A GIS-BASED BICYCLE FACILITY DEMAND-SUITABILITY PRIORITIZATION TOOL

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Bicycle facility planning is increasingly important for many small and medium-sized communities as they seek to develop livable communities, either to reduce congestion, manage air quality or improve the quality of life. In fact, many metropolitan planning organizations are developing bicycle and pedestrian master plans in accordance with Federal Highway Administration's new requirements. Some of the most significant challenges when developing a bicycle master plan are determining where the bicycle facility network should be placed as well as the types of facilities that should be constructed. While continuous facilities throughout a small or medium-sized community would be ideal, there are many constraints that limit this, including costs, right-of-way, traffic flow, and accessibility. Additionally, planners wish to avoid the worst-case scenario: spending funds on a bicycle facility that ends up not being used.

This work introduces an ArcGIS-based Bicycle Facility Demand-Suitability Prioritization Tool that identifies the specific road segments within community that should be prioritized for constructing bicycle facilities. The tool includes a user-friendly interface that utilizes local GIS road network and land use data to create a bicycle network prioritization map that 1) provides access to the places cyclists seek to travel to/from and 2) promotes the roadway routes that cyclists feel most comfortable cycling on. Planners can use this tool to effectively and efficiently develop maps of a preferred cycling network in any region as well as compare the preferred network with currently existing cycling facilities. Data required to use the tool includes census block group data, land use data, and roadway network data (with roadway characteristics).The tool operates in three stages:

- First, community cycling movements are calculated, in the form of an origin-destination cycling trip matrix. This matrix, which describes the amount of cycling travel between every pair of census block groups in the region, is calculated using a gravity model of cycling demand and cycling attractiveness. Cycling demand from each block group is calculated based on household cycling trip data from the 2009 National Household Travel Survey (NHTS). Cycling attractiveness to each block group is calculated by weighting popular cycling destinations.
- Second, the preferred cycling roadway network paths between every pair of block groups is identified. Rather than just shortest path, these routes are identified based on cycling suitability, which seeks roads with wider outside lane widths, lower traffic volumes, lower traffic speeds, shorter segment distances, fewer number of driveways, and fewer number of lanes. These paths are identified by weighting these factors in a route choice equation in ArcGIS network analyst.
- Third, the final Bicycle Facility Demand-Suitability Prioritization Map is generated, highlighting the road segments on which bicycle facilities should be prioritized. These segments are identified by joining the number of cyclists traveling between each pair of block groups (from Stage 1) with each roadway segment that is part of the preferred cycling route between that pair of block groups (from Stage 2). The total number of cyclists for each segment is then summed for all the routes across every pair of block groups. Cycling facilities can be prioritized based on usage, cycling suitability or a combination of both. Planners can use the tool to determine which is more important: road segments that need to support more cyclists (from Stage 1), road segments with lower cycling suitability measures (from Stage 2), or segments with lower cycling suitability that need to support more cyclists (both Stages 1 and 2).

The GIS-based Bicycle Facility Demand-Suitability Prioritization Tool is flexible to be used in any region, although it is calibrated to ideally support small and medium-sized communities. Perhaps the most significant output of the Tool are the GIS maps that can be used for public outreach and information gathering. These maps can improve regional cycling, coordinate cycling efforts, and efficiently allocate funds.