Getting In Gear: Exploring Potential Locations for New Hubway Terminals

**Project Overview**

This project was done for the purpose of determining new locations in Cambridge, MA that have the potential to be further assessed for the implementation of new Hubway terminals. This decision will be based on determining locations that are business dense, inconvenient to existing terminals, and in close proximity to bike facilities, as these are factors that will best determine potential new locations that will be expected to increase the usage and convenience of the bike share program.

The National Association of City Transportation Officials has found, in prior studies analyzing different bike share programs in different cities across the country, that the key factors in increasing ridership include station density, program area layout and the presence of complementary protected bike lanes (NACTO, 2015). Protected bike infrastructure takes people where they want to go and ensures that people of all cycling abilities will feel comfortable using the systems (NACTO, 2015). All across the world, data shows that proximity to a network of high quality bike lanes increases bike ridership. Bike share systems often bring in less experienced riders who will not ride without high comfort, protected bike lanes (NACTO, 2016). Along with being convenient, time saving, great for riders health and the environment, and cost effective (Hubway, 2017), they offer new transportation options for people at all income levels (NACTO, 2015). Bike share programs extend the reach of existing transportation programs, make one-way bike trips possible, and eliminate a number of the barriers to riding such as bike ownership, storage, maintenance and concerns about theft (NACTO, 2015).

Shopping opportunity dense locations will be defined as areas with the most businesses within 1/4 mile radius. Inconvenience, or inaccessibility, of these dense business areas to existing Hubway terminals, will be defined as businesses that are more than 1/2 mile walk of existing terminals, as the distance someone will walk to use a bike is about 1,000 feet or 5 minutes of walking (NACTO, 2015). Convenience to bike facilities will be defined as, being from 0 to 1/4 miles to the nearest bike lane or off-street path, as it would be best for riders to start on a bike lane immediately.

**Key Data Sets**

The Hubway Terminals Data includes latitude and longitude for all Hubway terminal locations in Boston as of July 2017. This is the most current official representation of Hubway locations. The original use was for the Hubway Data Visualization Challenge created by Hubway for the public to create visualizations, animations, maps, or info graphics that told them something new. The ESRI Business Attracors Layer includes data from the ESRI Business Analyst 2010 selection. It was accessed from Paul Cote GIS Information Services Trolley Pop tutorial. This layer includes recorded businesses from 2010. From this layer, a new layer was made with only the businesses in Cambridge, MA. The Bike Facilities Layer is a line layer that indicates streets within the City of Cambridge that have pavement markings or construction features that facilitate bicycle use. It also contains multi-purpose paths where bicycles can be used off the street. It was created for planning purposes, map making, and for public distribution.

**GIS Procedures**

Euclidean Distance

Euclidean Distance was used separately with both the Hubway Data Layer and the Bike Facilities Layer, in order to determine the distances to the nearest Hubway terminal and bike lane or path from each cell. The ranges of values produced for each were then reclassified into a common scoring system ranging from a value of 0 to 3.

For Hubway distance (c), an area receives an excellent score of a 3 if it is greater than 1/4 mile from an existing Hubway terminal, a good score of a 2 if it is between 0.3-0.25 miles away, an okay score of a 1 if it is between 0-0.1 miles away and a not good score of a 0 if it is 0 miles away.

For bike facilities distance (a), an area receives an excellent score of a 3 if it is 0 miles from a bike lane or path, a good score of a 2 for a distance of 0.15-0.25 miles away, an okay score of a 1 for a distance of 0.1 miles away and a not good score of a 0 if it is 0 miles away.

**Point Density**

The Point Density tool was used with the Business Attractor Layer to determine shopping opportunity “hot spots” or the the most dense shopping areas in a 1/4 mile radius as this is the farthest we would expect people to walk to nearby shops. The ranges of values produced were then scored (b) using the same system as above, with the areas with the greatest density receiving an excellent score of 3.

**Map Algebra**

The scores produced for each data set were then combined using the Map Algebra tool to create a suitability map (d). Greater weights of equal size were given to the Bike Facilities Distance Score and the Hubway Distance Score, as these were found by NACTO to be the key factors in increasing ridership (NACTO, 2015).

**Evaluation of Model**

The model will not be able to determine the best locations for new Hubways based on the factors discussed, but the best locations for further assessment based on those factors. I acknowledge as well, that the conclusions made are only based on estimates. A Suitability Map combining the weighted factors would reveal patterns that would not be visible just from looking at an aerial map. All of the data sets have a similar potential for systematic bias concerning overestimation of the suitability of locations with distance as the main focus, and not much focus on what the areas actually looks like is being considered. However, this t is why the model is only being used to make suggestions for further investigation. It also does not account for how wide, busy and suitable for biking some roads and paths or areas are. Only the places where bike lanes and bike paths exist are being determined; however, no specifics about which roads or paths are nicer, less busy or easier for a biker are available from just the lines, so this also would be an invitation for further research once locations are identified as having potential. The data used may determine an overestimation of potential locations for further use, as competing bike-share program locations are not being considered and basing location off of the number of businesses does not guarantee bike-share users are traveling to those locations specifically, this would be things to consider during the further investigation. Lastly, relationship to alternative forms of transportation in an area were not taken into consideration and this could lead to overestimation as well.