



CRASH TEST:

A SPATIAL RISK ANALYSIS OF BIKE CRASHES IN CAMBRIDGE, MA

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INTRODUCTION

An estimated 7% of Cambridge commuters aged 16 and over bike to work, with the number and popularity increasing yearly (American Fact Finder, 2019). However, an average of 1 or 2 people die each year in Cambridge from preventable, bike-related crashes. The city has agreed to upgrade existing bike lanes and install new protected bike lanes in high volume areas in Cambridge (Cambridge Community Development Department, 2019). But is this enough? Is high volume traffic the only factor influencing bike crash occurrence, or should the city be considering other factors, such as average road speed, road condition, and proximity to bike lanes?

PURPOSE

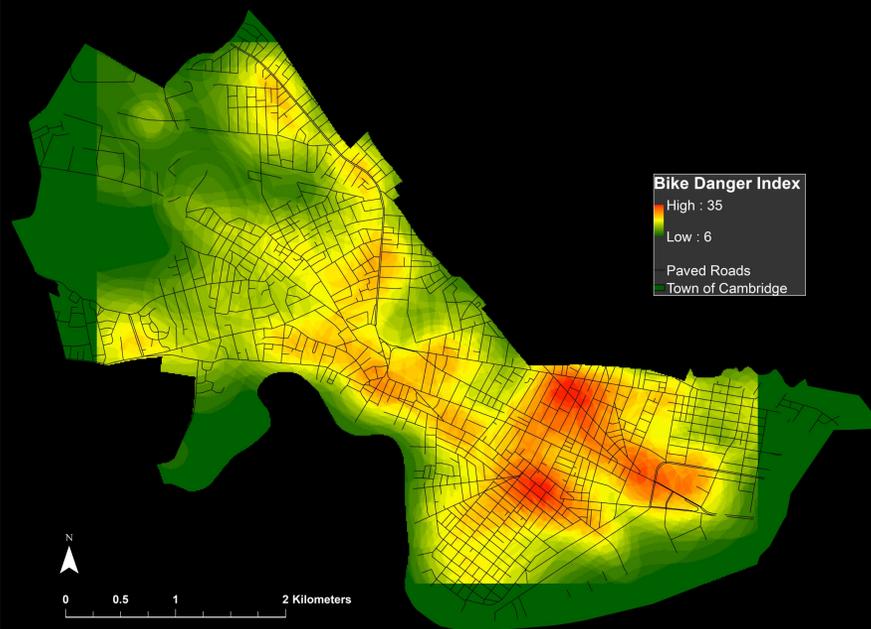
The goal of this spatial risk analysis is to discover where and why bike crashes occur in Cambridge, MA in order to provide road recommendations for the development of bike facilities in dangerous bike areas to increase biker safety. Six spatial factors are analyzed and combined to create a bike danger index, highlighting the most dangerous areas for bikers in Cambridge.

PUBLIC OPINION ON BIKE LANES



Source: City of Cambridge Bicycle Survey, 2014

Density Index of Dangerous Roads in Cambridge, MA for Bikers, 2019



BIKE DANGER INDEX

The 6 kernel density outputs were reclassified into a 1-9 scale, and the output values were combined using the raster calculator tool to create the bike danger index. Zonal statistics and select by location tools were used to find the 10 streets with the highest 'danger index' rating.

RESULTS

The result of my analysis is the bike danger index risk analysis map illustrating high risk biking areas due to the six different, additive factors, and the table listing the top 10 dangerous streets for biking. These 10 streets can be used to make location recommendations on the installment of separated bike lanes to enhance bike safety and decrease crash volume.

TOP 10 MOST DANGEROUS ROADS FOR BIKING

1. Massachusetts Avenue
2. Hampshire Street
3. Broadway Street
4. Cambridge Street
5. Galileo Galilei Way
6. Green Street
7. Prospect Street
8. Franklin Street
9. Pearl Street
10. Cardinal Madeiros Avenue

CONCLUSION

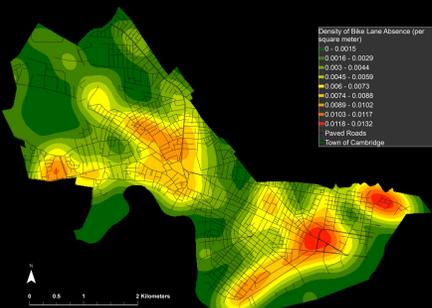
As the number of bike riders in Cambridge, MA continues to rise, we must expand bike facilities accordingly in order to protect and encourage biking as a healthy and sustainable practice. This study helps by identifying key problem areas for biking which can be remedied by the implementation of protected, separated, or grade-separated bike lanes.

SOURCES

- **Data Sources:** Tufts M Drive, Cambridge Department of Public Works, Cambridge Police Department, Cambridge GIS, Mass GIS
- **Graphics Sources:** City of Phoenix Bike Safety 2019, City of Cambridge Bicycle Survey 2014
- **Works Cited:** American Fact Finder, 2019, Cambridge Community Development Department, 2019
- **Coordinate System & Projection:** State Plane Projected Coordinate System; Lambert Conformal Conic Projection

SPATIAL ANALYSIS

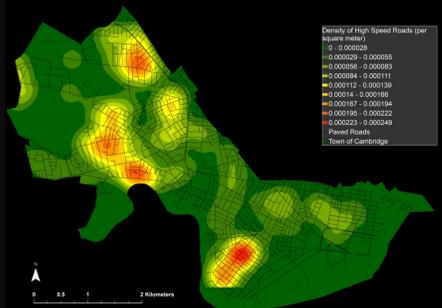
Density of Bike Lane Absence (per square meter) in Cambridge, MA, 2019



BIKE LANES

- Field calculator tool used to create a 0-2 scale ranking protected bike facilities (separated, buffered, bike path and/or grade separation) as 0, other bike facilities (edge-line, shared lane, standard bike lane) as 1, and no existing bike facilities as 2.
- Kernel density analysis performed on the ranking scale for the bike lane layer data to show areas with the greatest density of no existing bike facilities.

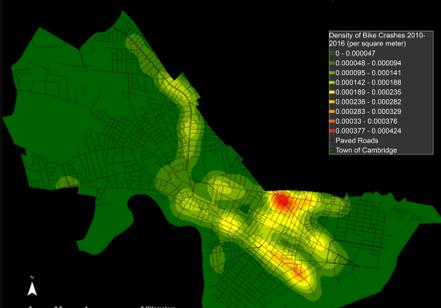
Density of High Speed Roads (per square meter) in Cambridge, MA, 2014



ROAD SPEED

- Field calculator tool used to create a 0-2 scale ranking roads with an average speed of <25 mph as 0, roads with an average speed of 25-30 as 1, and roads with an average speed of >30 as 2.
- Kernel density analysis performed on the ranking scale for the speed layer data to show areas with the greatest density of high speed roads.

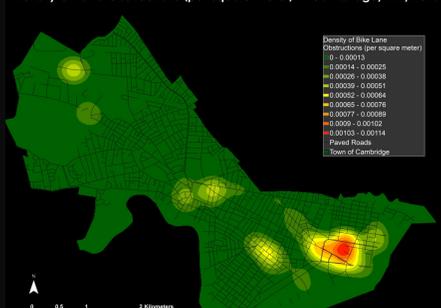
Density of Bike Crashes (per square meter) in Cambridge, MA, 2010-2016



BIKE CRASHES

- XY coordinates of bike crash locations were geocoded.
- Kernel density analysis performed on the bike crash layer data to show areas with the greatest density of bike crashes.

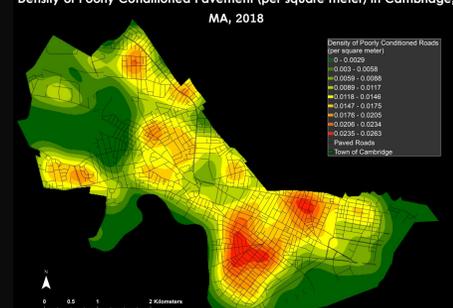
Density of Lane Obstructions (per square meter) in Cambridge, MA, 2019



LANE OBSTRUCTIONS

- XY coordinates of bike lane obstructions were geocoded.
- Kernel density analysis performed on the bike lane obstruction layer data to show areas with the greatest density of bike lane obstructions.

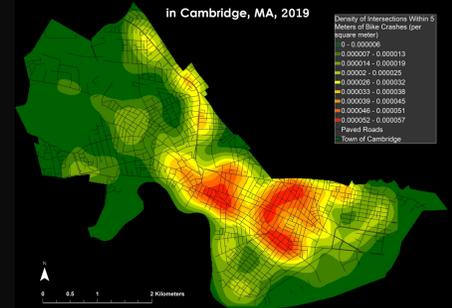
Density of Poorly Conditioned Pavement (per square meter) in Cambridge, MA, 2018



PAVEMENT CONDITIONS

- Field calculator tool used to create a 0-2 scale ranking roads with pavement condition index (PCI) scores of 70-100 (Good) as 0, roads with PCI scores of 55-69 (Fair) as 1, and roads with PCI scores of 0-54 (Poor) as 2.
- Kernel density analysis performed on the ranking scale for the pavement conditions data to show areas with the greatest density of poorly conditioned roads.

Density of Intersections Within 5 Meters of Bike Crashes (per square meter) in Cambridge, MA, 2019



INTERSECTIONS

- Select by location tool used to select all intersections that were within 5 meters of a bike crash, and a new layer was created from this selection.
- Kernel density analysis performed on the new intersection layer data to show areas with the greatest density of intersections that were within 5 meters of a bike crash.

