Understanding Bicyclist-Motorist Crashes in Louisville, Kentucky

A comprehensive look at crash data from 2003-2012 and
Recommendations for improved bicyclist safety

Bike Louisville
Public Works Department
Louisville Metro
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CONTENTS

EXECUTIVE SUMMARY

The 2010 Louisville Bicycle Master Plan[1] has two primary goals: (1) To increase bicycling activity throughout all parts of Louisville by making it a fun, comfortable and accessible mode of travel between 2010 and 2030 and (2) To simultaneously reduce the number of cyclists killed and injured in crashes with motor vehicles. Specific crash attributes were extracted from the Kentucky State Police database, analyzed and mapped. The findings in this report should be used to inform and influence the design of new bicycle facilities, the redesign of existing roadways, the development of education programs for bicyclists and motorists, enforcement campaigns, and the creation of bicycle-related policy in Louisville.

Key Findings from 2003-2012:

When crashes occur:

- An average of 155 bicyclist-motorist crashes occurs annually in Louisville.
- Crashes are most prevalent from April-October (80.2 percent), on weekdays (76.9 percent) and during afternoon peak period from 3:00-6:00 p.m. (30.3 percent).
- Crashes mostly occur on clear or cloudy days (94.4 percent), when the road surface is dry (91.8 percent).

Who is involved:

- Most vehicles on the roadways excluding bicyclists are passenger cars (66 percent) and light truck/sports utility/pickup (24%).
- Bicyclist age is tracked for 2000-2012 data. The cohort aged 25-34 was the most prevalent - involved in 15.2 percent of crashes.
- Crashes involving known drug use or drinking are limited. Bicyclists are impaired in 1.2 percent of crashes and motorists in 1.2 percent of crashes.

Injuries and fatalities:

- Bicyclists sustained an injury in 62.8 percent of crashes.
- There were 17 bicyclist fatalities from 2003-2012. Non-incapacitating injuries were sustained 31.3 percent of crashes.

Causes of crashes:

- The most common pre-crash maneuvers for bicyclists in 2006 were going straight ahead (87.5 percent), bicyclist making left turn (2.5 percent), bicyclist parked (2.5 percent), and bicyclists going the wrong way (2.5 percent).
- The most common pre-crash maneuvers for motorists in 2003 were vehicle going straight ahead (49.2 percent), vehicle making left turn (16.3 percent) and vehicle making right turn (14.3 percent).

[1] Louisville Metro. Bicycle Master Plan. June 2010.
http://www.louisvilleky.gov/BikeLouisville/bikefriendly/2010bikemasterplan.htm

Where crashes are occurring:

- Crashes occur in all areas of Louisville, although there is a clear concentration along major arterial with high volumes of motor vehicles.
- The highest crash volume intersections in 2012 are Eastern Parkway and Bardstown Road (14), Bardstown Road and Grinstead Drive (11), Broadway and 2nd Street (8), East Broadway and South Jackson Street (8) and Taylor Boulevard and Oleanda Avenue (6).

Summary

The analysis of bicyclist-motorist crashes found that crashes are complex events and there is no one factor that is contributing to crashes. However, four primary conclusions emerge from the data:

1. Most crashes are occurring at intersections along major arterials.
2. Motorist are not seeing or yielding to bicyclists.
3. Bicyclists are failing to yield right-of-way.
4. Bicyclist inattention.

Recommendations

The recommendations aim to reduce perceived fears of "interested but concerned" bicyclists and are presented within the framework of the "Five E's of Bicycling": Education, Encouragement, Enforcement, Engineering and Evaluation.

Education

- Continue Traffic Schools- with a strong bicycle education component
- Implement a Sharing the Road social marketing campaign to reach a wide audience
- Continue the comprehensive school-age and adult bicycle safety programs

Encouragement

- Continue Bike to Work events that provide motorists awareness about bicyclists on the roads
- Expand the See and Be Seen Campaigns
- Ask employment centers to host rules of the road Lunch and Learns

Enforcement

- Continue DUI Enforcement Campaigns
- Progressive Ticketing Program- where enforcement can be used as an educational tool

Engineering

- Highlight areas where bicyclists and motorists cross paths
- Provide designated and comfortable places for bicyclists to ride

Evaluation

- Publish a regular safety bicyclist report
- Increase understanding of crashes

Chapter 1 – Introduction

PURPOSE

Over the past decade Louisville has undergone a bicycling reawakening. More residents, workers and visitors are choosing to ride a bicycle for more trips. Expansion of the city's bicycling network, increased encouragement and education, and a more visible bicycling culture have made Louisville one of the best cities for bicycling in the Midwest. Louisville intends to continue this trend and is committed to making bicycling a safe, easy and comfortable way to get around Louisville.

Vision: As it becomes a healthier and more livable bicycle-friendly community, one with a dynamic economy and diverse transportation system, Louisville will reclaim its heritage as a center for bicycling.

The 2010 Louisville Bicycle Master Plan has the goals of (1) to increase bicycling activity throughout all parts of Louisville by making it a fun, comfortable and accessible mode of travel between 2010 and 2030 and (2) to simultaneously reduce the number of cyclists killed and injured in crashes with motor vehicles. These goals outline the steps Louisville will take in several areas to achieve the Vision.

USING THIS REPORT

Because this is the first comprehensive crash analysis conducted by the City, the data are presented in a comprehensive manner – thoroughly educating readers about crash data sources, the findings of the analysis and most importantly, how the data can inform countermeasures.

The report begins by providing crash data and reporting (Chapter 2). Chapter 3 discusses the approach and methodology used for this analysis. Chapter 4 is the results section – covering when, why and where crashes are occurring. Chapter 5 closes with a discussion about approaches to improving bicyclist safety and using the results to implement countermeasures. The Appendix includes supplemental data, a comparison of peer cities, additional maps, crash rates and corridor analysis.

Planners and engineers should refer to this document when designing new facilities to ensure bicyclists comfort is prioritized and prevalent crash types are considered in the design. Those educating road users should incorporate the findings into curriculum, safety campaigns and other media. Policy makers and enforcement officers should use the findings to affect behavior change that engineering or education cannot efficiently address. And lastly, Public Works staff can reference this report to determine methods for continued crash reporting and efficient evaluation of safety measures.

While this report highlights the negative aspects of bicycling, it is only done to advance the safety of all road users. Research has shown that the benefits of riding a bicycle in an urban environment far outweigh the risks.[2] It is the hopes that this research will help mitigate the potential risks – further promoting the benefits bicycling can bring to Louisville.

[2] De Hartog, Jeron Johan, et. al. "Do the Health Benefits of Cycling Outweigh the Risks? *Environmental Health Perspectives.* 18 (2010).

Chapter 2 – Understanding the Data

HOW IS A CRASH REPORTED?

A traffic crash is an unfortunate and complex event. There are often multiple contributing factors, multiple parties involved and several layers of interpretation and reporting. In Kentucky, if a police officer is not immediately called to the scene, involved parties have up to ten days to notify authorities.[3]

Once a police officer collects the necessary information, he or she completes a Kentucky State Police accident report. Location, time, personal information, weather, roadway conditions, roadway surface, road character and other attributes are recorded using a standardized coding system. To supplement the codes, a crash narrative and diagram are also completed as part of the report.[4]

The Louisville Metro Public Works Department receives copies of accident reports from the Louisville Metro Police Department upon request. The reports are used to better understand the crash data and improve public outreach. Select information documented by Public Works and the crash reports are then destroyed.

UNREPORTED CRASHES

This report examines data from *reported* traffic crashes. Crashes of all types go unreported, but it is estimated that bicycle and pedestrian crashes are overrepresented among unreported crashes. Reasons for not reporting a crash may be that no party was injured, property damage was marginal, and individuals fled the scene or were not aware that they are required to report a crash. Crashes are mandatory to report if there is injury or death as well as property damage of $500 or more occurs.

A possible method for determining the number of unreported crashes is to examine the Close Call Form. The close call form is another tool we use to assess potential conflict points and the frequency of near misses at these locations. The form asks: At the time of the incident were you a bicyclist, pedestrian or motorist? Did you have a close call with a bicyclist, pedestrian or motorist? Please let us know where you had your close call, intersection or specific address or landmark. Please let us know what time of day this incident occurred. The form concludes with a space for more detail on the close call. This form offers another way to address issues before they result in a crash.

ACCIDENT REPORTS & DEFINITIONS

On a crash report, an array of information is compiled by the police officer assigned to the case. A series of standardized codes are used to efficiently categorize crash attributes. While all codes help explain the cause(s) and circumstance(s) of a crash, the two codes of particular interest are contributing factor and pre-crash maneuver.

Pre-crash maneuvers describe the actions of each party just prior to the collision. Common pre-crash maneuvers are “Vehicles Making Left Turn,” “Bicyclist Riding With Traffic,” or “Bicyclist Riding Against Traffic.” While other crash attributes are useful in determining cause, it is primarily contributing factors and pre-crash

[3] “Accident Guide in Kentucky.” *DMV.org*. Web. 11 June 2013.
[4] “Civilian Traffic Collision Report.” *Kentucky State Police*. Commonwealth of Kentucky, n. d. Web. 11 June 2013.

maneuvers that allow for the determination of crash causes and crash typing.

INTERPRETATION & ASSUMPTIONS

While collision reports are the most reliable source of bicyclist-motorist crash information, only the information available from the Kentucky Collision Analysis for the Public database was used for these evaluations due to the number of pedestrian collisions. This website is developed and maintained by the Kentucky State Police to give the public the ability to analyze data related to collisions occurring in the state of Kentucky. This repository contains information gathered from collision reports submitted by Kentucky law enforcement agencies.

The integrity of the data is dependent upon both the accuracy and frequency with which the data is entered and user's interpretation.

All pedestrian crashes, including crashes on private property are included in these analyses.

WHAT IS NOT CAPTURED IN THE DATA?

A number of attributes are not collected on collision reports or analyzed as part of this research.

Bicyclist position prior to the crash – While some reports describe the bicyclist's riding position in detail, reporting is not always consistent.

Driveway, alley and mid-block crashes – Crashes occurring at driveway entrances, alleys or mid-block locations are included in this dataset, although the location information is aggregated to the closest intersection and may not reflect the actual location of the crash. Data is also not available for crashes occurring on private property such as a store parking lot. Only crashes occurring in the public right-of-way are recorded.

Bicyclist and motorist demographics – Gender and home address are collected on crash reports, although Public Works does not report the information.

Specific bicyclist crash types – At this time, the Louisville Metro Police Department does not record specific bicycle crash types such as right hooks, left hooks or "dooring."

NOTES ABOUT TERMINOLOGY

There is a difference between the terms "accident" and "crash". In the discussion of traffic safety, "crash" is becoming the accepted term when describing a collision. According to the National Highway Traffic Safety Administration, "Continued use of the word accident promotes the concept that these events are outside of human influence or control."[5]

[5] Amsden, Michael and Thomas Huber. *Bicycle Crash Analysis for Wisconsin using a Crash Typing Tool (PBCAT) and Geographic Information System (GIS).* Wisconsin Department of Transportation. June 30, 2006

Chapter 3 – Approach & Methodology

APPROACH

To yield patterns of statistical and spatial significance, planning was done to determine an appropriate sample size of bicyclist-motorist crash records.

Motivation for a larger time period was selected to avoid the possibility of false readings. A San Francisco study on corridor level analysis of bicyclist and pedestrian crashes found that, "Basing decisions on individual intersections and single year is of limited efficacy and will yield substantial numbers of… false positives and false negatives."[6] The same study recommends a three year period as it, "provides a good balance between changes in the intersections over time." Although, it is noted that five years is better for intersections with a relatively low number of crashes.

Public Works selected a sample period of 5 years because little was understood about local bicyclist safety and there was a desire to gain a broad understanding of crashes in Louisville.

METHODOLOGY

As outlined in Chapter 2, Public Works evaluated select crash attributes from the Kentucky Collision Analysis for the Public database. The primary attributes available for each crash are:

Context, environment & injuries

- Date
- Time
- Environmental Conditions
- Roadway Condition
- Weather Condition
- Road Surface
- Light Conditions
- Injury Severity/Fatalities
- Roadway Type

Bicyclist information

- Bicyclist Age
- Bicyclist Condition
- Bicyclist Factors

Motorist information

- Motorist Pre-Crash Maneuver
- Motorist Condition
- Motorist Vehicle Type

[6] Ragland, David, et. al. *Strategies for Reducing Pedestrian and Bicyclist Injury at the Corridor Level.* UC Berkeley Safe Transportation Research & Education Center. July 2011.

Chapter 4 – Results

OVERVIEW

The analysis of bicyclist-motorist crashes found that crashes are complex events and there is no one factor that is contributing to crashes. That said, four primary conclusions emerge from the data:

1. Most crashes are occurring at intersections along major arterials.
2. Motorist are not seeing or yielding to bicyclists.
3. Bicyclists are failing to yield right-of-way.
4. Bicyclist inattention.

This chapter provides support for these conclusions and highlights other prevalent crash attributes.

Topics presented in the chapter are:

Background

- When crashes occur
- Environmental conditions
- Bicyclist age
- Bicyclist condition
- Driver condition

Causes of Crashes

- Pre-crash maneuver

Injuries and Costs

- Injury severity
- Fatalities
- Cost of Crashes

Where Crashes are Occurring

- Top crash intersections
- Top crash corridors
- Safety in number

WHEN ARE CRASHES OCCURRING?

By Year

Between 2003 and 2013, there was an average of 154.6 bicyclist-motorist crashes per year. The peak occurred during 2011 with 181 crashes and the low was in 2009 and 2012 with 142 crashes

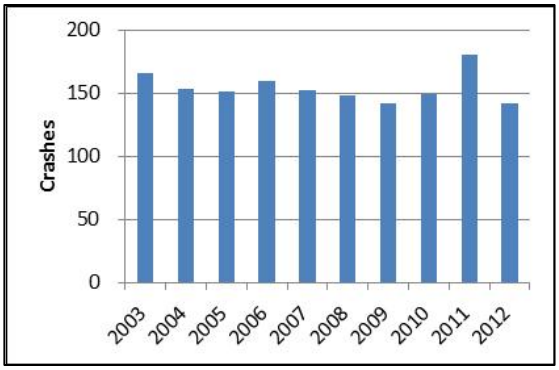

Figure 1 - Crashes by year, 2003-2012

By Month

Crashes by month adhere closely to local climate conditions in Kentucky and bicycle traffic patterns in Louisville. Crashes are least prevalent in winter, increase in the spring, peak in the summer and decrease in the fall. Less than three percent of annual crashes occur in January, while over 13 percent occur in June and August. Mild weather months from April-October account for 80.2 percent of annual crashes.

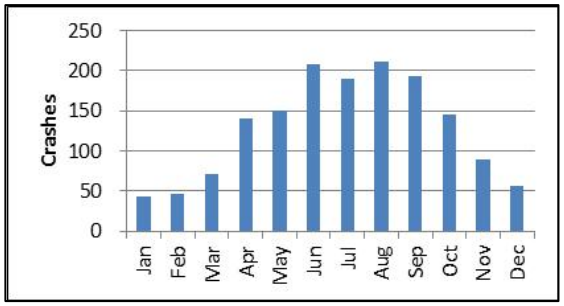

Figure 2 - Crashes by month, 2003-2012

By Day

Crashes are more prevalent on weekdays than weekends. The most common day is Thursday with 16.4 percent of crashes and the lowest is Sunday with 10.2 percent. The lowest weekday is Friday with 14.3 percent

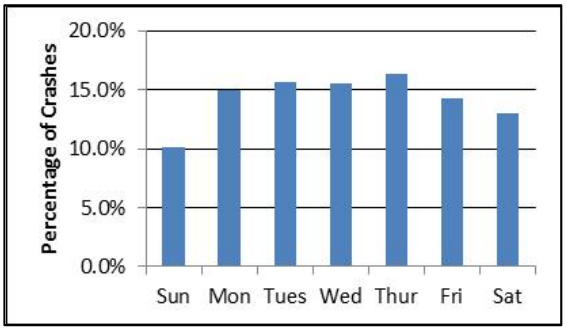

Figure 3 - Crashes by day of the week, 2003-2012

By Time of Day

Most crashes occur during the afternoon peak period between 3:00-6:00 p.m. Crashes increase steadily throughout the day, peak in the late afternoon and drop off into the evening. The lowest period of crashes is from 3:00-6:00 a.m. These patterns adhere closely to bicyclist traffic patterns and traffic patterns for all modes in Louisville.

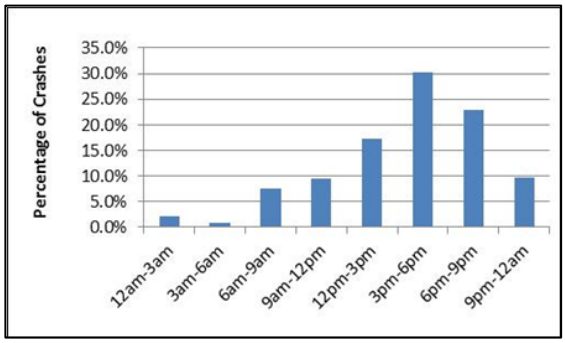

Figure 4 - Crashes and bicyclist traffic by time of day, 2003-2012

ENVIRONMENTAL CONDITIONS

Weather

Weather conditions at the time of crashes were generally favorable. Conditions were clear 76.5 percent of the time and cloudy 17.9 percent of the time. It was raining for five percent of crashes and snowing for less than one percent of crashes.

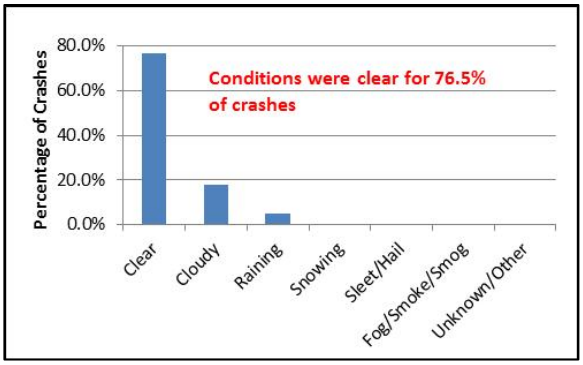

Figure 5 - Crashes by weather conditions, 2003-2012

Road Surface

The road surface at the time of crashes was generally favorable. Conditions were dry 91.8 percent of the time and wet 7.8 percent of the time. Snow, slush or ice were present for 0.3 percent of crashes.

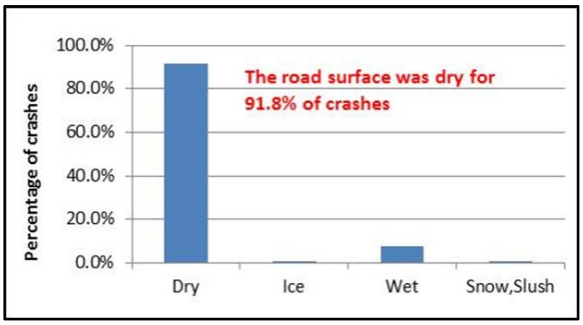

Figure 6 - Crashes by road surface, 2003-2012

VEHICLE TYPE

Most motor vehicles were automobiles, 66 percent was the passenger car while 24 percent was light truck or sports utility. There were 17 emergency vehicles, 15 motorcycles, 9 buses and 9 single unit trucks. Other vehicles, motor scooter or motor bicycle, school bus, truck & trailer, taxicab, and unknown round out the total.

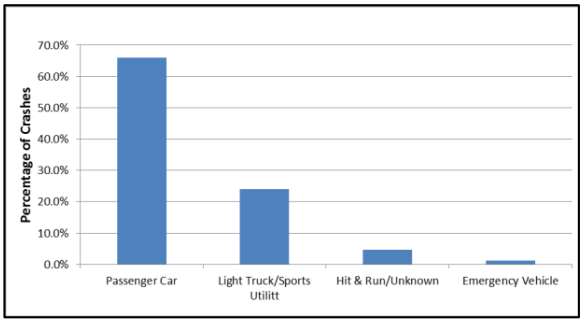

Figure 7 - Crashes by vehicle type, 2003-2012

BICYCLIST AGE

Bicyclist age 25 to 34 is the most prevalent cohort representing 15.2 percent of bicyclists. Those 65 and older represent 4.4 percent.

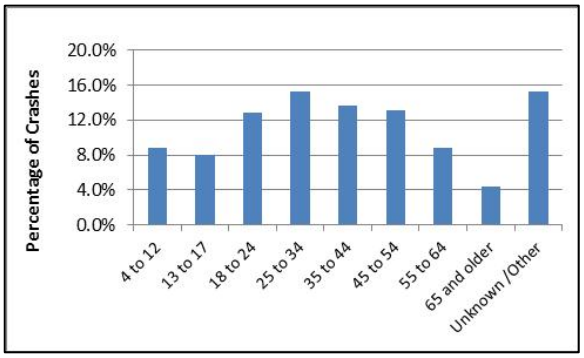

Figure 8 - Crashes by bicyclist age, 2003-2012

RIDER & DRIVER CONDITION

Bicyclist Condition

Bicyclist had a normal condition in 51.7 percent of crashes. Bicyclists were impaired (under the influence, had been drinking or drug use) 1.2 percent of the time and three bicyclists, or 0.2 percent of bicyclists were emotional.

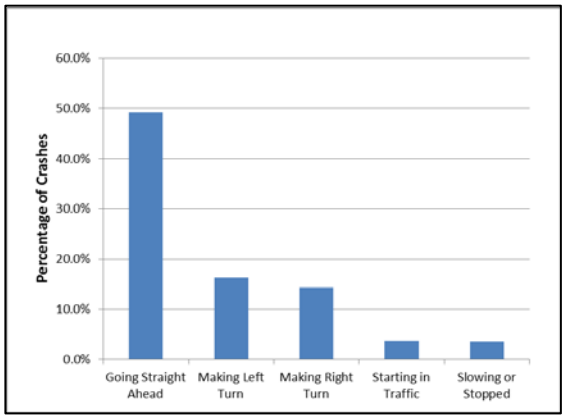

Figure 9 – Crashes by bicyclist condition, 2003-2012

Motorist Condition

Motorist had a normal condition in 54.1 percent of crashes. Motorist were impaired (under the influence, had been drinking or drug use) 1.2 percent of the time and 2 motorist, or 0.1 percent of motorists were emotional.

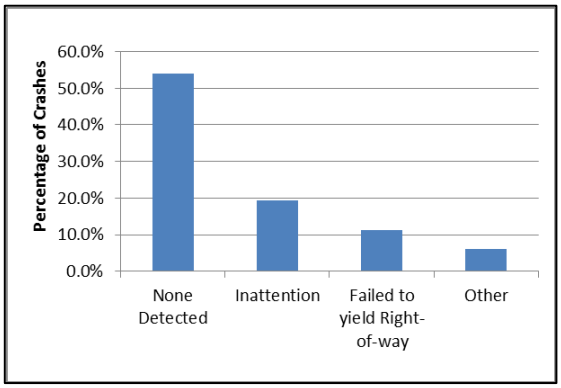

Figure 10 – Crashes by motorist condition, 2003-2012

WHAT IS CAUSING CRASHES?

Bicyclists Pre-Crash Maneuvers

Bicyclist pre-crash maneuver document the actions of a bicyclist just prior to the collision. The top three pre-crash maneuvers are bicyclists going straight ahead (87.5 percent), bicyclist making left turn (2.5 percent), bicyclist parked (2.5 percent), and bicyclist going wrong way (2.5 percent). All other maneuvers occurred in five percent of crashes.

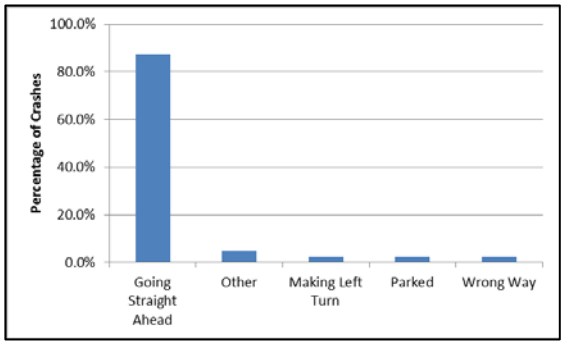

Figure 11 – Crashes by bicyclist pre-crash maneuvers, 2003-2012

Motorists Pre-Crash Maneuvers

Motorist pre-crash maneuver document the actions of a motorist just prior to the collision. The top five pre-crash maneuvers are vehicle going straight ahead (49.2 percent), vehicle making left turn (16.3 percent), vehicle making right turn (14.3 percent), vehicle starting in traffic (3.6 percent), and vehicle slowing or stopped (3.5 percent)

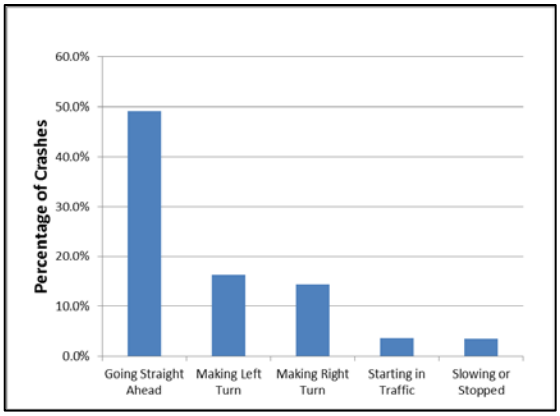

Figure 12 – Crashes by motorist pre-crash maneuvers, 2003-2012

INJURY SEVERITY/FATALITIES

Injuries are categorized as Type A, B or C and listed in decreasing order of severity:

- Type A: incapacitating injury
- Type B: non-incapacitating injury
- Type C: possible injury (victim complains of pain or discomfort)

Detailed analysis of crash reports from 2003-2012 found that 61.7 percent of bicyclist-motorist crashes result in some level of injury. 20.8 percent of crashes resulted in Type C injuries, 31.3 percent Type B and 9.6 percent Type A. There were 17 fatalities from 2003 - 2012, or an average of 1.6 fatalities per year. There were no fatalities in 2011 while one occurred in 2004, 2007 and 2012.

WHEN ARE CRASHES OCCURRING*?*

By Year

Between 2003 and 2013, there was an average of 1.7 bicyclist-motorist fatalities per year. The peaks occurred during 2005, 2008 and 1010 with 3 crashes and the low was in 2011 with zero fatalities.

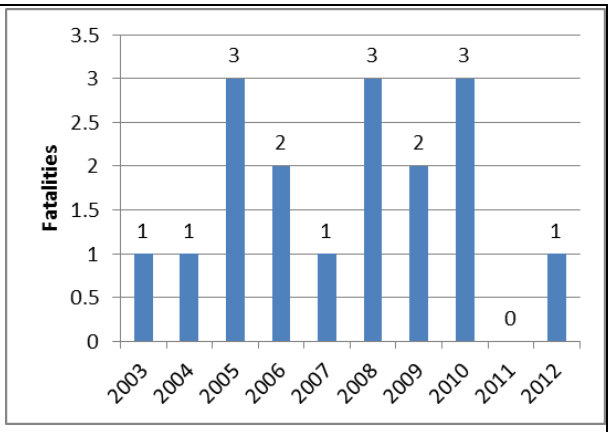

Figure 93 – Fatalities by year, 2003-2012

By Month

Fatalities by month adhere closely to local climate conditions in Kentucky and bicycle traffic patterns in Louisville. Fatalities are least prevalent in winter, increase in the spring, peak in the summer and decrease in the fall. Zero percent of annual fatalities occur from December to February, while over 17 percent occur in October. Mild weather months from April-October account for 82.4 percent of annual fatalities.

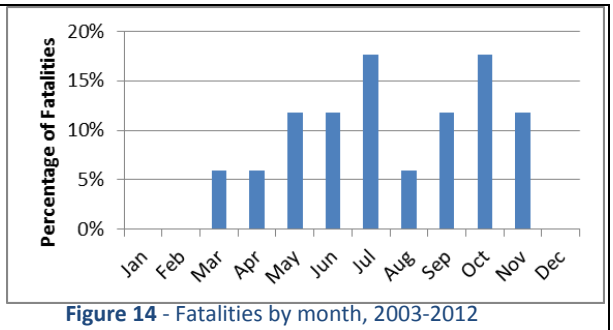

Figure 14 - Fatalities by month, 2003-2012

By Day

Fatalities are most prevalent on Thursdays and Saturdays at 23.5 percent. Fatalities are the lowest on Mondays and Wednesdays with 5.9 percent.

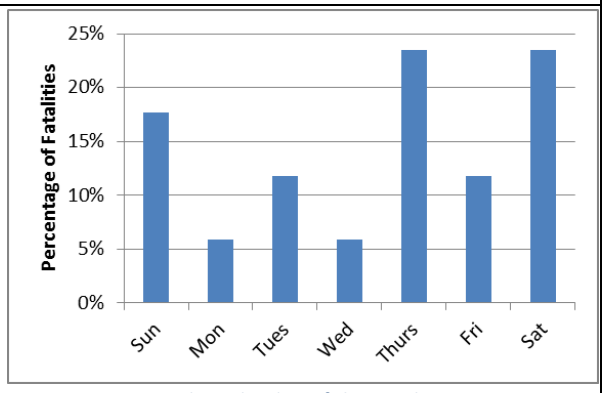

Figure 15 - Fatalities by day of the week, 2003-2012

By Time of Day

Most fatalities occur during the afternoon and evening peak period between 3:00-9:00 p.m. The lowest period of fatalities is from 9:00 a.m. to 3 p.m. These patterns adhere closely to bicyclist traffic patterns and traffic patterns for all modes in Louisville.

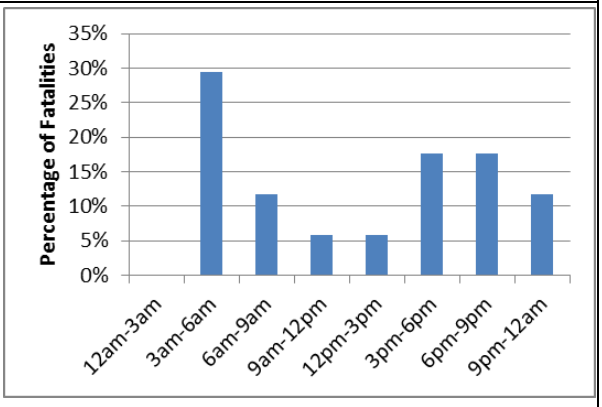

Figure 16 - Fatalities and bicyclist traffic by time of day, 2003-2012

ENVIRONMENTAL CONDITIONS

Weather

Weather conditions at the time of fatalities were generally favorable. Conditions were clear 58.8 percent of the time and cloudy 35.3 percent of the time. It was raining for 5.9 percent of fatalities

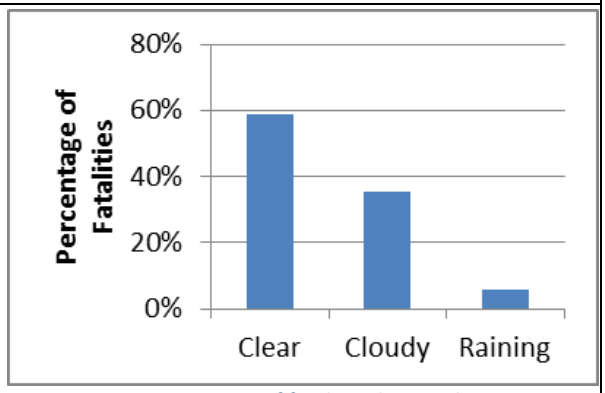

Figure 17 - Percentage of fatalities by weather conditions, 2003-2012

Light Condition

The light condition for crashes was generally favorable. Crashes occurred during daylight 47.1 percent of the time and dark-highway not lighted 35.3 percent of the time. Crashes occurred during dusk and dawn only 11.8 percent of the time.

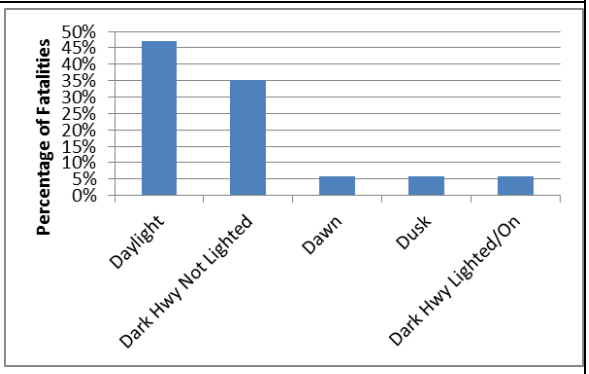

Figure 18 - Fatalities by light conditions, 2003-2012

Road Surface

The road surface at the time of crashes was generally favorable. Conditions were dry 91.8 percent of the time and wet 7.8 percent of the time. Snow, slush or ice were present for 0.3 percent of crashes.

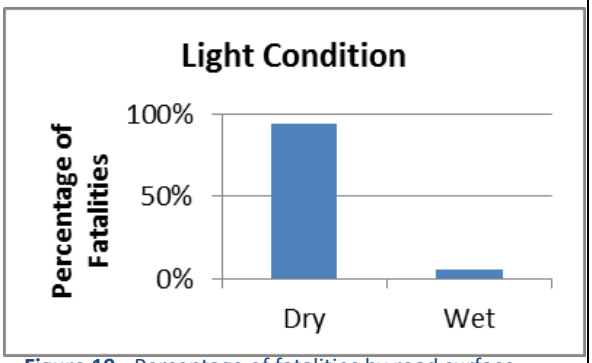

Figure 19 - Percentage of fatalities by road surface, 2003-2012

VEHICLE TYPE

Most motor vehicles were light truck or sports utility at 47.1 percent. The passenger car at 41.2 percent. There was 1 emergency vehicle, and 1 hit and run.

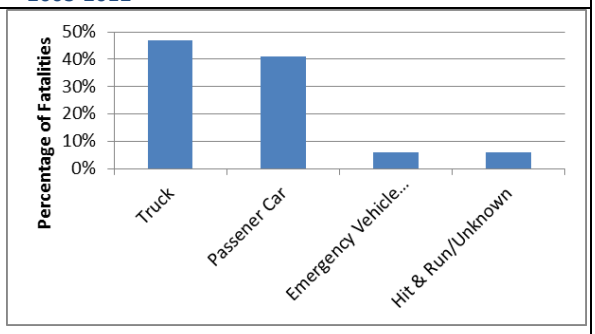

Figure 20 - Fatalities by vehicle type, 2003-2012

BICYCLIST AGE

Bicyclist age 35 to 44 is the most prevalent cohort representing 29.4 percent of bicyclists. Fatalities are the lowest at zero percent among 13-17 year olds.

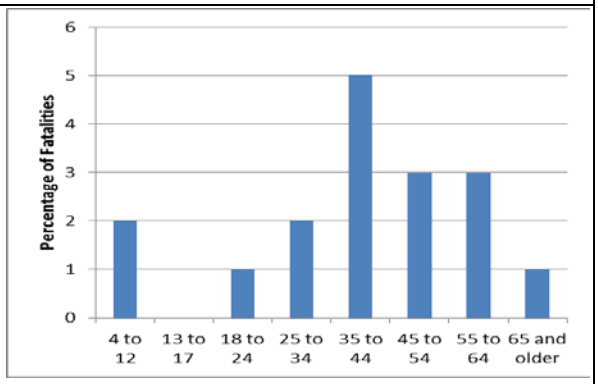

Figure 21 –Percentage of fatalities by bicyclist age, 2003-2012

MOTORIST AGE

Motorist age 25 to 34 is the most prevalent cohort representing 41.1 percent of bicyclist fatalities. All other motorists' age groups resulting in bicycle -motorist fatality resulted in less than two motorists.

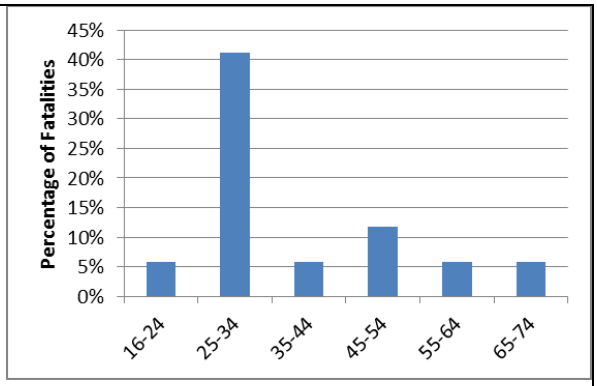

Figure 22 –Fatalities by bicyclist age, 2003-2012

RIDER & DRIVER CONDITION

Motorist Condition

Motorist was inattentive for 26.1 percent of the fatalities. Motorist had a normal condition in 21.7 percent of crashes. Motorist was under the influence or had been drinking for 17.4 percent of the fatalities.

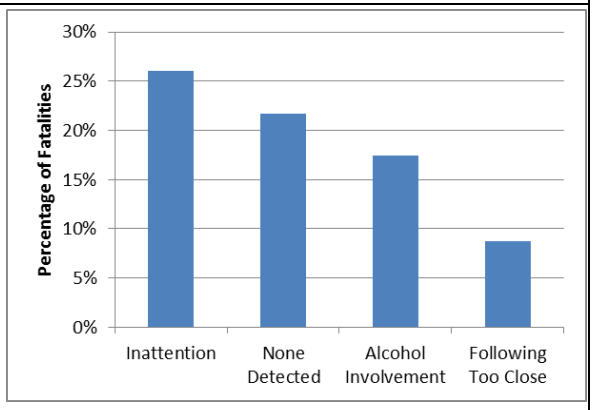

Figure 23 – Fatalities by motorist condition, 2003-2012

WHAT IS CAUSING CRASHES?

Bicyclists Pre-Crash Maneuvers

Bicyclist pre-crash maneuver document the actions of a bicyclist just prior to the collision. The pre-fatal maneuver is bicyclists going straight ahead (82.4 percent). All other pre-fatal maneuvers are equal at 5.9 percent.

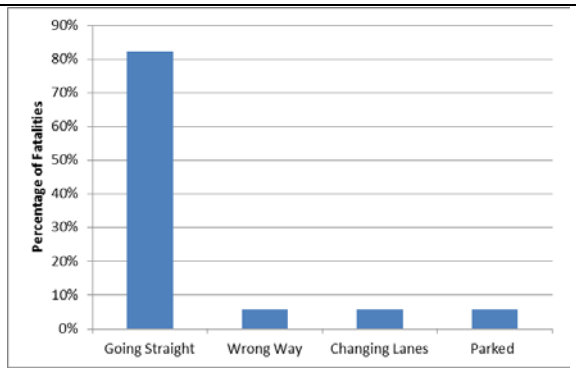

Figure 24 – Fatalities by bicyclist pre-crash maneuvers, 2003-2012

Motorists Pre-Crash Maneuvers

Motorist pre-crash maneuver document the actions of a motorist just prior to the collision. The top five pre-crash maneuvers are vehicle going straight ahead (49.2 percent), vehicle making left turn (16.3 percent), vehicle making right turn (14.3 percent), vehicle starting in traffic (3.6 percent), and vehicle slowing or stopped (3.5 percent)

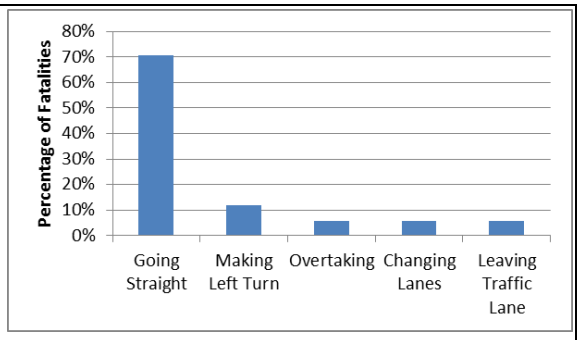

Figure 25 – Fatalities by motorist pre-crash maneuvers, 2003-2012

Manner of Collision

Bicyclist and Motorist manner of collision document the type of collision based on the pre-crash maneuvers. Most prevalent manner of collision at 58.8 percent is the rear end, followed by angle at 23.5 percent and opposing left turn at 11.8 percent.

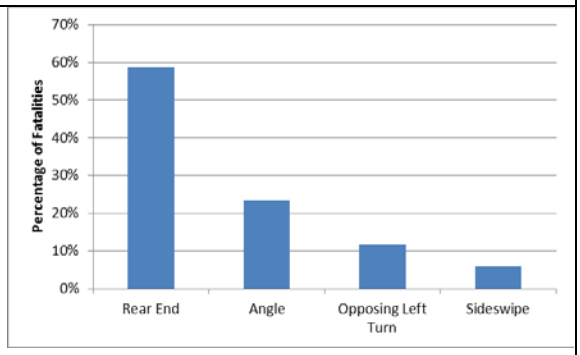

Figure 26 – Fatalities by manner of collision, 2003-2012

Hit and Run

The majority of motorists did not leave the scene after the collision with the bicyclists, but 17.6 percent of motorist hit and drove away without stopping.

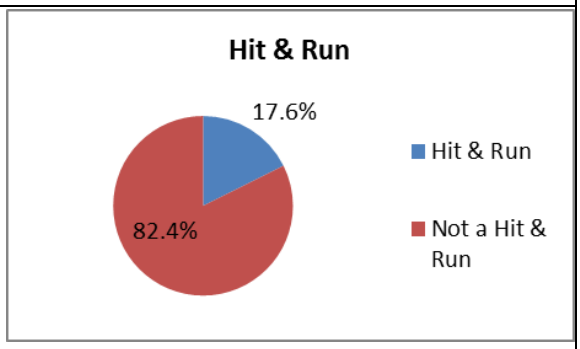

Figure 27 – Fatalities by hit and run, 2003-2012

Roadway Type

Most Fatalities occurred on State roadways at 41.2 percent. The fewest fatalities occurred on local streets at 5.9 percent.

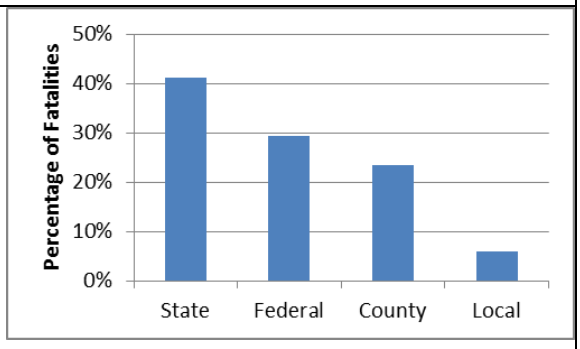

Figure 28 – Fatalities by roadway type, 2003-2012

Intersection vs. Non Intersection

Most Fatalities occurred at non intersection at 67.7 percent and 35.3 percent at intersection. Motorists exiting the interstate have led to 11.8 percent of bicycle fatalities.

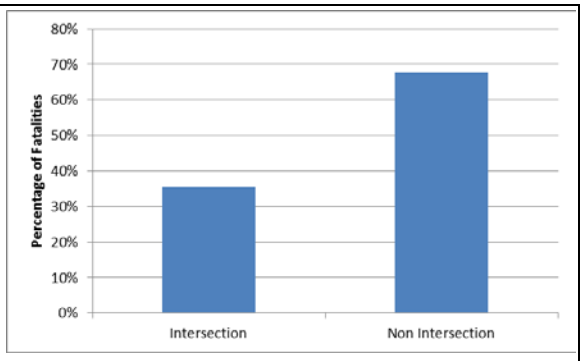

Figure 29 – Fatalities by Intersection vs. Non Intersection, 2003-2012

COST OF CRASHES

Public Health

Following are the top five leading causes of death per 100,000 populations of youth ages 5 to 25 years of age in Jefferson County for 2009:

- Unintentional injuries 53.2
- Assault (Homicide) 25.8
- Motor vehicle crash 21.2
- Suicide 14.6
- Cancer 7.7

Unintentional injuries were the leading cause of death in 2009 of children nationwide and in Metro Louisville. Though traffic deaths among the young are a small portion of the total, these crashes are a leading cause of death among people ages 5 to 24. Only unintentional injuries and homicide kill more people in this age group in Louisville Metro.

There are added social costs to fatalities in this age group as they are in their prime productive years and are likely to have dependent family members([7]).

Street and neighborhood design focused on pedestrian safety encourage children and families to incorporate walking into daily living.

Research indicates that people who live in areas with high quality sidewalks are more likely to be active and less likely to be overweight.[8]

Economic

Since crashes often strike people in their prime productive years, are usually accompanied by property damage and cause extensive injury as well as death, the economic impacts of crashes are substantial.

The United States Department of Transportation (USDOT) estimates the national impact of crashes at $230.6 billion, representing 2.3% of GDP in 2003. To put this in perspective, Medicare annual costs in 2008 were just above 3% of GDP.

USDOT also broke down the total costs for motor vehicle crashes by state. According to the National Transportation Research Group, motor vehicle crashes cost Kentucky $3.1 billion per year, $771 for each resident, in medical costs, lost productivity, travel delays, workplace costs, insurance costs and legal costs. State cost per capita varied due to differing state income levels and state medical, insurance and legal

[7] "Did You Know??" *FARS Encyclopedia*. Web. 18 July 2013. <http://www-fars.nhtsa.dot.gov/>.

[8] Active Living Research. 2009. Active *Transportation: Making the Link from Transportation to Physical Activity and Obesity, Research Brief*. San Diego: San Diego State University

costs. Based on these state costs the annual cost of all traffic crashes in Louisville Metro are estimated at $460 million dollars annually.

Equity

Traffic fatalities and injuries do not impact all people equally. Certain demographic groups are threatened more by road safety problems than others, requiring solutions tailored to reach and protect specific populations. Seniors comprise 12% of the population whereas they make up over 17% of all traffic fatalities while 25-34 year olds make up 14% of the population, but 18% of the total traffic fatalities.[9]

Moreover, national studies have shown that populations with low socioeconomic status (lowest income level, low educational attainment, blue-collar occupation) and unemployed status are at a higher risk for traffic fatalities. Gender is also an indicator of risk. During 2009 in Louisville men died in crashes at more than twice the rate of women.

Access to care is also part of the equation: A study from Wisconsin found that the medically uninsured receive 20% less care when hospitalized after a serious crash. This disparity appears to lead to higher mortality rates, as the uninsured experienced a crash mortality rate 39% higher than the average.

Louisville's Center for Health Equity has a commitment to address issues of race and social justice, and the design and implementation of pedestrian projects are no exception. The Pedestrian Master Plan will provide for the needs of all of Louisville's neighborhoods, with the goal of improving the walking environment for Louisville's diverse populations.

Sustainability

Sustainable transport is about finding ways to move people, goods and information in ways that limit the impact on the environment, economy and society. Choosing to walk or bicycle rather than travel by automobile may help individuals get exercise, save money, interact with neighbors, and reduce tailpipe emissions. Yet, non-motorized transportation modes may require more time and physical effort, be less convenient for carrying packages and traveling in bad weather, and be perceived as having a higher risk of traffic crashes or street crime than driving. Safety risks, both real and perceived, are two factors that limit pedestrian trips, especially for children and seniors. Many of these trips are handled instead by less sustainable modes.

Quality of Life

Street safety (and perceived safety) is a major quality of life concern, especially for families with children. Guaranteeing street safety, like reducing crime, is a key factor in attracting and retaining a middle class population. Unsurprisingly, traffic calming improvements that reduce speed and volume have been strongly linked to increased home values, a key factor in family location decisions.

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[9] "Census Bureau Homepage." Census Bureau Homepage. Web. 18 July 2013. http://www.census.gov/.

WHERE ARE CRASHES OCCURRING?

Bicyclist-motorist crashes are occurring in all parts of the city, although crashes are most prevalent in Downtown and Old Louisville. There is also a clear connection along major arterials.

To simplify the discussion and illustration of the results, crash locations are aggregated to the closest intersection. This is a good assumption as most bicyclist-motorist crashes are occurring at or near intersections.

Top Crash Locations

The most prevalent locations for crashes are long the city's busiest streets. Primary arterials have seen the highest numbers of crashes compared to residential streets. The majority of crashes occurred at Eastern Parkway and Bardstown Road.

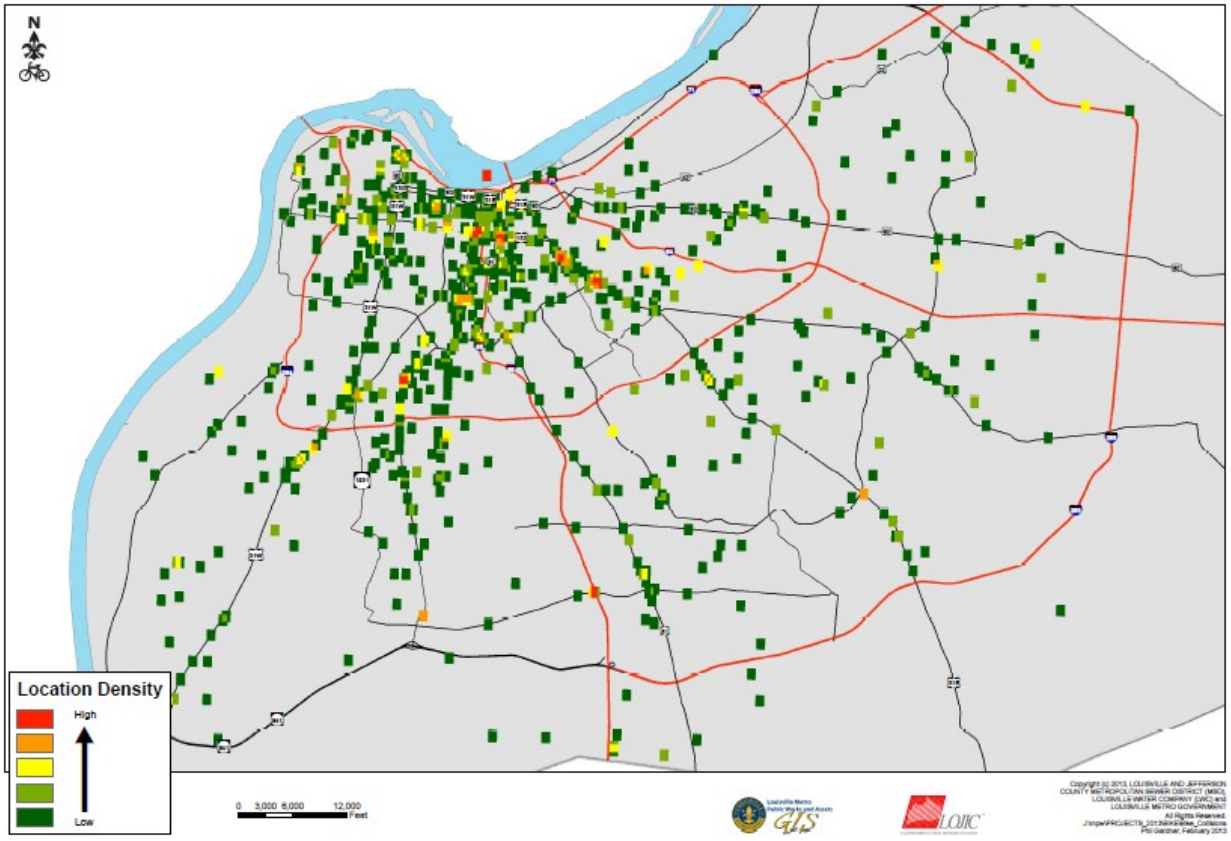


Figure 29 - Location Density of Bicycle Collisions

Chapter 5 – Discussion, Approaches & Recommendations

SUMMARY OF FINDINGS

To summarize the data presented in the previous chapter,

- Crashes are most prevalent in the summer months, on weekdays and in the afternoon peak period.
- Crash weather conditions are generally clear and dry.
- Bicyclists and motorists are generally not impaired at the time of crashes.
- There is a clear concentration of crashes along major arterials.

Reducing these findings further, four primary conclusions emerge:

1. Most crashes are occurring at intersections along major arterials,
2. Inattention among both motorists and bicyclists
3. Bicyclists and motorists are failing to yield right-of-way.

APPROACHING BICYCLISTS SAFETY

These four conclusions help simplify the complex nature of crashes. However, translating the findings into effective countermeasures is the next task. While posed with good intentions, the discussion of

countermeasures can quickly become detailed and itemized: *Which intersections should be improved first? How should bicyclists be educated? How should motorists be educated? How can the police be involved?*

Before moving forward, a framework for implementation should be established and a clear understanding of who the countermeasures are intend for is needed. Safety is an evolving goal and it may be better to front load the discussion with high-level considerations, rather than specific countermeasures. The approach to bicyclist safety discussed in this section revolves around two ideas: (1) The Five E's of Bicycling and (2) The Four Types of Transportation Cyclists.

Five E's of Bicycling

In order to support a great bicycling community, the League of American Bicyclists recommends a balanced approach of the following five categories:

- Education
- Encouragement
- Enforcement
- Engineering
- Evaluation

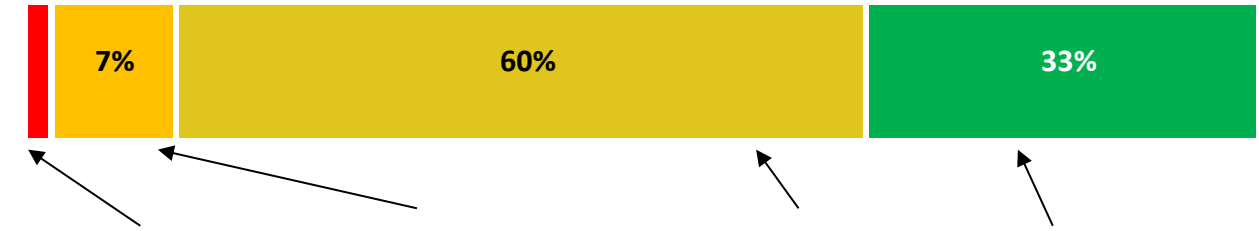
Know as the Five E's of Bicycling[10], this straightforward approach is becoming the norm in cities across the U.S. and was used as a framework for the Louisville Bicycle Master Plan, 2010-present. While originally intended as a checklist for increasing bicycling, it can easily be applied to decreasing crashes. Developing a set of countermeasures to increase bicyclist safety should use the Five E's approach.

[10] League of American Bicyclists. *Cyclist's Equity Statement.* www.bikeleague.org

Four Types of Transportation Cyclists

The Portland Bureau of Transportation developed a demographic spectrum known as the Four Types of Transportation Cyclists.[11] Based on surveys and academic research, the spectrum is a revealing estimate of who bikes for transportation and who does not. Most importantly, the research finds that a large part of the population *may* ride for regular trips, although they currently have reservations about doing so. The four categories include the "strong and fearless," "enthused and confident," "interested but concerned," and "no way no how."[12]

The Four Types of Transportation Cyclists[6]



Strong and Fearless (<1%)

- More experience bicyclists
- No problem riding in traffic
- Will bike on any street, no facility required

Enthused and Confident

- Confident riding in traffic
- Will bike on most streets, prefer a bike lane

Interested but Concerned

- May bike for recreation
- Fearful of riding in traffic, prefer exclusive facilities like trails
- Safety strongly tied to comfort

No Way No How

- Have never biked before
- No interest in bicycling for transportation or otherwise

The "strong and fearless" tend to be experienced bicyclists and will ride on any street regardless of the facility. "Enthused and confident" riders may be newer to bicycling for transportation. They are confident riding in traffic, but prefer a bike lane or other facility. "Interested but concerned" riders are the largest group, comprising nearly two-thirds of the population. They may ride on trails for recreation, but are currently fearful of riding on streets and with traffic. For this group, safety is strongly tied to comfort. Lastly, the "no way no how" group have never biked before and are not interested in bicycling for transportation, or otherwise.

Throughout the 1990's, most bicyclists fell into the "strong and fearless" group. As bikeways were added throughout the 2000's, the "enthused and confident" group likely burgeoned. A bicycle commute mode share data of 3.4 percent supports this estimate.

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[11] Geller, Roger. *The Four Types of Transportation Cyclists.* Portland Bureau of Transportation. 2007.
[12] U.S. Census Bureau. 2011 American Community Survey. www.census.gov

ACTION PLAN

Recommendations for Improved Bicyclist Safety

Over the past decade, Louisville has made great strides in the area of bicyclist safety. This analysis confirms that many of the improvement made are effective and should continue. The findings also highlight the need for new focus areas, including continued use of best practices in engineering. The recommendations for improved bicyclist safety are the following:

Education

- **Distracted Driving Campaign.** Generate awareness about "On Text or Call Could Wreck It All." Remind others that the price for not paying attention to the road is too high, and that we all have a part to play in making sure everyone keeps their eyes and mind on the road and hands on the wheel.
- **Distracted Bicyclist Campaign.** Develop and implement a safety campaign aimed in part at bicyclists who are not paying attention while bicycling.
- **Sharing the Road safety campaign.** For drivers and bicyclists, media can efficiently disseminate safety messages quickly and broadly. Public service messages produced by the City are currently available online and are played regularly on local television.
- **Comprehensive school-age and adult bicycle safety program.** Local certified bicycling host dozens of rides and classes each year, reaching hundreds of bicyclists. Moreover. Louisville's Bike Sense program teaches 1,000's of youth how to ride safety through a 5 day on-bike curriculum. While these curriculums often focus on commuting, maintenance and route planning, safety is always an underlying theme. Findings of this research should be incorporated into future curriculum.

Implement a distracted driving campaign

Safety videos produced by the City have been widely viewed by the public. Media should continue to be used to efficiently

Public Works and other local organizations teach dozens of bicycle classes every year. Curriculum should incorporate the new findings of this report.

Encouragement

- **Bike to Work Day events.** Such events promote bicycling through media, events, literature and online materials. However, the most visible bicycling element in the city is the infrastructure itself. "Interested but concerned" bicyclists will not ride unless they see a comfortable place to ride.
- **Publish data and document results**. Actual safety can help inform perceived safety. Publishing data and reporting on countermeasures will hold Public Works accountable and can let road users know if safety is improving
- **See and Be Seen Campaign**. Distribute and encourage the use of lights to make bicyclists more visible, and lower night time death and injury rate

Enforcement

- **Use enforcement as an educational tool**. While enforcement should be an authoritative action, it can also educational. Many motorists and bicyclists simply do not know the rules of the road. Diversion programs can allow first time offenders a chance to learn the rules while avoiding a full penalty.
- **Ensure bicyclists and motorists are treated equally under the law**. Bicycles are legally traffic and should be coded as such in crash reports. Current practices indicate this may not be the norm for bicycle-related motorist's crashes.
- **Expand a relationship with the LMPD**. The primary actions of Public Works and Assets and the Police Department are separate. However, both departments share the goal of creating safer streets. This common goal should be explicitly recognized between department management and expand collaboration at all ranks.

Facilities like buffered bike lanes (above) and cycle tracks have a high degree of safety and can attract a new demographic of bicyclists.

While enforcement should be an authoritative action, it can also be an educational tool seen in Louisville's Bike Sense Cops for Kids Program.

Above, the Bicycle Advisory Committee meets with LMPD staff to discuss enforcement efforts. Expanding a relationship with the LMPD is essential to improving safety for all road users.

Engineering

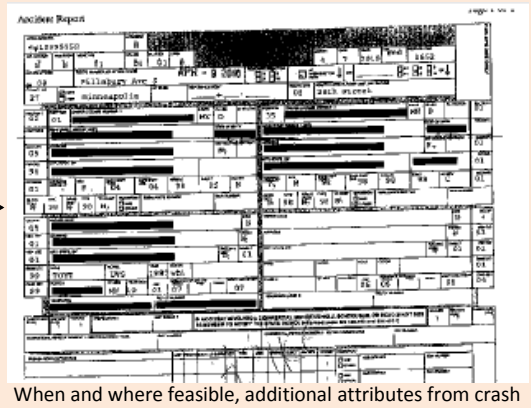
- **Guide and protect bicyclists at intersections and on busy streets**. Most crashes are occurring at intersections and along major arterials. Protected signal phases or separated approaches may give bicyclists confidence when riding through complex spaces.
- **Provide designated and comfortable places for bicyclists to ride**. Bicyclists are not always riding in a predictable manner. While much of this is simply improper riding and illegal behavior, existing roadway design may contribute to risky maneuvers. Providing designated space for bicycle traffic can foster more predictable riding and increase bicyclist comfort.

Evaluation

- **Publish a regular safety report**. This report is the first step in understanding bicyclist safety in Louisville. To monitor changes and evaluate future countermeasures, continuous and regular reporting is needed.
- **Increase understanding of crashes**. While a there is now a greater understanding of what is causing crashes, many circumstances remain unclear. Public Works and Assets should continue to work with the Louisville Metro Police Department, to better understand what is causing crashes
- **Analyze bicycle automated counts**. Analyze data from bicycle automated counters to target high traffic areas for improvements or future bicycle facilities.

Colored pavement markings can alert motorists that they are crossing a bike lane and should yield to bicyclists before turning or merging.

Providing designated space for bicyclists can increase the predictability of where bicyclists ride and create a safer and more comfortable riding experience.



When and where feasible, additional attributes from crash reports should be analyzed to gain a greater understanding of crash events.

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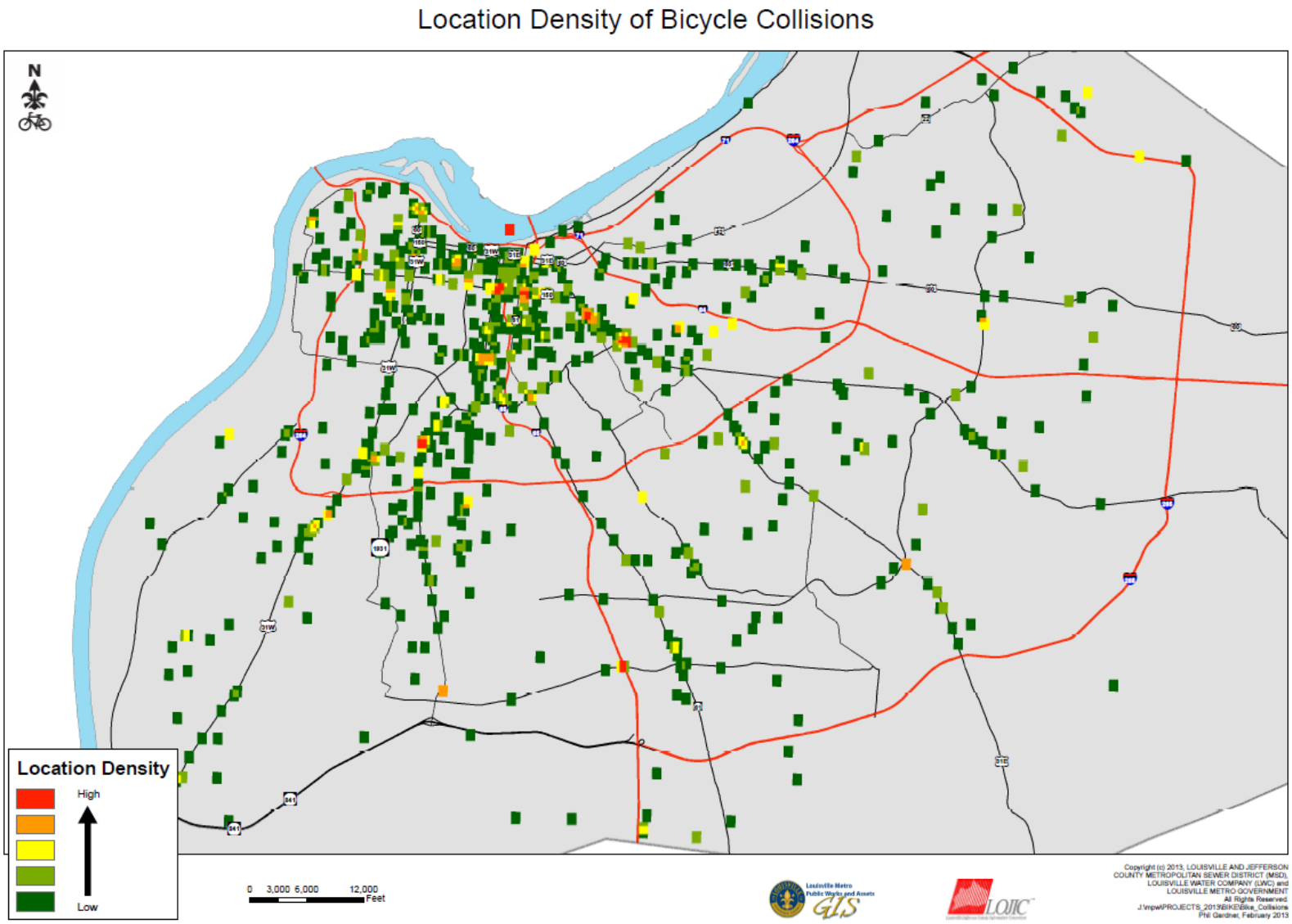
APPENDIX



Downtown crash map
Non daylight

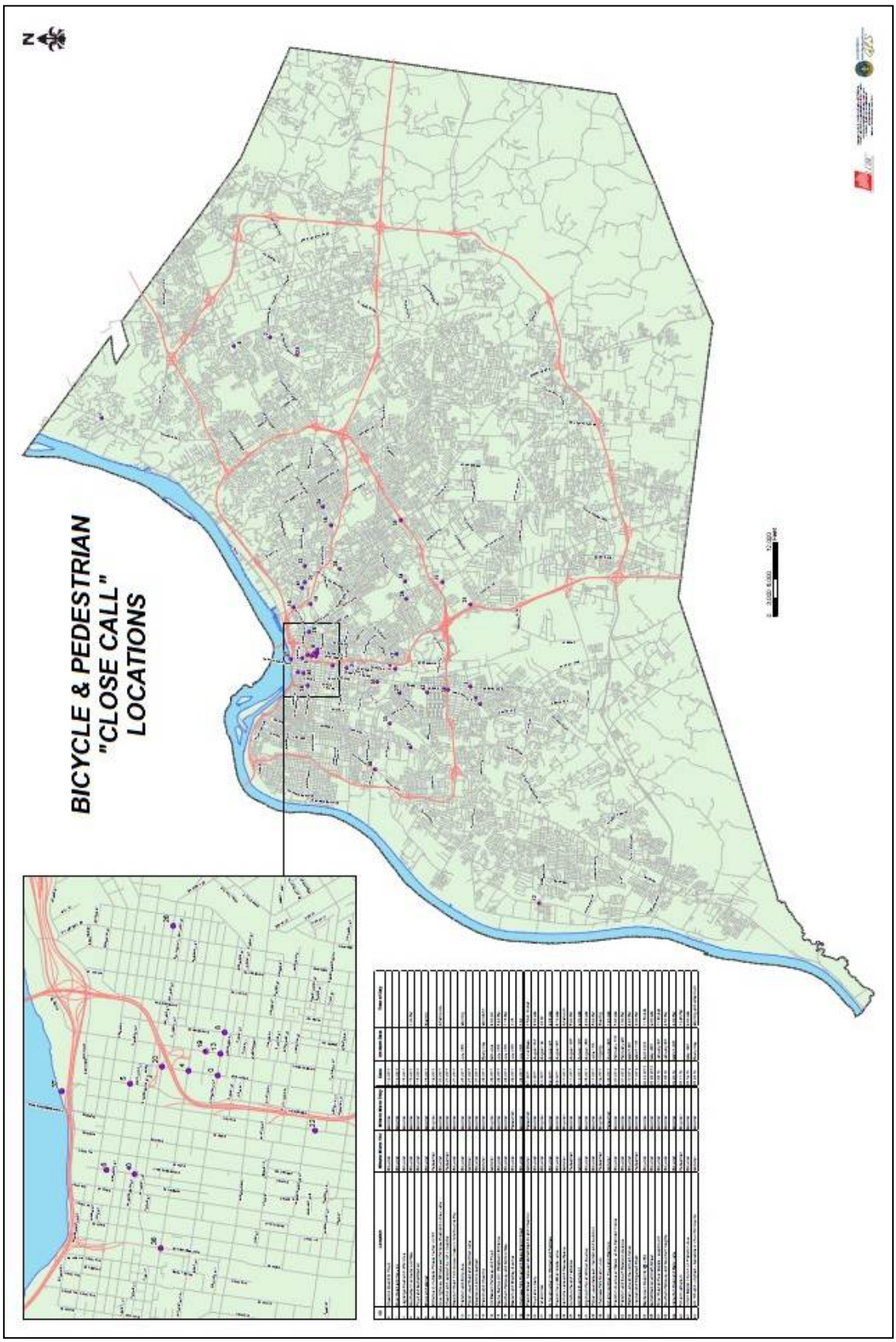
Close Calls

The close call form is another tool we use to assess potential conflict points and the frequency of near misses at these locations. As you may know, bicycle and pedestrian related crashes are under reported and this offers another way to address issues before they result in a crash.

The form allows you to fill out your personal information and detailed questions about your close call. At the time of the incident were you a bicyclist, pedestrian or motorist? Did you have a close call with a bicyclist, pedestrian or motorist? Where did you have your close call, intersection or specific address or landmark? What date did this incident occur? What time of day did this incident occur? Finally, the form asks for a description of the close call.

The map below entitled Bicycle and Pedestrian “Close Call” Locations provides the exact locations of each reported close call.

The Close Call form is not a used to report a service request. For service requests, please call 311.


N
BICYCLE & PEDESTRIAN
"CLOSE CALL"
LOCATIONS