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 application can be useful for bikers.

## Introduction

As car-dependent urban planning raise all kinds of traffic issues, many cities are thriving to promote walking and biking. Philadelphia is known for its walkability, and people think that it is highly bikeable as well. In fact, 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.