

# Using Observational Surveys and Crash Analysis to Understand Bicyclist Behaviors and Crash Factors

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#### **1 INTRODUCTION**

This study incorporated observational survey findings and crash data analysis from 2010-2015 to better understand bicyclist behaviors and crash factors. This was part of a larger project funded by the Texas Department of Transportation (TxDOT) which investigated both pedestrian and bicyclist behaviors and crash statistics. The focus area for this investigation was Harris County, TX which includes the City of Houston. The project consisted of three major components:

- 1. Analysis of bicyclist crash reports to determine common behaviors and factors associated with fatal and incapacitating crashes.
- 2. Observational surveys of bicyclists and surrounding motorist behavior to identify common reckless actions.
- 3. Public outreach and education campaign that integrated the crash and behavioral data to educate and motivate bicyclists and motorists to increase safe behaviors.

The observational surveys included: volume counts, unique site characteristics, and the notation of bicyclist and surrounding motorist behaviors. The crash data was analyzed to better understand the conditions under which bicyclists are involved in serious or fatal crashes. The data was then combined to discover the common behavioral factors and reckless behaviors affecting the safety of bicyclists.

# 2 METHODOLOGY

The observational surveys were conducted at 10 sites throughout Harris County in November 2016 to identify bicyclist behaviors and motorist interaction. Observations were conducted at sites that represented different biking and driving environments including: high speed road, interstate (limited access) highway frontage road, city street, school area, major arterial, and university area. During data collection, the surveyors recorded bicyclist and motorist behaviors including but not limited to: where bicyclists were riding, proper/improper use of the roadway, helmet use, actions of surrounding motorists, and a tally of the number and type of reckless behaviors and traffic law violations. The surveyors also noted surrounding bicycle infrastructure (e.g. bike lanes) to see how existence or non-existence of these affect behavior. The crash analysis included analysis of all bicyclist fatal and incapacitating injury crashes in Harris County from 2010-2015 to identify when crashes are occurring, the types of roads they occur on, where on the roadway they occur, and who was involved.

The integrated data was then used to create strategic campaign messages to increase awareness of bicyclist vulnerability, educate individuals on traffic laws, and motivate these users to replace reckless behaviors with safe behaviors. As part of the outreach, traffic safety seminars were organized and conducted, handouts were provided at public cycling events, and information was dispersed on social media outlets.

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# **3 OBSERVATIONAL SURVEY FINDINGS**

#### 3.1 Motorist Behavior

One or two lanes were identified for observation at each site, and only actions or distractions by motorists in these lanes were actively observed and recorded. Motorists' behaviors were recorded in two main categoriesactions and distractions. Actions are defined as reckless behaviors that motorists engaged in that could pose a safety risk for themselves and/or other road users. Distractions are broadly defined as anything that takes the motorists' attention away from the driving task. This includes visual distractions that can take a driver's eyes off the road, cognitive distractions that divert attention from the driving task and manual distractions that affect the ability of a driver to physically maneuver the vehicle [1]. These included using or holding a mobile phone, eating, talking to other passengers or into a Bluetooth device, or personal grooming. Distractions were only recorded while drivers were in a moving vehicle (drivers were not monitored for distractions while stopped).

Overall, 3% of the motorists performed a reckless action while being observed. The most common motorist action was disregarding the traffic signal (e.g., running a red light). Distracted behavior was more common. Nearly 20%, or one in five, of all motorists observed were distracted in some way. Note that data was collected only for vehicles in the closest lane or lanes in one direction. The most common distractions were use of or holding a mobile device and talking to other passengers or into a Bluetooth device.

## 3.2 Bicyclist Behavior

Bicyclist behaviors were coded into three main categories: locations, actions and distractions. The location data is a recording of where the bicyclist was riding while being observed. Actions refer to the reckless actions of bicyclists that pose a safety risk to the bicyclist themselves and/or other road users, and distractions refer to anything that distracts the bicyclist from their primary task.

Overall, the observations showed that **30%** of bicyclists failed to maintain their travel in one pathway. For example, common behavior included moving to and from sidewalk to side of the road. This unpredictability confuses other road users and poses a safety risk to the bicyclist as well as motor vehicles and pedestrians. Frequent reckless actions were also observed among bicyclists, with **25** reckless actions observed among the 59 bicyclists and in some cases the same bicyclist performing more than one reckless action. The most common reckless actions were disregarding the signal (**12** occurrences) and riding in the road in the opposite direction of traffic (**6** occurrences). Distraction among bicyclists was relatively low with only **three** distracted bicyclists in the 59 observed. Observed helmet use was **8.5%**, with 5 of the 59 bicyclists observed wearing a helmet.

In terms of infrastructure, three sites had either bike lanes or a separated bicycle path/trail. At two of these three sites, the number of observed reckless actions were the lowest of the 10 sites. At one site, despite having a separated bike path and a separate bike signal, observers recorded several bicyclists disregarding the bicyclist signal. However, these three sites with bike infrastructure had the least amount of occurrences of some of the other reckless actions such as: failing to yield right-of-way, riding against traffic, and improper lane positioning. At another site, where there were 13 bicyclists observed, of particular note was the high number of bicyclists that moved between the marked bike lane in the roadway to the sidewalk or vice versa, making them unpredictable to motorists and pedestrians. In fact, more than half of the bicyclists riding through this intersection used the sidewalk rather than the marked bike lane. However, reckless actions on behalf of the bicyclists were very low at this intersection with one bicyclist observed riding against traffic in the roadway (but in the bike lane). At the site where there was a protected bike lane, of the 16 bicyclists observed, the majority (**73%**) of the bicyclists used the protected bike lane.

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# **3.3 Situational Observations**

In addition to observation of individual motorist and bicyclist behavior, situational factors were observed during the same timeframe for each site. These observations attempted to capture interactions between a motorist and a bicyclist that have potential to result in an incident or crash. A total of **10** negative situational observations were gathered. All of the observations were a failure to yield right of way on behalf of the motorist or bicyclist. The situational observations reveal the importance of educating both motorists and bicyclists on common behaviors that can lead to crashes.

## **4 CRASH ANALYSIS**

A high number of bicyclist crashes involved those who are middle-school age up until age 30, and then again with middle-aged adults (46-55). Very young children and older adults are less likely to be involved in crashes. The slight drop in bicyclist crashes for individuals aged 31-45 may indicate that bicycles are less common than other modes of transportation for these age groups.

Males are overrepresented in bicyclist crashes, making up **84%** of crashes in Harris County. Previous research has found that males typically ride bicycles more than females [2, 3]. Caucasian bicyclists made up **39%** of fatal and incapacitating crashes. Hispanic (**31%**) and African American (**25%**) were the second and third most common bicyclist ethnicities of these crashes.

Of the crashes where helmet use was known, only **12.6%** were wearing a helmet at the time of the crash. When broken down by age group, the highest percentage of helmet use was for bicyclists aged 26-30; however, only **21.1%** of this age group (roughly 1 in 5) wore helmets. Additionally, **37%** of bicyclist deaths and incapacitating injuries occurred in the dark. The most common type of road for bicyclist crashes were "Urban principal arterial (other)" roads, with over **60%** of these crashes occurring on this road type. An urban principal arterial "other" is a major road with multiple lanes in each direction with high traffic volumes, but not a limited access highway.

#### **5 SUMMARY**

Observational surveys were conducted to document actions and distractions of motorists and bicyclists. The type of reckless actions or behaviors varied by type of road user, although road type and infrastructure may be factors. Specifically, nearly **20%** of motorists were observed being distracted in some way. Of the 59 bicyclists observed, **25** occurrences of reckless actions were observed. The behaviors on the part of all road users showed the serious nature of crashes involving bicyclists in Harris County.

Crash data for fatal and incapacitating bicyclist crashes from 2010-2015 in Harris County were analyzed to uncover the demographics, commonalties of when crashes occurred (i.e., time and day), and which road types they happened on. The most common ages of bicyclists were uncovered, as well as gender and ethnicity types. The crash data also revealed the noteworthy low percentage of bicyclists who wore helmets at the time of the crash. Additionally, the most frequent road type and location on the road for which crashes occurred were also exposed.

#### REFERENCES

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