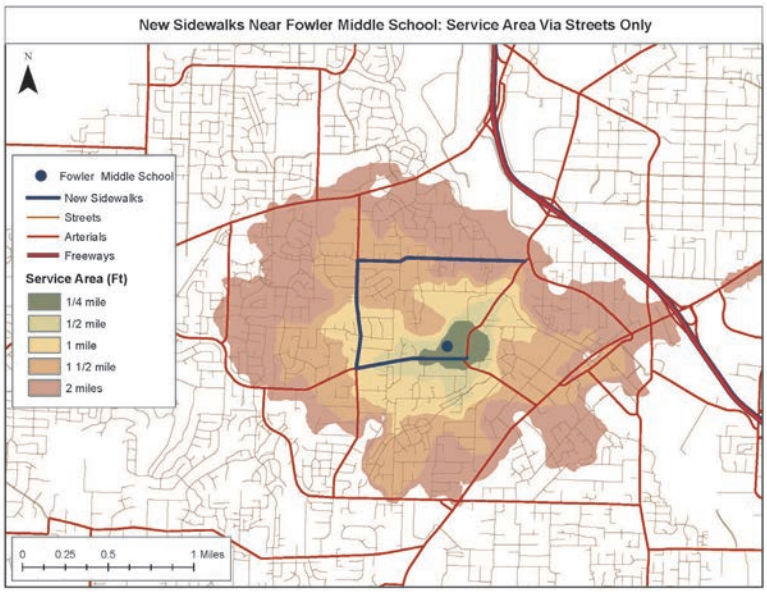
Fowler Middle School - Network Performance

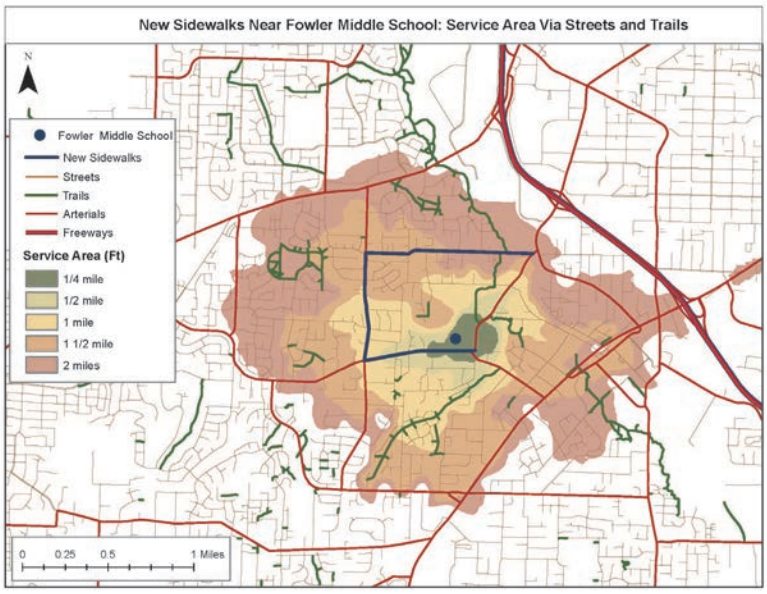


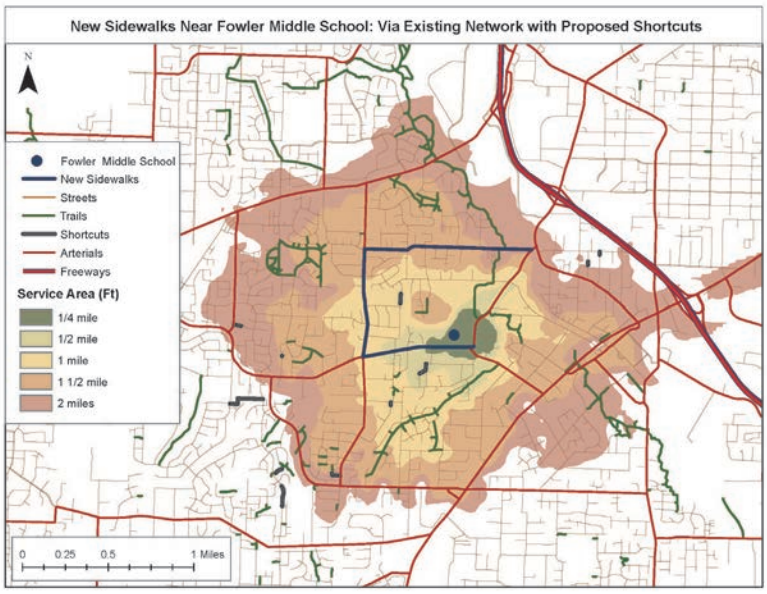




Fowler Sidewalks - IDW







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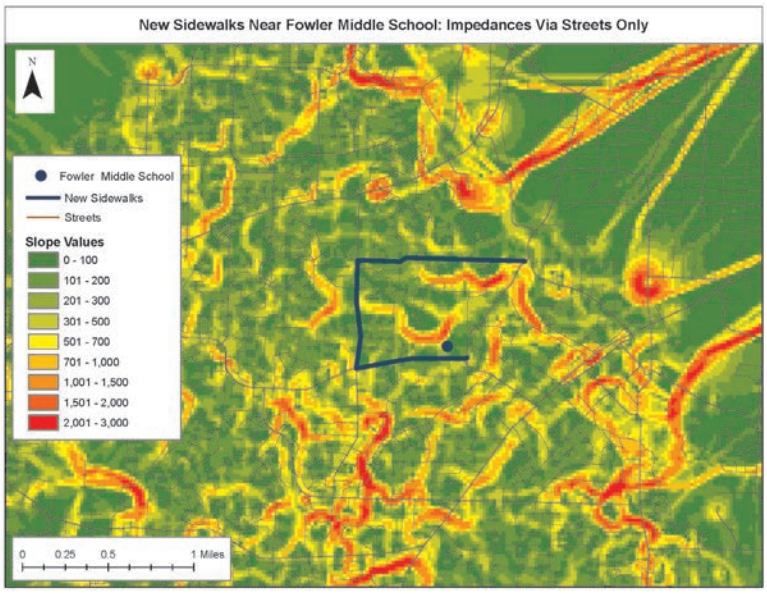

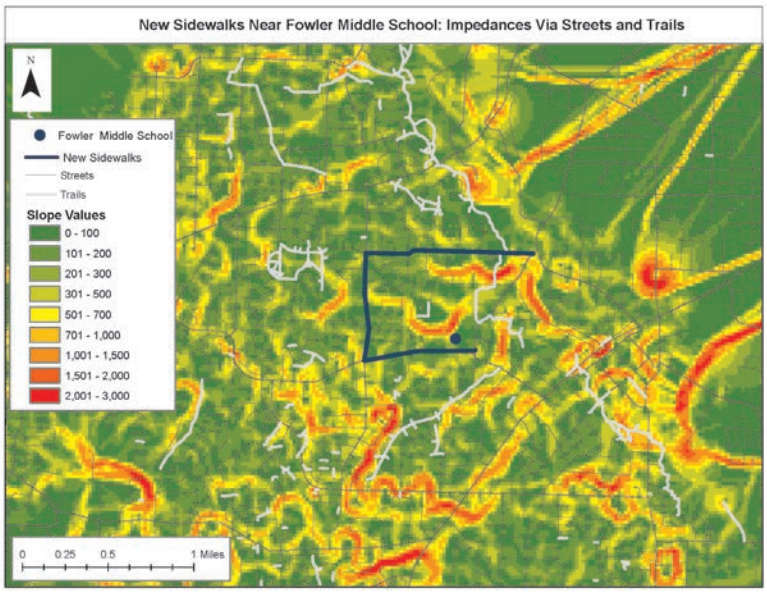

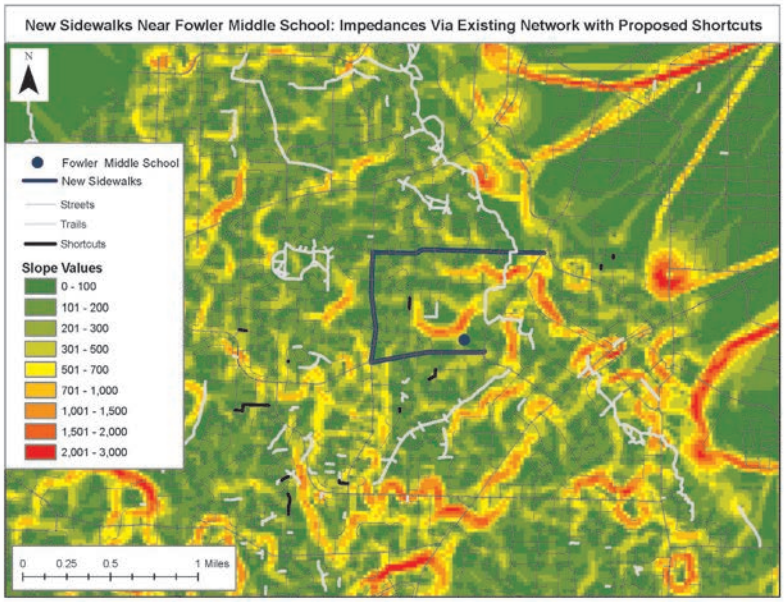

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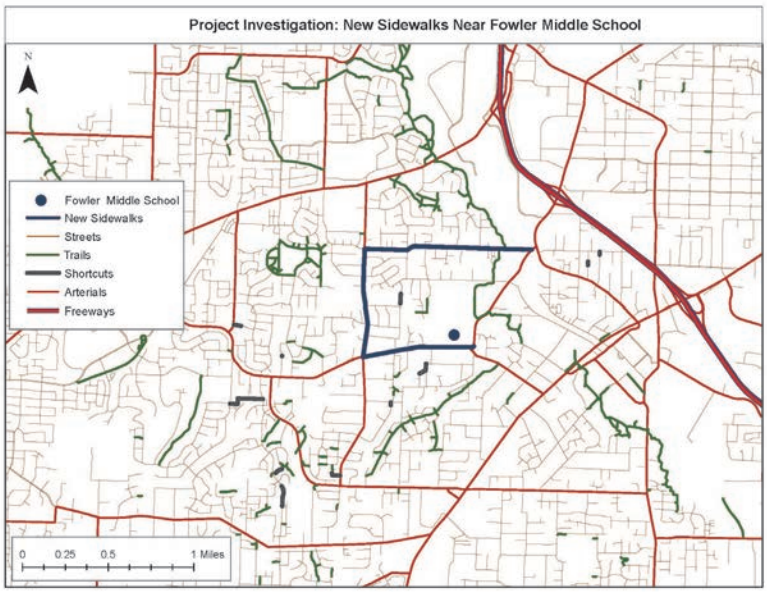
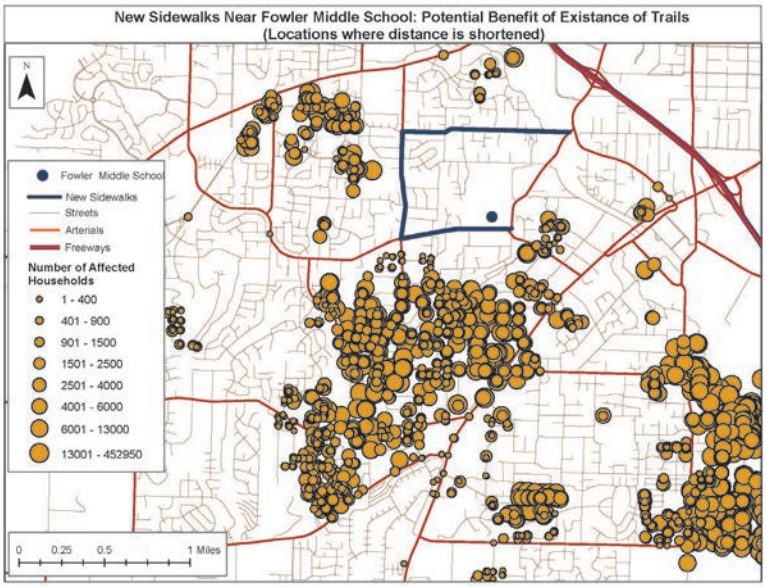
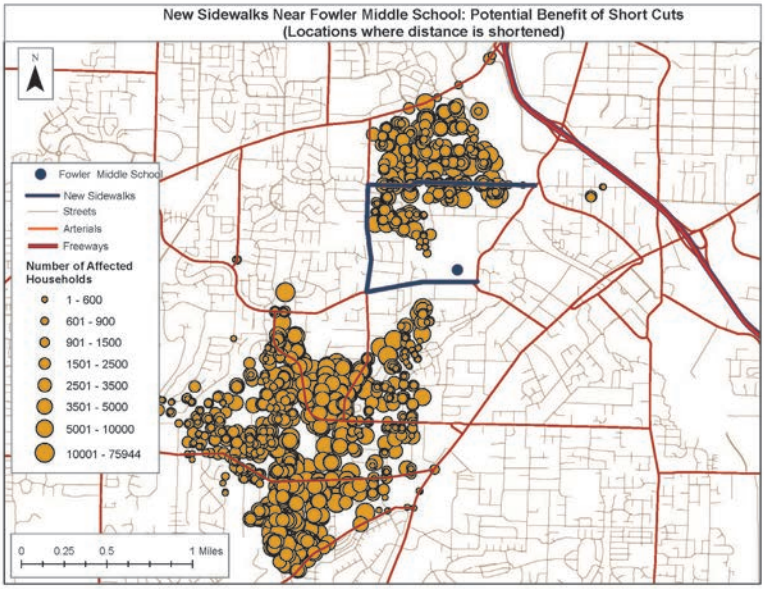
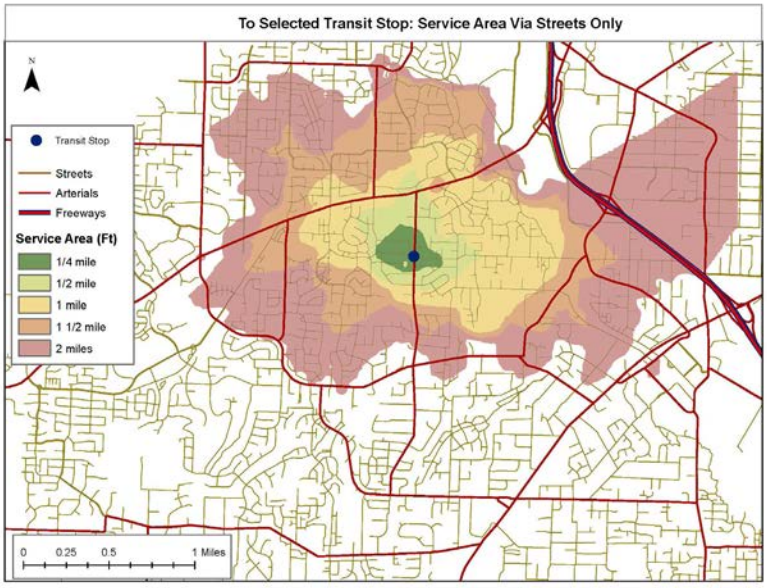
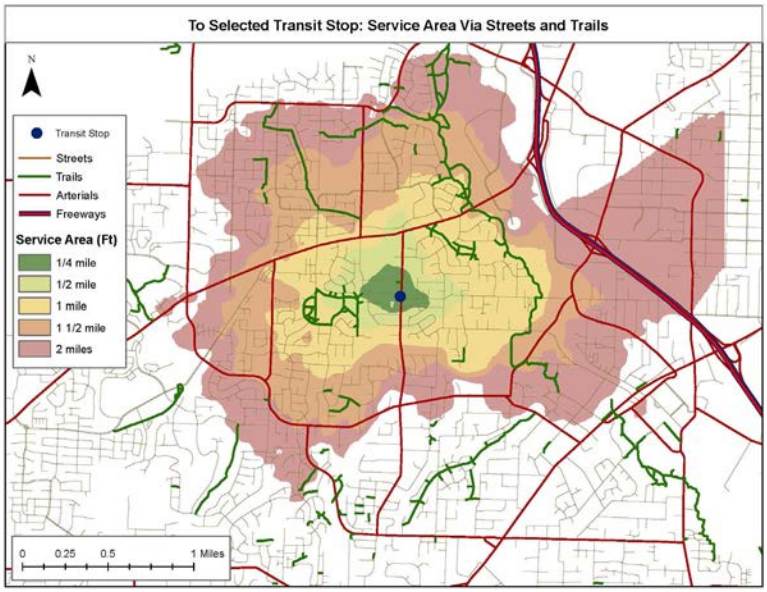


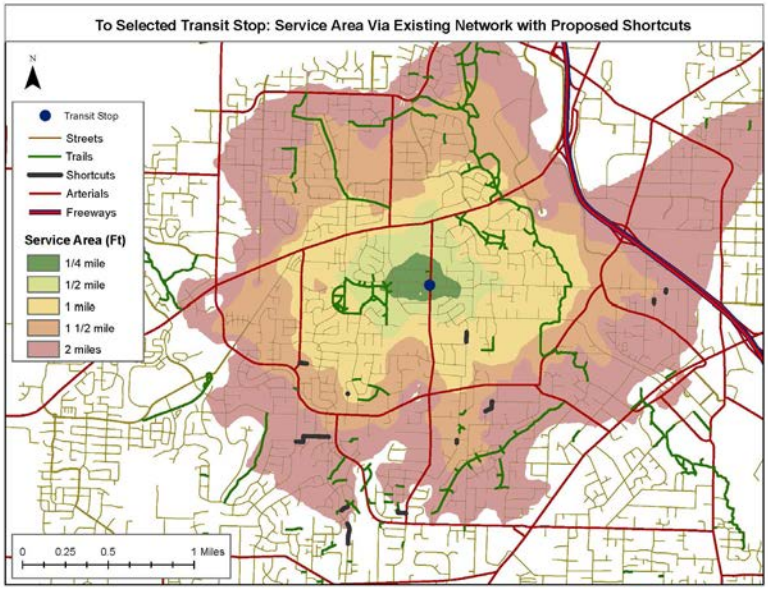




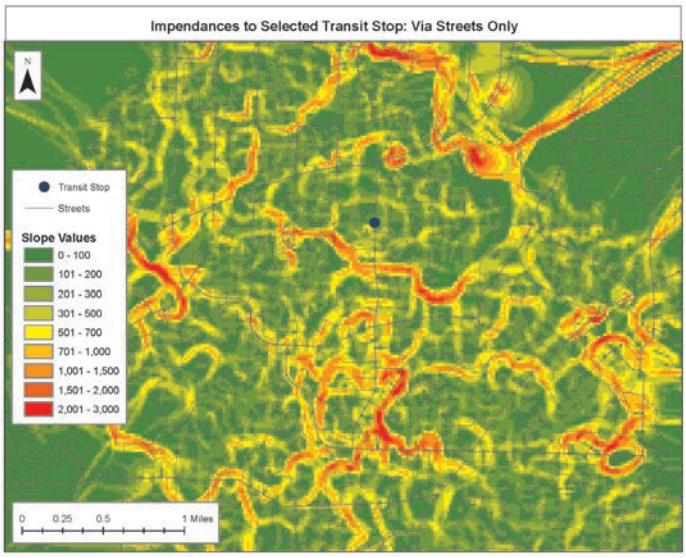
Line 45 Bus Stop - IDW

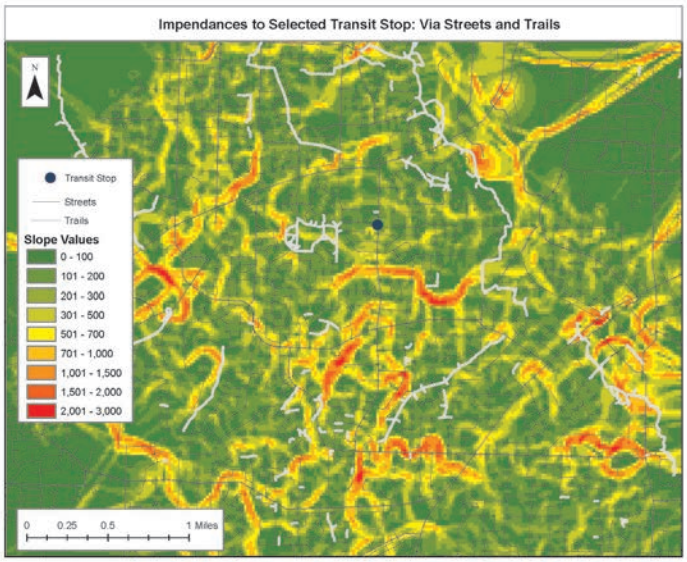


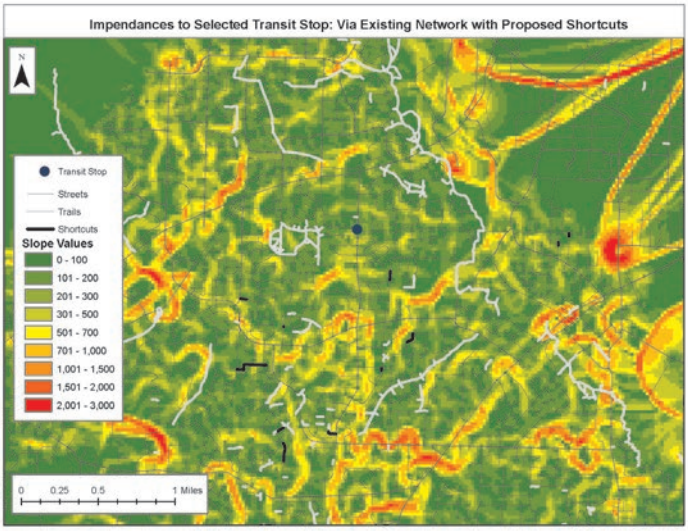




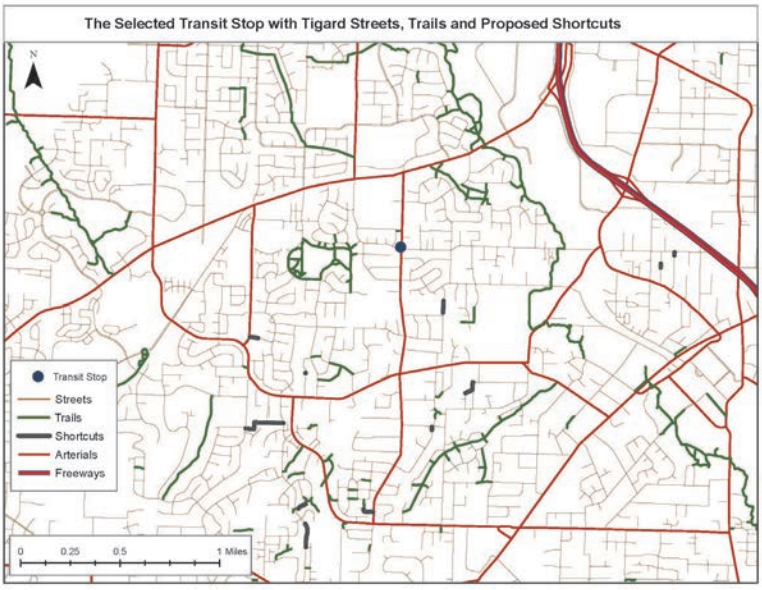
Line 45 Bus Stop - Slope

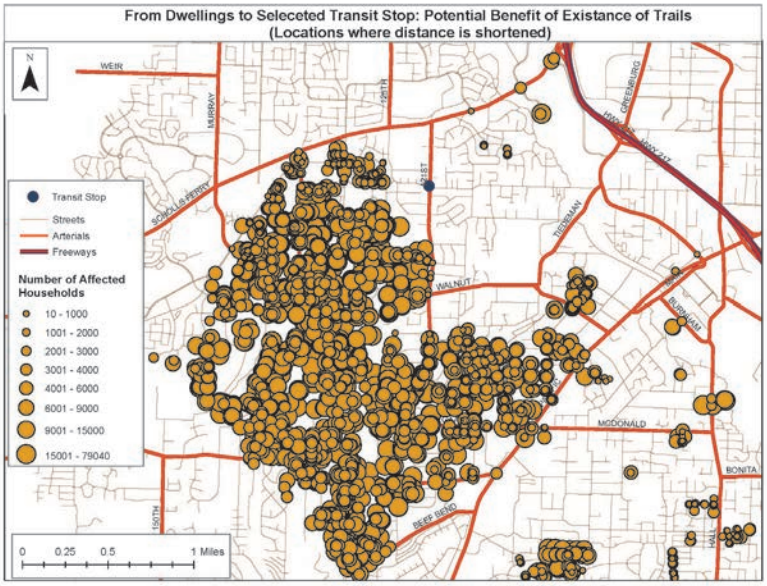


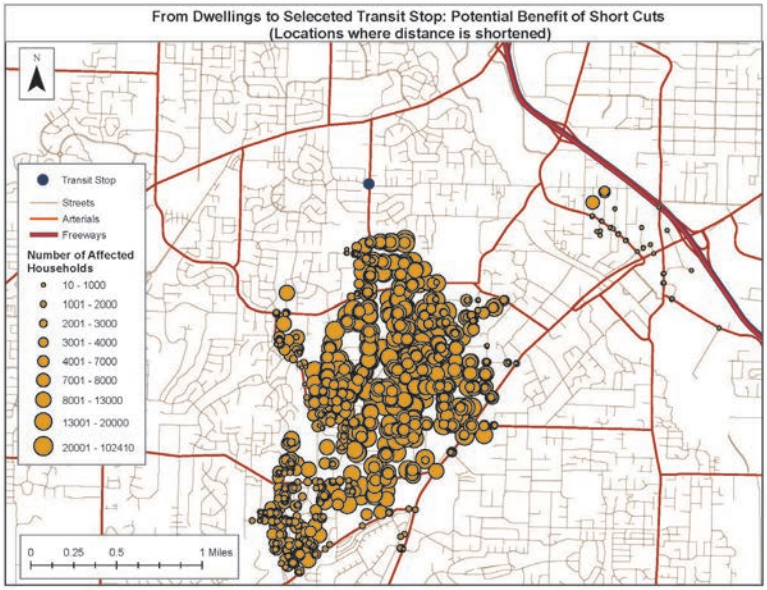




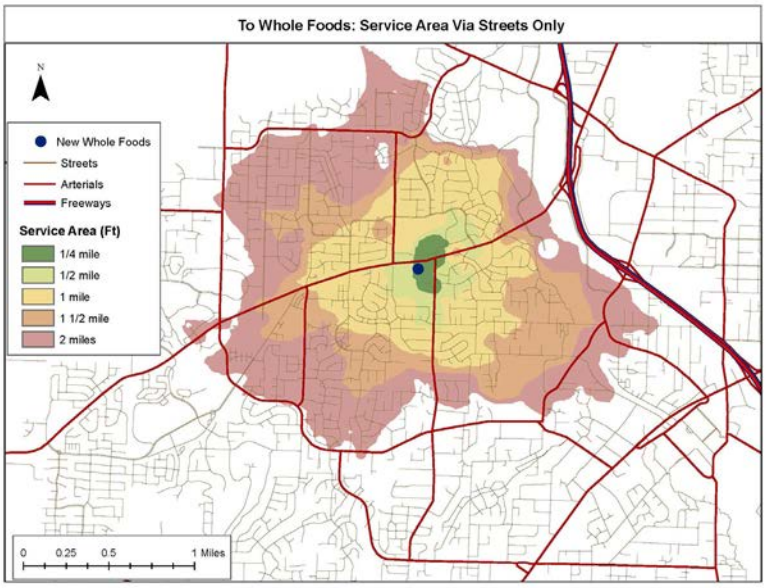
Line 45 Bus Stop - Network Performance

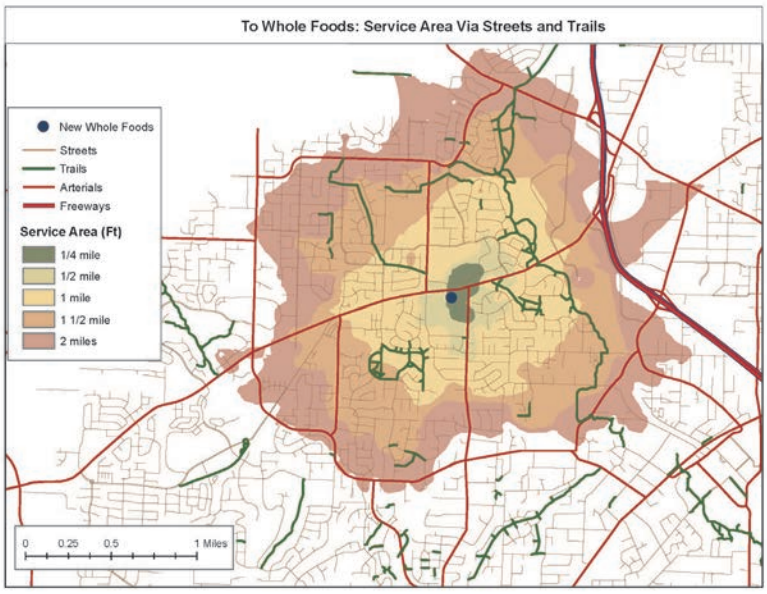


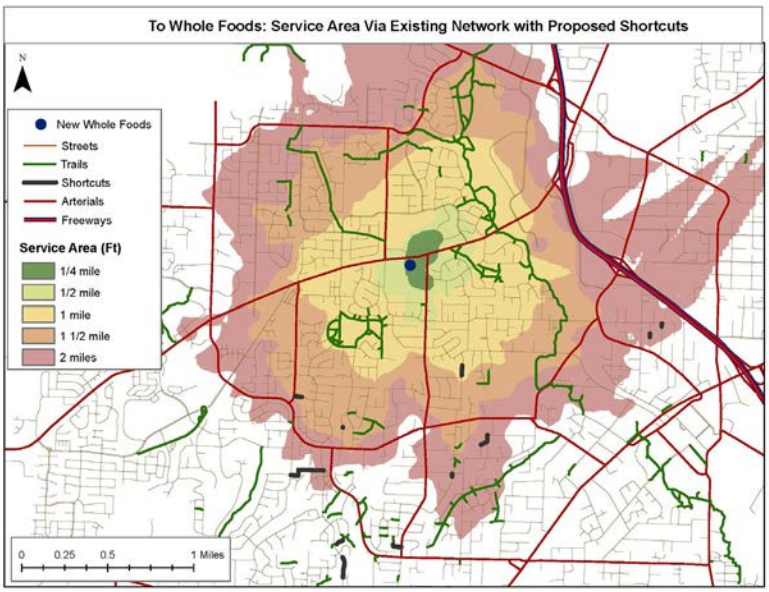




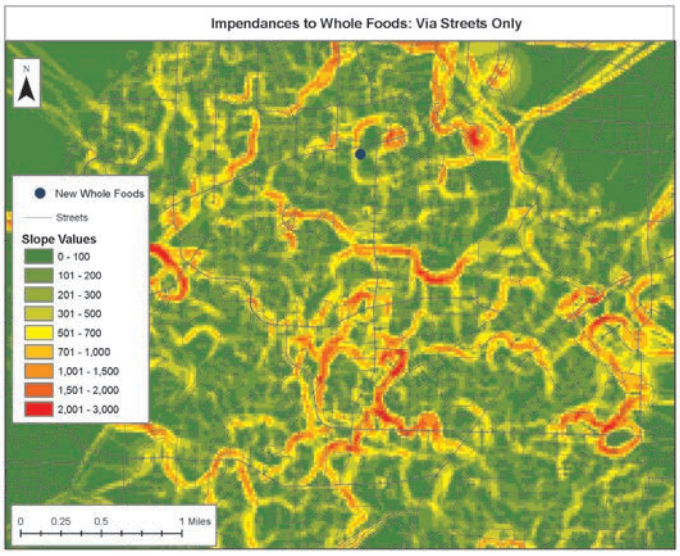
Whole Foods - IDW

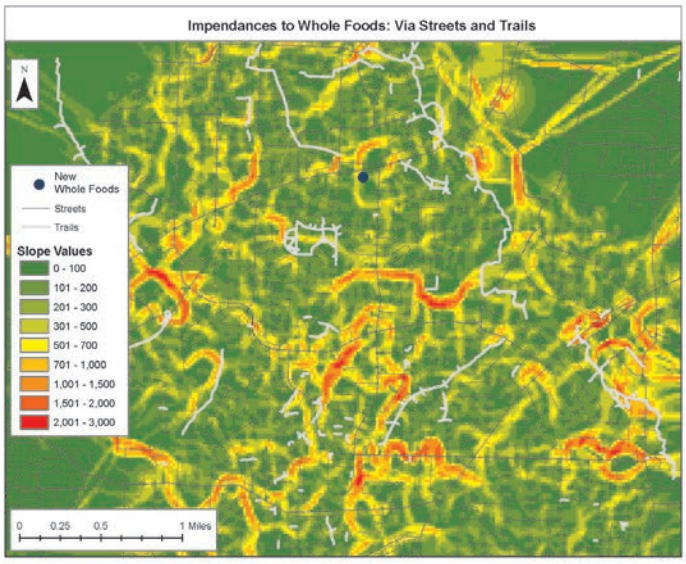


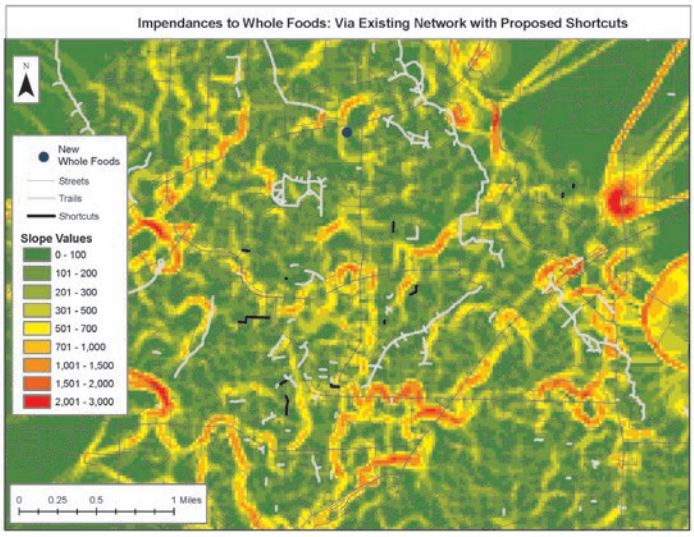




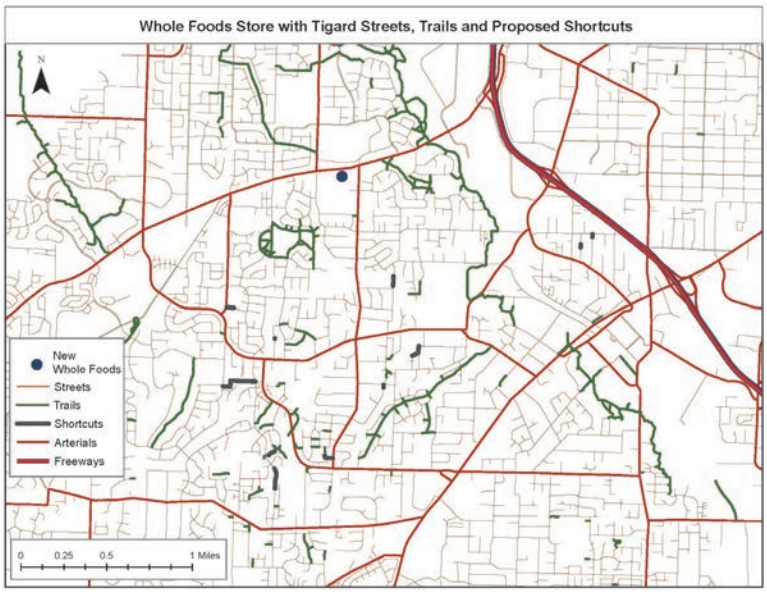
Whole Foods - Slope

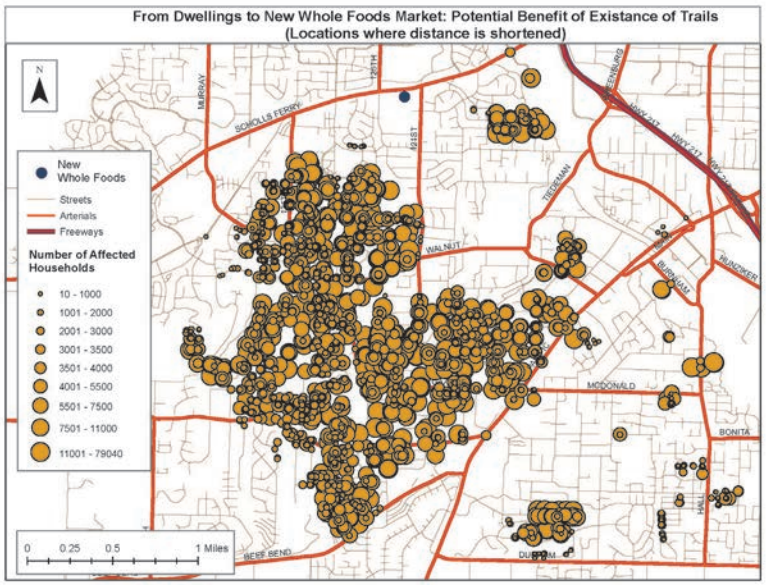


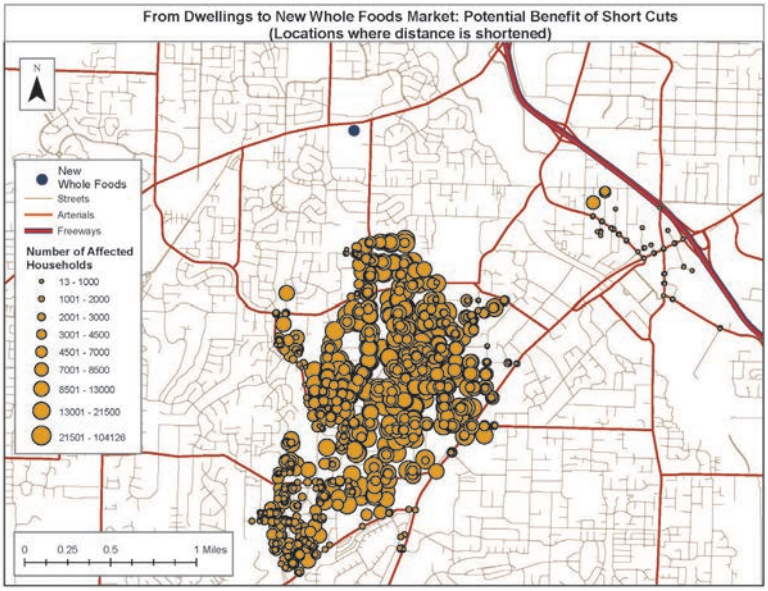




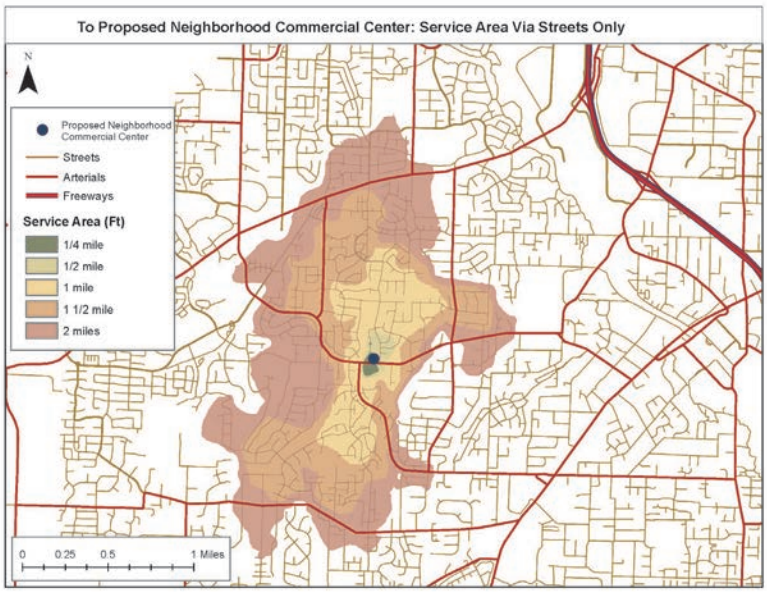
Whole Foods - Network Performance

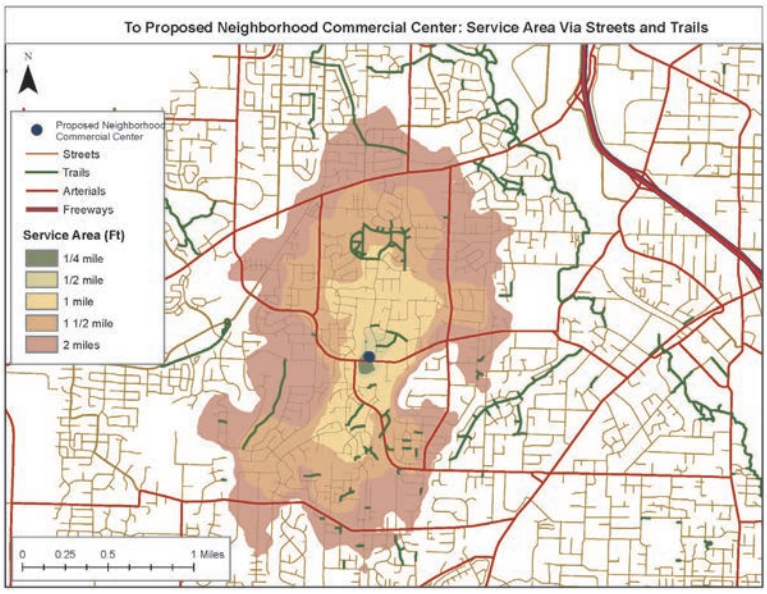


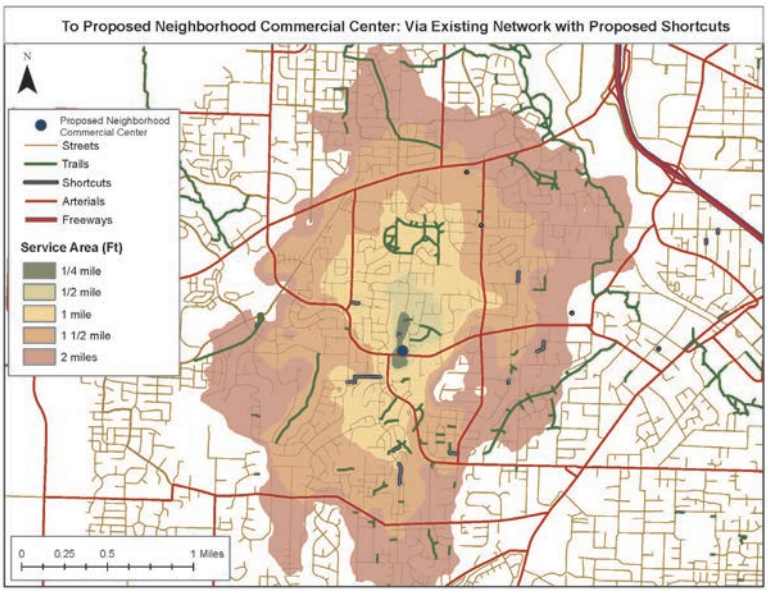




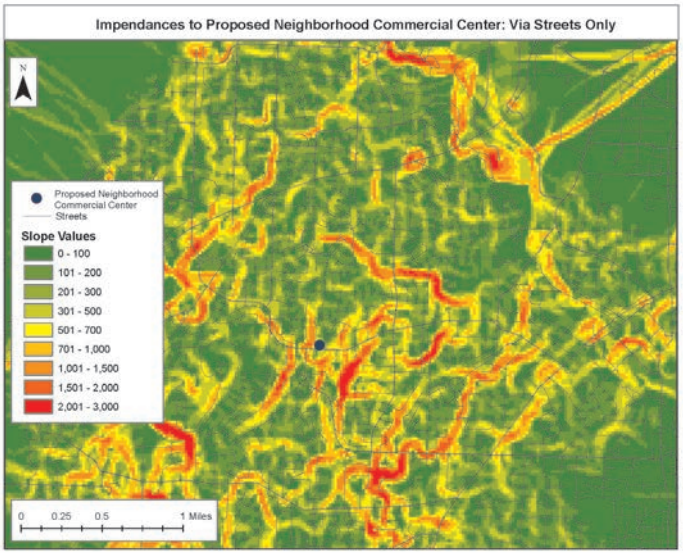
Sample Neighborhood Commercial Location - IDW

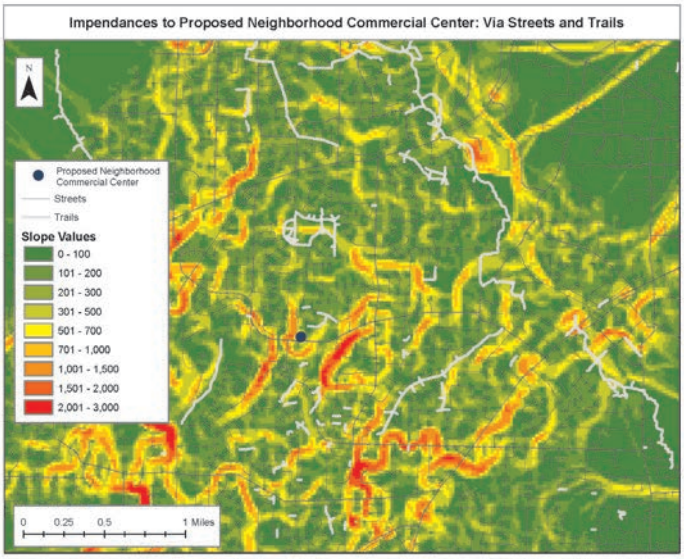


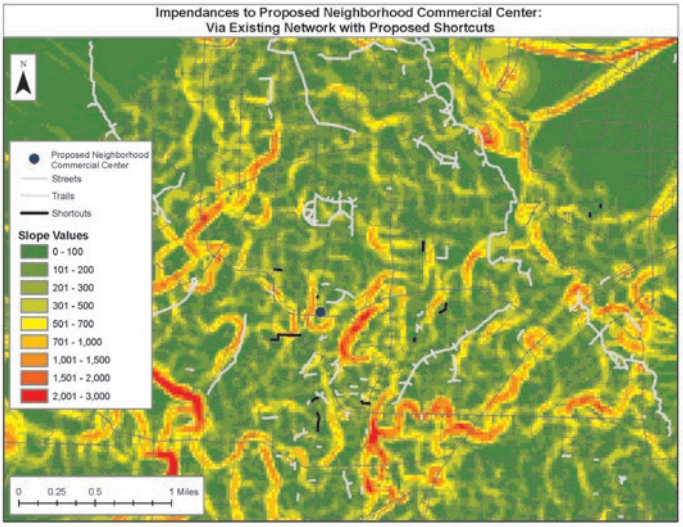
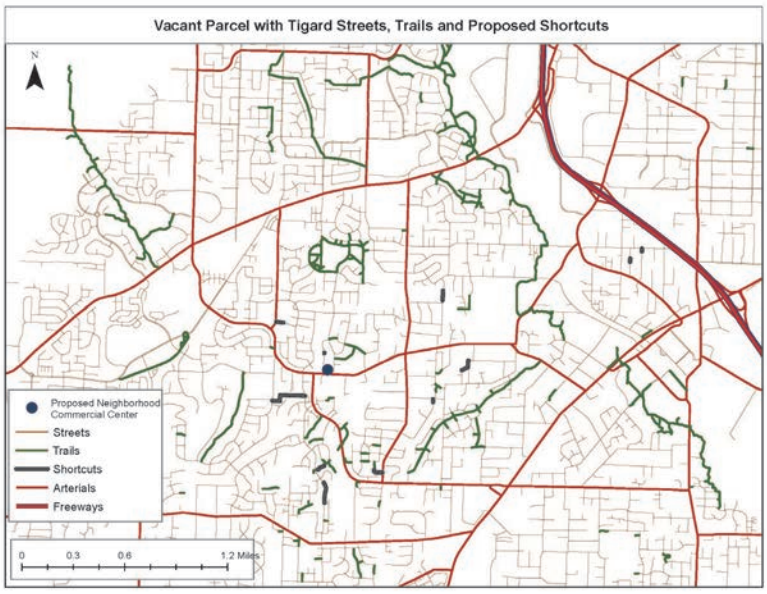
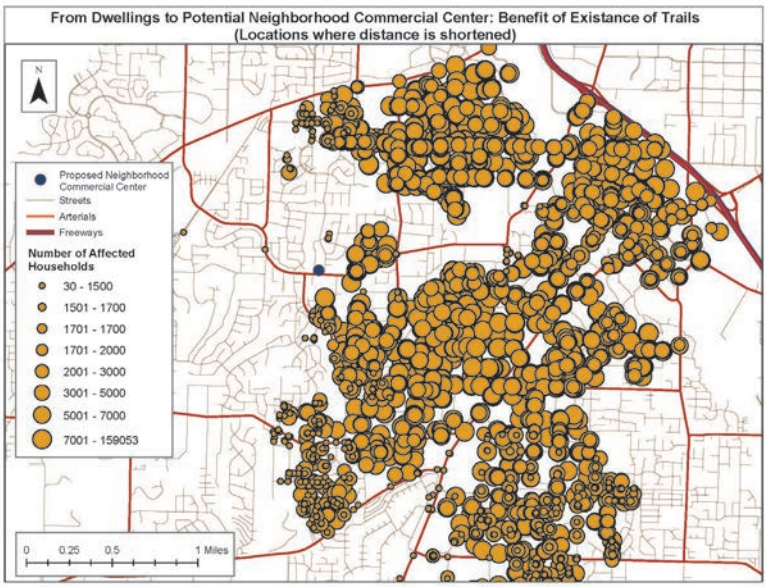
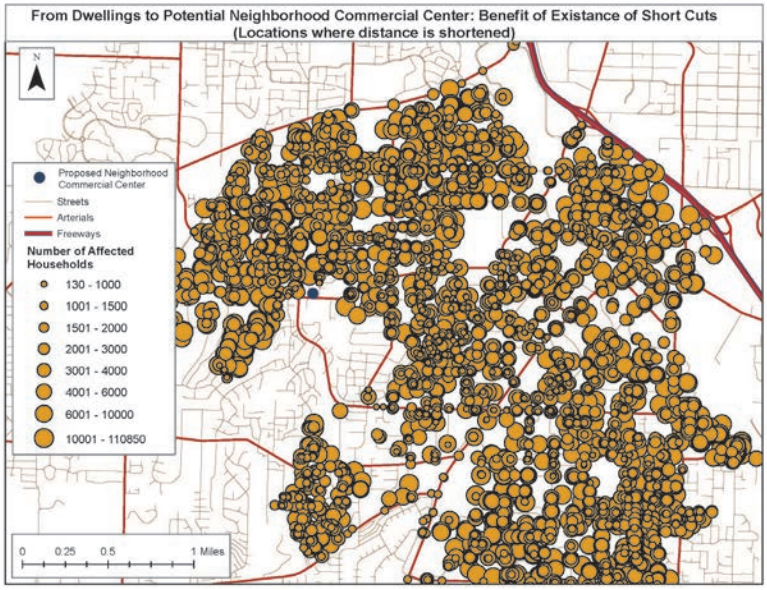




Sample Neighborhood Commercial Location - Slope







Sample Neighborhood Commercial Location - Network Performance