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

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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

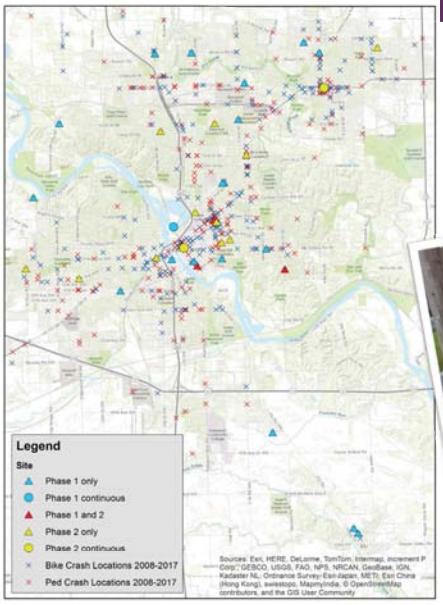
Need

- 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

- 41 counting sites (39 one-week, 2 permanent sites)
  - Short duration counts conducted August 2017 – May 2022
  - Permanent counters in operation since September 2017
- 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

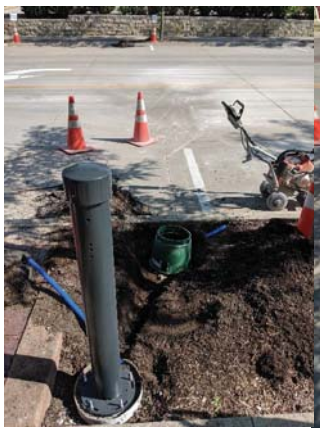
Counting photos and data examples

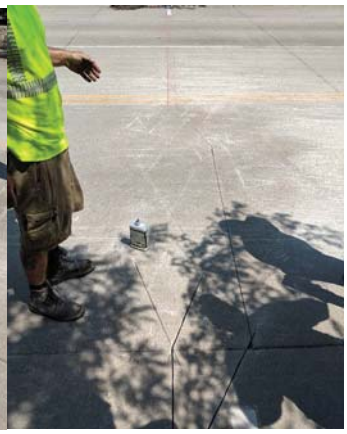


Practical Knowledge

Typical Short-duration Sites

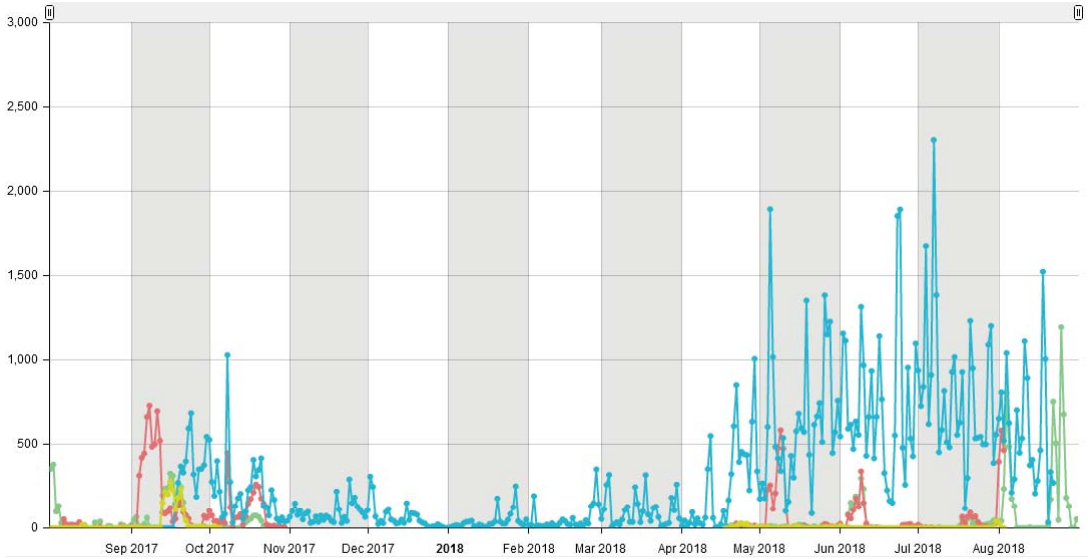
Permanent Site Installation

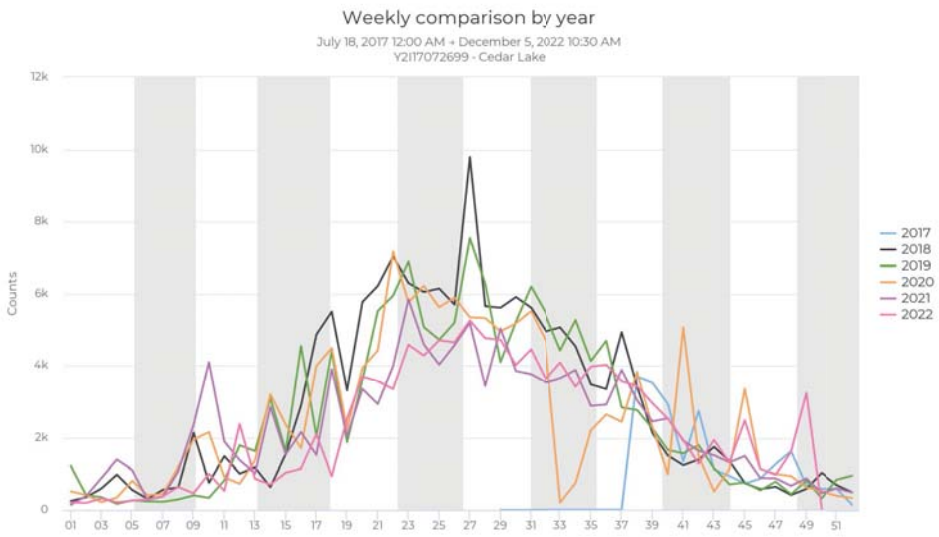




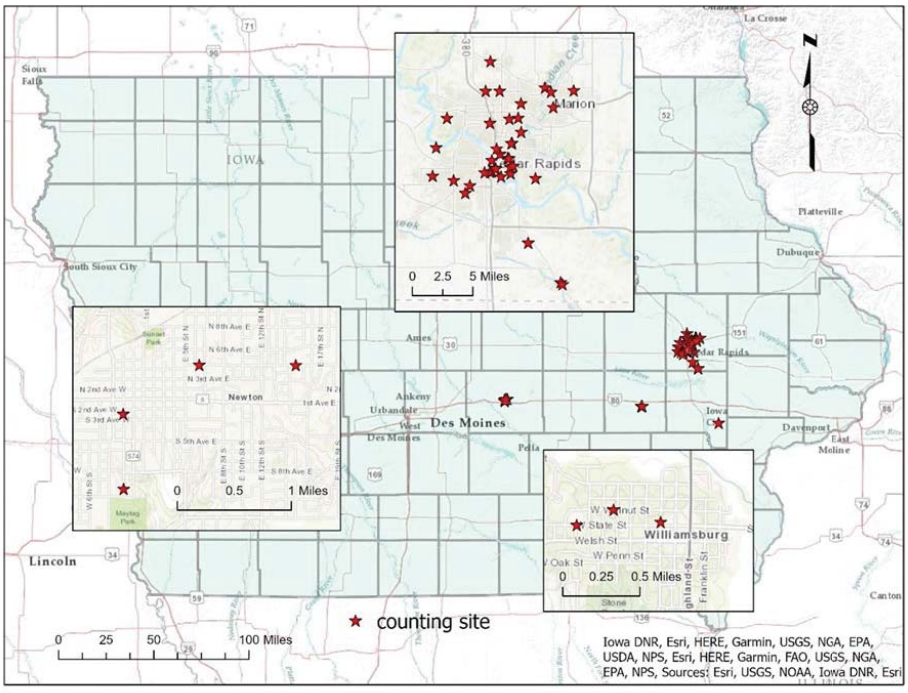
Completed Permanent Sites

Count Data – Cyclists (all sites)





Yearly Comparison: Cedar Lake



Count Locations

39 one-week
2 continuous

Count Modelling

- Annual count estimates – analogous to AADT
- Estimated by regression models
- Computed for all streets included in the Iowa DOT 2020 Statewide Bicycle and Pedestrian Systemic Safety Analysis
  - Urban streets with AADT < 20k and speed limit < 40 mph
  - Rural roads with AADT < 10k and speed limit < 55 mph
  - No divided highways / controlled access / Interstate with speed limit 55 or greater
  - No gravel or dirt rural roads

Network Data

- Statewide network of streets and trails
  - Iowa DOT SSA for street network
  - OpenStreetMap trail/sidepath/bike lane data

Variables: Weather/Climate

- Hours of Daylight
- Temperature (daily average)
- Precipitation (daily total)

Variables: Roadway Features

- Road type (single/multiple lane – bike facility/no bike facility – trail)
- Average Annual Daily Traffic (AADT)
- Bicycle / Pedestrian Safety Score (from statewide systemic safety analysis)

Variables: Roadway Features

- Employment Density
- Population Density
- Intersection Density (within ¼ mile of segment)

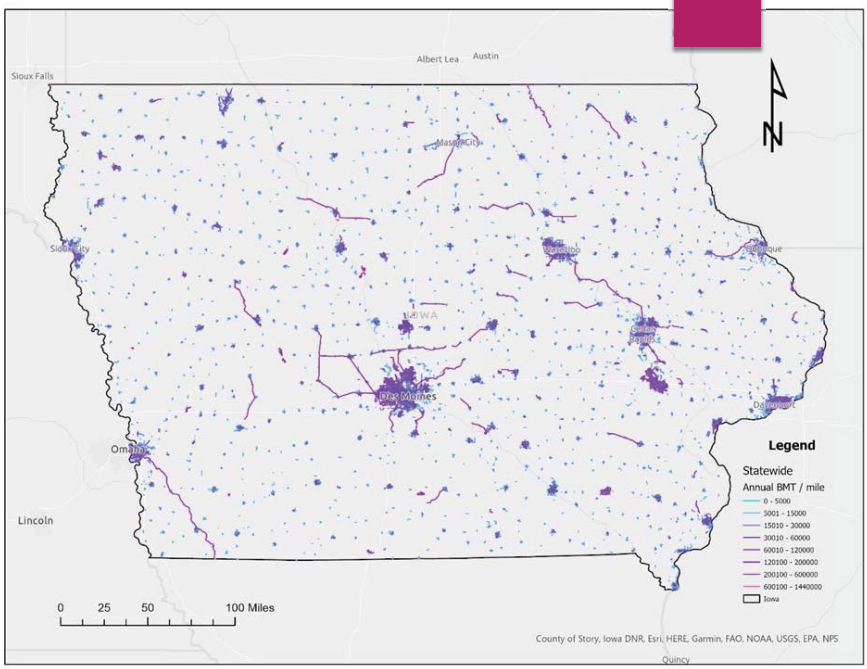
Model Results

- Model predicts average daily counts per roadway segment for bicycles and pedestrians (AADB, AADP)
- Annual distance traveled by computed by:
  - $BMT \approx AADB * 365 * length\ of\ road\ segment$
  - $PMT \approx AADP * 365 * length\ of\ road\ segment$

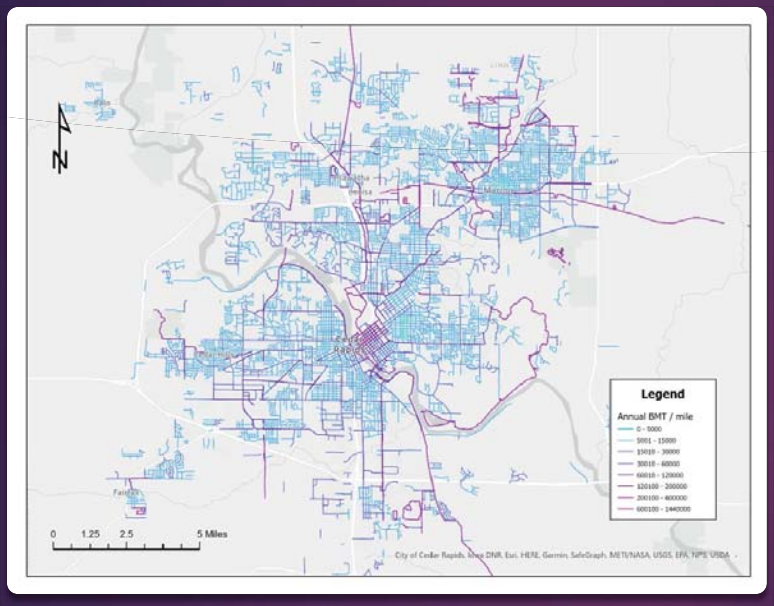
Model Results

Annual BMT:
696 million miles

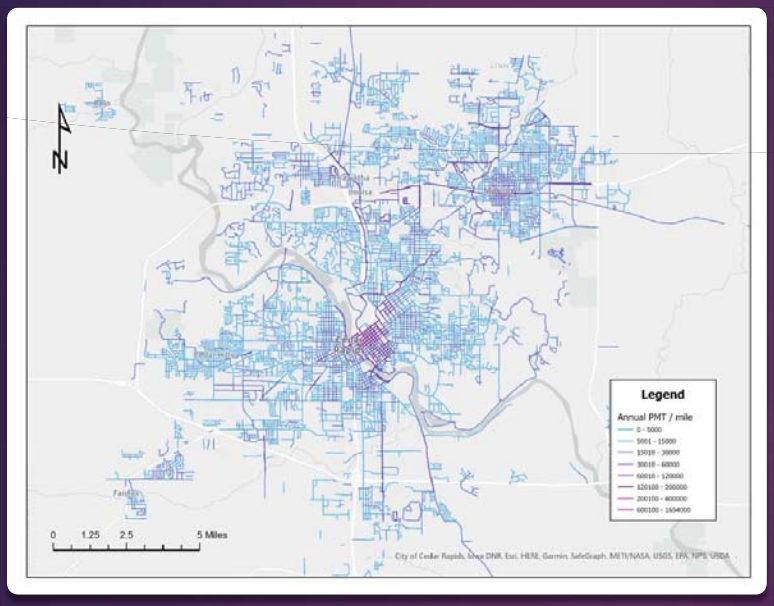
Annual PMT:
434 million miles



Corridor MPO BMT per Mile Map



Corridor MPO PMT per Mile Map



Statewide Crash Rate Analysis

Year	Pedestrian			Bicycle			Motor Vehicles		
	Crashes	Injuries	Fatalities	Crashes	Injuries	Fatalities	Crashes	Injuries	Fatalities
2017	406	401	24	340	346	5	56001	19088	331
2018	387	194	23	348	346	7	56898	18185	319
2019	346	357	23	346	341	10	58564	18614	337
2020	336	338	28	237	226	10	47891	15246	343
2021	360	359	31	278	264	11	54483	17206	356
Average	367.0	329.8	25.8	309.8	304.6	8.6	54767.4	17667.8	337.2

Annual Crash and Injury/Fatality Rates

	Miles Traveled (millions)	Percentage of total miles traveled	Average # of Crashes	Crash Rate*	Average # of Injuries	Average # of Fatalities	Injury and Fatality Rate*
VMT	32828	96.7%	54767	1.67	17668	337	0.55
Model BMT	696	2.1%	310	0.45	305	9	0.45
Model PMT	434	1.3%	367	0.85	330	26	0.82
Total	33958	100.0%	55444	1.63	18302	372	0.55

* Per million miles traveled

Conclusion

- The models give estimates of BMT/PMT that can be used to evaluate general travel patterns and crash rates.
- Not intended to be used for detailed segment-level analysis.
- Could be useful at larger scales (census tract / city / region) for what-if analysis of infrastructure or land use changes.
- Should be updated with major updates in underlying data (e.g., statewide systemic safety analysis) to provide updated predictions.
- Improvement could be made from added short- or long-term counts.

Thank you…

- Questions?

Thanks to our Technical Advisory Committee and DOT project lead:

- Sam Sturtz
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- Ron Griffith