Where Is It Safe to Ride? A Cycling Hazard Index for Cambridge, MA

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Outline

- Introduction
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- Methods
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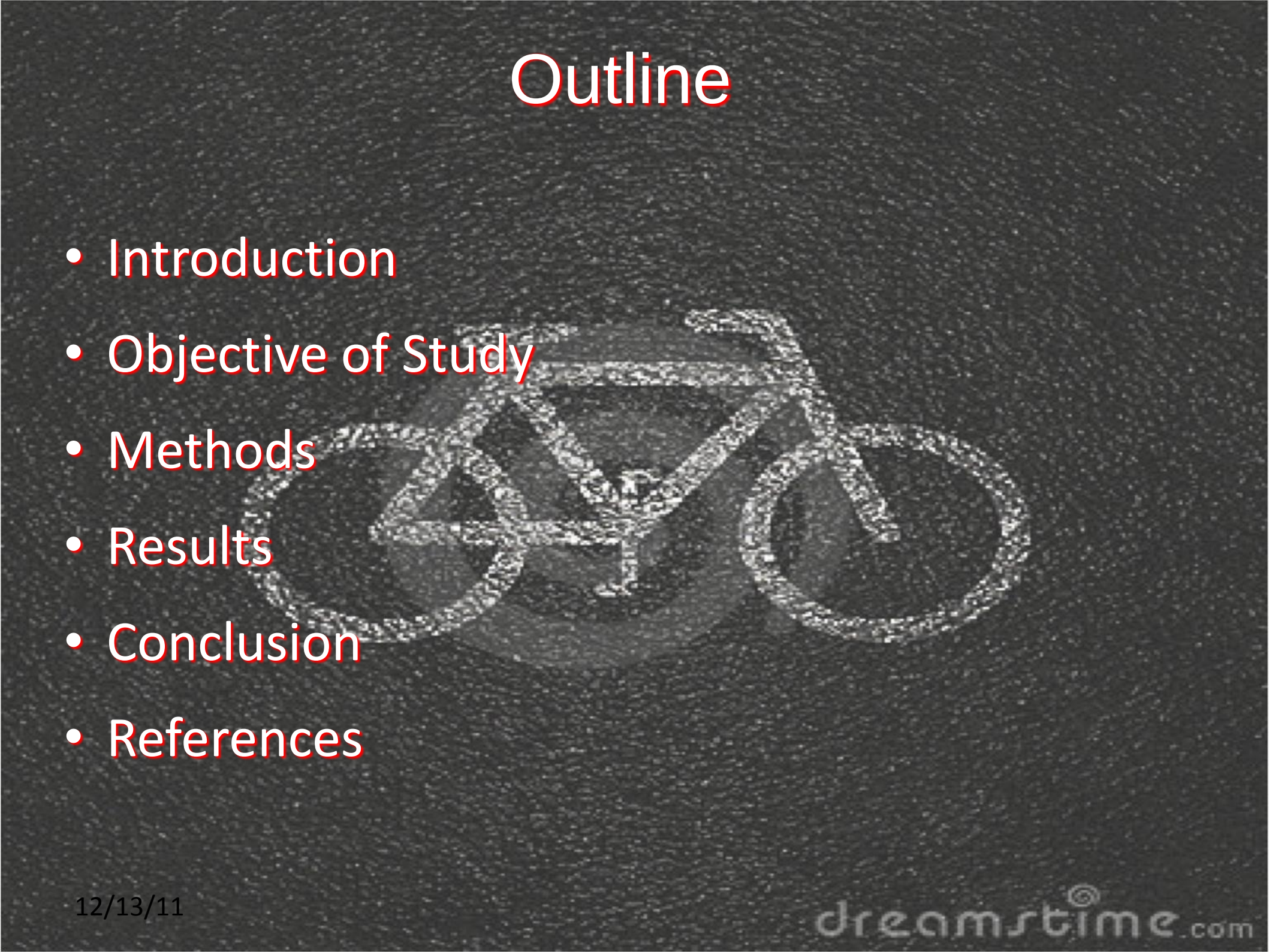
- References



Introduction

Question: How many of you have ever considered riding a bicycle to work?

Why or why not?

Often cited reasons:

- Too Far
- Too Lazy
- Too Dangerous

http://barreralawfirm.com/files/2008/11/bike_accidents_fairfax_alexandria.jpg

Introduction

Either way, it's on the rise:

Bicycling in Cambridge, MA has increased 150% since 2002 (City of Cambridge 2011)

Part is demand, part is supply

- Realization of environmental costs
- High cost of gas
- Rising public transportation costs
- Better public facilities such as bike lanes, bike trails and lock stands

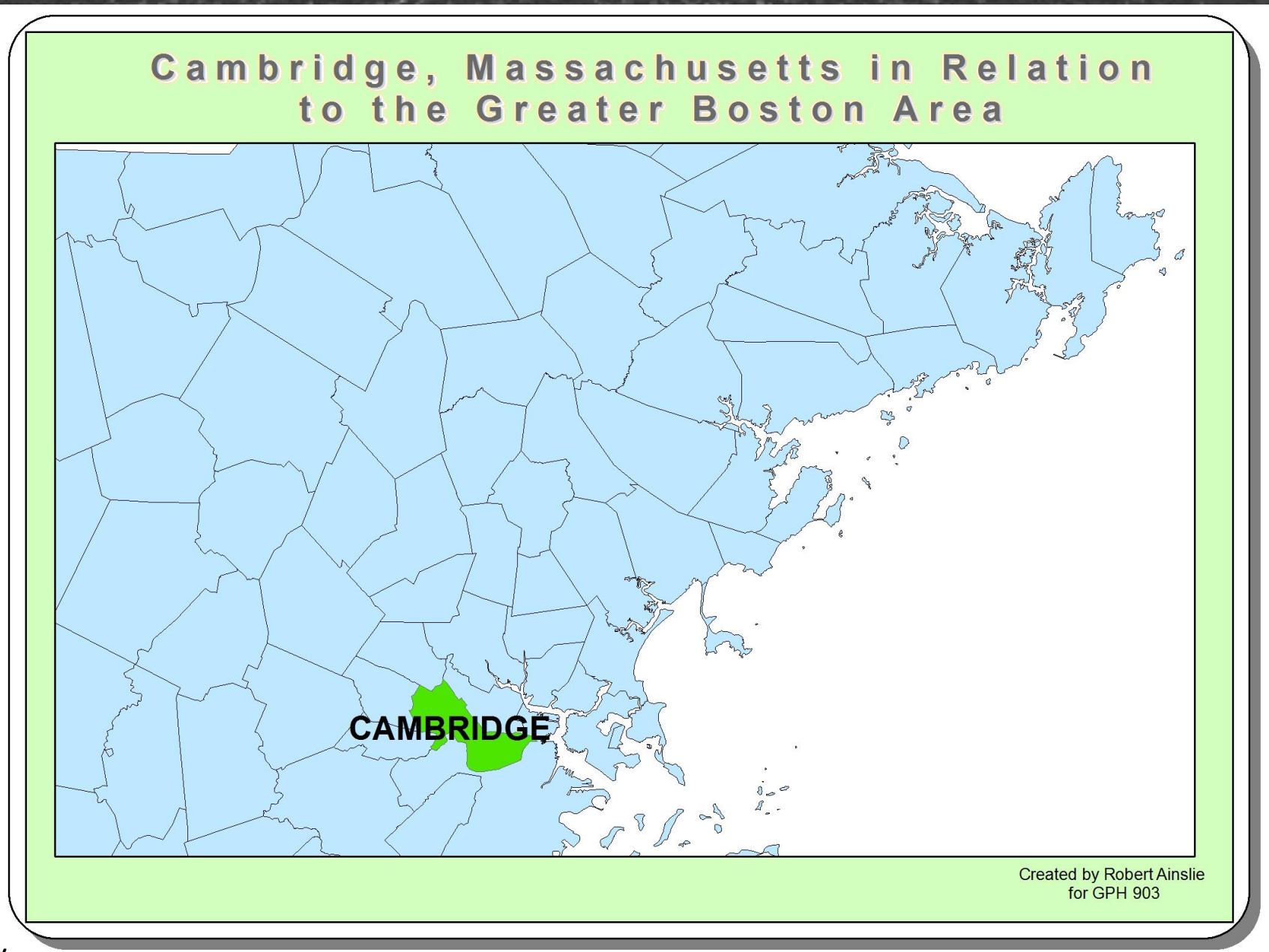
Objective

To show which roads are the most hazardous to ride a bicycle on in Cambridge, MA by creating a road hazard index map, using automobile accident and volume data as proxy for bicycle similar bicycling data

Factors considered (suggested by Allen-Munley and Daniel 2006 and Aultman-Hall et al. 1998) (ideal and actually used):

- Rate of accidents (Crashes per year per car volume)
- Presence of painted bike lanes
- Presence of bike trails
- Speed limit (ideal)
- Width of road (ideal)

Study Area


Cambridge, Massachusetts in Relation to the Greater Boston Area
CAMBRIDGE
Created by Robert Ainslie for GPH 903
0
5
10
20 Kilometers
Note: Created from automobile crash data from the year 2009

Methods

Data Acquisition:

- Background imagery from MassGIS (30 cm color orthophotos)
- Automobile crash and volume data from Mass DOT, (crash by mail request) Used 2009 crash points
- NAVTEQ road layer from Salem State DGL servers
- Bicycle trails layer from MassGIS
- Bicycle lanes by ArcGIS selection of road layer using Google Maps as a reference
- Massachusetts' Towns layer from MassGIS

Data Preparation

- Crash points plotted by x,y geographic coordinates
- Roads, Bike Lanes and Bike Trails clipped by Cambridge town outline
- NAVTEQ streets and State Roads merged to combine unlike street types (i.e. Rt 2 and Massachusetts Ave in different tables)
- Road layer then dissolved to group small line segments

Data Preparation (Cont.)

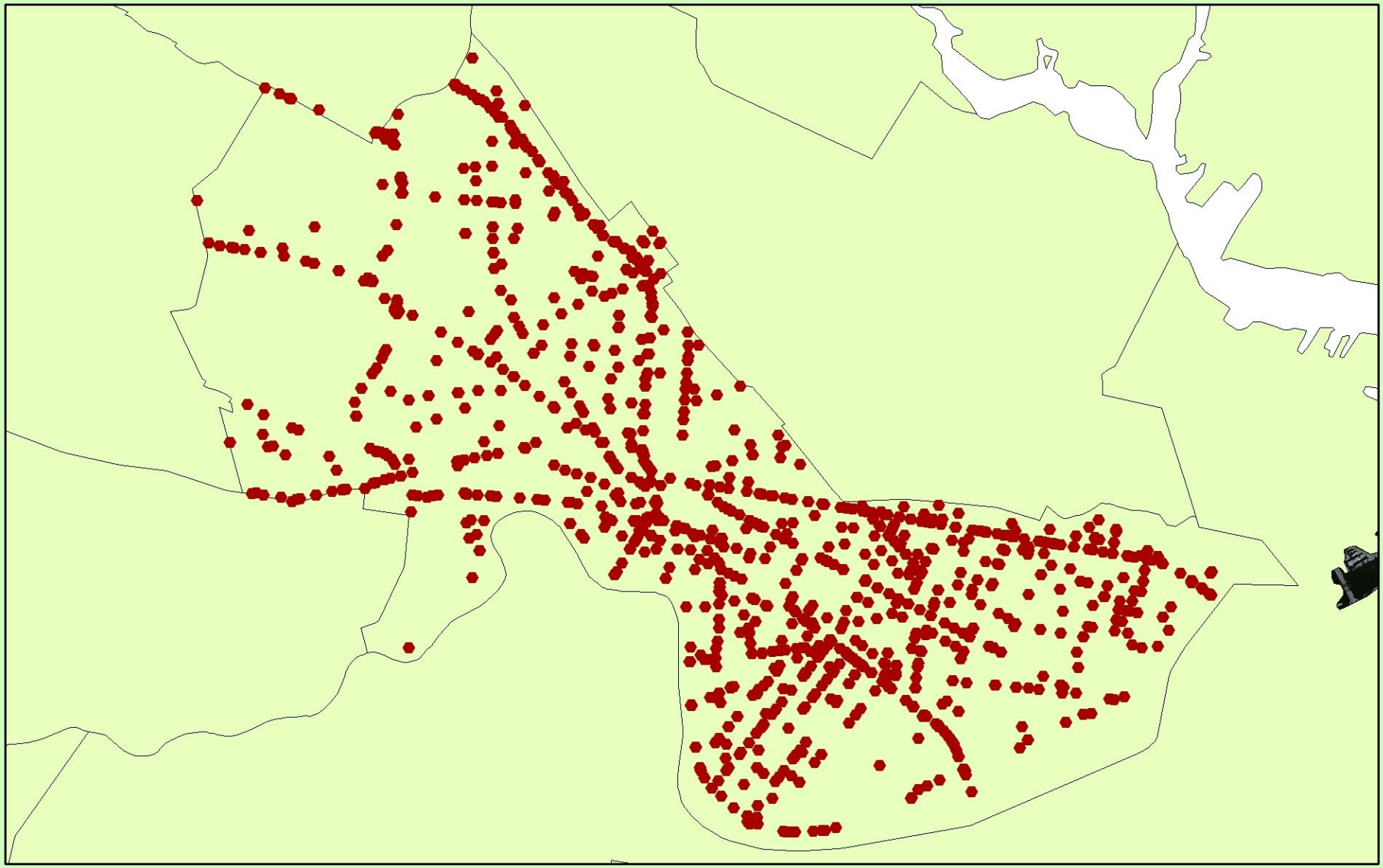
- Traffic volume counts table was summarized and average for road segments to create 1 volume count per road
- Traffic volume counts joined to road layer by street name
- Bike lanes and trails had a “dummy” field of 1 added to aid in conversion to raster (to show presence)

GIS Analysis

Hazard Index Creation:

- Road layer converted to raster to aid in classification for indexing using traffic volume count as the cell value field
- Bike trail and lane layers converted to raster using “dummy” field for cell value
- Crash points converted to raster by kernel density function with 5 meter cell size (see next slide)

Automobile Accidents in Cambridge in 2009



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0 0.5 1 2 Kilometers

Note: Created from automobile crash data from the year 2009

Density of Automobile Accidents in Cambridge, MA in 2009

Created using kernel density function with points and a cell size of 5 meters

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0 1,250 2,500 5,000 Meters

Note: Created from automobile crash data from the year 2009

Hazard Index Creation (Cont.)

- Raster calculator was used, dividing crash density raster by traffic volume raster, creating roads with crash rate (so we can know how dangerous a road is)
  - Reclassified using Jenks Natural Breaks with 5 divisions
  - Reconverted to vector layer, each segment now assigned a grid value of 1-5
- Trail and lane layers reconverted to vector after being assigned a cell value of 1

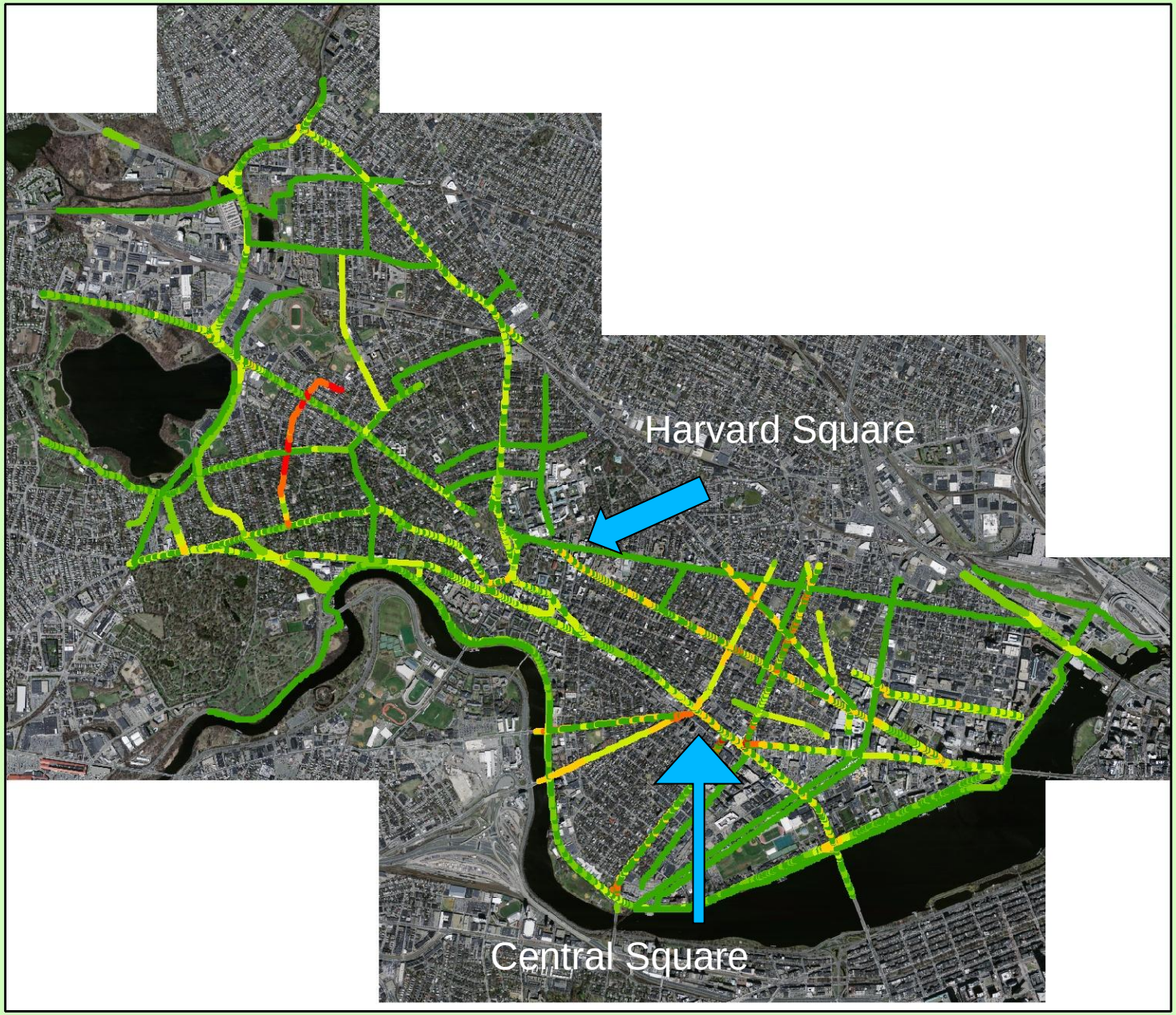
The Final Method Step…

- Finally, all three vectors were combined to one layer using “Feature to Line”, creating one layer with grid code values for:
  - Normalized Crash Rate
  - Presence of Bike Trail
  - Presence of Bike Lane
- Field calculator created index using the expression: Hazard Index = (crash rate) – (trail + lane)
- Now…the map!!

Results

- Highest bicycle hazard is on Massachusetts Ave., and near Harvard and Central Squares
- Results make intuitive sense: areas with more cars and near high traffic intersections are the most dangerous areas to ride a bicycle
- Now to see the map…

Bicycle Hazard Index for Cambridge, MA



Bicycling Hazard Index

- Very Low
- Low
- Moderate
- High Moderate
- High
- Very High

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0 1,250 2,500 5,000 Meters

Note: Created from automobile crash data from the year 2009

Discussion

The assumptions must be examined:

- How dangerous it is for cars is probably fairly similar to danger for bikers, but we don't know
- A main flaw: automobile volume rates are not the same as bicycle rates, so crash rates are VERY different
- However, the most dangerous intersections for cars are probably also the most dangerous for bikers
- Crash rate was crashes per year per car volume per month, not car volume per year (a mistake)
- It would be nice to know all roads, not just roads with volume data

References

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