

White Paper Executive Summary: Bicycling Facilities, Crash Types, and Bicyclist Risk

There have been a number of studies showing lower overall crash rates for bike lanes and other types of bikeways, and it is generally assumed that improved motorist behavior is primarily responsible for those reductions. But such reports have not differentiated between crashes caused by motorists and those caused by bicyclists. Nor have they examined which crashes might have been relevant to the presence or absence of a bikeway, or other likely factors that may have had an impact. The reason for this shortcoming is that these studies have not catalogued and analyzed the motorist and bicyclist behaviors contributing to the crashes.

In order to get a comprehensive understanding of how bicyclist/motorist crashes occur and how different bikeway types might mitigate (or aggravate) such crashes, we need to classify crashes by bicyclist position and direction, and by the motorist and bicyclist actions that lead to crashes. If we are to determine which type of facility is likely to provide the most “protection” from motorist-caused crashes, we need to limit the analysis to just those types of crashes that are caused by the motorist rather than by the bicyclist.

MetroPlan Orlando studied ten streets that have had bike lanes for at least ten years, and ten comparable streets without bike lanes, and analyzed and categorized ten years of police crash reports for those streets. Five streets with adjacent shared use paths (called sidepaths because they are beside the roadway) were similarly studied with ten years of crash data. In order to estimate bicyclist exposure, bicyclists were counted along all of the above facilities, noting the bicyclists’ direction (relative to the normal direction of vehicular traffic), position (the right edge of a regular travel lane, bike lane, sidewalk or sidepath), and bicyclist speed.

Key Findings

The factors most likely to contribute to motorist crashes with bicyclists are:



Bicyclist Direction: bicyclists traveling facing the flow of normal vehicular movement, whether on a sidepath, sidewalk, bike lane or travel lane, are 5 times more likely to be involved in a crash.



Frequency of Intersections and Commercial Driveways: since 95% of urban and suburban bicycle crashes involve turning and crossing conflicts at intersections and driveways, the frequency of those conflict points is a key contributing factor. Reduced crash rates attributed to bicycle facilities are likely due more to this underlying factor than to the bikeway itself.



Bicyclist Speed: on average, bicyclists who travel on sidepaths, sidewalks and bike lanes travel slower than those who use regular travel lanes. Slower cyclists need less time and distance to stop when a motorist violates the bicyclist’s right-of-way.

The “safety-in-numbers” correlation – which shows reduced crash rates as the numbers of bicyclists increases – is due to a *lower rate of bicyclist-caused* crashes, rather than a broadly-assumed reduction in motorist-caused crashes.

Questions?

Please contact the author of this white paper here:

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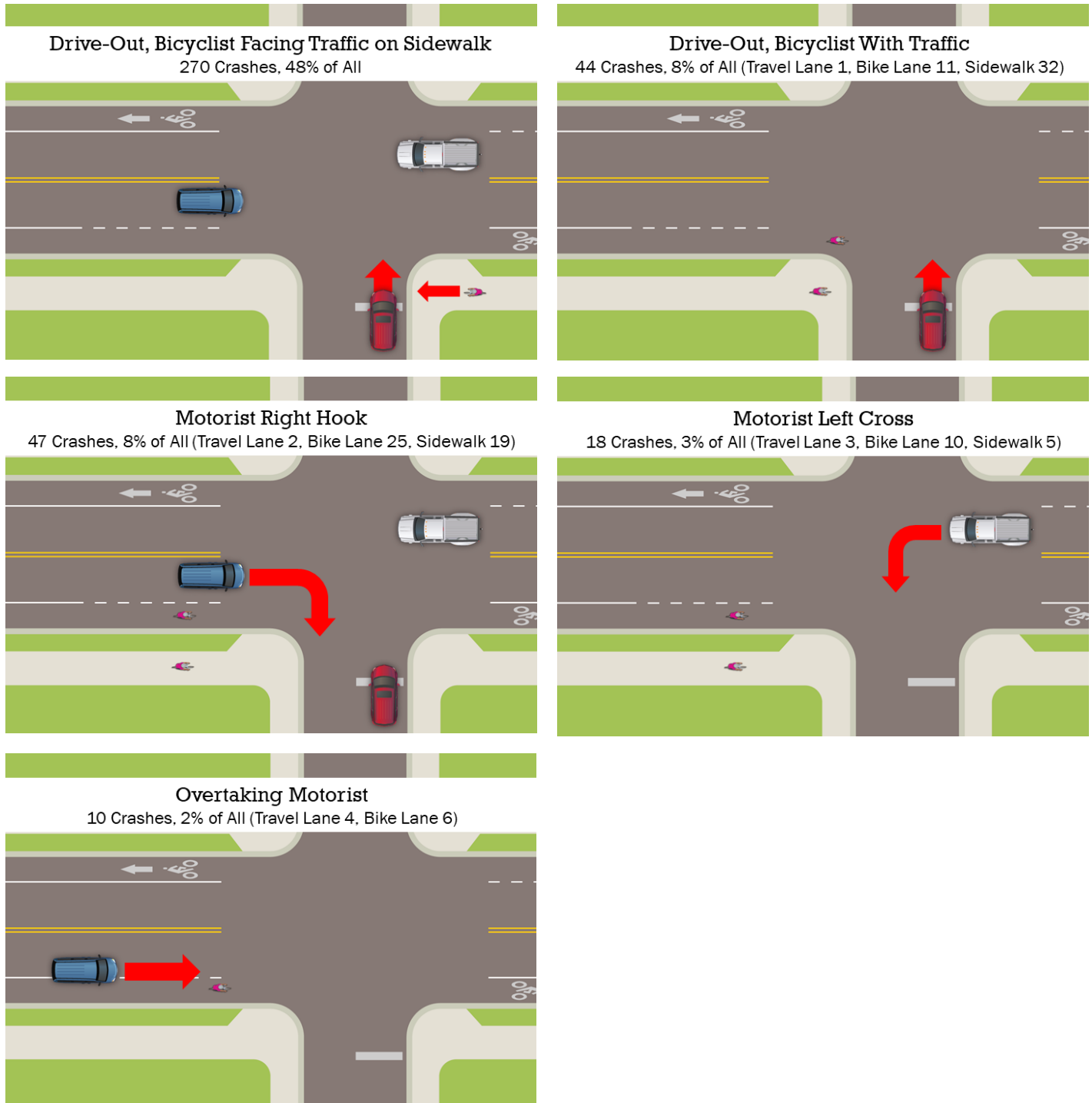
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Most Common Crash Types

Below are the most common types of bicyclist/motorist crashes on the 20 study streets. There were 560 reported crashes for these streets in the ten-year period. These seven types account for 87% of all crashes.

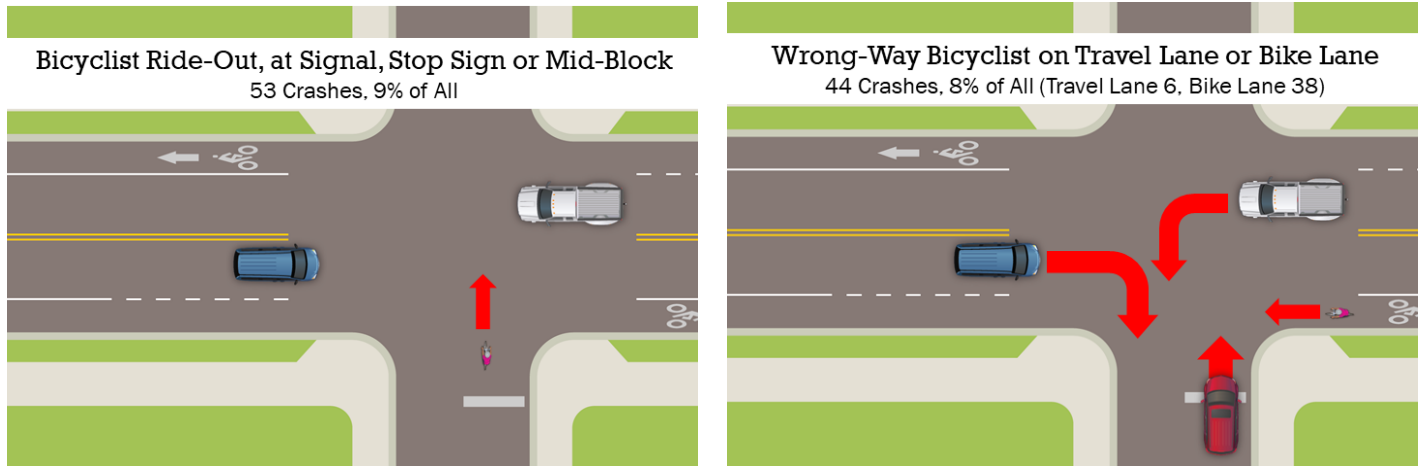
Most Common Motorist-Caused Crash Types

72% of the crashes in this study were motorist-caused, and 97% of those involved a motor vehicle turning across the path of a cyclist or pulling out from a cross street or driveway



Most Common Bicyclist-Caused Crash Types

20% of the crashes in this study were bicyclist-caused. Nearly half involved a bicyclist who violated the right-of-way of a motorist, and 39% involved a bicyclist driving against the flow of traffic while on a travel lane or bike lane.



The remaining 8% of crashes involved less common crash types, ones in which fault cannot be assigned, and ones with uncertain or unknown causes.

For the five sidepaths studied there were 60 total crashes over ten years, with:

- 15% involving bicyclists traveling with the flow of traffic
- 80% involving bicyclists traveling facing the flow of traffic
- 80% caused by motorists
- 17% caused by bicyclists
- 70% involving motorist drive-outs
- 10% involving motorist turning conflicts

From the above crash data, bicyclist counts and bicyclist speed measurements we can estimate relative risks for different types of crashes, for travel with versus against the flow of traffic, and for the position and speed of the bicyclist. We found the following factors to be most important.

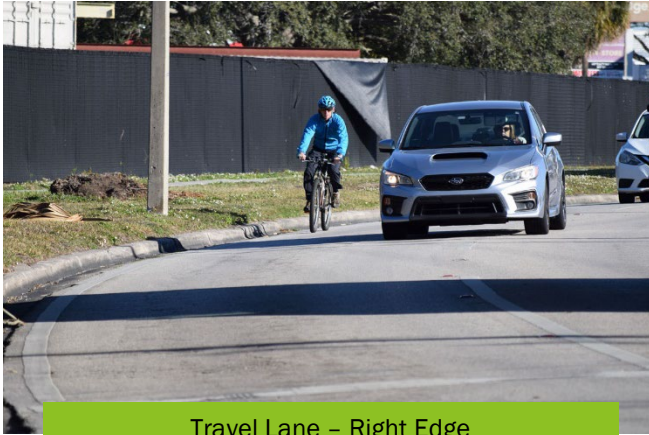
Bicyclist Direction

Bicycling facing the normal direction of vehicular traffic is about five times riskier than bicycling with the flow, regardless of whether the bicyclist is on a travel lane, a bike lane, a sidewalk or a sidepath. This is so because motorists crossing the paths of approaching bicyclists are looking in the direction of where normal vehicular traffic is approaching. Since bicyclists travel significantly faster than pedestrians, they can be much farther from the intersection or driveway as the motorist arrives at the point of conflict, and are less likely to be noticed.

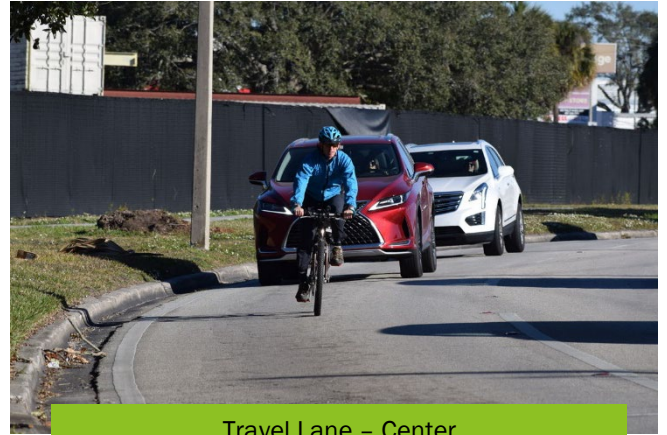
BICYCLING FACING THE NORMAL DIRECTION OF VEHICULAR TRAFFIC IS ABOUT FIVE TIMES RISKIER THAN BICYCLING WITH THE FLOW.

Bicyclist Position

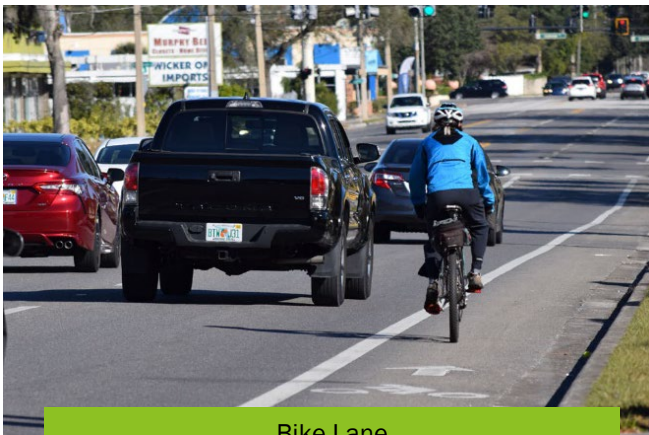
For bicyclists traveling *with the flow of traffic*, those using bike lanes had risk for motorist-caused crashes that was 106% lower than for those using the right edge of travel lanes. The risk for sidewalk users was 294% lower, and the risk for sidepath users was 587% lower. But bicyclist speed varies a great deal between those who use travel lanes, bike lanes, sidewalks and sidepaths.



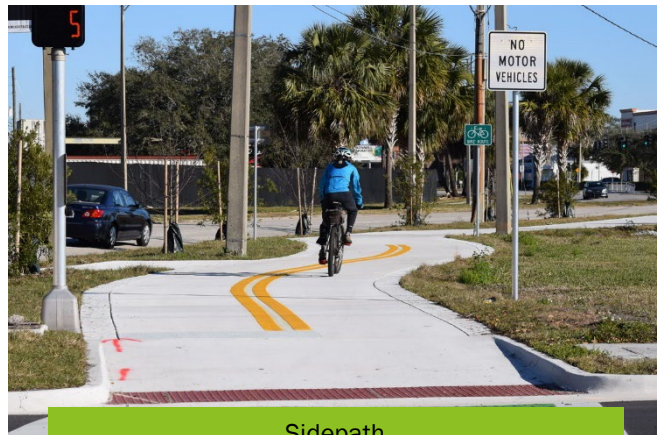
Travel Lane – Right Edge



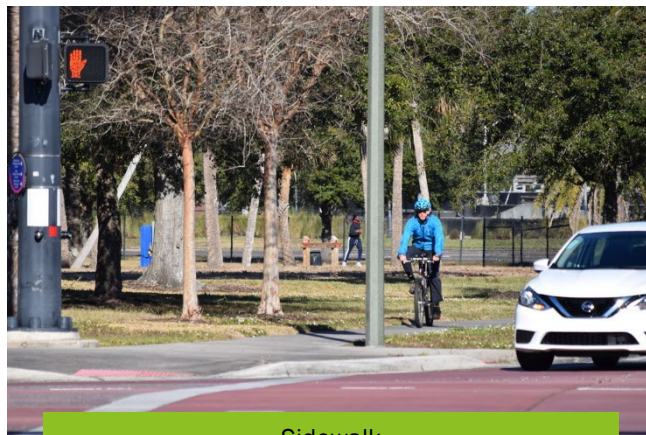
Travel Lane – Center



Bike Lane



Sidepath

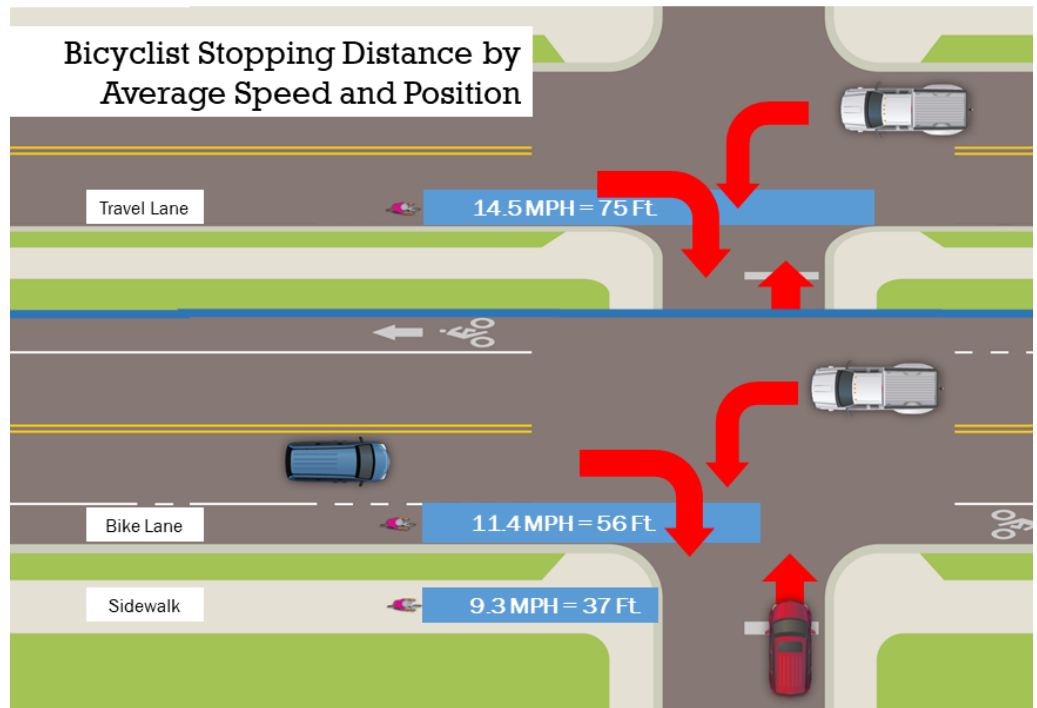


Sidewalk

Bicyclist Speed

Bicyclist speed is an important risk factor, and we measured the speeds of bicyclists in the different positions. Travel lane bicyclists averaged 14.5 mph; bike lane users averaged 11.8 mph; sidewalk users averaged 9.3 mph, and sidepath users averaged 11.7 mph.

85% of motorist-caused crashes involving bicyclists traveling with the flow on travel lane or bike lane involved a motorist *crossing* the bicyclist's path rather than hitting the bicyclist from behind. For such crossing path conflicts a faster bicyclist would need much greater stopping distance to avoid a crash. The lower risk experienced by bike lane, sidewalk and sidepath users is largely due to their slower speeds. ***Each additional mile per hour for the bicyclist above 9 mph increases their risk for a motorist-caused crash by about 9%.***



Frequency of Conflict Points

Since most motorist-caused crashes involve crossing movements, ***the number of intersections and commercial driveways is also an important factor.*** Three of the five sidepaths studied had less than half as many intersections and commercial driveways per mile compared to the other sidepaths and the bike lane and comparison streets. The sidepaths with higher numbers of intersections and driveways had worse crash rates than the sidewalks along the bike lane and comparison streets. In the table below, a higher number of Bicyclist Miles Between Motorist-Caused Crashes means a lower risk.

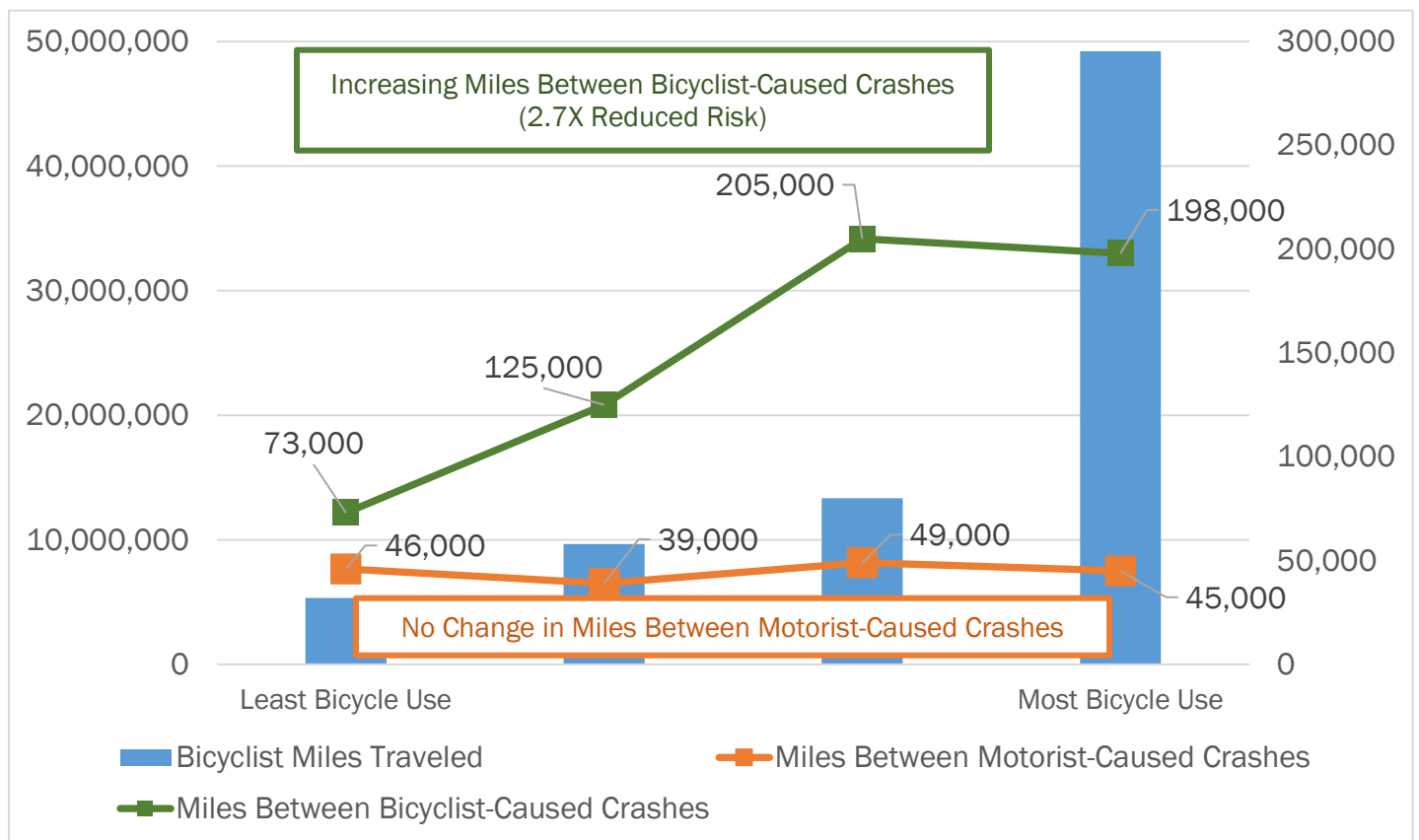
Facility	Number of Motorist-Caused Crashes	Miles of Bicyclist Travel	Average Number of Intersections and Commercial Driveways per Mile	Bicyclist Miles Traveled Between Motorist-Caused Crashes
Sidepaths: Cross Seminole Trail (Lake Mary) Cross Seminole Trail (Oviedo) Pleasant Hill Road Path (Osceola)	36	3,003,000	4.6	81,000 (Lowest Risk)
Sidepaths: West Orange Trail (Apopka) Daniels Road Path (Winter Garden)	14	411,000	11.6	29,000 (Highest Risk)
Sidewalks: Along Bike Lane and Comparison Streets	363	14,628,000	10.5	40,000

Safety in Numbers

In a 2003 paper in Injury Prevention, researcher Peter Jacobsen found a correlation between higher numbers of bicyclists and lower bicyclist crash rates. A consensus has developed around this correlation that it must be because motorist behavior is better in places with more bicyclists, but no specific data has ever supported this assumption.

With our data, we were able to compare corridors with higher and lower levels of bicyclist travel and compare them to the numbers of motorist-caused and bicyclist-caused crashes. Rather than motorist behavior improving with the increase in bicyclists, our data shows that it is bicyclist behavior that is better, with lower rates of bicyclist failure-to-yield crashes on the corridors with more bicyclists.

An 11-fold increase in bicyclist activity corresponded to a 2.7 times lower rate of bicyclist-caused crashes, while there was no measurable improvement in motorist-caused crashes.



Key Recommendations for Bicyclists and Motorists

For Bicyclists

Go With the Flow

With the risk being five times higher for bicyclists traveling against the flow of traffic compared to traveling with the flow – whether they are on a sidewalk, sidepath, bike lane or travel lane – minimizing the time spent riding against the flow should be a bicyclist’s top priority, especially on streets with frequent intersections and driveways. Some bicyclists will say they will just “be more careful” when riding facing traffic, but such bicyclists would ***need to be five times more careful*** than normal. Such heightened vigilance is not sustainable.

Speed & Position

The faster a bicyclist goes, the riskier it is to be on the sidewalk, on a sidepath, a bike lane, or even along the edge of a regular travel lane, especially on streets with frequent intersections and driveways. The faster you bike, the more important it is to ***use the time-tested strategy called “lane control.”*** Lane control means cycling near the center of a regular travel lane, rather than along the right edge. For more information: <https://cyclingsavvy.org/road-cycling>



How fast is too fast to use a sidewalk or bike lane? If you are experiencing too many conflicts from crossing and turning motorists, either slow down or move to the lane control position.

For Motorists

Bicyclists on the Roadway are Legal Vehicle Drivers

Bicyclists are not required to use sidewalks or sidepaths, may have legitimate safety reasons to avoid bike lanes, and are not required to hug the right edge when a lane is too narrow to share. Pass safely and with courtesy, making a full lane change if a bicyclist is ahead of you in the same lane.

Look Right

Many bicyclists are uncomfortable using the roadway, so they use the sidewalk. A bicyclist on a sidewalk or path has the same rights and duties as a pedestrian, so they can travel in either direction. When crossing a sidewalk or sidepath from a cross street or driveway be sure to look well down the right side to see if a bicyclist is approaching from that direction.

Some Bicyclists Are Fast

Bicyclists can be faster than you expect, especially if they are on a bike lane or travel lane. It can be easy to misjudge the speed of an approaching bicyclist, especially in poor seeing conditions. Give yourself an extra second or so to make sure you understand how fast the bicyclist is moving so you don’t violate their right-of-way and cause a crash.

Check Your Blind Spots

Bicyclists can approach from behind on the right when you are turning right, and can be hidden by vehicles on the other side of the road when you are turning left. Use extra care to check those spots when preparing for turns.