

Development of Statewide Pedestrian Safety Performance Functions

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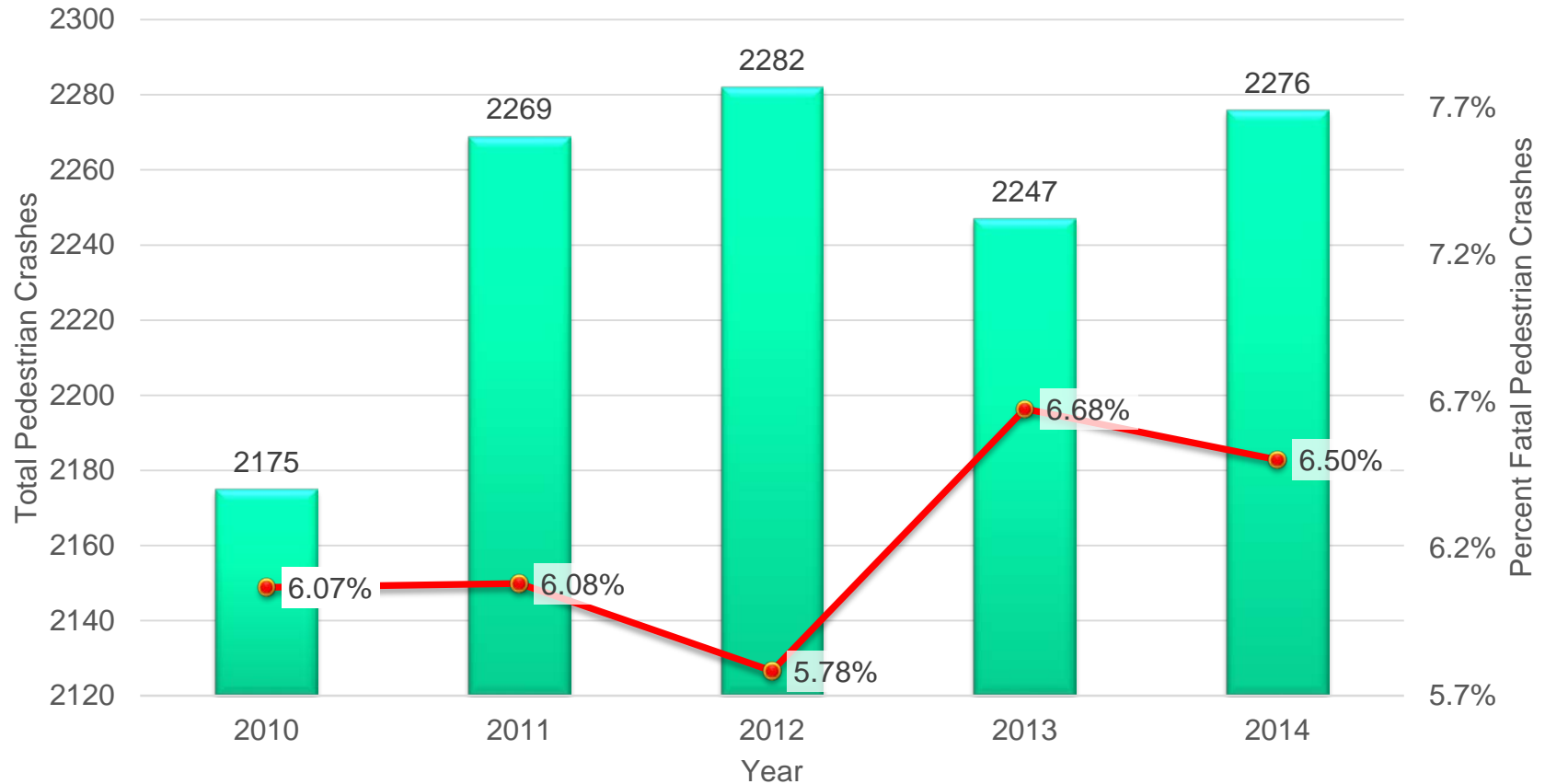


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Michigan Pedestrian Crash 2010-2014



Total Pedestrian Crashes and Fatality Percentages



 Total number of pedestrian crashes

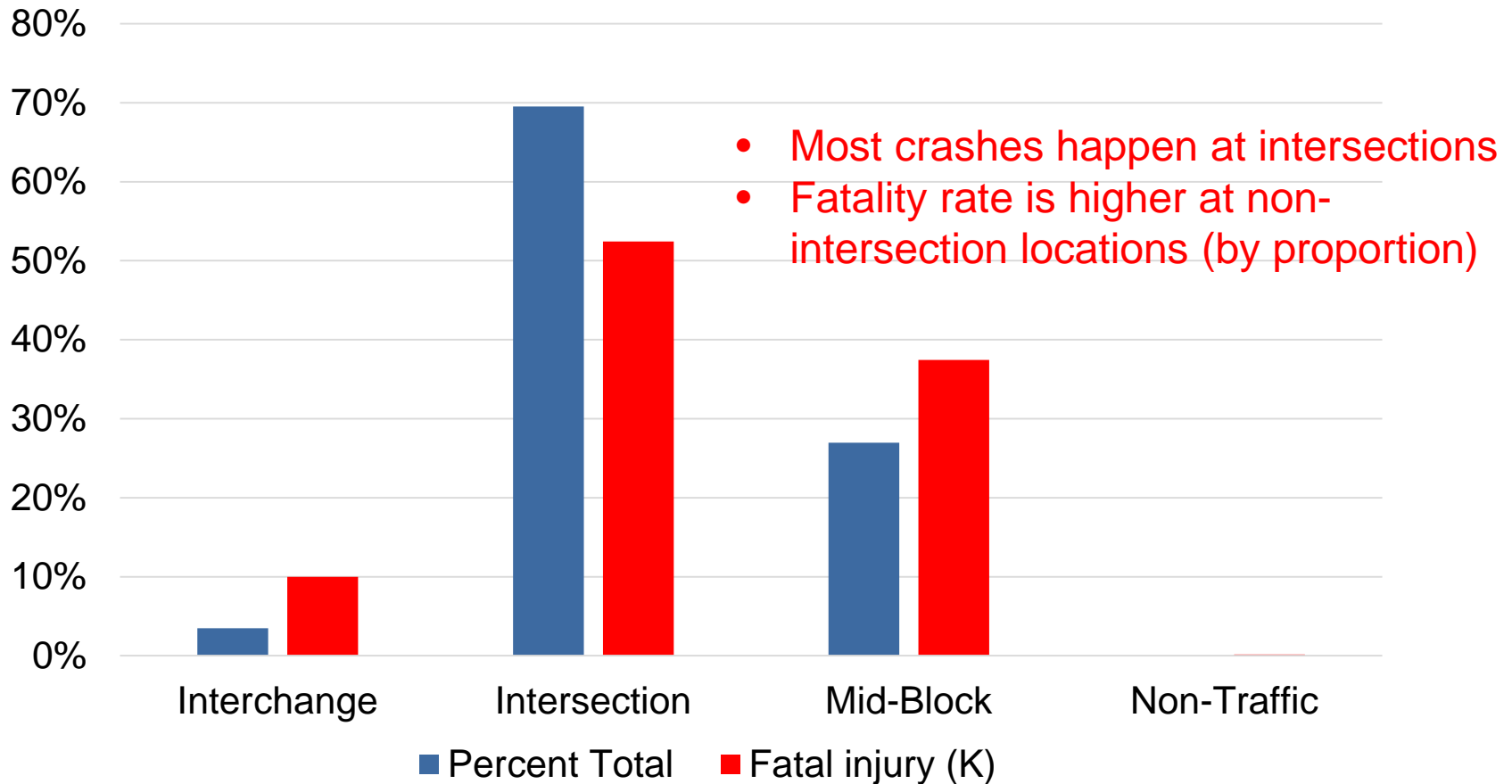
 Percent Fatal Crashes



Distribution of Pedestrian Crashes by Crash Location

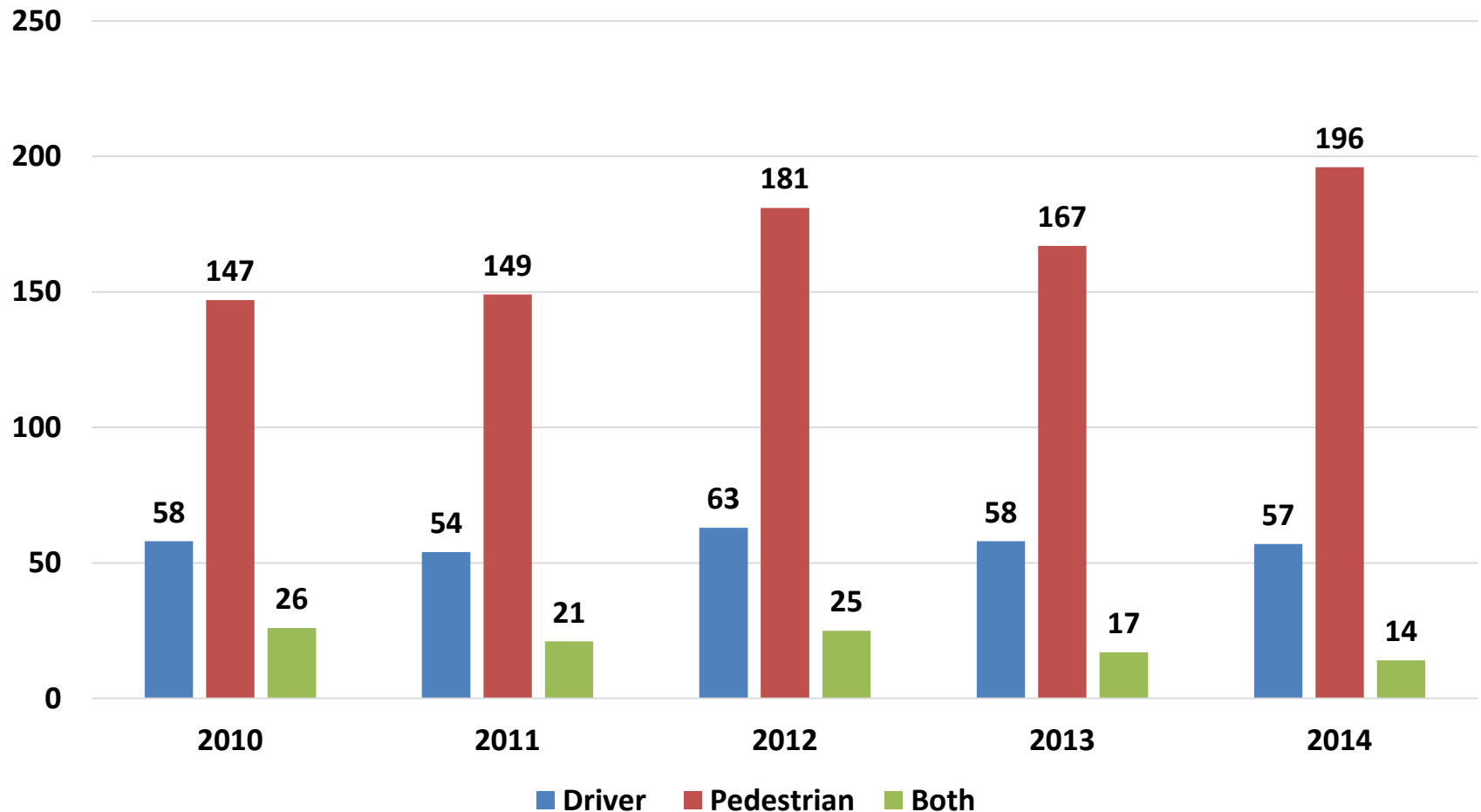


% Total and % Fatal by Location



Alcohol Involvement: Who had used alcohol - driver or pedestrian?

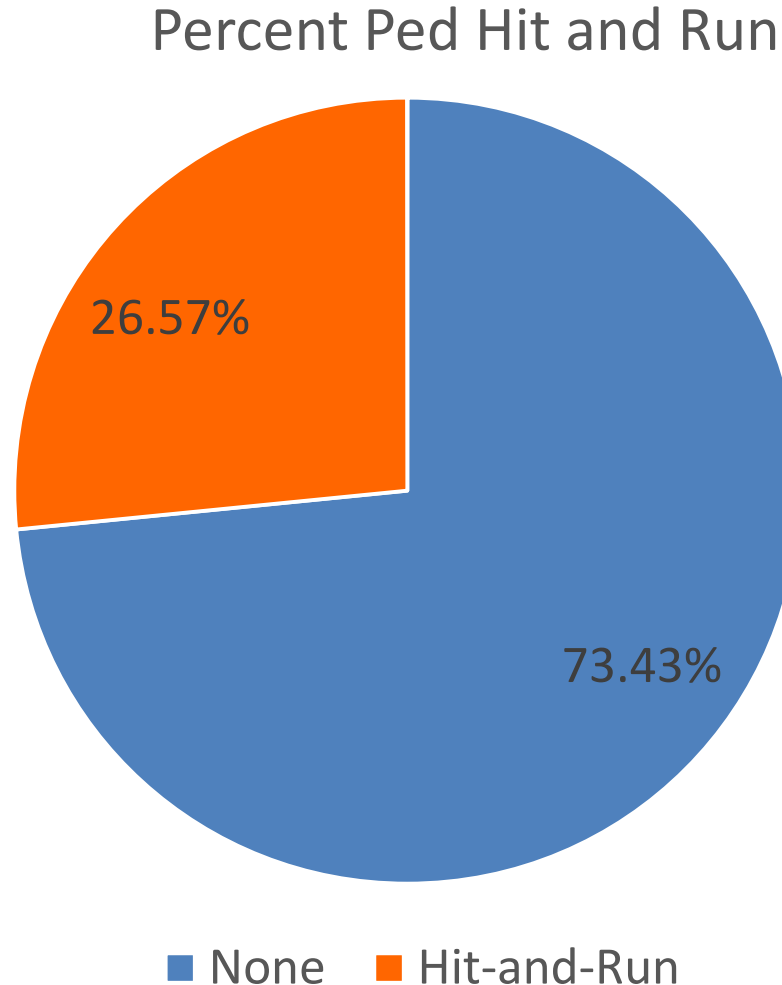
Alcohol use by pedestrians and/or drivers in alcohol-involved crashes



Hit and Run Crashes (2010-2014)



- Almost 27% of total pedestrian crashes are hit and run



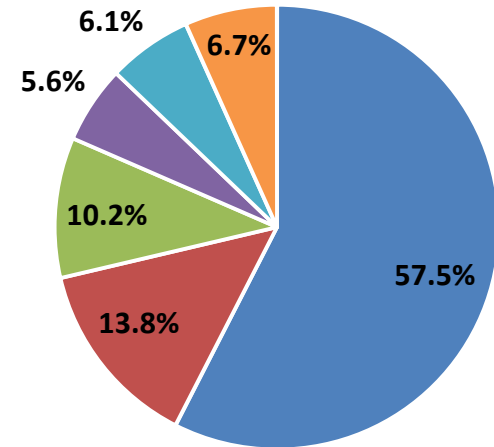


Risk Behaviors and Crash Causes

Six (6) pedestrian-related risk behaviors and crash causes:

1. Failing to yield and disregarding traffic control (by both pedestrians and motorists)
2. Pedestrians being in roadway (standing, lying, walking, playing, etc.)
3. Pedestrian being near vehicle (disabled vehicle, entering/exiting parked vehicle, bus-related, etc.)
4. Pedestrian walking along roadway (with traffic, etc.)
5. Loss of control (by motorists or pedestrians)
6. Other/unknown (off-road parking, unusual circumstances, etc.)

Distribution of Pedestrian Risk Behaviors and Causes



- Failure to Yield
- Pedestrian in Roadway
- Pedestrian Near Vehicle
- Loss of Control
- Pedestrian Walking Along Roadway





Safety Performance Functions

- Data from 4 Michigan cities

Ann Arbor, East Lansing, Grand Rapids, and Flint

Intersection Pedestrian SPF

$N_{int_ped_crash}$

$$= \exp(-.043449 NLN_{minor} + .000018 ADT + .000056 PedVol + .0455736 NumBar - .0035416 NumGrad + .043991)$$

Possion Regression Model

- Number of Lanes on Minor Street
- ADT
- Ped Vol
- Number of Bars (within 1/4 mile)
- Population with Graduate Degree (within 1/4 mile)

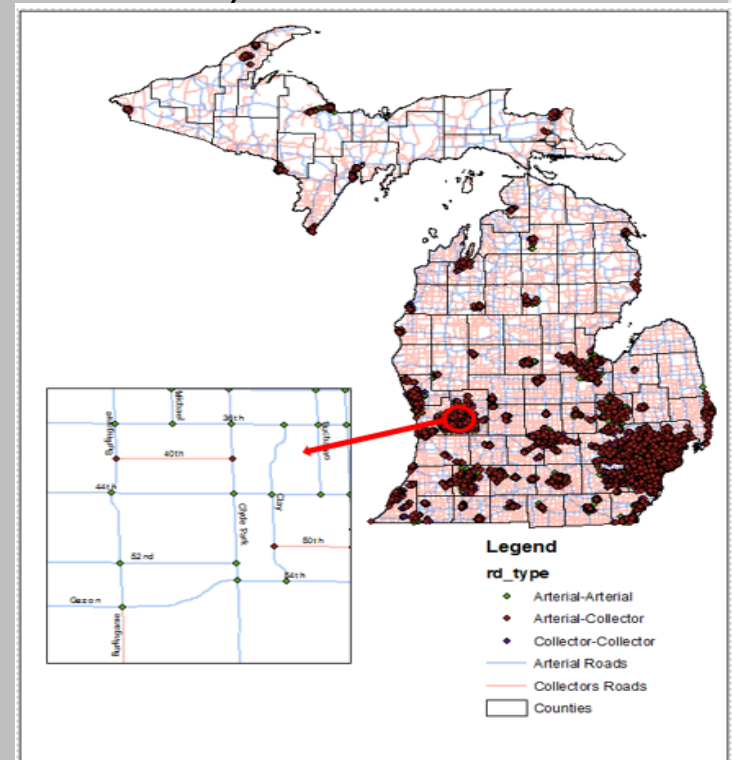
Statewide Data & Sampling

Case study: All intersections on arterials and collectors in Michigan urban areas (over 12,000 intersections)

Preliminary data collection

- Intersections by the number of legs
- Intersections by roadway class
- Urban population
- Pedestrian crash data (2010-2014)

Output: Sample intersections for detail data collection (300 samples)





Pedestrian Exposure Surrogate Measure

Pedlevel =

$$0.0707(\text{perc}_{\text{publ}} - 0.974) + 0.0008(\text{pop}_{\text{sqmile}} - 420.178) +$$

$$0.0153(\text{pov}_{\text{totblw}} - 13.473) + 0.0011(\text{walking}_{\text{qmile}} - 36.32) +$$

$$0.1222(\text{walksc} - 0.526) + 0.0014(\text{walksc} - 0.526) + 0.0000(\text{walksc} - 0.526) + 0.0000(\text{walksc} - 0.526) + 0.0000(\text{walksc} - 0.526)$$

| Factor Analysis | Standardized Coef. | Std. Err. | z | P>z |
|---------------------------------|--------------------|-----------|-------|-----|
| Percent using public transport | 0.5397 | 0.0440 | 12.26 | 0 |
| Population Density (per mile^2) | 0.6959 | 0.0345 | 20.17 | 0 |
| Percent of Poverty | 0.6131 | 0.0392 | 15.65 | 0 |
| Walking per square mile | 0.5299 | 0.0448 | 11.82 | 0 |
| Pedestrian Facility | 0.2568 | 0.0545 | 4.72 | 0 |
| Walk Score | 0.8347 | 0.0288 | 29.01 | 0 |
| Proportion of Commercial LU | 0.3244 | 0.0518 | 6.26 | 0 |



Models

Count models

- Poisson Regression Model (NRM)
- Negative Binomial Regression Model (NBRM)
- **Zero Inflated Poisson Regression Model (ZIP)**
- Zero Inflated Negative Binomial Model (ZINB)

Results

Zero Inflated Poisson Regression Model

$$\text{Ped-crashes} = \left[1 - \frac{1}{1 + e^{(0.918 + 2.375 \text{ Pedlevel})}} \right] X$$

$$\left[e^{-1.094 + 0.0234 \text{ AADT}_{maj} + 0.0405 \text{ AADT}_{min} + 0.2392 \text{ Pedlevel}} \right]$$

- *Ped_Level: + 0.2392 (2.69)*
- *AADT-maj: + 0.02364 (2.14)*
- *AADT-minor: + 0,0405 (2.51)*

Conclusion

■ Difficulties in Pedestrian Crash Modeling

- Randomness of Pedestrian Crashes
- Lack of Exposure Data

■ Future Needs

- Statewide pedestrian exposure data
- Pedestrian facility database/inventory
- Alternative approaches?