

| UTC Project Information | |
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| Project Title | MPC-455 – Why Are Bike-Friendly Cities Safer for All Road Users? |
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| Brief Description of Research Project | Bicycling as a fundamental mode of transportation is being reinvented in the United States. On one hand, Americans are becoming increasingly reliant on bicycling, as evidenced by the 61% increase in bicycling to work between 2000 and 2010 (U.S. Census |

Bureau 2013). At the same time, more and more U.S. cities are improving their bicycling infrastructure. For instance, the number of protected bike lanes in the U.S. increased by almost 65% in 2012 alone (Snyder 2013). Despite these changes, a recent bicycling safety report from the Organization for Economic Cooperation and Development (OECD) states that Americans still bicycle less than residents of the other 33 OECD countries. Moreover, Americans are also among the most likely to die as bicyclists (OECD and International Transport Forum 2013).

Just how dangerous is bicycling? Given the lack of exposure data and bicycling counts in the U.S., this is a difficult question to answer definitively. However, we will attempt to estimate the relative safety of bicycling in the U.S. as compared to driving. For instance in the U.S. in 2012, 33,561 people were killed in motor vehicle crashes, of which 726 involved a bicycle. In 2012, Americans drove 2,938,535 million miles, which equates to a fatality rate of 1.14 fatalities per 100 million VMT (FHWA 2013). With respect to bicycling, the National Sporting Goods Association reports that 39.3 million Americans aged 7 or older rode a bike in 2012 (National Bicycle Dealers Association 2012). So given that number of bicyclists and the 726 bicyclist fatalities in 2012, each bicyclist would have to bike more than 1,600 miles each year to achieve a better fatality rate than those in motor vehicles. This would mean that the 12.5% of Americans who bike were bicycling 4.5 miles every day of the year. While this level of bicycling would be encouraging on many fronts, it is not a realistic level of bicycle exposure in the U.S. context given current travel patterns (Mapes 2009). Another bicycling safety estimate from Pucher and Dijkstra approximated bicycling exposure from commute data and found that the per-mile fatality rate for drivers in the U.S. was approximately ten times lower than that for bicyclists (Pucher and Dijkstra 2003, Mapes 2009). Either way, these estimates suggest that there is a much higher chance of a fatality per mile cycled than per mile driven.

Transit, on the other hand, has been shown to be a much safer mode of transportation than driving. Recent numbers suggest fewer than 0.06 fatalities per 100 million passenger transit miles traveled, which is approximately nineteen times safer than driving (Politifact.com 2011). Given this difference between transit and automobile safety, it would stand to reason that cities with a high percentage of people traveling by transit would be safer overall than the typical automobile-based city. This trend turns out to be the case. In an international study, Kenworthy and Laube concluded that cities with higher transit use also tended to have lower overall fatality rates (Kenworthy and Laube 2000). Litman, in a separate analysis, found that the per capita fatality rates of U.S. cities were lower with increased transit use and that residents of automobile-oriented cities had a traffic fatality rate five times that of those living in transit-oriented communities (Litman 2009, 2013). One reason

behind these results is that more transit use tends to also lower the overall level of vehicle use. Another explanation is that transit use is higher in relatively dense metropolitan areas with urban forms designed for relatively slow speeds, thus reducing the number of deaths of travelers by just about any mode.

So given these safety trends, one might conclude that bicycling-based cities must be far more dangerous than either transit-based cities or automobile-based cities. However, the evidence strongly points to the fact that cities known for their bicycling are not just safer for bicyclists but for all road users (Marshall and Garrick 2011). For instance, the U.S. city with the greatest percentage of people bicycling to work – Davis, California – endured only nine fatal road crashes over a recent twelve year period. Only three of those fatalities occurred on non-limited access streets, and not one involved a bicyclist. These results equate to a fatal crash rate of less than 1.5 per 100,000 residents. With the current per capita crash rate in the U.S. more than seven times higher at 10.7 fatalities per 100,000 residents, it is easiest to discount Davis as an outlier. Yet, Davis is not alone. Another city that has become renowned for its bicycling over the last twenty years – Portland, Oregon – has concurrently improved its road safety record. Between 1990 and 2010, Portland’s bicycle mode share increased from 1.2% to 6.0%; at the same time, the total number of road fatalities in Portland dropped by 75% over the last ten years with no bicyclist fatalities in more than half of those years (City of Portland Bureau of Transportation 2011). This is a remarkable safety record (4.5 fatalities per 100,000 residents for 2010) for a city of over 580,000 people and is only comparable internationally to countries reporting the lowest crash rates in the world such as the Netherlands at 4.0 per 100,000 residents (OECD 2011). Perhaps not coincidentally, the Netherlands also boasts a bicyclist mode share of 27% (Pucher and Bueler 2008).

Examples such as Davis, Portland, and the Netherlands are often written off as outliers because their cultures of bicycling have been prevalent for decades. New York City, however, is a relative newcomer to the bicycling experiment, having installed over 350 lanes miles of bike lanes since 2006 (New York City DOT 2013). Over the last five years, bicycling has nearly doubled in New York City while traffic deaths are down more than 30% (Donohue 2013, Miller 2013).

Despite conventional logic, the evidence continues to build that bike-friendly places are not only safer for bicyclists but for all road users. The motivating question for this research, however, is: why is this the case?

A handful of existing studies have tackled the bicyclist ‘safety in numbers’ concept where individual bicyclist risk drops with an increasing number of bicyclists (Ekman 2006, Jacobsen 2003,

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| | <p>Jensen 2002, Nordback and Marshall 2010, Nordback, Marshall, and Janson 2013). The rationale most often given for this safety benefit is a shift in driver expectations and behavior based upon the perceived possibility of encountering a bicyclist. However, these studies only attempt to understand the difference in bicyclist safety. Far fewer studies have investigated the safety effect of a bike-friendly city on the safety of all road users (Marshall and Garrick 2011).</p> <p>Beyond safety in numbers, there are other theories as to why these places seem to be safer for all road users. Accordingly, we hypothesize the following four pathways through which high-bicycle-mode-share cities improve transportation fatality rates for all road users:</p> <ol style="list-style-type: none"> 1. Socio-demographic and socioeconomic changes, as cities become more populated by those with generally lower transportation injury risks; 2. Built environment changes, as cities promoting bicycling create streets and land use patterns; 3. Travel behavior changes, as the shifting demographics, incomes, and land use patterns help reduce exposure; and 4. Traffic and operation changes, as the above differences help promote lower speed environments. <p>This will be the first research study to attempt disaggregate and understand what makes these high-bicycle-mode-share cities safer for all travelers, the differential impact of these various influences, and the interactions of these variables on different groups of road users.</p> <p>Research Objectives - This study will:</p> <ol style="list-style-type: none"> 1. Identify the influence of socio-demographic and socioeconomic changes in cities experiencing a concurrent increase in bicycling and improvement road safety; 2. Characterize the influence of built environment changes in these cities; 3. Investigate the relationship between evolving travel behaviors and overall road safety; 5. Advance knowledge by carrying out analyses to answer research questions 1–4; 6. Advance policy and practice by identifying important explanatory variables with respect to building safer cities; 7. Advance education through the training of students; and 8. Build an evidence base on a novel topic by share findings through publications, presentations, and a project website. |
| <p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p> | <p>Cities will be able to use the results of this research project to more effectively establish a data-driven approach to safer streets.</p> |

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| <p>Impacts/Benefits of Implementation (actual, not anticipated)</p> | <p>Our results suggest that building more compact places is typically representative of lower-speed urban environments with better bike facilities, increased non-driving modes, and improved emergency response. Such combinations of factors need to be considered when looking towards trying to build a safer and healthier transportation system with an evidence-based approach.</p> |
| <p>Web Links</p> <ul style="list-style-type: none">• Reports• Project Website | <p>https://www.ugpti.org/resources/reports/details.php?id=928</p> |