# Development of a State-wide Bicycle and Pedestrian Counting Program to Evaluate Crash Exposure in Iowa

STEVEN SPEARS, SCHOOL OF URBAN AND REGIONAL PLANNING, UNIVERSITY OF IOWA
STEVEN-SPEARS@UIOWA.EDU
CARA HAMANN, COLLEGE OF PUBLIC HEALTH, UNIVERSITY OF IOWA
CARA-HAMANN@UIOWA.EDU

This project is sponsored by the Iowa Department of Transportation, Traffic Safety Improvement Program

## Purpose

- Establish a regional non-motorized traffic monitoring program to estimate bicycle and pedestrian distance traveled (BMT & PMT).
- Expand the program statewide.
- Evaluate
  - Trends in bicycle and pedestrian crash rates (exposure)
  - Effect of infrastructure on bicycle/pedestrian use
  - Crash hotspots and effectiveness of infrastructure improvements

# Need

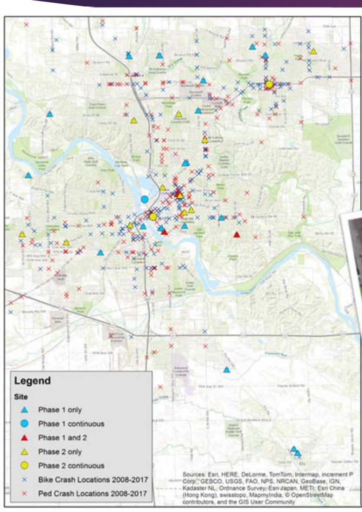
- Traffic counting programs for motorized vehicles began in the 1930s
  - Estimate vehicle volumes for roadway capacity modeling / traffic flows
  - Estimate Vehicle Distance Traveled (VMT)
  - Compute crash rates for vehicle travel
- No analogous programs exist for non-motorized (bicycle/pedestrian) traffic monitoring
  - No means of computing crash exposure rates (crashes/distance traveled)for non-vehicle road users

# Project Description

- 33 counting sites (30 one-week, 3 permanent sites)
- Counts conducted August 2017 – June 2019
- Sites selected to capture range of conditions:
  - Recreation / commuting / mixed
  - Urban / rural
  - Federal roadway classification ( local / collector / arterial / trail )
- Counts used to estimate
  - annual average daily counts by type
  - Total bicycle/ pedestrian distance traveled by roadway segment
  - Crash rate for bicycle / pedestrian modes

Count Locations via google maps: https://drive.google.com/open?id=1ZnMlpicL5DHaXR5pAyMl6-WrkeKc_sRy&usp=sharing

# Counting photos and data examples

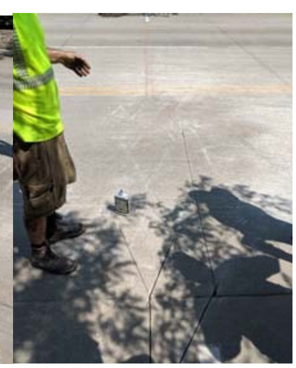




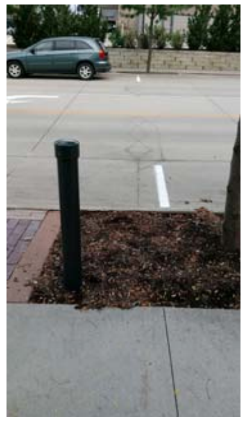
# Practical Knowledge

## Typical Short-duration Sites

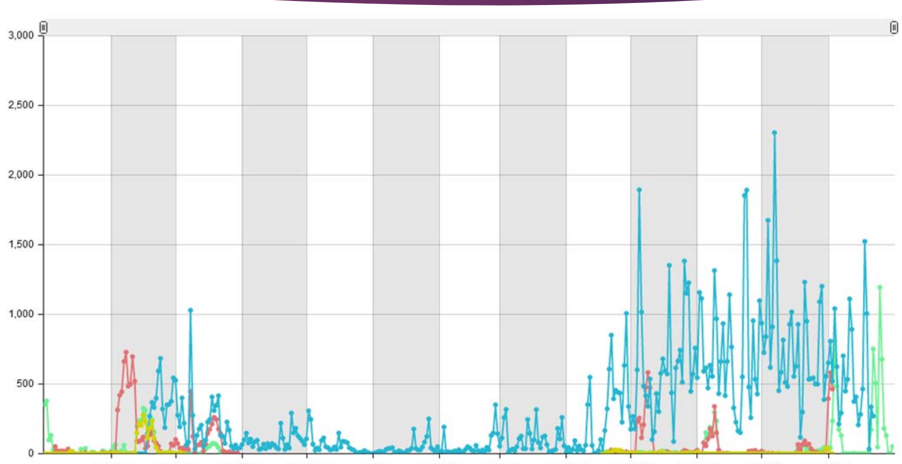
## Permanent Site Installation



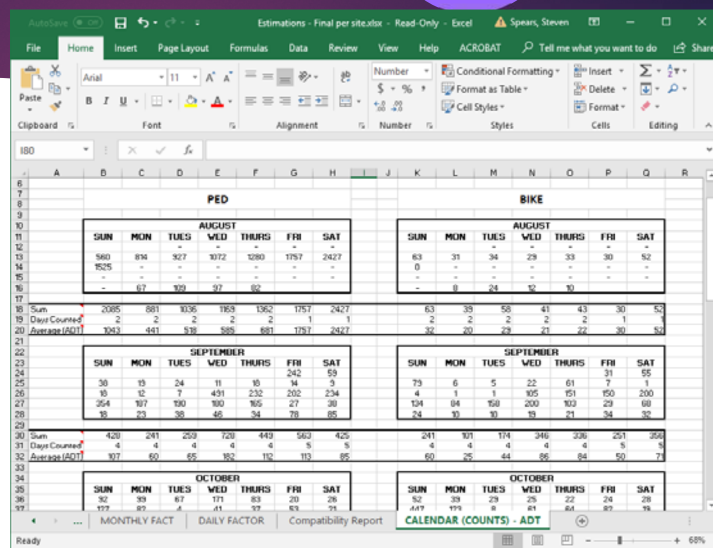
## Completed Permanent Sites



## Count Data – Cyclists (all sites)

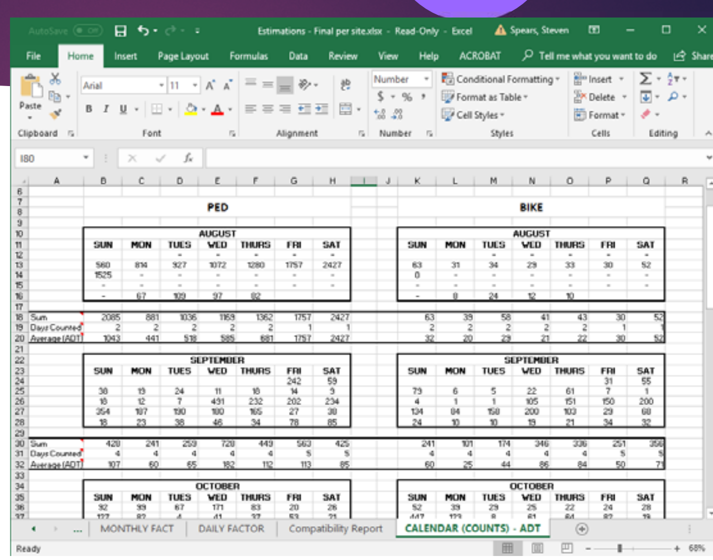


# Computing Regional Bicycle Distance Traveled




- Spreadsheet-based
- Compute Average Annual Daily Bike/Ped (AADB/P) by facility class
  - Arterial highway
  - Collector
  - Local street
  - Rural local street
  - Trail / shared-use path

# Computing Regional Bicycle Distance Traveled




- day of the week
- month of the year
- average daily temperature
- daily precipitation
- number of travel lanes
- Annual Average Daily Traffic (AADT)
- census population and employment density
- posted speed limit

## Computing Bicycle Distance Traveled

- Calculate average daily bicycle (ADB) count by facility class

$$ADB = \frac{Sum\ of\ bicyclist\ counts}{Number\ of\ site - days\ counted}$$

- Compute daily and monthly factors (weights)

$$MF = \frac{Annual\ ADB}{Month\ ADB} \qquad DF = \frac{Month\ ADB}{Daily\ ADB}$$

## Computing Bicycle Distance Traveled

- Multiply daily observed counts by factors to get adjusted daily bicycle counts

$$Estimated\ AADB = \frac{\sum(daily\ count\ x\ MF\ x\ DF)}{number\ of\ days\ counted}$$

- Repeat Average Annual Daily Bicycles (AADB) estimation for each facility class:
  - Arterial highway, collector, local, rural local, trail

# Computing Bicycle Distance Traveled

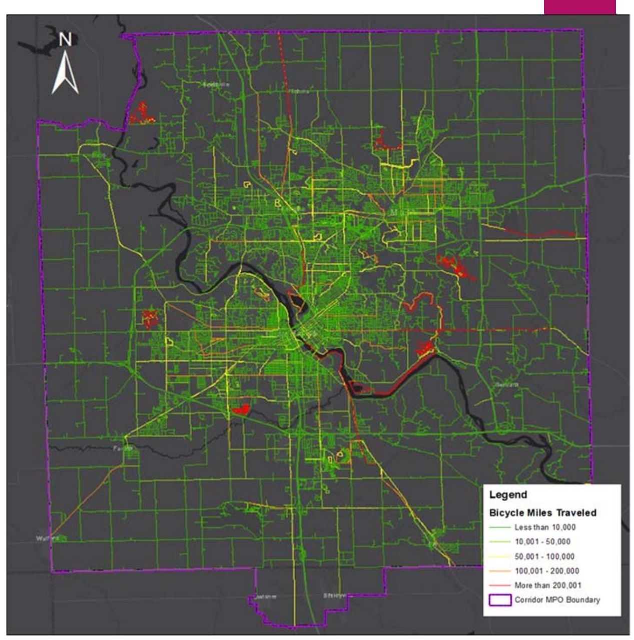
- Multiply AADB by segment length to obtain distance traveled (BDT) on that segment:

$$Segment\ BDT = \text{AADB x segment length}$$

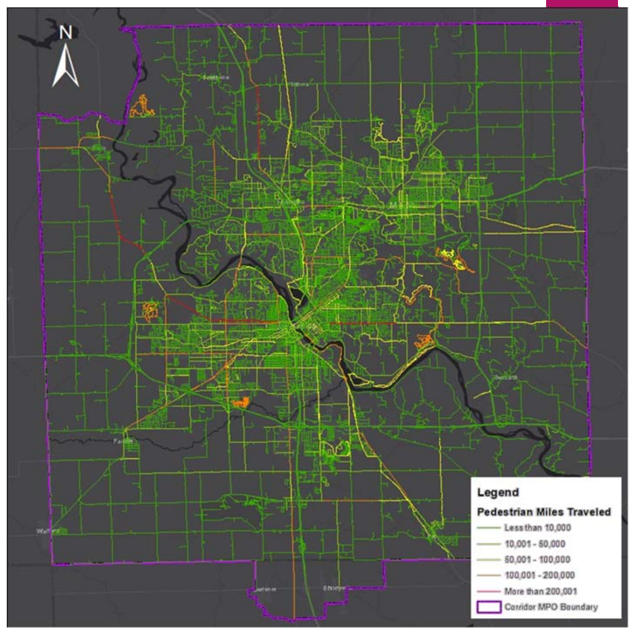
- Sum BDT for all segment in the region to estimate total regional distance traveled:

$$Estimated\ Regional\ BDT = \sum Segment\ BDT$$

# Regional BMT Map: Cedar Rapids, Iowa USA



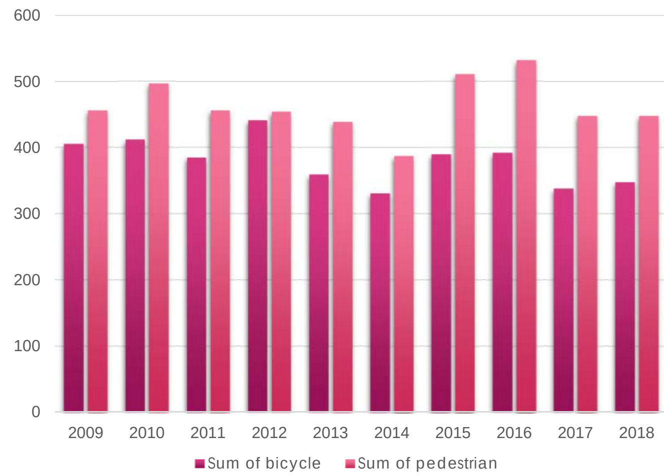
# Regional PMT Map:
## Cedar Rapids, Iowa USA




# Regional Travel Distance Estimates

| Mode | Miles traveled (millions) |
|---|---|
| **Pedestrian (PDT)** | 23.6 |
| **Bicycle (BDT)** | 17.5 |
| **Vehicle (VDT)*** | 1257.8 |

*Iowa DOT estimate




# Iowa Bike/Ped Crashes by Year

# Regional Crash Rates (per 100 million miles traveled)

| Mode | Overall Crash Rate | Fatal/Major Injury Crash Rate |
|---|---|---|
| **Pedestrians** | 95.4 | 27.6 |
| **Bicyclists** | 139.6 | 11.4 |
| **Motor vehicles** | 294.1 | 6.36 |

# Regression Modeling (Phase III)

- More sophisticated per segment method (negative binomial regression)
- Full set of covariates
  - Road characteristics (posted speed, travel laves, traffic volume, bike/ped facility)
  - Weather/Season (temperature, precipitation, hours of daylight)
  - Land Use (employment/population density, intersection density)
- Before-after evaluation

# Current Status and Future Directions

- Currently a rough estimate
  - Road classifications not particularly useful
  - Estimates are applied uniformly across road class
  - Used consistently, still provides information on trends in crash rate
- Analysis of before/after & crash hotspots
- Automated video counts / calibration
- More sophisticated modeling (regression) and scale up to statewide level (Phase III)

# Thank you…

- Questions?

The University of Iowa
IPRC Injury Prevention Research Center
Iowa DOT

Thanks to our Technical Advisory Committee and DOT project lead:
- Sam Sturtz
- Brandon Whyte
- Milly Ortiz-Pagan
- Michael Pillman
- Ron Griffith