Effects of Safe Bicycle Passing Laws on Drivers’ Behavior and Bicyclists’ Safety

Ron Van Houten
Jun-Seok Oh
Valerian Kwigizile
Ahmad Feizi
Motorist Turns or Drives in Front of Bicyclist and Motorist Overtakes Bicyclist Crash types

These crash types are related and have particular relevance to the proposed study.

In the Motorist Overtakes Bicyclist case, the motorist misjudges space required to pass bicyclist.

This crash type had the highest number of fatalities in the Cross and Fisher (1977) study.

Recent study in 2017 confirms this has not changed in recent years.
Most States have a 3 ft bicycle passing law

Only one State has a 4 ft passing law

Some Cities have a 5 ft bicycle passing law (Grand Rapids, Ann Arbor, Kalamazoo and Portage)

Crash reduction for 3 ft law is next to nil
One component was to survey Drivers in cities with a 3ft law a 5ft ordinance and no specific law in order to determine their knowledge.

The second component was to measure passing distance on various road types in each of these cities.
C3ft Device Used to Measure Passing Distance
Camera On Board Also Recorded Passing Distance
<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
<th>State</th>
<th>Passing distance law</th>
<th>Population (2016)</th>
<th>Area (mi²)</th>
<th>Population density (/mi²)</th>
<th>Bicycle commuters (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grand Rapids</td>
<td>Kent</td>
<td>Michigan</td>
<td>5 feet</td>
<td>196,458</td>
<td>45.27</td>
<td>4,200</td>
<td>1.5</td>
</tr>
<tr>
<td>Kalamazoo</td>
<td>Kalamazoo</td>
<td>Michigan</td>
<td>5 feet</td>
<td>75,988</td>
<td>24.11</td>
<td>3,000</td>
<td>0.8</td>
</tr>
<tr>
<td>Portage</td>
<td>Kalamazoo</td>
<td>Michigan</td>
<td>5 feet</td>
<td>46,262</td>
<td>35.17</td>
<td>1,300</td>
<td>0.2</td>
</tr>
<tr>
<td>Lansing</td>
<td>Ingham, Eaton</td>
<td>Michigan</td>
<td>No specified distance</td>
<td>117,400</td>
<td>36.68</td>
<td>3,100</td>
<td>1.2</td>
</tr>
<tr>
<td>South Bend</td>
<td>St. Joseph</td>
<td>Indiana</td>
<td>3 feet</td>
<td>102,442</td>
<td>41.82</td>
<td>2,457</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Roadway Types Selected

- 2-lane roadway with separated bike lane
- 3-lane roadway with separated bike lane
- 2-lane roadway with shoulder bike lane
- 3-lane roadway with shoulder bike lane
- 2-lane roadway with sharrow
- 3-lane roadway with sharrow
- 2-lane roadway with none of the above
- 3-lane roadway with none of the above
Eight types of roadway configurations have been proposed to facilitate the comparison purposes:

<table>
<thead>
<tr>
<th># of lanes</th>
<th>Bike services</th>
<th>With bike lane</th>
<th>With shared lane (sharrow)</th>
<th>With paved shoulder</th>
<th>Without bike services</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-lane roadways</td>
<td>With bike lane</td>
<td>2-lane with bike lane</td>
<td>2-lane with shared use lane (sharrow)</td>
<td>2-lane with paved shoulder</td>
<td>2-lane without bike services</td>
</tr>
<tr>
<td>3-lane roadways</td>
<td>With bike lane</td>
<td>3-lane with bike lane</td>
<td>3-lane with shared use lane (sharrow)</td>
<td>3-lane with paved shoulder</td>
<td>3-lane without bike services</td>
</tr>
</tbody>
</table>
Survey Data

- Intercept survey of 150 drivers in each of the four cities
- Intercepted in parking areas of grocery stores, Malls and Gas Stations
- Most drove passenger car followed by pick up trucks and vans
- Equal numbers of men and women
Does this city have a law on how to safely pass a bicyclist?

- **South Bend**: 14% Unsure, 32% No, 54% Yes
- **Grand Rapids**: 11% Unsure, 24% No, 41% Yes
- **Lansing**: 20% Unsure, 20% No, 69% Yes
- **Kalamazoo**: 20% Unsure, 20% No, 44% Yes
If Yes, what does this law say?

- **Kalamazoo**: 76%
  - 3% (3ft)
  - 3% (4ft)
  - 5% (5ft)
  - 10% (6ft)
  - 0% (10ft)
  - 0% (17ft)
  - 0% (25ft)
  - 0% (Unsure)
- **Lansing**: 60%
  - 0% (3ft)
  - 0% (4ft)
  - 0% (5ft)
  - 20% (6ft)
  - 13% (10ft)
  - 0% (17ft)
  - 0% (25ft)
  - 0% (Unsure)
- **Grand Rapids**: 44%
  - 4% (3ft)
  - 6% (4ft)
  - 2% (5ft)
  - 2% (6ft)
  - 10% (10ft)
  - 0% (17ft)
  - 0% (25ft)
  - 0% (Unsure)
- **South Bend**: 43%
  - 7% (3ft)
  - 0% (4ft)
  - 14% (5ft)
  - 14% (6ft)
  - 0% (10ft)
  - 0% (17ft)
  - 0% (25ft)
  - 0% (Unsure)
Do you ride a bicycle?

- **South Bend**
  - Yes: 44%
  - No: 56%
  - Total: 49%
- **Grand Rapids**
  - Yes: 46%
  - No: 54%
  - Total: 53%
- **Lansing**
  - Yes: 37%
  - No: 63%
  - Total: 45%
- **Kalamazoo**
  - Yes: 38%
  - No: 62%
  - Total: 62%

"Yes" in total | No | Yes
--- | --- | ---
South Bend | 49% | 56% | 44%
Grand Rapids | 53% | 47% | 46%
Lansing | 45% | 55% | 37%
Kalamazoo | 62% | 38% | 38%
How many feet do you try to keep when passing between your car and a bicycle?

![Chart showing distribution of distances kept between a car and a bicycle in different cities.](chart.png)
Do you think it is a good policy for drivers to be required to pass bicyclists by at least 5ft?

- **Yes**: 86% (Kalamazoo), 84% (Lansing), 93% (Grand Rapids), 99% (South Bend)
- **No**: 3% (Kalamazoo), 8% (Lansing), 5% (Grand Rapids), 1% (South Bend)
- **Unsure**: 11% (Kalamazoo), 8% (Lansing), 2% (Grand Rapids), 0% (South Bend)

The graph shows the distribution of responses, with a focus on the percentage of respondents who believe it is a good policy for drivers to pass bicyclists by at least 5ft. The data is stratified by city, with Kalamazoo, Lansing, Grand Rapids, and South Bend each displaying a high percentage of affirmative responses, ranging from 91% in Lansing to 99% in South Bend.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Err.</th>
<th>Z</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of lanes</td>
<td>0.443</td>
<td>0.039</td>
<td>11.24</td>
<td>0.366 - 0.521</td>
</tr>
<tr>
<td>Lane width</td>
<td>0.100</td>
<td>0.027</td>
<td>3.65</td>
<td>0.046 - 0.154</td>
</tr>
<tr>
<td>Presence of shoulder</td>
<td>0.310</td>
<td>0.049</td>
<td>6.34</td>
<td>0.214 - 0.406</td>
</tr>
<tr>
<td>Presence of 5-foot law</td>
<td>0.405</td>
<td>0.040</td>
<td>10.16</td>
<td>0.327 - 0.483</td>
</tr>
<tr>
<td>Overtaken by truck</td>
<td>-0.264</td>
<td>0.055</td>
<td>-4.78</td>
<td>-0.373 - -0.156</td>
</tr>
</tbody>
</table>
presence of **paved shoulders**, in spite of sharrows, significantly increases the passing distance.

The significant level of the **five-foot law** variable properly describes the prominence and the necessity of such a law to enhance bicyclists’ safety.

Reinforced the idea that the **large vehicle** drivers are more likely to pass closer from the bicyclists
Knowledge of the law seems to fit the data very well. Kalamazoo had the greatest knowledge. This may be because of the multi-bicycle crash was so widely publicized. Grand Rapids is next.

Enforcement might also increase passing distance with either law.
Data Collection

- More violations occurred in 2-lane roadways
- Drivers in roadways with bike-lane may think that the bicyclist is riding in his own way and it doesn’t need to keep more distance during the overtaking

![Passing Distance in Kalamazoo](chart.png)
Data Collection

Passing distance in Kalamazoo

- More than 8 ft.
- 5 ft.
- 3 ft.
- Less than 3 ft.

2-lane with bike lane
2-lane with shoulder
2-lane with sharrow
3-lane with bike lane
3-lane with shoulder
Drivers gave greater passing distance to bicyclists for all types of 2 and 3 lane roadways in the two cities with a 5 ft law than in the city with a 3 ft law and the city with no law.

Most drivers in all four cities indicated that they felt they should give at least 5 ft when passing.
Greater violation rate in areas with five-foot passing law (14%) comparing with areas three-foot law (2%) reveals that the five-foot law is more reasonable for police enforcement in future.

The roads with paved shoulders, wider roads, and roads with more lanes contribute to larger passing distances.

Shared use lanes (sharrows) or high truck concentration traffic are associated with closer passing distance.

The algorithm can be used in autonomous car applications for automated overtaking procedures.
Questions

- Would these data be different if police enforced the 5 ft and 3 ft passing laws?
- Would these data be different if more people were aware of the passing law?
- Did the serious crash killing multiple cyclists have an impact on Kalamazoo/Portage drivers?
Recommendations

- That cities consider passing a 5 ft passing law to increase passing distance
- That cities consider more widely promoting the passing law distance
Thank you!