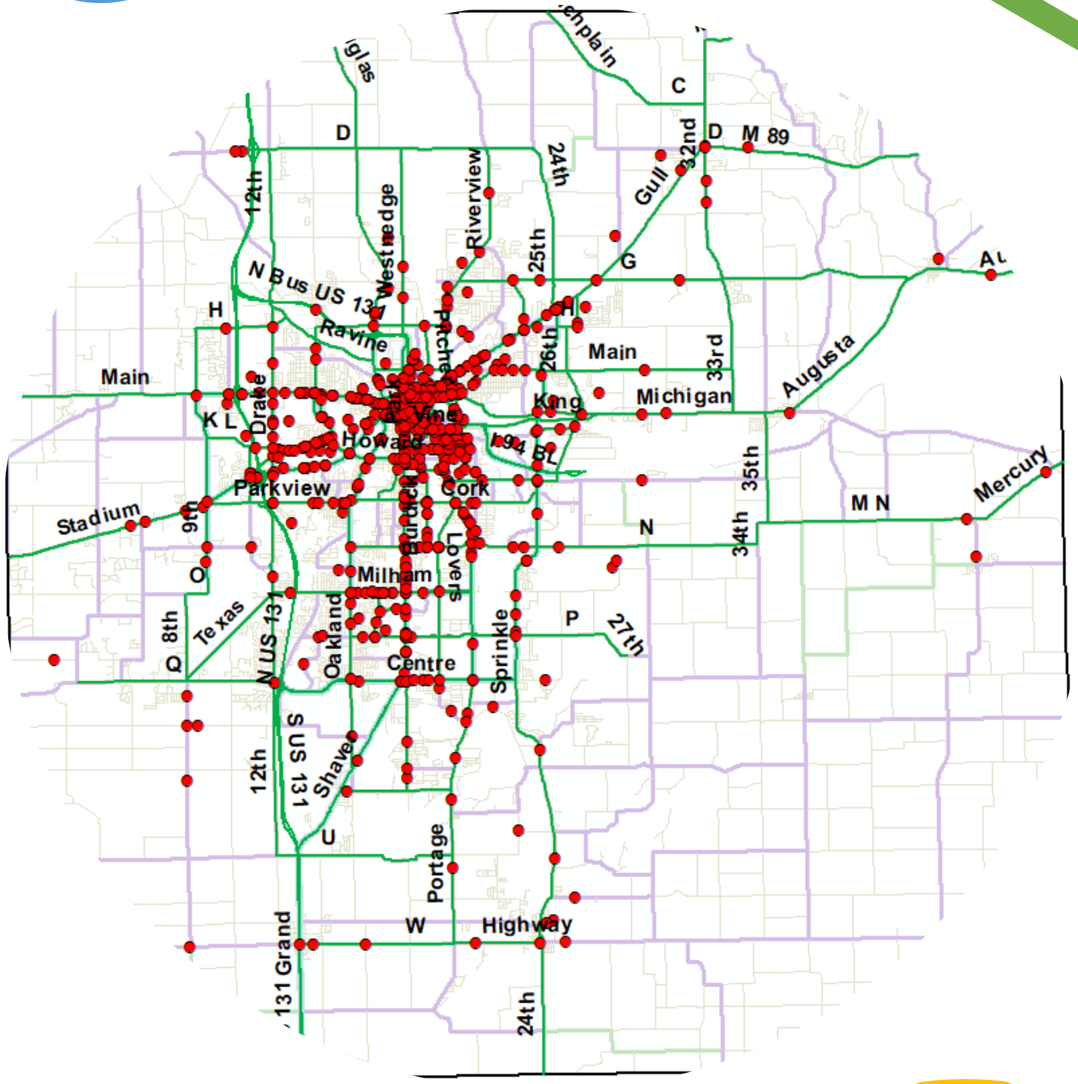


Examining the Patterns and Causes of Bicycle Crashes in Kalamazoo County

Valerian Kwigizile
Jun-Seok Oh
Keneth Morgan Kwayu
Ali Atallah E Alhawiti

Transportation Research Center for Livable Communities (TRCLC)
Western Michigan University

January 28, 2021

Overview

General analysis: Bicycle crash data between 2009 to 2019 were used in the analysis

- The year that the crash occurred
- Hour of the day
- Traffic control
- Bicyclist and driver age
- Bicyclist and driver actions prior to a crash
- Bicyclist and driver hazardous action

In-depth analysis: Crash typing from PBCAT software (2017,2018,2019)

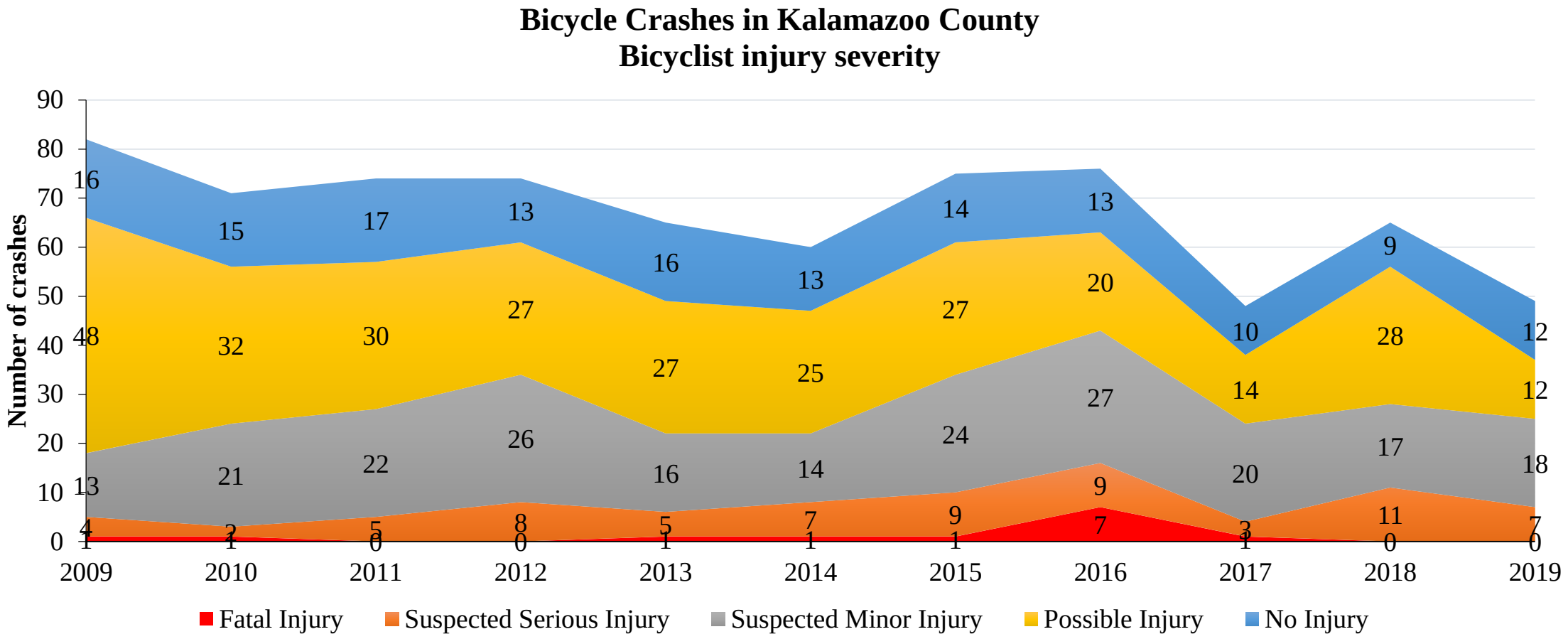
- Prevalent crash types
- Review of UD-10 police reports
- Review of roadway infrastructure using Google Earth maps

Disclaimer

- All analyses were based on data provided by the Michigan State Police (MSP).
- The driver and bicyclist actions reported in the analyses were as assigned by police officers in the traffic crash reports (UD-10s).
- The analyses were based on the number of police-reported crashes and their attributes without consideration of exposure measures.

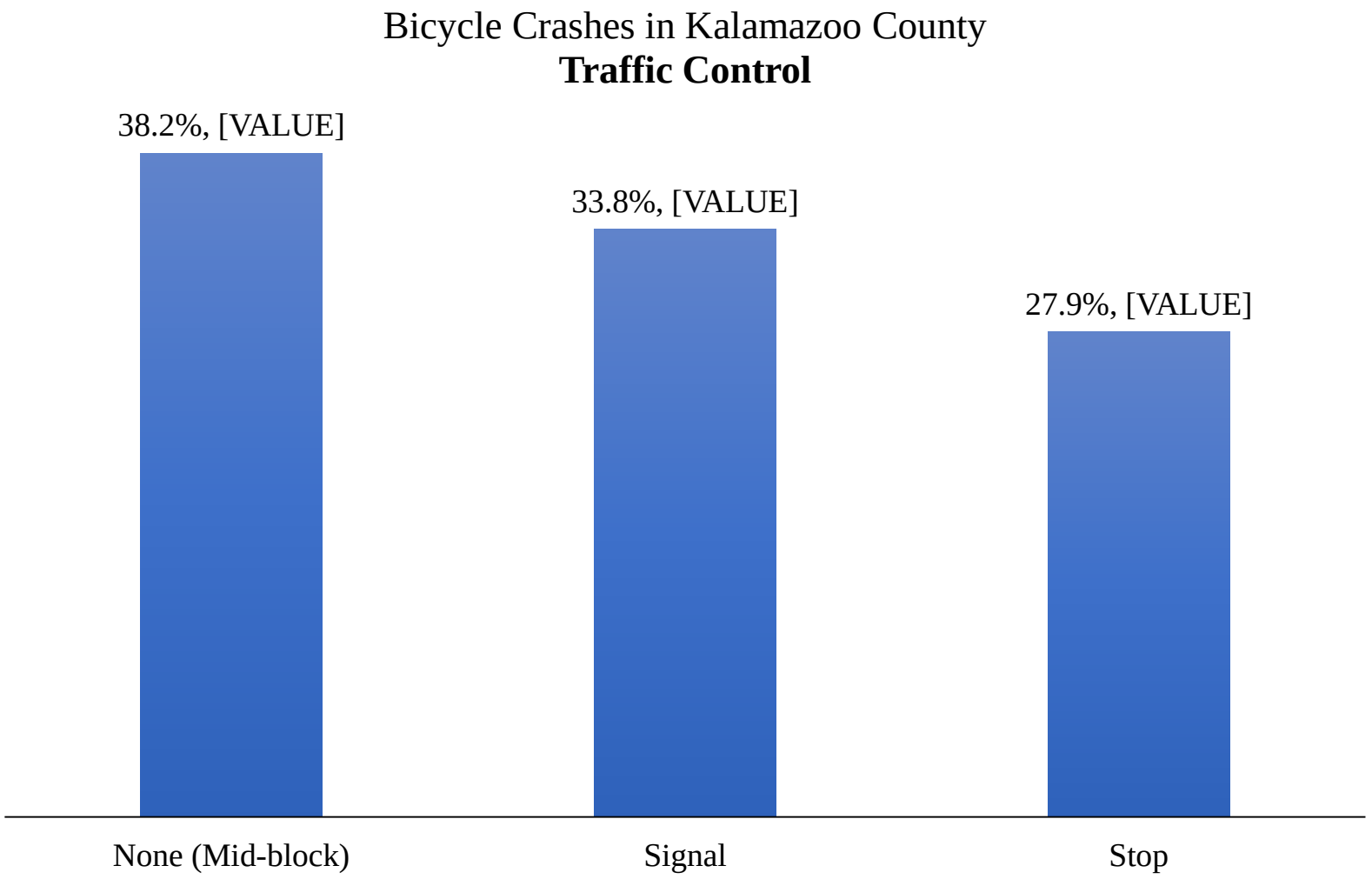
PART 1: GENERAL CRASH ANALYSIS TRENDS AND PATTERNS

Trend of Bicycle Crashes in Kalamazoo County



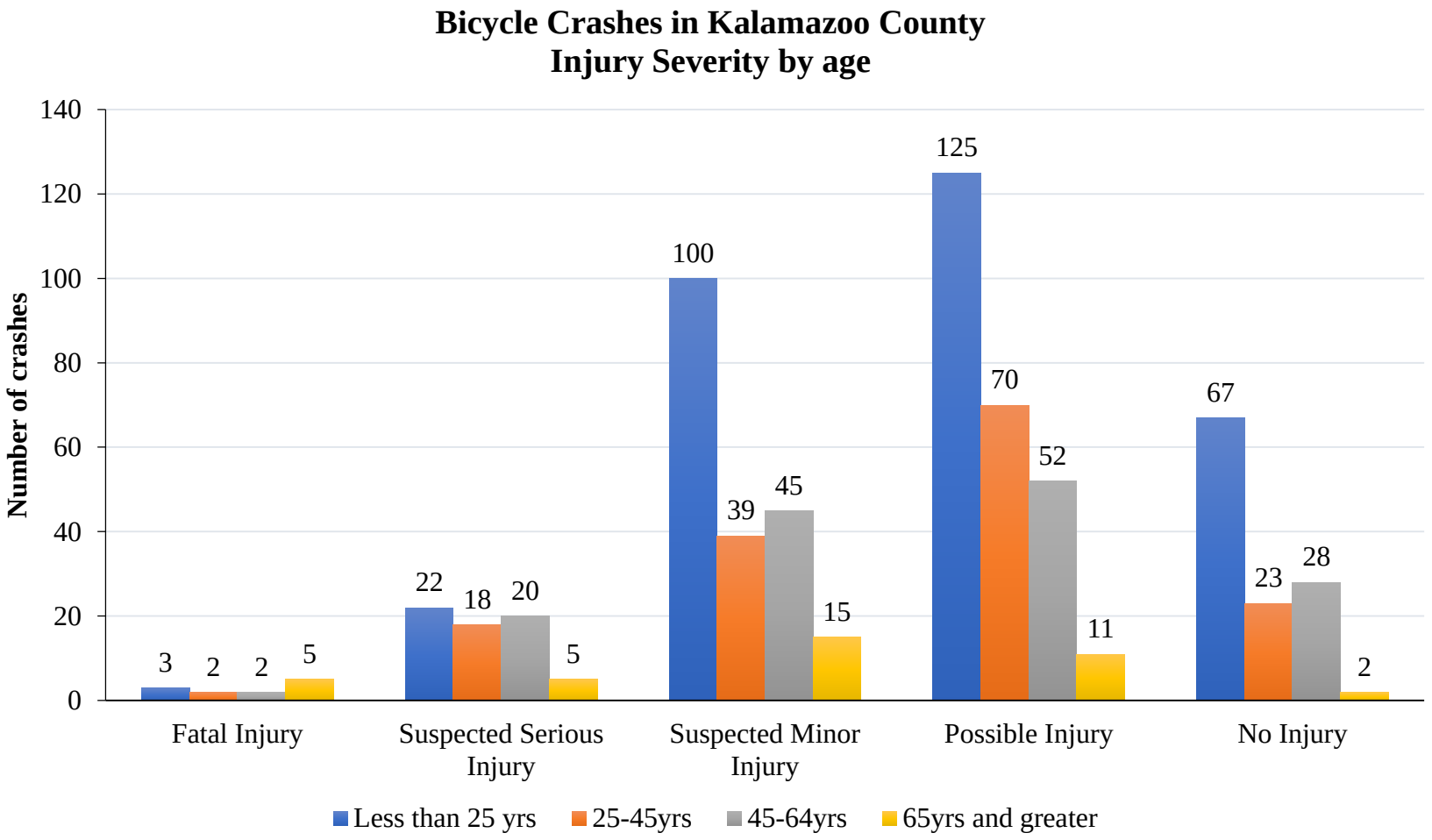
- In 2016, 5 bicyclists were killed in a single largest bicycle fatal crash in Michigan

Crash by location



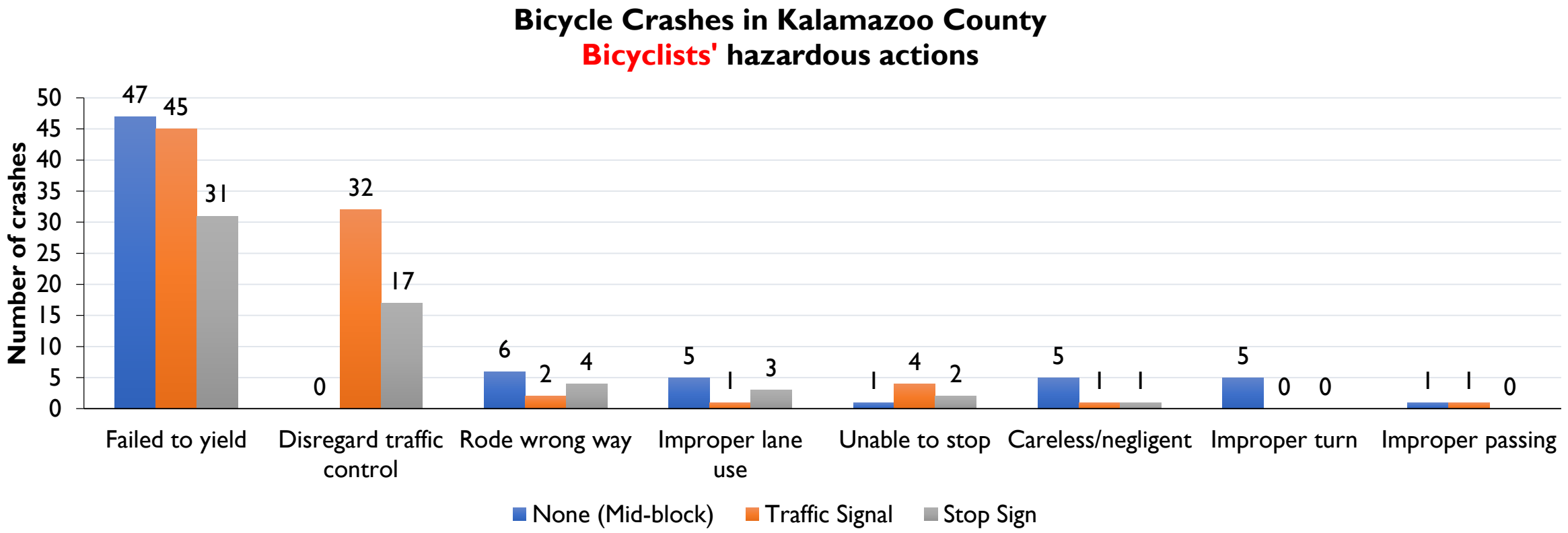
- Slight difference in percentage of bicycle crashes by location
- A higher percentage of bicycle crashes occurred in the midblock area

Injury Severity by bicyclist age

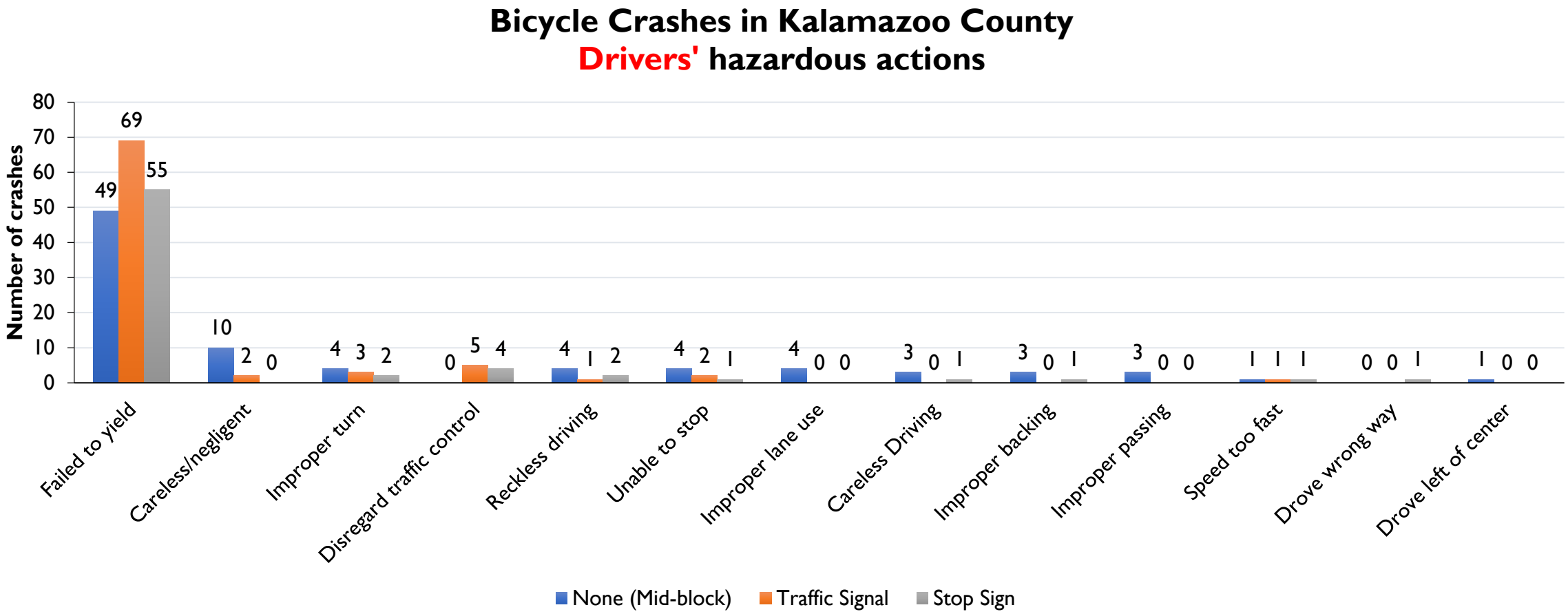


- Bicyclist over 65yrs and young bicyclist(<24 years) likely to suffer fatal injury
- Helmet usage was the lowest for young bicyclists(5.2%)
- Majority of crashes involved young bicyclist less than 25 years (48.4%)

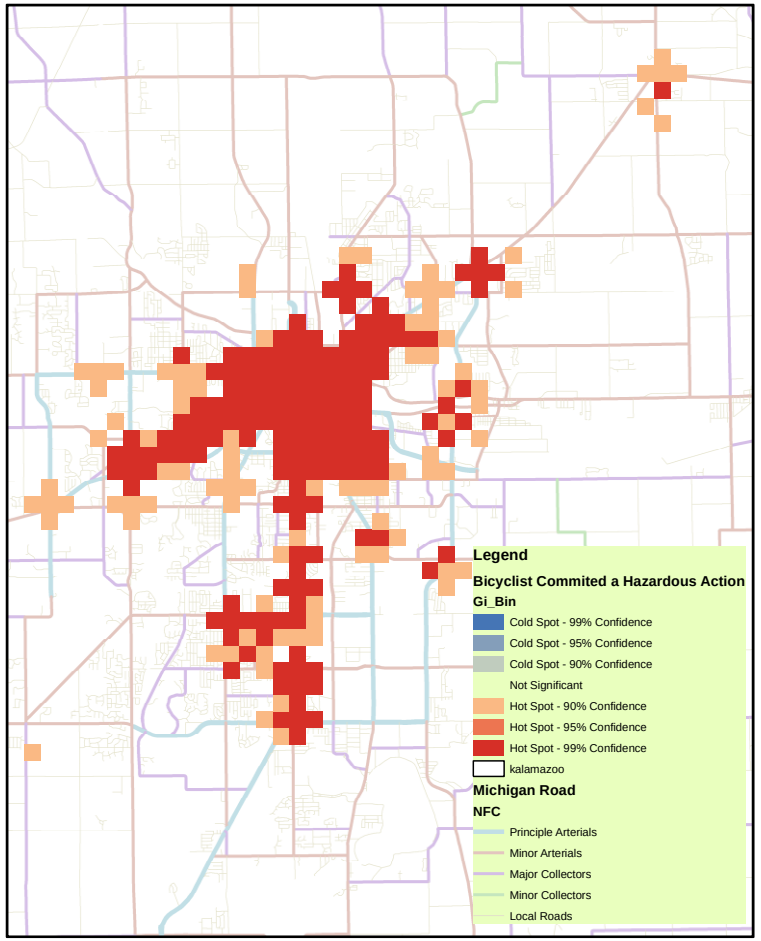
Hazardous actions committed by bicyclists



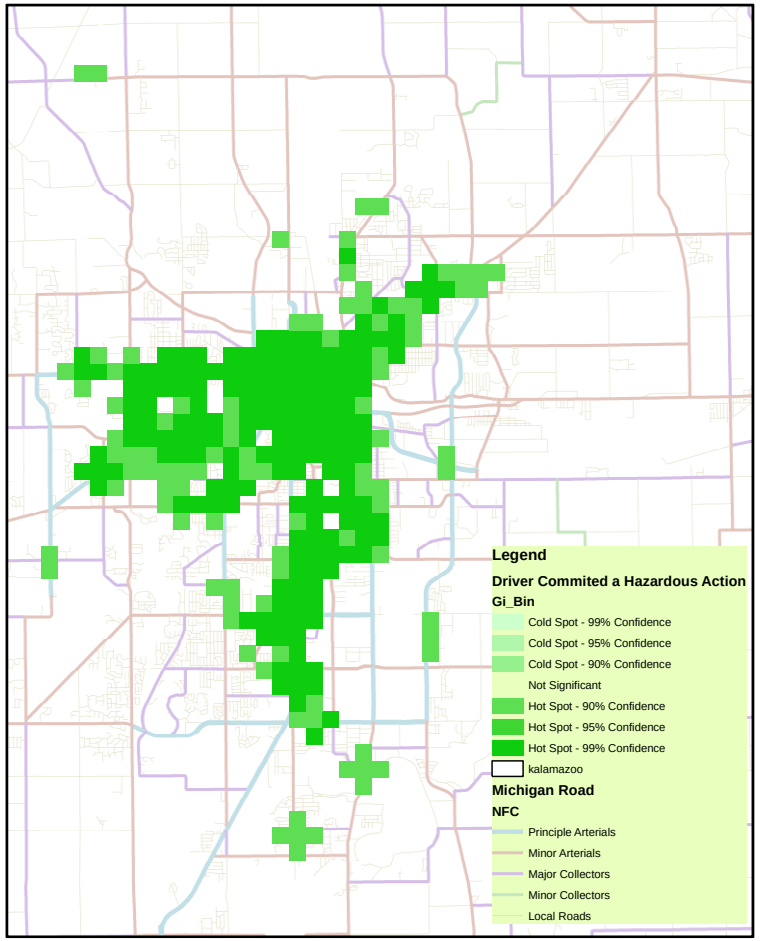
Hazardous actions committed by drivers



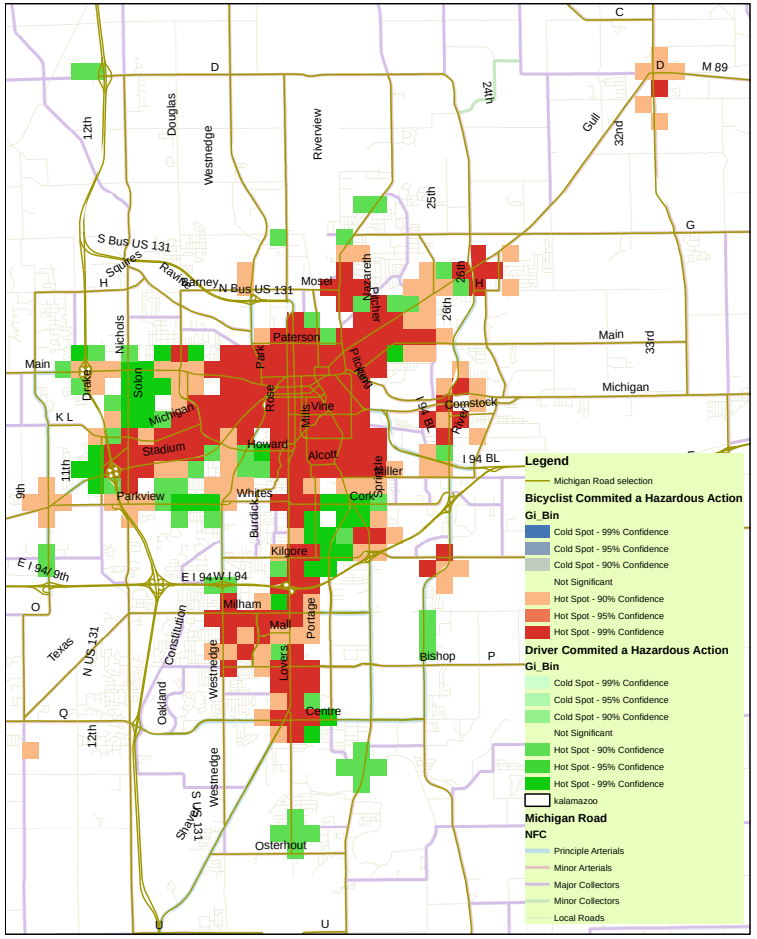
Spatial pattern of bicycle crashes



A. Bicyclist committed a hazardous action



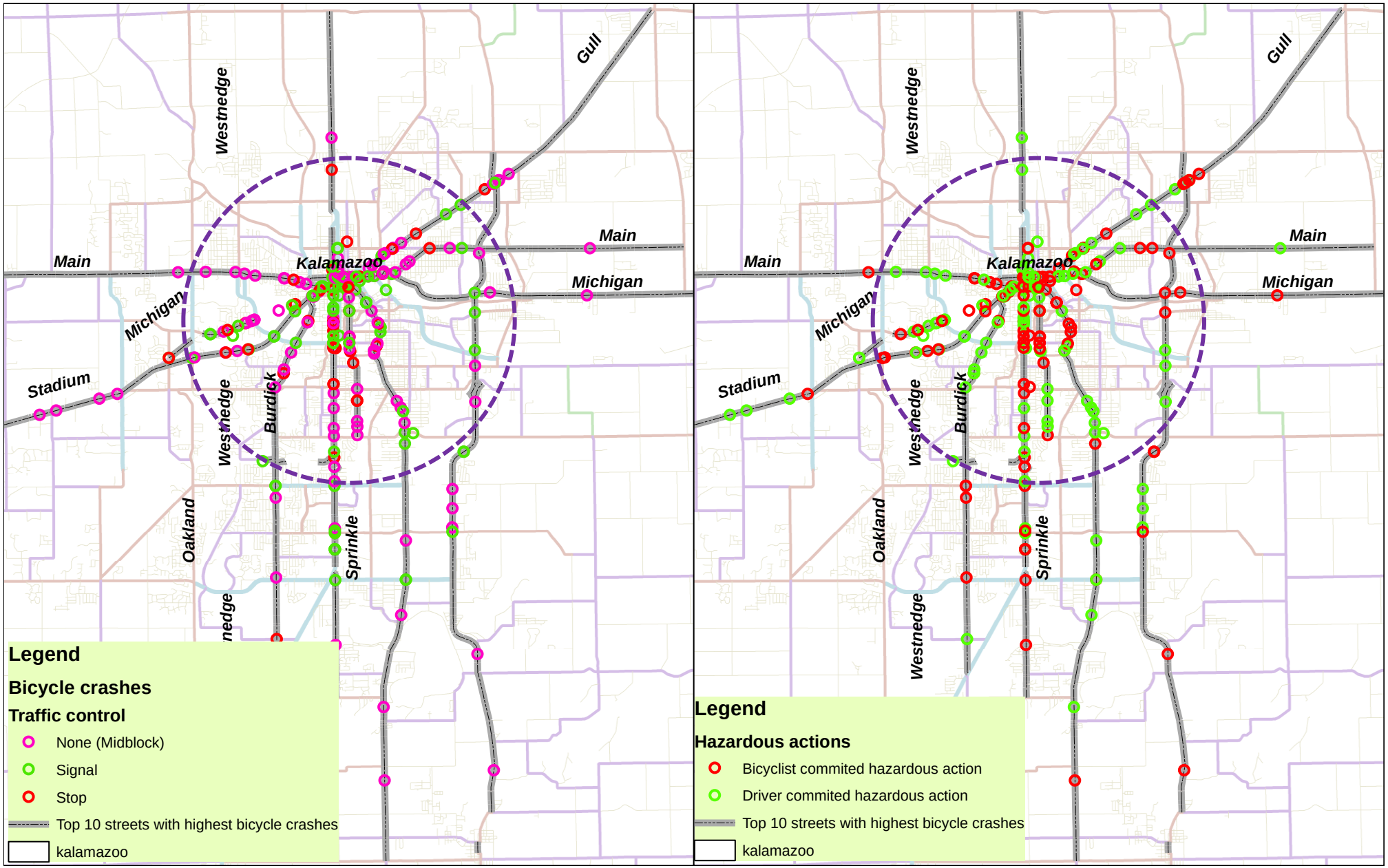
B. Driver committed a hazardous action



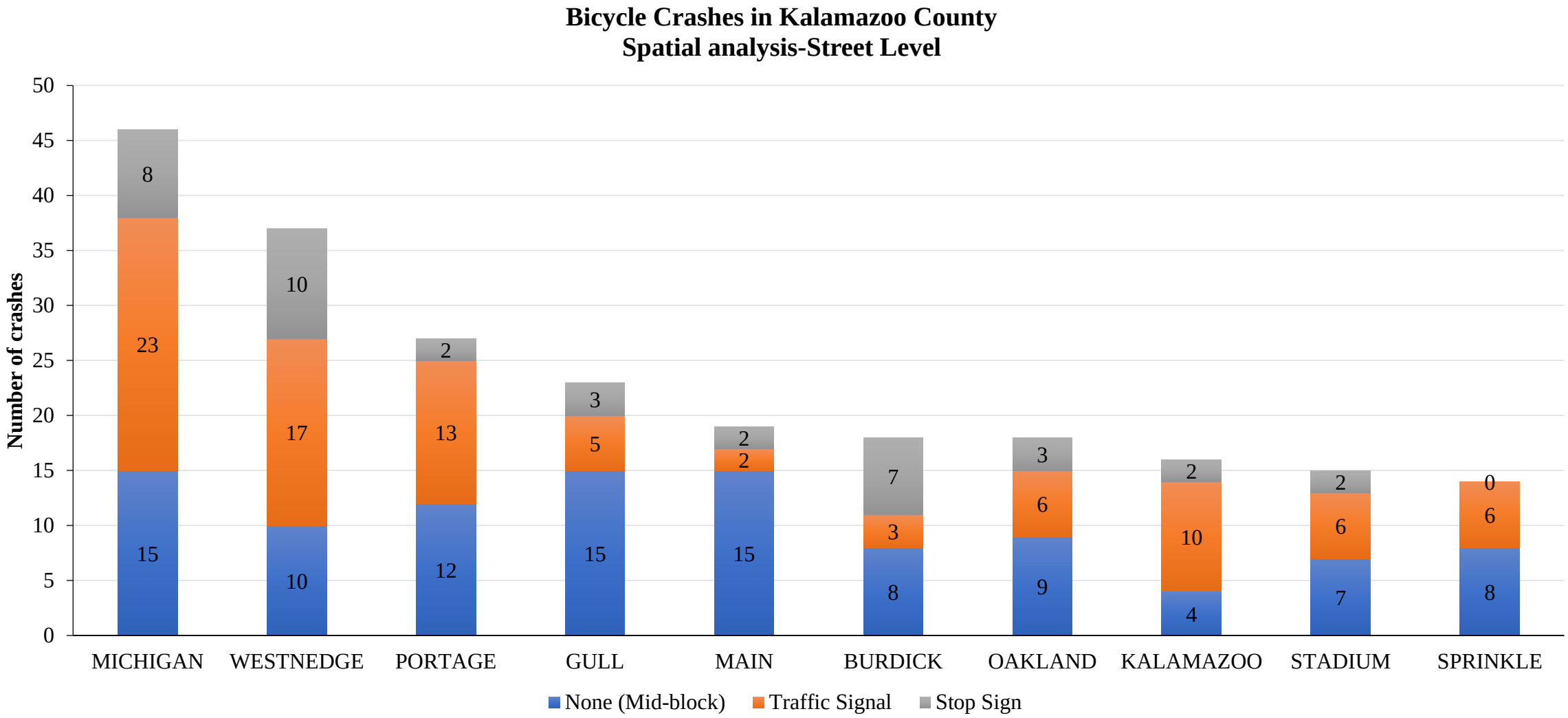
Overlap of A and B

- Bicycle crashes occurred mostly in downtown area

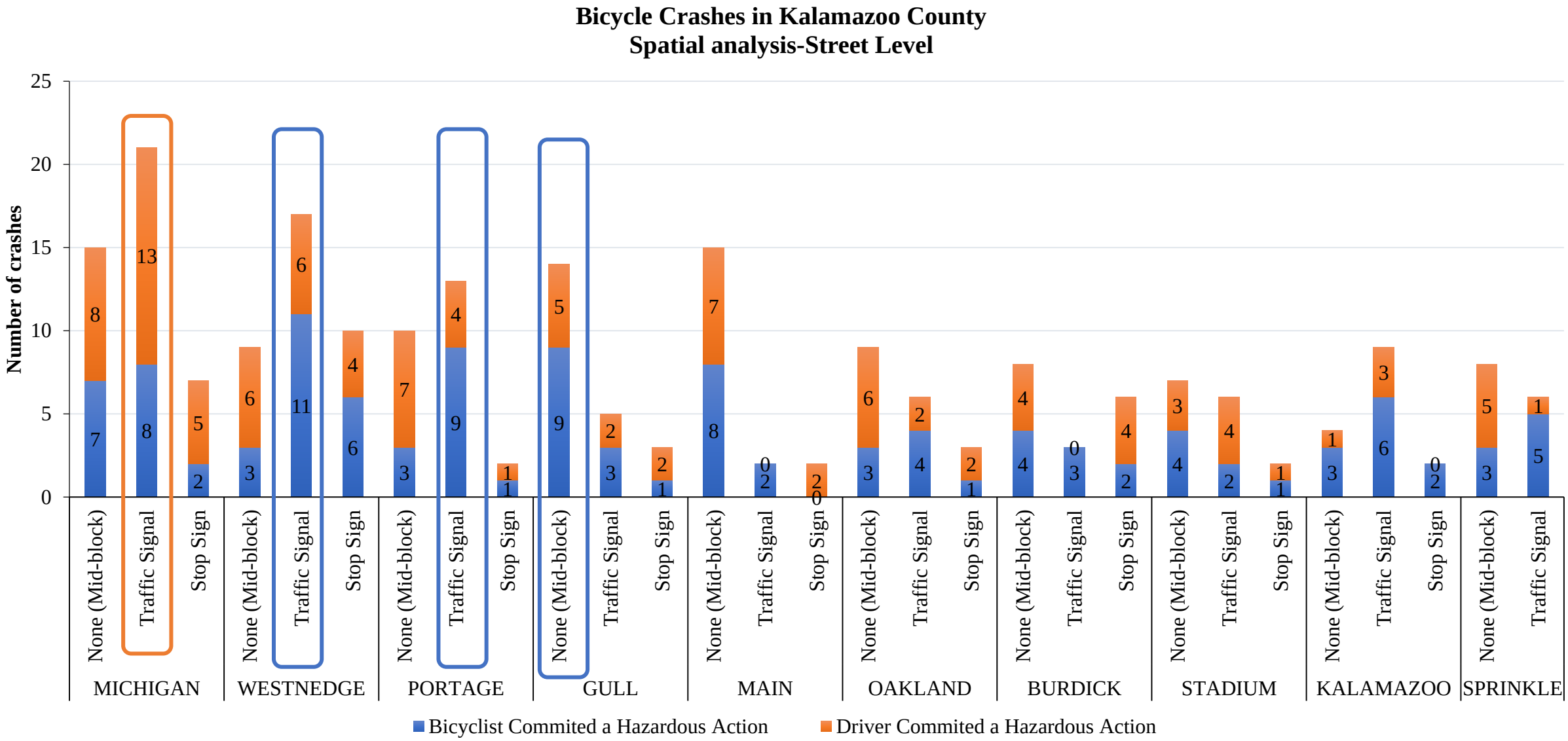
Spatial pattern of bicycle crashes-Street Level



Spatial pattern of bicycle crashes-Street Level

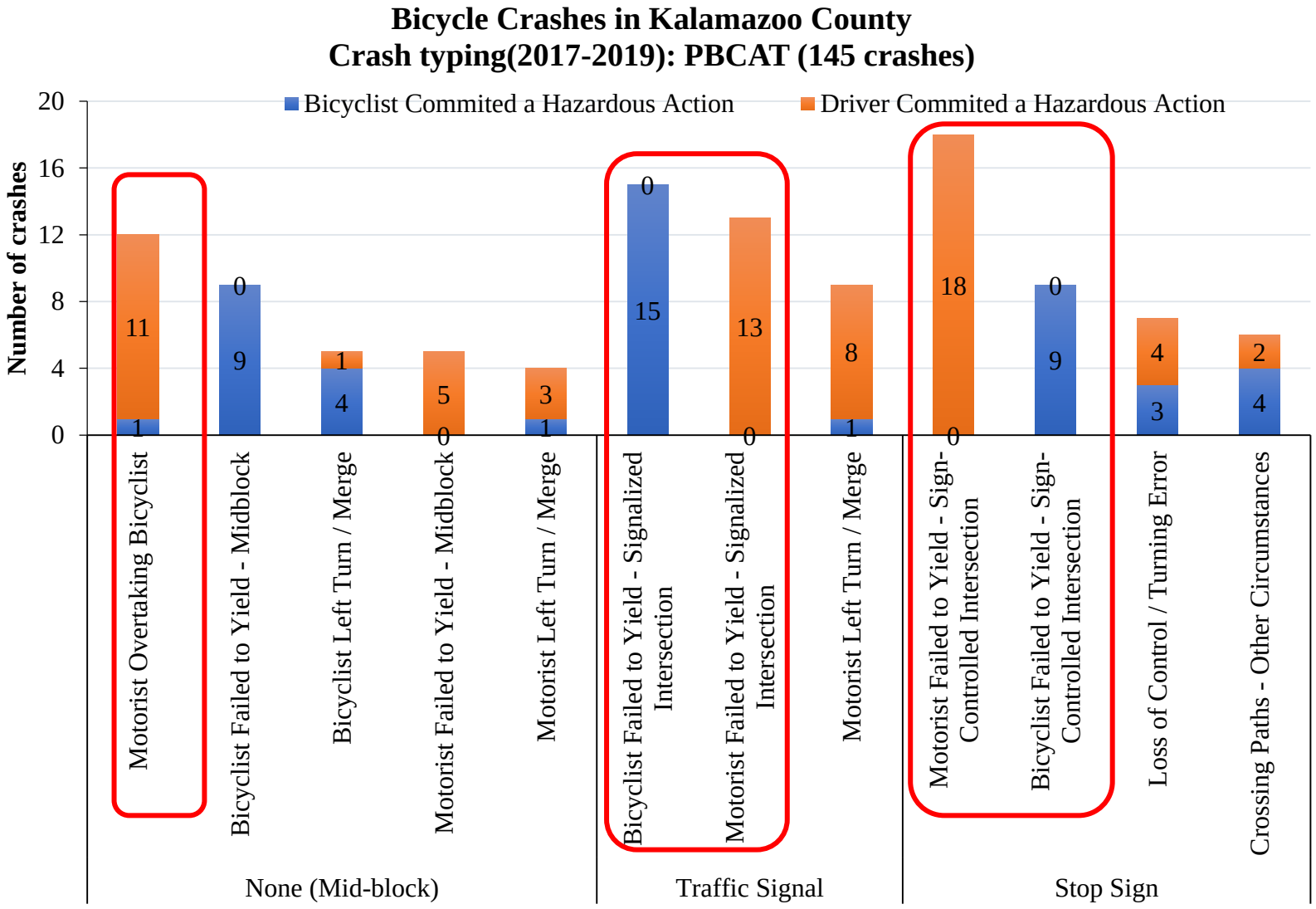


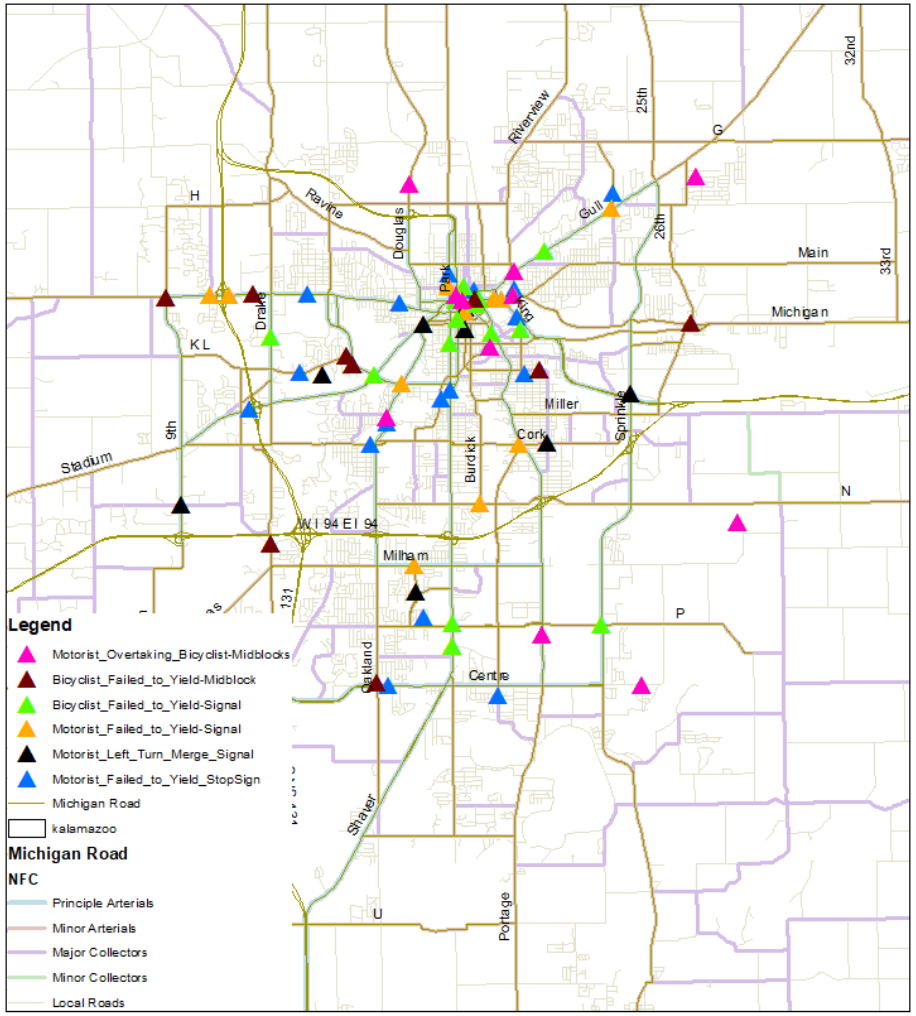
Spatial pattern of bicycle crashes-Street Level



PART 2: PBCAT CRASH TYPING

Crash typing using PBCAT

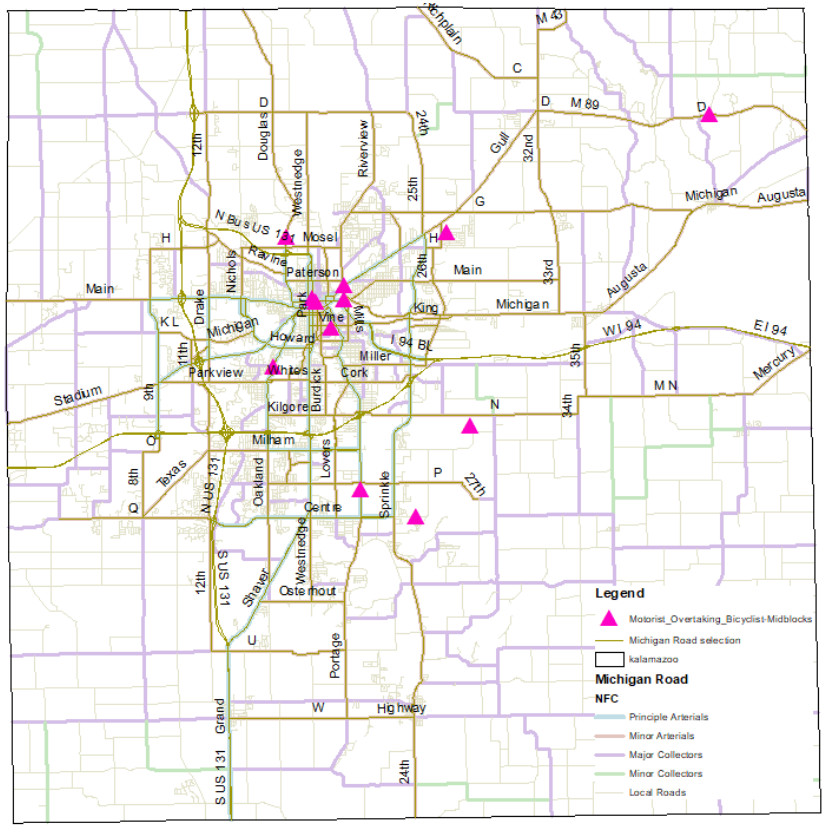




Motorist Overtaking Bicyclist-**Midblock**

- The motorist misjudges the space needed to pass a bicyclist
- 10 out of the 12 locations had no bike lane
  - 4 out of them had no bike lane, no shoulder, no sidewalk, and no markings

Infrastructure issues	Number of crashes
Bike lane	2
No bike lane	2
No bike lane, no shoulder	2
No bike lane, no shoulder, no markings	1
No bike lane, no shoulder, no sidewalk	1
No bike lane, no shoulder, no sidewalk, no markings	4
Total	12



Bicyclist Failed to Yield -**Traffic Signal**

Signal-related issues

- The bicyclist rides into the intersection through a red signal without stopping
- Bicyclist crossing minor streets (10, out of 15).
- Pedestrians' push button were not available in 6 out of 15 locations

Other issues

- No bike lane on the main road (13 out of 15 crashes)
- Bicyclist travelling on a sidewalk(11 out of 15 crashes)
- Bicyclist travelling against traffic (4 out of 15)

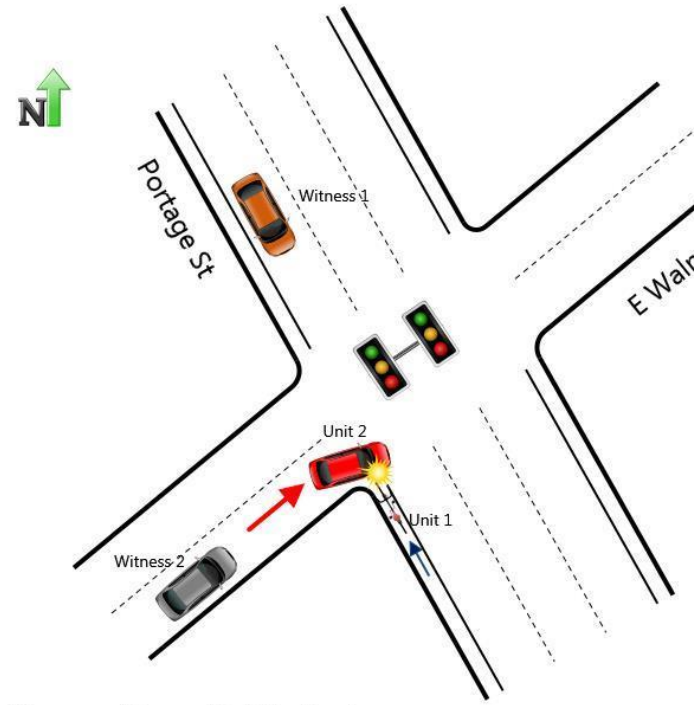
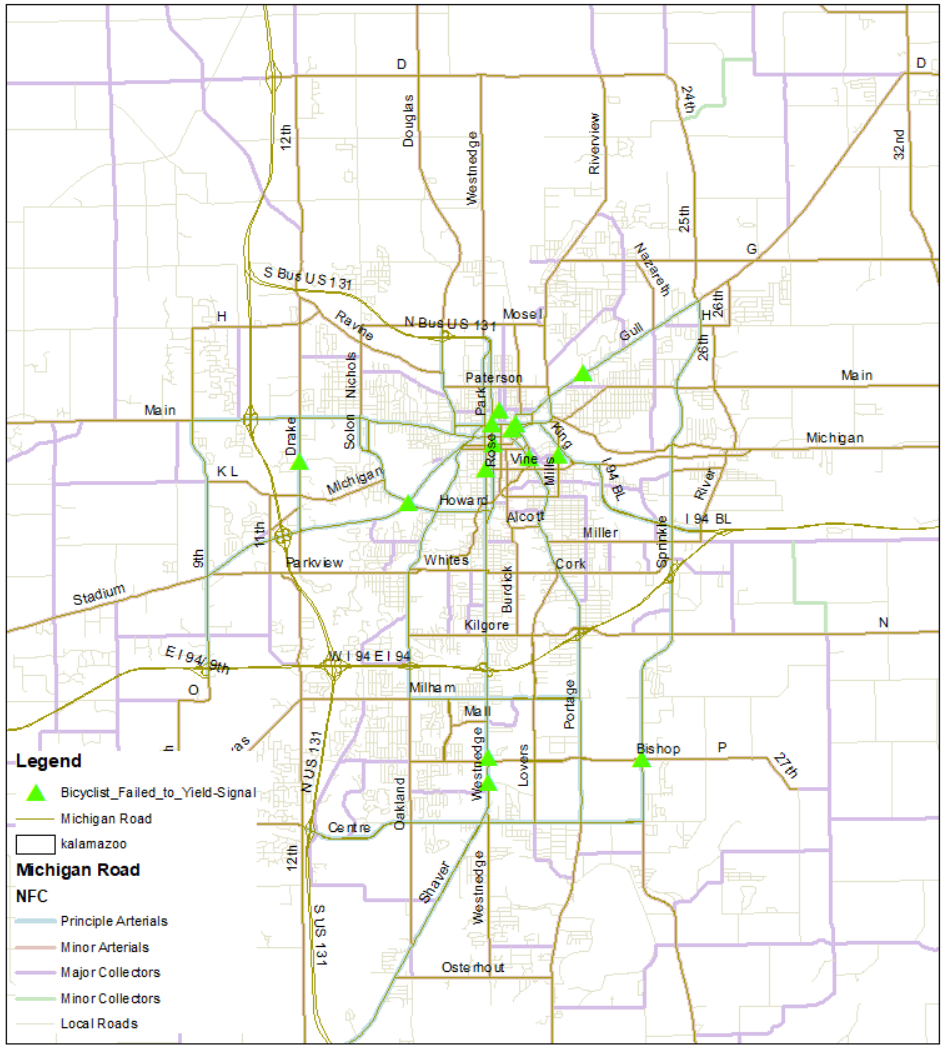


Diagram Drawn Not To Scale



Motorist Failed to Yield -**Traffic Signal**

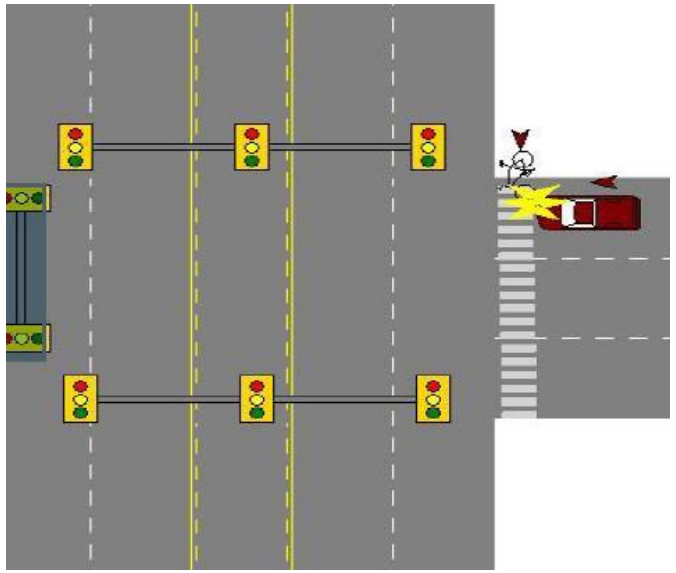
<u>Signal-related issue</u>

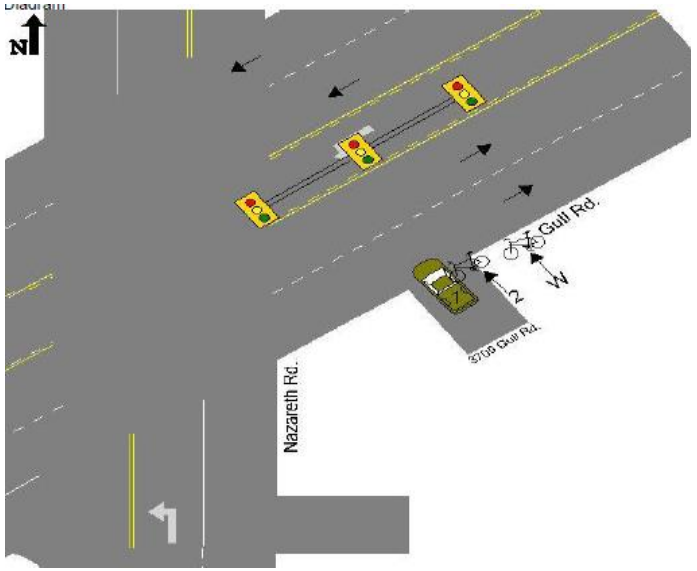
Out of 13 crashes, 8 drivers were turning right

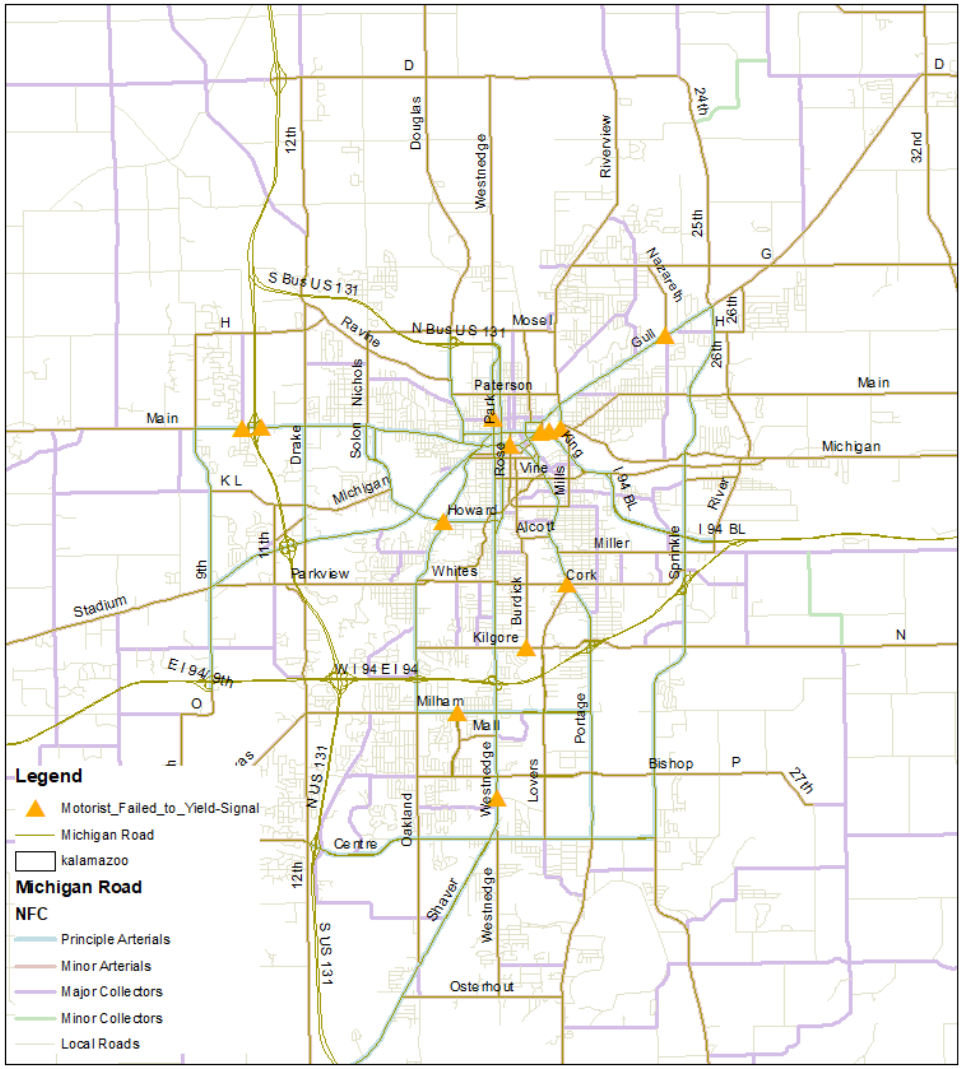
<u>Other issues</u>

Out of 13 crashes:

- 11 locations did not have bike lanes
- 9 bicyclist were riding the wrong way (facing traffic)
- 9 crashes involved bicyclists crossing minor streets
- 11 bicyclists were using sidewalk to cross the streets
- 6 locations had no push button



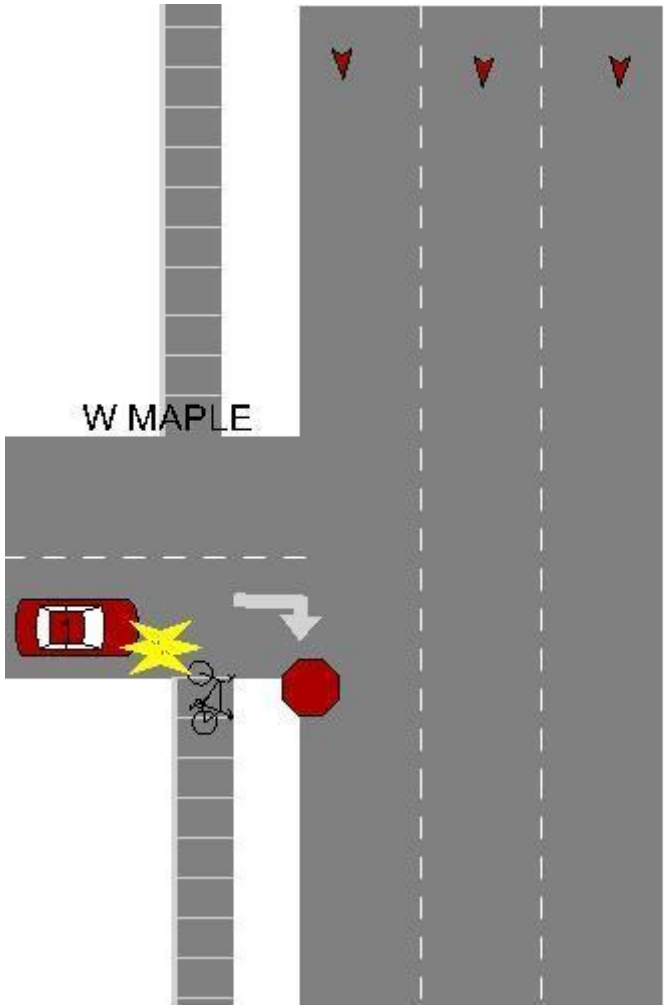


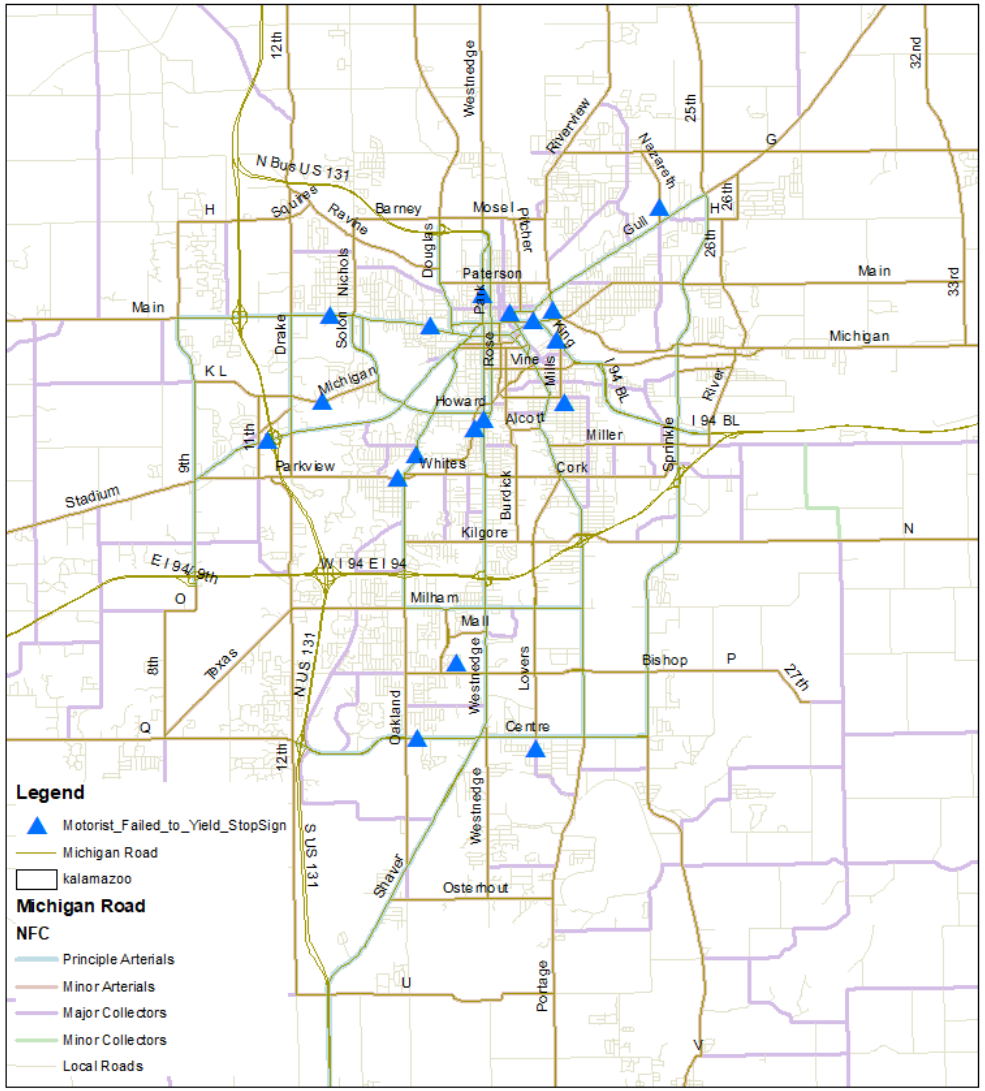


Motorist failed to yield: **STOP-sign** intersections

Most common scenarios:

- Bicyclist crossing the minor street/driveway(18 crashes(18 out of 18 crashes)
- No bike lane or shoulder on the main road (17 out of 18 crashes)
- Bicyclist travelling against traffic on a sidewalk (15 out of 18 crashes)





Conclusions

Behavioral

- Overtaking is associated with a significant number of bicycle crashes
  - Provide motorist education (5-feet passing distance)
- Yielding is still one of the leading causes of bicycle crashes
- Wrong way riding contributes to bicycle crashes
- Changing driver and bicyclist behavior for safety should be considered

Infrastructural

- More bike lanes could improve bicyclist safety
- Connectivity of bicycle network
- Pavement markings visibility

Operational

- Motorists turning right are associated with bicycle crashes
  - Right-Turn-On-Red prohibition should be considered
- Leading pedestrian interval should be considered at signalized intersections

Messages for Bicyclist Safety

1. Leave 3-5 feet when passing bicyclists (1 - overtaking)
2. Bicyclists must obey stop signs and signals (2 - yielding)
3. Drivers, watch for bikes when turning right. (4 - yielding)
4. Bicyclists should ride with traffic. (7 - compliance)
5. Bicyclists should wear helmet (6 – education for young riders)
6. Bicyclists must be visible. Use lights, reflectors and bright clothing. (3)
7. Bicyclists and motorists must be extra careful at intersections. (10, too general)
8. Motorists and bicyclists must be extra careful at driveways. (11, too general)
9. Bicyclists must use turn signals. (12)
10. Don't drink and ride. (8)
11. Do not park or drive in bike lanes (5)
12. Do not open vehicle doors in a way that blocks or injures bicycles. (14)
13. Bicyclists and motorists must follow the same rules of the road. (9, too general)
14. Bicyclists must be predictable. (13, too general)

Suggestions for Future Work

- Incorporation of bicyclist exposure data (volume) is necessary for planning and safety analyses
- Inclusion of hospital data in crash analysis is important
- Targeted behavior modification campaign(s)/plans are necessary
- Conducting before-after analyses for behavior modification is important