Bike Smart - A redefined bike rating and route planning

application for Philadelphia

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# Report

## Abstract

My interests in conducting bike score evaluation and route recommendation for Philadelphia stem from my concern about bikers' safety on Philadelphian streets. I introduced the concept "Low stress street biking" (Furth & Mekuria, 2013), which about reducing bikers' stress level and improve biking safety.

In this project, my first goal is to use this concept as a guideline to create a rating system that reflects the bikeability of each street in Philadelphia. More specifically, I will use the street information from Opendataphilly.org and conduct a weighted overlay analysis. And my second goal is to create a useful App that recommends bikers the optimal bike routes that minimizes stress level. I would accomplish this goal by using a my bike score outcome and a handful of APIs and programming languages including Google Map Javascript API.

To summarize, I hope that the bike scores can be used as a decision making tool for the city planners to prioritize bike infrastructure improvements, and that the App can be useful for bikers.

## Introduction

According to Walkscore.com, Philadelphia is a quite walkable and biker friendly city. Many media rank Philadelphia high in bikeability. A prevalent website that provides bike scores, walkscore.com, only count limited factors into the rating system, with equal weights. I suspect this would reflect the actual biker experience, and therefore I hope to provide one that is much more realistic. The concept “low stress street biking” (Furth & Mekuria, 2013) is a measure of how stressful a street is for bikers. With the absence of real-time traffic speed and volume data, stressfulness is reflected in lane type and crash density.

I hope to use these criteria to…

## Methodology

### Data Gathering and Normalization

### Analysis

### Front-end programming and web spatial analysis

## Bike Score Outcome

## Application Result

## Discussion and Conclusion

# Application Documentation (write on github)

## Come up with instructions with illustration

# Appendices

## Notes and Reference

Google polyine decode function:

<https://gist.github.com/ismaels/6636986>

https://www.w3schools.com/howto/tryit.asp?filename=tryhow\_js\_sidenav\_push

## Thank you notes

**Conceptual Model:**

Calculate each street segments’ traffic stress level and rider Detour tolerance based on trip purpose

Unexpected Difficulty

* Algorithm challenge

Route planning based on traffic stress level

Outcome of Interest

* Overall bike score of Philadelphia (side product)
* Route suggestions for different biking purposes: commute and recreation

Aggregate data to each street segments

Construct algorithm to calculate route connectivity

Gather relevant data

Change project immediately

**What data inputs are required for each portion:**

Step. 1 - For constructing rating system:

* PhillyStreet CenterLine \*
* Bike network.shp \*
* DEM\_philly.tif \*
* Street\_trees.shp \*
* Intersection\_controls.shp \*
* Bike crash in Philadelphia
* Car crash with bikes in Philly
* Pedestrian crashes involved with bike in Philly \*\*\* (only 34 cases. Too few. Ignore)
* Bike trail in Philly (downloaded Feb. 14th from PASDA.PSU.edu)
* Street lighting (downloaded Feb. 14th , from opendataphilly)
* Lane type: combine with lane stress level. (refer to Drexel research)

Step.2 – Route suggestion:

* Bike connectivity (need to create algorithm for)
* Bike rack locations (downloaded csv Feb. 14th from opendataphilly)
* Provide multi-trip planning option
* Maybe incorporate with Yelp or google map to help route planning
* Need to think of planning algorithms for recreational and commuting

Step. 3 - Validation / comparison with Google Map’s bike route suggestion:

* Compare and contrast the travel time difference and length difference
* This is not to compare which one is faster and shorter, but just to show the difference between my App and google Map

\* (downloaded. Need to check for possible updates)

**Make a data catalog with data you are collecting**

• Data source mostly come from Opendataphilly.org

• The datasets with \* sign are those I downloaded in early December 2016.

• Metadata are available on opendataphilly.org

• I will conduct literature reviews about biking experience, also learn and create my own algorithm to calculate score for bike connectivity

**What steps are you taking to get the data into the form you need it to be in**

* I will consolidate data in the street segment level

**References:**

1. Connectivity calculation (for roads in general. Not designed for bike route connectivity)
   1. <https://www.cnu.org/our-projects/street-networks/street-networks-101>
2. Low-stress biking
   1. <http://transweb.sjsu.edu/PDFs/research/1005-low-stress-bicycling-network-connectivity.pdf>
3. Bike Routing based on street stress level in Montgomery County, Maryland
   1. <http://mcatlas.org/bikestress/>
4. More measurements for measuring road stress
   1. <http://mcatlas.org/bikestress/documentation/ModifiedLevelOfTrafficStressMethodology.pdf>
   2. A methodology developed by the Northeastern University transport scholar Peter Furth
5. <http://www.citylab.com/commute/2016/05/mapping-how-stressful-streets-can-be-for-cyclists/482469/>
   1. By Laura Bliss, a staff writer at CityLab
6. Drexel researchers recently completed a citywide bikeability analysis, which you can find described here:

<http://drx.maps.arcgis.com/apps/MapJournal/index.html?appid=faaee7e182594ffa9934d16d04e63185>

1. Another graduate student from Penn and Michelle Kondo from the US Forest Service recently presented on a detailed data analysis around bicycle volumes and crashes in Philadelphia- see the attached slideshow.
2. We (Josh Rocks as lead analyst) mashed up a number of datasets that are predictive of bike demand as part of an early analysis we did for bike share in Philadelphia--see attached paper.
3. Corey Acri has a project developing a recommended route 'concierge' service, for lack of a better description, called WhyABike (<http://www.whyabike.com/>) --he might be interested in (and have input for) your recommended routes.
4. Finally, Sarah Moran is project manager for our low-stress analysis, which is under development right now. Feel free to contact her directly.