



**Bicycle and Pedestrian Safety, Education, and
Enforcement Campaign:
Project Summary and Evaluation**

NCDOT Contract #MA-2009-07

FINAL REPORT

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North Carolina Department of Transportation
Division of Bicycle and Pedestrian Transportation
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Background and Project Goals

In both the United States and North Carolina, pedestrians and bicyclists represent 16% of all motor vehicle traffic (MVC) fatalities. According to the latest data available from the National Highway Traffic Safety Administration (NHTSA, 2014a; NHTSA, 2014b), in 2012 4,743 pedestrians and 726 bicyclists were killed in MVCs in the US. An additional 76,000 pedestrians and 49,000 bicyclists were estimated to have been injured.

In North Carolina (NC), there are 2,400 pedestrian-involved MVCs each year, leading to between 150 and 200 pedestrian deaths and an additional 500 serious injuries (UNC, 2011). The geographic focus of this study, the Triangle region of NC, has been identified as a particularly high-risk region of the country and the state. In a 2014 report, the Raleigh-Cary region had the 16th highest pedestrian danger index (a measure of total pedestrian fatalities, fatalities per capita, and walking rates) out of the 52 metropolitan areas in the US with over 1 million people (Ernst, 2014).

In the past two decades, the magnitude of the pedestrian crash problem coupled with a growing awareness of the health benefits (among other co-benefits) of walking has inspired a number of interventions to improve pedestrian safety. While the number of pedestrian safety programs is growing, more information is needed to guide the development of such programs, document how the programs are implemented, and provide evidence of the effectiveness of various program activities.

In 2012, the Watch for Me NC pilot program was launched in the Triangle region with support from NHTSA and the North Carolina Department of Transportation (NCDOT). The aim was to conduct high-visibility enforcement of pedestrian and motorist laws; to disseminate safety messages through various outreach and education strategies; and to evaluate program effectiveness. A summary of the first year program activities and evaluation results was submitted to NHTSA in October 2013 and, at the time of this report, is still undergoing internal review. In October 2013, funding was added by NCDOT to include additional partners in the Triangle pilot region and to expand the messaging to incorporate bicycle safety messages, as well as messages for pedestrians and drivers. The overall goal of the 2013 effort was to assist pilot communities within the Triangle region of North Carolina in implementing and evaluating the Watch for Me NC program established in 2012. To accomplish this goal, the project team from the UNC Highway Safety Research Center (UNC-HSRC) sought to:

1. Review the literature and identify best practices in conducting community-based pedestrian safety programs and theoretical evidence to support program development and expansion
2. Perform crash-based analyses to identify local bicycle safety concerns and target populations and geographic areas of interest
3. Work with local partners to develop and implement the Watch for Me NC program
4. Provide technical assistance and training to support the program implementation
5. Coordinate with local agencies to collect, manage, and analyze data related to the intervention
6. Evaluate the program and present findings and lessons learned

The intent of this report is to document the development of the second year of the intervention (conducted in 2013), its implementation, and the results based on the 2013 evaluation.

Campaign Focus Area

Since October 2011, municipalities in Orange, Durham, and Wake Counties have been active partners in the Watch for Me NC campaign, as along with NCDOT and other regional agencies. After the implementation of a comprehensive pedestrian education and enforcement program in 2012 in Raleigh, Durham, Chapel Hill, and Carrboro, additional partners joined in the planning of the 2013 program. These additional partners included the Wake County communities of Apex, Cary, Fuquay-Varina, Knightdale, Morrisville, and Wake Forest (see Figure 1). To participate, each of these communities passed a resolution with their city council, acknowledging the importance of pedestrian and bicycle safety and pledging to support outreach and enforcement activities to improve safety in the community. Within these municipalities, eight area universities also initially joined in the project (described later).

This report largely details the 2013 efforts in the three-county Triangle region to conduct the Watch for Me NC program.

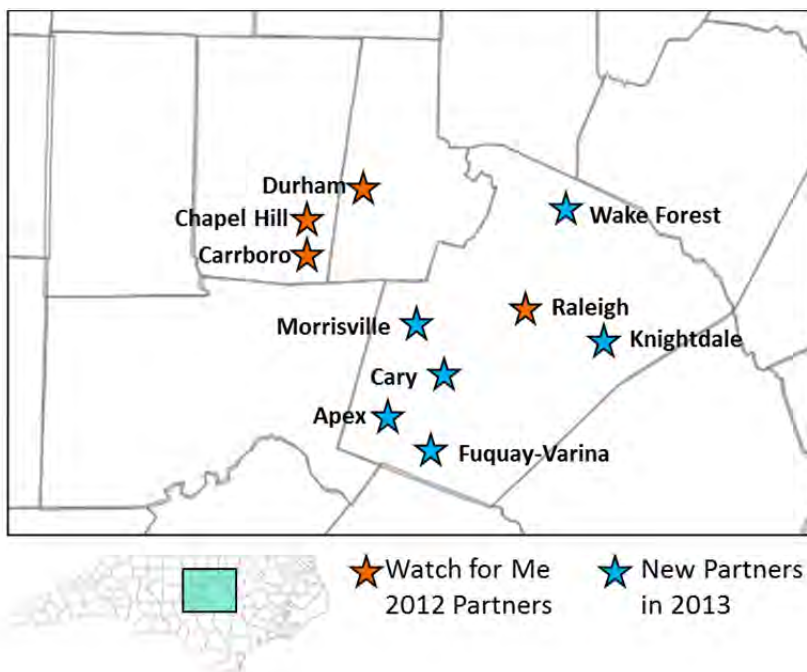


Figure 1. Map of project focus areas.

Campaign Development

Background Research and Program Recommendations

As a first step in enhancing and expanding the 2012 program, a literature review of best practices in community outreach was performed. This review summarized existing education and enforcement programs, highlighted best practices, and provided an overview of the behavior change theory and research underpinning such programs. An analysis of five years of bicycle crashes in the 3-county area was also conducted in order to identify the most common bicycle crash trends, pre-crash actions, and contributing factors. A report submitted by HSRC to NCDOT and the stakeholder steering committee (which consisted of representatives from each of the participating municipalities, the Metropolitan Planning Organization, NCDOT, and HSRC) highlighted:

- Key Crash Issues
- Key Target Audiences
- Recommended Program Components
- Recommended Focus of Safety Materials
- Reinforcement of Safety Messages Through Law Enforcement Action
- Triangle Region Bicycle Crash Trends (sub-Appendix A)
- Summary of Existing Programs (sub-Appendix B)
- Summary of Program Effectiveness and Best Practices (sub-Appendix C)
- Summary of Behavior Change Theory (sub-Appendix D)
- Legal Issues and Considerations (sub-Appendix E)
- Resources and References (sub-Appendix F)

For details on these background issues, see Appendix A for the original 62-page report, titled *Watch for Me NC Year 2 Program Recommendations*.

Stakeholder Input

Multiple in-person meetings with various stakeholders were held, both in the beginning stages of planning the program and regularly throughout 2013. Stakeholders included a range of partners at the local, regional, and state level, including:

- Capital Area Metropolitan Planning Organization
- City of Durham (Planning, Engineering, and Police Departments)
- City of Raleigh (Planning, Transit, and Police Departments)
- Duke University (Transportation Demand Management and Police Department)
- Durham Chapel Hill Carrboro Metropolitan Planning Organization
- North Carolina Central University (Police Department)
- North Carolina Department of Transportation, Division of Bicycle and Pedestrian Transportation
- North Carolina State University (Police Department and ITRE staff)
- St. Augustine’s College (Police Department)
- Town of Carrboro (Planning, Communications, and Police Departments)
- Town of Chapel Hill (Planning, Engineering, and Police Departments)

These stakeholders often represented and coordinated closely with other community groups, including municipal Bicycle and Pedestrian Advisory Councils (BPACs), local advocacy groups, transit services, parks and recreation departments, city councils, business districts, and others.

A sub-set of this group, including a representative from each municipality, NCDOT, and the two regional MPOs, was defined as a “steering committee” and held monthly meetings throughout the year. This group had previously met regularly in 2011 to decide upon the name of the campaign; provided input on logo and material design; and help inform the overall campaign strategy and identify opportunities for community engagement. In 2012 and 2013, additional feedback was gathered regarding the new bicycle campaign elements and input from the steering committee and other stakeholders was used to identify populations of interest and to develop communication strategies to target specific groups, such as bicycle riders. Stakeholder input was also used to help conceptualize and test the messages to be

developed for the public outreach components of the project. Stakeholders helped identify and refine past lists of potential law enforcement sites and opportunities for outreach and engagement with the broader community. In most cases, the stakeholders took the lead in implementing the intervention, including performing the enforcement operations and distributing the educational materials to disseminate pedestrian safety messages to the broader public.


Campaign Products

The campaign development resulted in several communication and training products that are documented below. All media and messaging materials can be found at the project website: www.watchformeNC.org. In general, messages were developed internally by NCDOT’s communication staff, in coordination with the input received from HSRC and the steering committee.



Purchased Media


Purchased media includes radio ads, printed materials, and outdoor and indoor advertising space purchased. Radio ads were developed in English and Spanish, as were some of the print materials, including the posters and brochures. The purpose of this media was to deliver specific behavioral messages regarding pedestrian and bicycle safety to the general public in order to raise awareness of safety concerns and encourage road users to drive, bike, and walk more safely. Messages were disseminated through a variety of outlets, depending on the format of the media. Table 1 provides a description of the media and a summary of its placement and duration.

Table 1. Summary of purchased media campaign materials.

Item Description	Placement and Time Frame	Example
<p>Transit Ads: External</p> <p>Ads of various sizes placed on 3 regional bus systems on 32 buses. Had a series of 2 specific messages aimed at safe driving behaviors. Bus vendors estimate 90% of riders are “exposed” to transit ads each month</p>	<p>CAT Buses: 20 ads; run August-November</p> <p>Chapel Hill Transit: 11 ads; run August-November</p> <p>Wolfline: 1 external wrap</p>	

Item Description	Placement and Time Frame	Example
<p>Transit Ads: Internal</p> <p>526 (11 x 17 inch) ads placed on 7 regional bus systems on more than 300 buses; ads ran from August until mid-November. Had a pedestrian-oriented ad (with 6 specific messages) and a bicycle-oriented ad (with 8 specific messages).</p>	<p>CAT Buses: 160 ads on 80 buses.</p> <p>R-Line Interiors: 6 ads on 3 buses</p> <p>DATA Durham Buses: 54 ads on 50 DATA buses and 4 Bull City Circulator Buses</p> <p>Chapel Hill Transit: 98 ads</p> <p>NCSU Wolfline: 35 ads</p> <p>Duke: 45 ads</p> <p>Triangle Transit: 128 ads</p>	 <p>The first ad, 'Tips for Being a Safe Cyclist', lists eight tips: Be Right at Night, Look Before Changing Lanes, Use Hand Signals, Be Right at Night, Check a Mirror, and Remember to signal with the left hand. The second ad, 'Remember Your Cycling Hand Signals', shows three hand signals: left, stop, and right, with the instruction 'Always Signal with the Left Arm'. The third ad, 'Tips for Being a Safe Pedestrian', lists six tips: Be Right at Night, Watch for Turning Cars, Pull the Flag and Pay Attention, Walk Facing Traffic, Be Careful in Parking Lots, and Cross Safely When Exiting the Bus.</p>
<p>Bumper Stickers</p> <p>Two standard-size bumper stickers with pedestrian and bicycle safety messages aimed at drivers.</p>	<p>27,500 bumper stickers distributed to ten city planning departments and eight universities for distribution in Fall 2013.</p>	 <p>The first bumper sticker features silhouettes of a person pushing a stroller, a child, a person with a cane, and an elderly person, with the text 'I brake for people.' and the Watch For Me - NC logo. The second bumper sticker features a bicycle silhouette and the text 'I bike for bikes.' with the Watch For Me - NC logo.</p>
<p>Radio PSAs</p> <p>15-second ads with safety messages aimed at drivers; versions in English and Spanish.</p>	<p>459 plays on 10 radio stations from August to October.</p>	<p>Listen to PSAs on campaign website: http://www.watchformenc.org/campaign-materials/</p>

Item Description	Placement and Time Frame	Example
<p>Brochure/Rack Card</p> <p>Two-sided 4.25 by 11 inch document with laws and safety tips aimed at drivers, pedestrians, and bicyclists.</p>	<p>25,900 printed in English and 2,950 printed in Spanish.</p> <p>Provided to all 18 partners and law enforcement agencies for distribution through libraries, community centers, local businesses, and direct contact</p>	 <p>SAFETY IS A SHARED RESPONSIBILITY</p> <p><i>When you're driving:</i></p> <ul style="list-style-type: none"> • Yield to people in crosswalks. • Before making a turn, be sure the path is clear of people walking. • Look behind your vehicle for people before backing up. • Keep an eye out for people walking at night. <p><i>When you're walking:</i></p> <ul style="list-style-type: none"> • Look for cars in all directions—including those turning—before crossing the street. • Obey all pedestrian traffic signals. • At night, walk in well-lit areas, carry a flashlight, or wear something reflective to be more visible. • Watch for cars backing up in parking lots. • Cross the street where you have the best view of traffic. At bus stops, cross behind the bus or at the nearest crosswalk. • Always walk on the sidewalk; if there is no sidewalk, walk facing traffic and as far from the road as you can.
<p>Banners</p> <p>Ninety seven 3 ft by 6 ft or 3 ft by 8 ft outdoor banners with messages aimed at drivers.</p>	<p>Placed in 13 of the 18 communities in high-visibility locations or used at community events.</p>	

Item Description	Placement and Time Frame	Example
<p>Posters</p> <p>A total of 10,776 posters (11 by 17 inch or 18 by 24 inch) posters with a series of six messages aimed at pedestrians and eight messages aimed at bicyclists</p>	<p>Placed in businesses, community centers, libraries, campuses, and other public locations throughout participating communities.</p>	
<p>Bike Lights</p> <p>2,200 bike light sets (front and tail lights with the Watch for Me NC logo), intended for bicyclists</p>	<p>Distributed primarily by police officers to bicyclists observed riding without lights during the Fall campaign months; also distributed through community events</p>	
<p>Bracelets</p> <p>3,400 bracelets/arm or leg straps with LED lights and the Watch for Me NC logo</p>	<p>Distributed at community events during the Fall campaign months by the 18 partners</p>	

Website

To distribute information to a wide audience, inform the public and media, and track the development of the project, the team created a website, <http://www.watchformenc.org> (see Figure 2). The site serves as a central information point for the campaign. It consists of four main sub-pages: About the Campaign, Crash Facts, Safety Resources, and Media. The site provides relevant data regarding crashes in the area

as well as tips and information for being a safer driver and pedestrian. Furthermore, the site provides a single repository for all campaign materials so that all partner organizations or other interested groups, such as advocates or neighborhood associations, may access them as needed. Finally, the site also catalogs much of the media coverage of the campaign and lists contacts for the campaign. The site is regularly updated by UNC-HSRC staff.

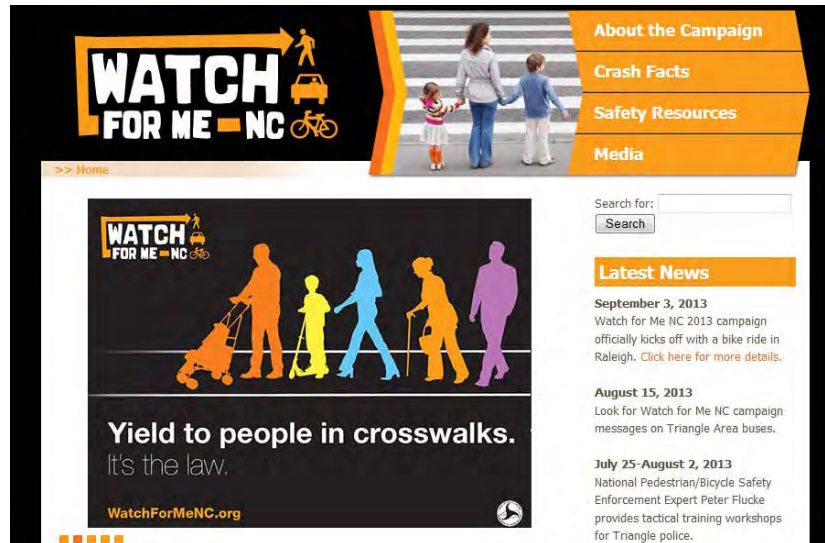


Figure 2. Watch for Me NC project website home page.

Law Enforcement Training and Support

Training was provided to 55 officers from 20 agencies in July and August 2013 to prepare them for performing pedestrian safety operations as part of the Watch for Me NC campaign. Peter Flucke of WE BIKE, etc., LLC was sub-contracted to lead the two-day courses. The course involved classroom education regarding relevant North Carolina laws and best practices in conducting enforcement, as well as field exercises in conducting targeted operations aimed at improving driver yielding at crosswalks as well as bicycle safety exercises (see Figure 3).



Figure 3. Law enforcement field training exercises.

Changes in officer attitudes and sense of capacity as a result of the training course are described in the Evaluation Results section to follow. Officers received copies of the rack card to hand out during routine or targeted enforcement operations, as well as a template operations plan to help them coordinate and perform consistent and safe operations (see Appendix D). Additionally, NCDOT equipped officers with sandwich boards to help them raise awareness of the purpose of their field operations and encourage safer behaviors (see Figure 4). Finally, officers were provided with bicycle light sets (headlight and taillight) and light-up bracelets to give to local residents when observed walking or bicycling at night without a light (see images in Table 1).



Figure 4. Sandwich board for law enforcement operations.

Evaluation Methods and Results

To comprehensively evaluate the Watch for Me NC program, the project team examined multiple measures, including program implementation records; self-reported measures of law enforcement knowledge, attitudes, and capacity; and measures of driver yielding behaviors, pedestrian behaviors, and bicyclist behaviors.

Program Implementation Measures, Methods, and Results

Program implementation records were used to document the intensity of the Watch for Me NC program. To collect such information, the project team developed paper forms and web-based surveys and distributed these to community partners to help track and document activities. Data was regularly requested from partner groups during the program through direct emails, calls, and in-person meetings. See Table 2 for a summary of the program implementation records available.

Table 2. Key Watch for Me NC program implementation measures.

Domain	Variable(s) Available
Purchased Media	<ul style="list-style-type: none"> • Number of print materials produced and disseminated by NCDOT and duration of exposure time • Total cost of all printed materials and print and radio ad space purchased and cost/capita reached • Number of times PSAs were aired, radio station sources, and estimated number of impressions
Earned Media	<ul style="list-style-type: none"> • Press release dates • Media coverage source and publication date • Media coverage type, length, and slant • Number of impressions (e.g., media circulation) per media coverage • Ad equivalency (value of earned media) per media coverage
Website Usage	<ul style="list-style-type: none"> • Website visits • Unique website visitors • Page views • % new vs. returning visitors • Visit frequency and duration
Law Enforcement Activities	<ul style="list-style-type: none"> • Count of safety operations run by agency • Count and type of warnings and citations administered per operation • Count of enforcement officer hours spent per operation, by agency • Count of safety materials disseminated, by agency
Community Engagement Activities	<ul style="list-style-type: none"> • List of partner agencies • Brief description of community engagement strategies used by partner agencies, including type of event, population reached, frequency, staff involvement, etc.

Purchased Media

NCDOT and their media purchasing contractor, MSA Marketing, Inc., provided information regarding paid media contracting and printing services used from July 2013-January 2014. A total of \$114,903.94 was spent on purchased media, including radio, outdoor advertising (e.g., transit ads), and digital materials. A summary of the radio and outdoor media purchased, including the amounts, locations distributed, and timeframe of the ad placement is provided in Table 1.

As mentioned, the radio PSAs aired about 459 times on ten stations during peak commute times for eight weeks between August and October 2013. The majority of the ads ran during am and pm weekday drive times from 7-10am and 3-7pm. The radio PSAs were estimated by MSA Marketing, Inc. to have made a total of 10,518,000 gross impressions on adults aged 18 and up. It was projected that 59% of adults in the media region were reached and that the average person should hear the message a total of 14 times. The purchased radio media package included three bonus on-air exposure times on two stations (WRAL-FM and NC News Network).

In addition, Facebook ads (see Figure 5) were purchased in order to spread the campaign messages through the use of social media. From August 5 to November 1, 2013, Facebook ads generated an estimated 28 million impressions on adults age 18 and up within a 10 mile radius of Raleigh, Durham, and Chapel Hill. While the number of impressions was high, the resulting proportion of viewers who clicked on the ads was relatively low. The bicycle-focused ad generated 3,255 clicks (0.028 percent of the impressions); the pedestrian-focused ad generated 571 clicks (0.003 percent of the impressions). Using data from Google Analytics, it is known that 589 of the web visitors between August 5 and

November 1 (when the Facebook ads ran), were directed to the site from Facebook. These viewers stayed on the site an average of 22 seconds, much less time than the duration spent on the site by those who directly searched for the web address (3.5 minutes), meaning that many may have reached the site in error or perhaps did not see the type of information they expected. With a total cost of Facebook advertising at \$3,900, an average of \$1.02 was spent per ad click, or \$6.62 per web site visitor referred from Facebook. It is not known how clicks on the ads or visits to the site may have translated into changes in knowledge, attitude, or resulted in improved travel behaviors, but the cost per person “reached” may be relatively high compared to other media modes or outreach strategies.

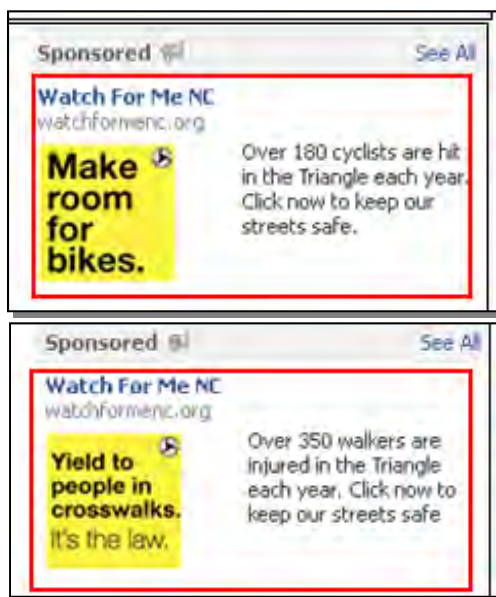


Figure 5. Facebook ads.

Earned Media

Earned media consisted of TV, radio, and print news coverage of the program that was not purchased. The project team began tracking news articles in July 2013, and has routinely searched Lexis-Nexis archives and Google News Alerts from the period of July 2013 to end of January 2014. The campaign released a total of six press releases during the period from June to November 2013, about the same as were released in 2012. In 2013, the releases generated more than a half-dozen stories in local media, including a large article in one of the area’s Spanish language papers. Each media story reached approximately one-half million readers/television viewers. The campaign sought to leverage events, such as a community bike ride kick-off event (see Figure 6) and the law enforcement training courses, into news stories. The kick-off bicycle safety ride held on September 3 in Raleigh was attended by close to 100 cyclists and spectators. Additionally, NCDOT Transportation Secretary Tata mentioned the campaign at the new pedestrian bridge-opening celebration on the American Tobacco Trail on October 12, 2013. While the community bike ride was a successful event, it did not generate any media coverage to more broadly call attention to the start of the campaign. The law enforcement workshop series drew more local coverage, and law enforcement public information officers stepped up efforts in many of the communities to announce their law enforcement events. In total, the advertising value equivalency (AVE) of all news coverage exceeded \$1,000. AVE reflects the approximate cost to purchase an advertisement of equal size or duration and placed in a similar location in the newspaper or timeslot during the television news broadcast to the news story produced. The figure is calculated based on posted newspaper rate cards and rates charged by television stations during Fall of 2013.



Figure 6. Bicycle safety ride campaign kick-off.

As with the first round of the campaign in 2012, news coverage remained largely positive toward the campaign. Newspaper articles and television reports largely focused on crash statistics and road fatalities and how the campaign is working to reduce those figures through better education of drivers, pedestrians, and bicyclists, as well as enhanced enforcement of existing pedestrian and bicycle safety laws. However, in comparison to the initial campaign launch in 2012, the 2013 campaign year saw a significant decrease in earned media and stories about the campaign. The first year of the program resulted in nearly two dozen stories in local media, including a front page story in the Raleigh News and Observer, with an estimated total AVE of \$15,000. The decrease in earned media in 2013 may have resulted from the loss of novelty as the campaign was no longer a new—and therefore newsworthy—topic for reporters. Also, the campaign launch in 2012 was attended by David Strickland, the top Administrator of the National Highway Traffic Safety Administration at the time, and thus resulted in significant media attention from major news outlets. The 2013 campaign launch took more of a grassroots approach, which may have resulted in greater awareness about the program through word of mouth and social media, but less quantifiable traditional media attention. This speculation is bolstered by the fact that partnering organizations reported using a variety of other social media strategies between August and February. Of the 18 organizations responding to the survey, 67% reported posting messages on their website, 61% reported using Facebook, 50% reported issuing a press release or newsletter (print or e-news), and 44% used Twitter to spread safety messages.

Website Usage

Data from the Watch for Me NC website usage during the relevant time period were extracted from Google analytics. From July 1, 2013 to Feb. 1, 2014, more than 4,000 unique visitors logged onto the site more than 4,900 times and viewing more than 9,300 pages. The bulk of the web traffic—80.2% of visits—came during the first three months of the campaign, when the purchased radio and Facebook advertisements were running and the bulk of the press releases were issued.

More than half of the site's web traffic, 55.7%, came from direct links, a sign that site visitors were aware of the web address. Another 16.6% of traffic was derived from organic searches and 15.4% from social media, including Facebook and Twitter. The most commonly visited sub-pages were the Media (878 page views), About (832 page views), Safety Resources (745 page views) and Crash Facts (513 page views).

There were several noticeable spikes in web traffic, most of which occurred around campaign announcements and news coverage. For example, traffic spiked on July 25 when the first of three police training sessions was held. Another spike occurred on October 30, following a press announcement regarding Halloween safety.

Law Enforcement Operations

Law enforcement activities were tracked through direct interaction with law enforcement agency staff. Appendix B includes the program implementation data collection forms sent to police. While most staff were responsive to requests for information, certain police departments had multiple units performing operations and not all were well-coordinated or planned in advance, so it is very possible that staff may have under-reported the true amount of enforcement activities taking place within their respective jurisdictions.

From July 2013 to February 2014, eight of the 10 city/town police agencies and three of the eight university police departments reported conducting more than 55 operations targeting enforcement of pedestrian- and/or bicycle-related laws, as well as various other routine enforcement patrols where officers incorporated pedestrian and bicycle safety surveillance. The towns of Knightdale and Morrisville were the only two community partners that failed to report any participation in the enforcement aspects of the program. Several of the university partners did not report any enforcement activity, including William Peace University, St. Augustine, Wake Tech, Durham Tech, and Duke University. Many of them had no official plans to perform active enforcement, but rather focused on outreach to students and campus staff.

The 55 or more operations that were reported involved at least 200 police officer hours, all performed without receiving any additional compensation from the Watch for Me NC program sponsor. The operations resulted in more than 318 warnings and 162 citations, which was slightly fewer warnings/citations than seen in the previous year, in which 37+ operations resulted in over 460 warnings and 172 citations. Pedestrians received 53% of the warnings issued, bicyclists received 17%, and motorists received 30%. All of the citations, however, were given to motorists. Table 3 provides a breakdown of the enforcement activities by agency.

Table 3. Number of targeted Watch for Me NC police operations.

Community	Number/ Date of Reported Operations	Total "Failure to Yield" Warnings Issued	Total "Failure to Yield" Citations Issued	Total Warnings to Peds	Total Warnings to Bicyclists	All Watch for Me NC Warnings / Citations
Communities						
Apex	2 (12/17 and 12/18)	7	6	11	2	26
Carrboro	12 (7/16 to 10/28)	3	24	0	25	52
Cary	4 (two on 9/4, one on 12/18, one on 1/22)	6	32	43	0	81
Chapel Hill	12 (10/6 to 10/16; 10/25, 11/5, 11/19, 11/22, 12/10, 1/8, 1/22, 1/28)	0	4	35	15	54
Durham	2 (10/15 and 10/16) and various directed patrols	1	21	16	0	38
Fuquay-Varina	Various (8/1 to 11/1)	4	0	3	9	16
Raleigh	3 (10/18, 10/24, 1/23) (no activity Nov. & Dec.)	47	12	0	0	59
Wake Forest	Various (Sept-January)	3	0	0	3	6
Universities						
NCCU	2 (7/23 to 9/4)	0	62	41	0	103
NCSU	7 (4/10, 5/31, 10/1, 10/2, 10/3, 10/8, 10/9)	2	1	0	0	3
UNC	11 (8/13 to 10/9; primarily campus outreach)	21	0	21	0	42
Total	55+ held	94	162	170	54	480

These figures are noteworthy, since for many it was only the first or second time to ever conduct pedestrian- or bicycle-focused operations. However, the overall enforcement intensity per capita was relatively low. Given that the population of the Triangle area (Orange, Durham, and Wake County) is estimated to be 1,369,733, the total direct reach of the enforcement was less than half of 1% of the area population. The majority of enforcement operations occurred in October, during the peak of the campaign, in step with the press event and other outreach efforts. Some additional enforcement occurred later in December and January 2014. However, there was no routine follow-up or repeat enforcement at the sites selected for evaluation. This is discussed more in the evaluation section that follows.

Community Engagement Activities

Nine of the 10 municipalities and six of the eight universities actively worked to distribute messages and engage the community from August 2013 to end of January 2014. Tables 4 and 5 present a summary of the activities performed by Watch for Me NC partners as of February 5, 2014 and what types of materials have been distributed. Only the Town of Morrisville, NC Central, and St. Augustine University

failed to report any outreach activities during the time of the program. The total sample size of 18 reflected the 17 participating communities and universities, one of which had two separate departments complete the survey in order to provide more complete (but not overlapping) information.

Table 4. Reported community outreach efforts.

Community outreach efforts conducted since August (N = 18 responses)	Percent	Count
Distributed messages, presentations, or materials at community events, public meetings or other gatherings	94.4%	17
Distributed materials at other locations (not part of an event)	94.4%	17
Distributed messages or materials using social or digital media	66.7%	12
Other (e.g., educated the public about pedestrian and bicycle safety through schools, fleet driver training, partnerships with interfaith groups, etc.)	44.4%	8
None of the above	5.6%	1

Table 5. Material distribution and use.

What type of materials did you distribute or use? (N = 18 responses)	Percent	Count
Bumper stickers	77.8%	14
Rack Cards/Brochures	72.2%	13
Posters	66.7%	12
Bracelets	50.0%	9
Bike lights	44.4%	8
Banners	33.3%	6

Partners received a web-based survey in October, December, and January to track outreach and education activities performed as part of the Watch for Me NC effort. Based on the survey responses, at least 71 local events were attended or hosted by Watch for Me NC partners from June 2013 to January 2014 in nine cities and at six universities. Events ranged in size and audience and included:

- University open houses or student orientations
- New employee orientations
- National Night Out
- Park or trail opening ceremonies
- Community open houses
- Committee or board meetings
- School events (such as walk or bike to school events)
- Festivals, fairs, and farmers markets
- Governor’s Highway Safety Symposium in Concord, NC

Additionally, materials were commonly distributed at city/town hall, local bike shops, community centers, as well as student centers and other campus locations. Materials were also distributed during police enforcement events, a taxi driver training, and through churches, crime prevention programs, and other partner organizations. For details on specific events, audiences reached, and materials distributed, please refer to Appendix C.

Law Enforcement Self-Report Measures, Methods, and Results

Fifty-five officers attended one of a series of two-day workshops offered in July and August 2013. The course covered common pedestrian and bicycle crashes and causes, NC laws relating to motorist, bicyclist, and pedestrian behaviors, and effective practices for law enforcement to reinforce safe behaviors and implement tactical operations aimed at improving compliance with laws, including yielding to pedestrians in crosswalks.

The two-day workshops were evaluated using a pretest-posttest comparative design. A brief, self-administered questionnaire was delivered before the start of the first day of the workshop and at the end of the second day. The questionnaire was designed to evaluate changes in officer knowledge, plans regarding participation in Watch for Me NC enforcement events, attitudes about pedestrians, and self-reported capacity to perform operations aimed at improving pedestrian safety (e.g., resources of the individual and support from his/her organization), as well as response efficacy (i.e., the sense that the work they perform will have lasting value/effect). Fundamental to the effectiveness of the Watch for Me NC intervention is the buy-in of the police officers responsible for implementing the enforcement operations to the full extent possible. A common premise is that officers who are familiar with the law and who have the resources/capacity to enforce the law, coupled with an attitude and sense of efficacy that supports conducting such activities, will be more able to successfully implement the enforcement elements of the program and contribute to the intensity of the intervention. See Appendix D for the questionnaire used.

Fifty-four officers completed both before and after surveys. Officers included those from bike squads, community police teams, traffic safety units, and other field operations or safety teams. Officers also represented various types of police departments: municipalities (43), universities/colleges (8), county (2), and state government (1). Of the 54 respondents, only 10 reported to have taken a previous course on pedestrian and bicycle laws (taught by HSRC in 2012 or another course).

Survey results indicate an increase in the number of correct responses regarding pedestrian and driver yielding requirements under different scenarios (e.g., at intersections and at midblock locations), and an improved recognition of North Carolina laws regarding pedestrians and bicyclists (see Table 6). Average test scores rose from 77 to 90% correct (a 17% increase). A matched-pair t-test of average scores resulted in a p-value of 0.0004 (one-tailed, alpha = .05), reflecting that the improvement in scores was statistically significant. The greatest gains in knowledge were seen in the questions regarding which party must yield right of way, while the baseline understanding of NC laws began and remained relatively high.

Table 6. Officer knowledge test scores before and after training.

Item	Facts/Knowledge	Before %	After %	Absolute Difference	Percent Difference
1	Selected the correct scenario regarding the yield law at an uncontrolled intersection	77%	92%	16%	20%
2	Selected the correct scenario regarding the yield law at a midblock location	66%	85%	19%	30%
3	Correctly identified which statement was not a NC law	88%	92%	4%	4%
Total	Average Correct Score	77%	90%	13%	17%
Total	Median Correct Score	83%	100%	17%	20%

Results of the survey also showed that there was an increase in the number of officers reporting plans/intentions to conduct pedestrian and bicycle operations in the next six months, and a decrease in those reporting that they didn't know their plans (Table 7). This indicates that the training may have been successful in encouraging officers to discuss or make plans to support pedestrian and bicycle safety.

Table 7. Officer enforcement plans before and after training.

Stated Plans for Pedestrian-Oriented Operations	Pre	Post
We have been performing operations regularly for more than 6 months	11	10
We have been performing operations regularly for less than 6 months	8	6
We intend to perform an operation in the next 6 months	9	19
We intend to perform an operation in the next year	2	3
We have no plans for conducting an operation in the next 6 months	2	1
I don't know or not applicable	21	15
Left blank	1	0
Total	54	54

Table 8 provides a summary of the findings from the questionnaire items assessing self-reported knowledge, attitude, resources/capacity, efficacy, and plans regarding pedestrian enforcement. For each item, a matched pair t-test (one-tailed, alpha = .05) was performed to assess the significance of the difference in individual scores from before and after the workshop. The p-values are reported in Table 8, with the bolded ones representing those that were statistically significant.

On the whole, there was a significant increase (27%) in officers reporting that they were familiar with the laws protecting pedestrians. There was also a significant decline in officers reporting the sentiment that pedestrian laws are difficult to enforce or do not need routine enforcement (14 and 18%, respectively). After the workshops, more officers also stated that they had adequate resources, training, time, and the ability to perform pedestrian operations; officers also agreed more strongly that enforcement can improve driver compliance with yielding laws and can help prevent crashes. Several officers also stated clear plans to conduct targeted enforcement in the next six months to a year.

Table 8. Officer attitudes scores before and after training.

Measurement Construct	Attitude/Belief Statement (1=Disagree; 6=Agree)	Item #	Before Avg.	After Avg.	% Difference	P-value
Knowledge	I am familiar with the laws protecting pedestrian safety in NC	5	4.15	5.26	27%	0.0000
Attitude	Motorists who do not follow traffic laws pose a serious threat to pedestrian safety	6	5.58	5.70	2%	0.2424
Attitude	Keeping pedestrians safe is an important part of my job	7	5.70	5.74	1%	0.3436
Attitude	Pedestrian laws are difficult to enforce	8	3.49	3.00	-14%	0.0111
Attitude	Enforcing pedestrian safety is a worthwhile endeavor	13	5.59	5.70	2%	0.1387
Attitude	Pedestrian safety does NOT need routine enforcement	17	2.00	1.65	-18%	0.0083
Resources/capacity	My colleagues/I have adequate resources to use towards making our community safer for pedestrians	9	4.33	4.67	8%	0.0163

Measurement Construct	Attitude/Belief Statement (1=Disagree; 6=Agree)	Item #	Before Avg.	After Avg.	% Difference	P-value
Resources/capacity	I have the support of my command staff to perform pedestrian safety operations	10	5.00	5.09	2%	0.2802
Resources/capacity	There is NOT enough pedestrian-focused training available that can help me do my job better	11	3.69	3.17	-14%	0.0020
Self/ Unit Efficacy	My department/unit could perform a pedestrian crossing operation	12	5.13	5.67	10%	0.0002
Self/ Unit Efficacy	On an average shift, I do NOT have time to enforce laws to protect pedestrians	14	2.94	2.66	-10%	0.0542
Response Efficacy	If I enforce pedestrian safety laws, more drivers will yield to pedestrians in marked crosswalks	15	4.63	5.09	10%	0.0028
Response Efficacy	I can help prevent crashes by enforcing pedestrian/motorist laws	16	5.11	5.53	8%	0.0018
Plans	I have been thinking that my unit should work on planning a crosswalk enforcement operation within the next 6 months	18	4.25	4.85	14%	0.0007
Plans	During the next 6 months, I plan to routinely enforce drivers yielding at crosswalks	19	4.80	5.20	8%	0.0021
Plans	It is likely that my unit/department will enforce pedestrian laws regularly during the next 6 months	20	4.89	4.85	-1%	0.4240

Note: **Bold** values are significant at the $\alpha=.05$ level

Additionally, survey participants provided the following qualitative feedback regarding the course:

1. Instructor performed an outstanding job presenting the material to students; very helpful tips; thank you for the insight.
2. Very informative information; really enjoyed the class.
3. I think once the other officers from my team come to this class, I am sure we will go ahead and set up some sort of campaign to ensure pedestrian and bicycle safety enforcement.
4. I really enjoyed this class. I have learned a lot of laws when it comes to pedestrians and cyclists. I will take my knowledge and skills to work with me. I think this class should be introduced into the police academy.
5. Very good class; great instructor. I learned a lot of info that will be helpful in enforcing laws as well as defense in court when questioned about understanding those enforced laws.
6. Gear towards law enforcement. Instructor must provide breaks every 45-50 minutes. Attention falls without!
7. Great course that is offered and instructor is very knowledgeable.
8. I think the instructor is very knowledgeable and personable. My only critique would be to adhere to breaks in the schedule. People can only take in so much and their attention span only lasts so long. People need to get up, use the restroom, and stretch their legs on a regular basis. People will learn more that way.

9. We are going to try to conduct our operation around our high school and down town in the coming months.
10. Learned quite a bit. Would like to incorporate biking into teaching. Ex: bike and learn at same time not just one or other.
11. The information in this course has a lot of common-sense education; removing this material can reduce the class down to one day.
12. Target audience: officers who are assigned to traffic units, crash units, and community police should be the focus of those who attend. They have the greatest influence or most interaction with those which can effect a change. Patrol shouldn't be the primary focus based on the dynamics of departments and manpower issues.
13. Thanks, enjoyed it. Need to discuss more enforcement and what has worked in other towns to help us improve ours.
14. Excellent class.
15. Very good class; I learned a lot of information regarding pedestrian and bicycle safety. I'm glad I attended this class.
16. Great information on both pedestrian and bicycle laws and how to educate the public on how to improve their safety.
17. Very good instruction! I specifically liked the hands-on demonstration of bike/crosswalk safety.
18. Great program! I feel that there are many applications to my newly acquired skills...can't wait!!!
19. I plan to use the training to address pedestrian and bicycle violations/safety issues along the New Bern Ave corridor in Southeast Raleigh
20. My unit will conduct several pedestrian safety operations in the months to come.
21. Plan to have a crosswalk enforcement operation soon in our areas of highest need.

Based on both the quantitative and qualitative survey responses, there is strong evidence that the two-day training provided significant value in terms of improving participants' knowledge of pedestrian law and confidence in their resources/capacity to perform operations, and in helping solidify plans to conduct targeted enforcement in the near-term to improve pedestrian safety.

Observational Behavior Data Collection Measures, Methods, and Results

In addition to the process and self-reported measures described above, observational data of driver, bicyclist, and pedestrian behaviors were collected at a sampling of crosswalks and bike facilities in the study area. Since crash data were unavailable for the after period (late 2012 and 2013) due to a processing lag and because pedestrian and bicycle crashes are relatively rare events for any limited geographic area or short time period, direct behavioral measures were considered to be a more appropriate outcome measure for evaluating the effectiveness of the intervention in changing behaviors that can lead to crash prevention.

Pedestrian and Driver Data Collection Approach

Field data were repeatedly collected by HSRC staff at 16 public street crossings in Raleigh, Durham, Chapel Hill, Carrboro, and Fuquay-Varina from August 2013 to February 2014. The crosswalk sites were selected based on the following criteria:

1. Posted speed limit was at or below 35 MPH
2. Crossings were located at unsignalized intersections or midblock locations
3. A marked crosswalk was present (high visibility or continental style markings)

4. The site was considered a safe/secure place for data collectors
5. No construction was planned that would affect the infrastructure at the site
6. The site was likely to receive a law enforcement operation
7. The site experienced adequate pedestrian traffic for conducting naturalistic observations

Sites were grouped into “treatment” and “comparison” sites after data collection, but prior to analysis. The comparison (i.e., standard enforcement) sites were defined as those that did not receive special or enhanced enforcement during the intervention period, based on the administrative records provided by police (see Table 9). Law enforcement departments, based on internal resources available, selected a few of the sites for enhanced enforcement. These sites were categorized as “treatment” sites. Although only enhanced sites received enforcement actions above the standard, all sites had the potential to be affected by spill-over as a result of the media and outreach campaign or unreported enforcement. See Table 9 for a description of the site characteristics. Although each site varies, the general composition of the standard sites have very similar physical characteristics (such as speed limit, land uses, crosswalk type, etc.) compared to the enhanced enforcement sites, as both were selected using the same criteria described above.

A few of the sites received additional treatments during the study period, such as re-stripped crosswalks during routine resurfacing, in-street signs, or rectangular rapid flashing beacons (RRFBs). Although efforts were made by the project team to reach out to municipalities in advance of the study to identify and avoid selecting sites with such planned improvements, the schedule for these treatments was not shared with the project team. For safety reasons, the team did not collect data during times when the crosswalk was removed. Table 9 describes the engineering treatments that were added. In most cases, improvements were made during the “after” period at sites that were also receiving enhanced enforcement; as such, we cannot disentangle the effects of the infrastructure treatments from the effects of the enforcement treatment in the analysis below.

At each site, observed measures of driver behavior (including yielding, close stopping, hard breaking, attempted passing, and conflicts) were collected by two trained data collectors following specific, well-established protocols (Van Houten et al., 2013). The protocols provided a standardized way to observe interactions with motor vehicles involving both naturalistic and “staged” pedestrians at the sites on dry-weather weekdays during day light hours. See Appendix E for these protocols.

Naturalistic crossings were observed where pedestrian activity was high in order to capture realistic pedestrian and driver interactions in an uncontrolled setting. To complement these, staged crossings were performed by the trained data collectors using a standardized crossing process in order to provide a consistent test of driver behavior under more controlled circumstances than naturalistic conditions could offer and to efficiently measure driver behavior at intersections with lower pedestrian volume. Staged crossings were designed to control certain conditions, including pedestrian volumes and pre-crossing behaviors, and achieve a higher sampling of pedestrian-driver interactions given the time available for data collection. For both types of crossings, several quality assurance and control measures were put in place to ensure high quality and consistent data collection. These included a three-part training program for the data collectors, including the provision of written protocols, in-class training with visual examples and crossing scenarios, and field-based practice at actual data collection sites. It also included routine, weekly checks on the data collector operations to confirm fidelity to protocols and review of the data to check for inaccuracies and inconsistencies in data coding. Although weather-dependent, the data collection schedule aimed for consistency in the time of day and the day of week

that each site was visited to help control for environmental effects. Similarly, data collection consistently used the same two primary data collectors from August to February to limit confounding due to individual differences in data collection or crossing behaviors.

Analysis of Driver Yielding Behaviors

A total of 24,941 drivers were observed in 11,817 crossing events (both natural and staged) observed at the 16 sites from August 6 to February 6 (see Table 9 and 10). The “pre-enforcement” period consisted of data collected in August and September, before the enforcement elements of the campaign were launched but after the general education and public education elements were in place (which began in August). The “post-enforcement” period consisted of data collected from October 1 (for comparison sites) or starting the day after the first enforcement wave if after October 1. The post period runs through the end of data collection in February. Pre-post changes in driver yielding behaviors (% yielded to pedestrians in marked crosswalks) were assessed using a z-statistic to test for differences between the two group proportions, assuming a null hypothesis of no change expected. Two-tailed p-values were calculated at the $\alpha = 0.05$ level to define significance. Staged crossings were analyzed separately from natural crossings.

Table 11 displays the results from the analysis of staged crossings. At the eight standard enforcement sites, driver yielding increased only marginally, from 28.7 to 29.8% on average, which was not statistically significant. The enhanced enforcement sites, however, saw a statistically significant increase in driver yielding from 40.7 to 47.6% on average across the eight sites. While differences varied at each site, five of the eight sites saw significant, positive increases in driver yielding, ranging from a 7.2 to a 17 percent difference.

Table 12 summarizes the results of the natural crossing observations, where no staged pedestrian (i.e., data collector) was present in the crosswalk. Generally, driver yielding to “real” pedestrians tends to be much higher (both in the before and after periods) compared to the staged pedestrian yielding rates. This is consistent with other studies (Van Houten et al., 2004; Van Houten et al., 2013) that theorized that typical pedestrians are more aggressive in indicating their intent to cross than “staged” pedestrians following the safety protocols for data collection. In this study, yielding rates for natural crossings at standard enforcement sites averaged 38% before the program began and 39% after, a small difference that was not statistically significant. However, at enhanced enforcement sites, the yielding rates increased almost 4%, from an average of 52.5 to 55.2%. This small, yet statistically significant, positive measure of effect was consistent with the patterns observed in the staged crossing data. Individual crosswalks varied widely, likely due to a limited sample size, as many sites had low pedestrian volumes during the times in which data collection was conducted and limited time was available for extended natural observations.

Overall, using both staged and natural crossings to observe driver behaviors, results indicate that driver yielding rates measured before and after the Watch for Me NC program was conducted were largely static at standard enforcement sites but improved slightly (between 4 and 7% on average) at sites receiving enhanced enforcement.

Table 9. Summary of data collection site characteristics.

Site	Crossing Type	Crosswalk Markings	Posted Speed Limit	Total No. of Lanes	Direction of Traffic	Nearby Land Uses	Enforcement and Other Treatments Received
Standard Enforcement Sites							
C-Greensboro	Midblock	Continental	20 MPH	2	Two-way	Restaurants, bars, government offices, library	n/a
D-Anderson	Uncontrolled Intersection	Continental	25 MPH	2	Two-way	Duke campus, parking lots, and student housing	n/a
D-Main	Midblock	High Visibility	25 MPH	2 + median	Two-way	Commercial shopping district	n/a
D-Tobacco	Midblock trail crossing with beacon	High Visibility	35 MPH	2	Two-way	American Tobacco Trail and residential housing and two schools	n/a for enforcement; had no crosswalk from August 6-October 1 due to resurfacing project; no data was collected during that period
R-Blount	Midblock	High Visibility	Not posted.; assume 35 MPH	3	One-way	Transit hub and downtown CBD	n/a
R-Capitol	Midblock	High Visibility	Not posted; assume 35 MPH	3	One-way	Government offices and downtown CBD	n/a
R-South	Midblock	High Visibility	25 MPH	3	Two-way	Raleigh Center for the Performing Arts, Shaw University, and CBD	n/a
R-Wilmington	Midblock	High Visibility	Not posted; assume 35 MPH	2	One-way	Transit hub and downtown CBD	n/a
Enhanced Enforcement Sites							
CH-Franklin	Midblock	Continental	20 MPH	4 + center turn	Two-way	Restaurants, bars, commercial, UNC campus	Visited at least 8 times; also received an in-street "Yield to Pedestrians" sign on October 23
C-Hillsborough	Uncontrolled Intersection	High Visibility	35 MPH	2	Two-way	Residential, school, transit stops	Visited at least 3 times, crosswalk was closed for construction from August 14 to September 11; no data was collected during that period
CH-Pittsboro	Midblock	Continental	25 MPH	2	One-way	Bank, UNC campus, transit stop	Visited at least 3 times

Site	Crossing Type	Crosswalk Markings	Posted Speed Limit	Total No. of Lanes	Direction of Traffic	Nearby Land Uses	Enforcement and Other Treatments Received
D-Fayetteville	Uncontrolled Intersection	Continental	30 MPH	2	Two-way	NCCU campus and police station	Visited at least 2 times
D-Ninth	Midblock	High Visibility	25 MPH	2	Two-way	Restaurants, bars, commercial, Duke campus	Heavy police presence in nearby (block) vicinity
D-University	Uncontrolled Intersection	High Visibility	25 MPH	4	Two-way	Duke campus and staff parking lot	Visited at least 1 time; a push-button activated rectangular rapid flashing beacon was installed and operating by December 17
F-Broad	Midblock	Continental	25 MPH	2	Two-way	Restaurants, bars, commercial	Several visits (limited data)
R-YMCA	Midblock	Continental	35 MPH	2 + median	Two-way	Fitness center, NC State campus	Visited at least 2 times; also received an in-street "Yield to Pedestrians" sign on January 15

Note: (C) represents sites in Carrboro, (CH) represents sites in Chapel Hill, (D) represents sites in Durham, (F) represents sites in Fuquay-Varina, and (R) represents sites in Raleigh.

Table 10. Summary of pedestrian crossing events and vehicles observed during two intervention waves.

Site	Pre-Enforcement						Post Enforcement						Total Crossing Events (N)	Total Cars Observed (N)
	Natural		Staged		Sub-Total		Natural		Staged		Sub-Total			
	Events (N)	Cars (N)	Events (N)	Cars (N)	Events (N)	Cars (N)	Events (N)	Cars (N)	Events (N)	Cars (N)	Events (N)	Cars (N)		
Standard Enforcement Sites														
C-Greensboro	93	129	200	371	293	500	136	184	350	598	486	782	779	1282
D-Anderson	62	134	196	542	258	676	86	178	285	696	371	874	629	1550
D-Main	60	87	196	309	256	396	93	127	340	544	433	671	689	1067
D-Tobacco	7	30	50	146	57	176	83	226	490	1615	573	1841	630	2017
R-Blount	115	308	185	608	300	916	189	410	275	887	464	1297	764	2213
R-Capitol	54	113	195	656	249	769	62	128	321	905	383	1033	632	1802
R-South	4	9	196	325	200	334	11	14	281	489	292	503	492	837
R-Wilmington	120	217	200	386	320	603	210	395	325	677	535	1072	855	1675
Standard Sub-Total	515	1027	1418	3343	1933	4370	870	1662	2667	6411	3537	8073	5470	12443
Enhanced Enforcement Sites														
CH-Franklin	120	228	200	451	320	679	210	332	350	736	560	1068	880	1747
C-Hillsborough	19	38	200	349	219	387	38	60	345	560	383	620	602	1007
CH-Pittsboro	120	216	200	495	320	711	240	454	370	800	610	1254	930	1965
D-Fayetteville	103	207	185	375	288	582	188	320	349	721	537	1041	825	1623
D-Ninth	71	109	193	338	264	447	100	146	350	534	450	680	714	1127
D-University	120	245	198	682	318	927	209	347	336	733	545	1080	863	2007
F-Broad	70	131	183	430	253	561	87	174	337	710	424	884	677	1445
R-YMCA	111	192	189	368	300	560	206	339	350	678	556	1017	856	1577
Enhanced Sub-Total	734	1366	1548	3488	2282	4854	1278	2172	2787	5472	4065	7644	6347	12498
Total	1249	2393	2966	6831	4215	9224	2148	3834	5454	11883	7602	15717	11817	24941

Table 11. Staged crossing analysis results.

	Pre-Enforcement			Post-Enforcement			Hypothesis Testing Statistics			
	# Yielded	Total N	Yield Rate	# Yielded	Total N	Yield Rate	Difference	std. error	z- value	2-tailed p value
Standard Enforcement Sites										
C-Greensboro	224	371	60.4%	374	598	62.5%	2.2%	0.0321	0.6738	0.5009
D-Anderson	136	542	25.1%	183	696	26.3%	1.2%	0.0251	0.4793	0.6319
D-Main	119	309	38.5%	205	544	37.7%	-0.8%	0.0346	-0.2393	0.8110
D-Tobacco	45	146	30.8%	380	1615	23.5%	-7.3%	0.0370	-1.9721	0.0505
R-Blount	145	608	23.8%	197	887	22.2%	-1.6%	0.0221	-0.7411	0.4589
R-Capitol	81	656	12.3%	188	905	20.8%	8.4%	0.0194	4.3510	0.0000
R-South	58	325	17.8%	99	489	20.2%	2.4%	0.0282	0.8497	0.3961
R-Wilmington	153	386	39.6%	282	677	41.7%	2.0%	0.0314	0.6432	0.5205
Average	961	3343	28.7%	1908	6411	29.8%	1.0%	0.0097	1.0439	0.2966
Enhanced Enforcement Sites										
CH-Franklin	188	451	41.7%	360	736	48.9%	7.2%	0.0298	2.4245	0.0157
C-Hillsborough	180	349	51.6%	342	560	61.1%	9.5%	0.0337	2.8159	0.0051
CH-Pittsboro	220	495	44.4%	430	800	53.8%	9.3%	0.0286	3.2545	0.0012
D-Fayetteville	91	375	24.3%	150	721	20.8%	-3.5%	0.0264	-1.3130	0.1900
F-Broad	240	430	55.8%	401	710	56.5%	0.7%	0.0303	0.2193	0.8265
R-YMCA	115	368	31.3%	223	678	32.9%	1.6%	0.0303	0.5419	0.5882
D-University	225	682	33.0%	355	733	48.4%	15.4%	0.0262	5.9008	0.0000
D-Ninth	161	338	47.6%	345	534	64.6%	17.0%	0.0343	4.9482	0.0000
Average	1420	3488	40.7%	2606	5472	47.6%	6.9%	0.0108	6.4145	0.0000

Note: **Bold** values are significant at the alpha=.05 level

Table 12. Natural crossing analysis results.

	Pre-Enforcement			Post-Enforcement			Hypothesis Testing Statistics			
	# Yielded	Total N	Yield Rate	# Yielded	Total N	Yield Rate	Difference	Std. Error	z-value	2-tailed p- value
Standard Enforcement Sites										
C-Greensboro	91	129	70.5%	130	184	70.7%	0.1%	0.0523	0.0209	0.9833
D-Anderson	55	134	41.0%	61	178	34.3%	-6.8%	0.0553	-1.2257	0.2225
D-Main	31	87	35.6%	60	127	47.2%	11.6%	0.0688	1.6877	0.0951
D-Tobacco	3	30	10.0%	59	226	26.1%	16.1%	0.0832	1.9348	0.0628
R-Blount	90	308	29.2%	126	410	30.7%	1.5%	0.0346	0.4369	0.6625
R-Capitol	25	113	22.1%	25	128	19.5%	-2.6%	0.0523	-0.4953	0.6213
R-South	1	9	11.1%	6	14	42.9%	31.7%	0.1966	1.6148	0.1450
R-Wilmington	96	217	44.2%	185	395	46.8%	2.6%	0.0421	0.6165	0.5382
Average	392	1027	38.2%	652	1662	39.2%	1.1%	0.0193	0.5482	0.5837
Enhanced Enforcement Sites										
CH-Franklin	114	228	50.0%	202	332	60.8%	10.8%	0.0426	2.5425	0.0117
C-Hillsborough	25	38	65.8%	29	60	48.3%	-17.5%	0.1031	-1.6928	0.0989
CH-Pittsboro	157	216	72.7%	346	454	76.2%	3.5%	0.0358	0.9862	0.3251
D-Fayetteville	55	207	26.6%	99	320	30.9%	4.4%	0.0406	1.0767	0.2829
D-Ninth	60	109	55.0%	78	146	53.4%	-1.6%	0.0631	-0.2570	0.7977
D-University	150	245	61.2%	238	347	68.6%	7.4%	0.0397	1.8568	0.0646
F-Broad	81	131	61.8%	90	174	51.7%	-10.1%	0.0574	-1.7606	0.0807
R-YMCA	61	192	31.8%	117	339	34.5%	2.7%	0.0426	0.6432	0.5209
Average	703	1366	51.5%	1199	2172	55.2%	3.7%	0.0172	2.1713	0.0301

Note: **Bold** values are significant at the alpha=.05 level

Analysis of Other Driver and Pedestrian Behaviors

Of the other behaviors observed during field data collection, most were observed rarely (particularly conflicts and attempts to pass) and data were too sparse to perform site-by-site analyses. Due to the safety measures integrated into the staged crossing protocols, most of these behaviors were not observable during staged crossing events, but only when monitoring naturalistic crossings. Pre-post changes in several driver behaviors and pedestrian crosswalk use were assessed across all sites using a z-statistic to test for differences between the two group proportions, assuming a null hypothesis of no change expected (Table 13). Two-tailed p-values were calculated at the alpha = 0.05 level to define significance. The only behavior that was measurably different after the Watch for Me NC program was pedestrian crosswalk use, which rose (significantly) from an average of 90% to 94% across all locations.

Table 13. Other behavior analysis results.

Behavior	Before		After		% Difference	Std Error	z-value	2-tailed p-value
	N	% (of 1249 obs)	N	% (of 2148 obs)				
Conflict	3	0%	13	1%	0%	0.002	1.498	0.134
Attempted to Pass	2	0%	7	0%	0%	0.002	0.906	0.365
Hard Brake	16	1%	29	1%	0%	0.004	0.170	0.865
Close Stop	31	2%	71	3%	1%	0.006	1.356	0.175
Trapped Ped	13	1%	15	1%	0%	0.003	-1.065	0.287
No X-walk use	121	10%	136	6%	-3%	0.009	-3.567	0.000

Longer-Term Trends

Of the 16 sites selected for data collection for this pilot program, nine of them had previously been visited in 2012-2013 to collect data for an evaluation of the first year of the program, which was funded by NHTSA. Although these sites cannot be compared in terms of “treatment” and “comparison” sites since the selection of sites for enhanced enforcement varied from year 1 to year 2, it is interesting to note the longer-term changes regarding driver yielding at these sites as a whole. From before the program began in August 2012 to after it was completed in February 2014, average driver yielding rates increased about 15-16%, which was consistent when looking both at staged and naturalistic crossings (Table 14). This provides some evidence that while short-term program effects may be limited or difficult to measure (as described above), the association of the Watch for Me NC program with safer driving behaviors over the longer term may be even more promising.

Table 14. Comparison of year 1 and year 2 driver yielding rates at nine sites.

	Year 1						Year 2						Total Difference (Pre-2012 to Post-2013)
	Pre-Enforcement			Post-Enforcement			Pre-Enforcement			Post-Enforcement			
	# Yielded	Total N	%	# Yielded	Total N	%	# Yielded	Total N	%	# Yielded	Total N	%	
STAGED PEDESTRIAN CROSSINGS													
Riddle @ Tobacco	82	554	14.8%	159	1579	10.1%	45	146	30.8%	380	1615	23.5%	8.7%
South btw Salisbury and Wilmington	30	417	7.2%	37	677	5.5%	58	325	17.8%	99	489	20.2%	13.1%
Wilmington @ the Capitol	21	615	3.4%	57	1417	4.0%	81	656	12.3%	188	905	20.8%	17.4%
Wilmington btw Hargett and Martin	77	574	13.4%	142	1208	11.8%	153	386	39.6%	282	677	41.7%	28.2%
Anderson @ Yearby	64	622	10.3%	89	1046	8.5%	136	542	25.1%	183	696	26.3%	16.0%
Blount btw Hargett and Martin	71	706	10.1%	120	1685	7.1%	145	608	23.8%	197	887	22.2%	12.2%
Fayetteville @ Pekoe	11	77	14.3%	185	1861	9.9%	91	375	24.3%	150	721	20.8%	6.5%
Main @ Brightleaf	72	400	18.0%	149	946	15.8%	119	309	38.5%	205	544	37.7%	19.7%
University @ Chapel	174	777	22.4%	92	355	25.9%	225	682	33.0%	355	733	48.4%	26.0%
Total Average	602	4742	12.7%	1030	10774	9.6%	1053	4029	26.1%	2039	7267	28.1%	15.4%
NATURAL PEDESTRIAN CROSSINGS													
Riddle @ Tobacco	3	26	11.5%	10	64	15.6%	3	30	10.0%	59	226	26.1%	14.6%
South btw Salisbury and Wilmington	8	29	27.6%	3	15	20.0%	1	9	11.1%	6	14	42.9%	15.3%
Wilmington @ the Capitol	5	69	7.2%	5	57	8.8%	25	113	22.1%	25	128	19.5%	12.3%
Wilmington btw Hargett and Martin	5	69	7.2%	5	57	8.8%	96	217	44.2%	185	395	46.8%	39.6%
Anderson @ Yearby	46	124	37.1%	86	225	38.2%	55	134	41.0%	61	178	34.3%	-2.8%
Blount btw Hargett and Martin	67	317	21.1%	109	418	26.1%	90	308	29.2%	126	410	30.7%	9.6%
Fayetteville @ Pekoe	6	21	28.6%	59	282	20.9%	55	207	26.6%	99	320	30.9%	2.4%
Main @ Brightleaf	18	40	45.0%	32	77	41.6%	31	87	35.6%	60	127	47.2%	2.2%
University @ Chapel	21	66	31.8%	10	54	18.5%	150	245	61.2%	238	347	68.6%	36.8%
Total Average	179	761	23.5%	319	1249	25.5%	506	1350	37.5%	859	2145	40.0%	16.5%

Bicycle Data Collection Approach

Data on bicyclist behaviors were collected at three locations. The bicycle data collection sites were selected based on:

1. The site experienced adequate bicycle traffic for conducting naturalistic observations
2. The site had bicycle lanes
3. Posted speed limit was at or below 35 MPH
4. The site had a traffic signal
5. The site allowed bicyclists and automobiles to turn or continue straight

The location of the sites chosen, the proximate university, the posted speed limit, the number of lanes and direction of traffic, and a description of the nearby land uses and/or traffic patterns can be seen in Table 15. While the Raleigh location did not have a posted speed limit, the observed speed was approximately 25 MPH at the intersection used for the study.

Travel patterns at each location varied based on the time of day and adjacent travel options. The observations at the Cameron at Pittsboro site were primarily conducted in the morning, and thus the majority of bicycle traffic was derived from bicyclists traveling northeast on Cameron toward UNC's campus. The observations at the Campus at Anderson site were primarily conducted in the afternoon, with the majority of bicyclist travelers heading east away from Duke's campus. The observations at the Hillsborough at Horne site near NCSU were primarily conducted in the afternoon, but due to the number of route options and destinations there was no clearly dominant route choice.

Table 15. Characteristics of bicycle data collection sites.

Site	Posted Speed Limit (MPH)	Number of Lanes	Direction of Traffic	Nearby Land Uses/Traffic Patterns
Cameron @ Pittsboro (Chapel Hill near UNC)	25	4 (2 + 2 turn lanes)	Two-way	Hotel, fraternity houses. Heavy traffic southwest on Cameron turning left onto Pittsboro. Traffic signal pattern leaves time for large gaps in traffic flow.
Hillsborough @ Horne (Raleigh near NCSU)	Not posted	4	Two-way	Retail on north side of street, college campus on south side. Heavy automobile/bus traffic on Hillsborough. Heavy bus/bicycle traffic also occurring on parallel campus road, Founders Drive.
Campus @ Anderson (Durham near Duke)	25	3 (2 + 1 turn lane)	Two-way	Parking lot, small offices. Mainly campus traffic on Campus Drive with high number of busses. Steady through traffic on Anderson.

A total of 3,178 observations of bicyclists were made at the three sites between the time period of August 14, 2013 and November 22, 2013. The observations were conducted during two-hour time periods, with 11 observation periods occurring at the Cameron at Pittsboro site, and 10 observation periods each at Campus at Anderson and Hillsborough at Horne. Each bicyclist was observed and recorded based on the following measures: wearing a helmet, using a device, using appropriate hand signals, the direction of travel, obeying traffic signals, and using a bicycle light. If it was not possible to determine one of these behaviors, if it was missed, or if the measure was not applicable (i.e. bicycle light use during the day), it was noted separately on the observation form. Procedures and forms used to collect bicycle observational data are documented in Appendix F.

Analysis of Bicyclist Behaviors

Table 16 shows the number of bicyclists observed exhibiting various behaviors, the total number observed, and the percentage (excluding unknown, missed, or not applicable observations). The highest volume of riders was at the UNC location, and the lowest volume of riders was at the NCSU location.

About half of all bicyclists were observed wearing helmets. The Duke location evidenced the highest helmet use of the three locations, with more than three-quarters (77%) of riders wearing them, while less than half (48%) did at the UNC location and less than a third (31%) did at the NCSU location.

Use of a cell phone or other electronic device ranged from 11 to 19%, with an average of 13%, which is consistent with other literature on the prevalence of device use by drivers and pedestrians. The highest percentage of device use was at the NCSU location, which also had the lowest percentage of using hand-signals and percentage of cyclists correctly riding with traffic. This location had a variety of possible destinations, and thus a higher number of cyclists were not continuing through Horne on Hillsborough using the bicycle lanes.

Adherence to traffic signals averaged 65%, with significant variation depending on conditions at the site. The Duke location had the highest percentage of riders obeying the traffic signal (91%), while the UNC location had less than half (48%) obeying the signal. The signal at the Cameron at Pittsboro location near UNC is at the bottom of the hill and experiences long gaps in traffic. It was noted that many riders would continue through the light if they perceived a gap, or they would stop and wait for a gap before continuing.

About 39% of bicyclists observed during all hours used a bike light (head or rear lamp or both). The observed bicycle lights were used during times of the day and light conditions that did not explicitly require their use by law. Due to limitations on when the data could be collected and lighting conditions during the data collection season, data on bike light use at night/during dark conditions were not available. However, data were collected in November at the Duke location at dusk. During this time, bike light use rose slightly to 43% (58 of 133 observed). Overall, observations of bike light use during relevant conditions were extremely sparse, and estimates are not considered reliable. Additional research is needed to understand the prevalence of bike light use at baseline and after campaigns such as Watch for Me NC.

A number of behaviors were observed during field data collection that were not coded or formally noted on the data collection sheets. One of the behaviors noted was the influence of one bicyclist's behavior on other bicyclists around him or her. When the lead bicyclist in a group stopped at a stop light, those following appeared to have a higher likelihood of stopping at the light also. Conversely, if the lead bicyclist ran the red light, those following were more likely to mimic the behavior and also run the light. The same was true regarding hand signaling to indicate a turn. Another observed behavior was the higher probability of combined negative bicyclist behaviors. If a bicyclist was observed wearing headphones, it was observed that the bicyclist was also more likely to not be wearing a helmet, run a red light, and/or be travelling in the wrong direction on the road or sidewalk. Future studies should be conducted to gather more information on this anecdotal evidence.

To assess whether observed bicyclist behaviors may have changed after implementation of certain elements of the Watch for Me NC program, the data were aggregated into pre-enforcement and post-enforcement time periods (see Table 17). Each university had a different starting point for

enforcement—Duke began operations October 16; UNC began on October 6; NCSU began on October 1—and these dates were used to define the pre and post periods. Missing, unknown, or not applicable data were excluded from the analysis. At the aggregate level, it appears that most behavioral measures maintained relatively stable rates before and after the program implementation, with only a small uptick in use of hand signals from 14 to 17%. As previously noted, due to seasonal confounding and limitations on when bike light use data were gathered, changes in bike light use may not be reliable estimates.

Several factors may have limited the ability of this analysis to detect short-term changes in bicyclist behaviors as a result of the Watch for Me NC program. Due to low bicycle mode share in the study region, only a small set of sites were deemed feasible for data collection given the available project resources. These sites may or may not have been in close proximity to the areas where enforcement was most intensively performed or Watch for Me NC messages disseminated, and they may not have represented areas where people impacted by the Watch for Me NC program tended to ride. Research on the prevalence of various bicyclist behaviors is extremely limited. These data may be very useful in providing a snapshot of baseline conditions in these locations, which can be examined more over time for long-term program evaluation.

Table 16. Summary of the prevalence of various bicyclist behaviors observed at three sites.

Site	Wearing Helmet (N)	Total (N)	%	Using Device (N)	Total (N)	%	Using Full or Some Hand Signals (N)	Total (N)	%	Riding with traffic on road (N)	%	Riding against traffic, on sidewalk, or both (N)	%	Total (N)	Obeys Traffic Signals (N)	Total (N)	%	Using one or more bike lights (N)	%	Total (N)
UNC	795	1669	48%	180	1623	11%	25	272	10%	1569	94%	100	5%	1669	769	1595	48%	14	100%	14
Duke	636	823	77%	85	788	11%	75	267	28%	779	95%	45	5%	824	732	805	91%	86	35%	249
NCSU	195	628	31%	117	601	19%	5	144	3%	497	79%	132	21%	629	332	441	75%	11	50%	22
Total Average	1626	3120	52%	382	3012	13%	105	683	15%	2845	91%	277	9%	3122	1833	2841	65%	111	39%	285

Table 17. Summary of bicyclist behaviors observed during two intervention waves.

Site	Before-After Period	Wearing Helmet (N)	%	Using a Device (N)	%	Using Full or Some Hand Signals (N)	%	Riding with traffic on road (N)	%	Riding against traffic, on sidewalk, or both (N)	%	Obeys Traffic Signals (N)	%	Using one or more bike lights (N)	%
UNC	Pre-Enforcement	361	48%	88	12%	11	8%	702	93%	52	7%	353	49%	6	33%
	Post-Enforcement	434	47%	92	11%	14	11%	867	95%	48	4%	416	47%	8	75%
Duke	Pre-Enforcement	255	76%	32	10%	31	27%	322	96%	14	4%	305	92%	8	20%
	Post-Enforcement	381	78%	53	12%	44	29%	457	94%	31	6%	427	90%	78	25%
NCSU	Pre-Enforcement	89	32%	49	18%	1	2%	227	82%	49	18%	144	77%	2	100%
	Post-Enforcement	106	30%	68	21%	4	5%	270	76%	83	23%	188	74%	9	20%
Total Average	Pre-Enforcement	705	52%	169	13%	43	14%	1251	92%	115	8%	802	65%	16	48%
	Post-Enforcement	921	52%	213	13%	62	17%	1594	91%	162	9%	1031	64%	95	38%

Discussion

Evaluation Summary

Overall, the measures used to evaluate this effort provided evidence of both successes and weaknesses of the program delivery to impact pedestrian and bicycle safety.

Outreach and Education

In regard to the outreach and education component of the program, several conclusions can be drawn. The radio ads, (which ran over 450 times on 10 stations for eight weeks) and the transit ads (which appeared on more than 300 buses on seven regional transit systems for three or more months) appear to have targeted a large audience during peak times when pedestrian and bicycle crashes occur and at a low relative cost. These highly-visual (and auditory) elements were generally perceived to be clear and focused on appropriate behavioral messages. They contributed to brand consistency, which may have helped with campaign recognition and awareness although this was not specifically measured as part of the scope of this study. A targeted approach focusing messaging in high-crash areas (such as bus routes) and at high-crash times (such as peak commutes) maximized the exposure given limited resources. Less is known about the impact of Facebook ad purchases, but the cost per person “reached” may be relatively high compared to other media modes or outreach strategies.

Compared to its first year, the 2013 campaign year saw a significant decrease in earned media regarding the campaign, possibly resulting from the loss of novelty as the campaign was no longer a new—and therefore newsworthy—topic for reporters. However, the 2013 program took a more grassroots approach, which may have resulted in greater awareness about the program through word of mouth and social media, but less quantifiable traditional media attention. Partnering organizations reported using a variety of social media strategies, including websites, Facebook, Twitter, and local newsletters. Partners also engaged in at least 71 local events from June 2013 to January 2014 in 9 cities and at 6 universities. This represented a significant in-kind contribution of time from local partners but also enabled the targeted distribution of Watch for Me NC messages and materials and more genuine community engagement.

Enforcement

In terms of the enforcement component of the program, the successful delivery of a two-day training course to 55 officers resulted in significant improvements in knowledge and self-reported behaviors and capacity to perform enforcement operations to support the campaign. As a result of the training, average test scores rose 17% and survey results showed an increase in participants’ knowledge of pedestrian law and confidence in their resources/capacity to perform operations, as well as an increase in the number of officers reporting plans/intentions to conduct pedestrian and bicycle operations in the next six months. This indicates that the training may have been successful in encouraging officers and agencies to discuss or make plans to support pedestrian and bicycle safety.

From July 2013 to February 2014, eight of the 10 city/town police agencies and three of the eight university police departments reported conducting more than 55 operations targeting enforcement of pedestrian and/or bicycle-related laws, as well as various other routine enforcement patrols where officers incorporated pedestrian and bicycle safety surveillance. However, the overall enforcement intensity per capita was relatively low, given the large regional population, and more effort is needed in

future years to maximize the visibility of enforcement efforts and plan more routine, sustained efforts throughout the region.

Behavior Change

Regarding behavioral outcomes, driver yielding behaviors varied depending on the site and nature of the person crossing (staged pedestrian or natural pedestrian), but modest yet significant changes from the pre-enforcement period to the post-enforcement period were observed at sites receiving enhanced law enforcement. At the eight “enhanced enforcement” sites, there was an increase in driver yielding from 40.7 to 47.6% on average. Evidence of modest, short-term improvements in driver yielding (such as the 7% improvements observed) are consistent with the findings of other studies (Van Houten et al., 2004; Van Houten et al., 2013), which have found improvement of similar magnitude and direction. When utilizing longer-term data, a more substantial increase in driver yielding was observed. From before the program began in August 2012 to after it was completed in February 2014, average driver yielding rates at nine sites increased about 15-16%, which was similar for both staged and naturalistic crossing data. This provides some evidence that while short-term program effects may be limited or difficult to measure, the association of the Watch for Me NC program with higher driver yielding compliance over the longer term may be more promising. Other driver behaviors (such as hard braking before a crosswalk or stopping close to the crosswalk) were rarely observed during the study period. Pedestrian crosswalk use also rose slightly but significantly from an average of 90% to 94% across all locations. Regarding bicycling behaviors monitored at three sites near campuses involved in the Watch for Me NC program, it appears that most behavioral measures maintained relatively stable rates before and after the program implementation. While these data may not show a strong association between the program and behavioral outcomes, it is the first time such data has been collected and provides unique insights regarding the baseline prevalence of various bicyclist behaviors that may help inform future program design and implementation.

Evaluation Strengths and Limitations

To date, very few studies exist that demonstrate the effectiveness of education, enforcement, or policy interventions on pedestrian safety. This study is innovative in that it is evaluating a comprehensive effort to impact pedestrian and bicycle safety at the regional scale. The documentation of the intervention development, implementation and process measures, in combination with outcome data regarding driver behaviors and police self-reports, should be of particular use to transportation and public health practitioners seeking information and guidance regarding intervention planning and evaluation. The scientific approach to collect a large sample of high-quality driver yielding behaviors, in the absence of crash data, should provide a useful model for others seeking to evaluate similar projects.

The evaluation was also limited in several ways. Primarily, the intervention evaluated was led by diverse community partners in a real-world setting, so it was not possible to fully control the intervention implementation or utilize randomization in any analysis approaches to strengthen the study design. Thus, various unmeasured, uncontrolled factors may have impacted the validity of the results to an unknown degree. For example, driver yielding rates may be associated with, or affected by, site characteristics such as crossing type and posted speed limit and seasonal trends such as traffic volumes, which could not be controlled for in this study. Future work is needed to adjust for these variables to understand how they may impact driver yielding rates in relation to education and enforcement efforts. Second, because pedestrian and bicyclist crashes with motor vehicles are relatively rare and often under-reported, and data is not available on “exposure” to traffic that could support an analysis of crash rates, other behavioral measures served as a substitute for a crash-based evaluation. Ideally, a longer

follow-up period would be provided in order to gather enough data to perform a crash-based evaluation. Finally, because this program is only measuring the second year of a fledgling pilot intervention, it may underestimate the programs' full or long-term impact. Many important elements in pedestrian and bicycle crash prevention that this intervention aims to accomplish indirectly, such as policy changes and modifications to the built environment, may require more time to achieve. Also, more time or contribution of local resources may be needed to reach sufficient intensity in the deployment of the enforcement operations (and/or educational components) so that changes in behavioral measures can be detected at the specific sites selected for evaluation.

Lessons Learned and Recommendations

Several elements proved critical in the delivery of the Watch for Me NC pilot program. Takeaway messages from the program successes and failures are described below, along with recommendations for future efforts at the local or statewide level.

Funding: Funding from NCDOT (and originally from NHTSA) was crucial for providing staffing and resources for the intervention development. Without these seed funds, the communities involved in the campaign could never have leveraged the resources to participate. These funds directly supported the program outreach and media purchasing, as well as a range of UNC-HSRC staff activities such as material development; partner coordination and outreach; and technical assistance and training, as well as program evaluation efforts. Municipal partners devoted significant in-kind support in the form of labor hours for project coordination meetings, enforcement operations, and community outreach. Unlike other programs, no NHTSA or NCDOT funds were used to provide overtime pay or additional support enforcement. This scenario is reflective of the real-world conditions other community programs may face and can lead to a more sustainable program in the long-term by enabling police departments to pledge commitment due community priorities rather than financial incentives. However, even with the funding available for program operations, this issue of program costs was a constant concern for program leaders. With limited budgets from municipal and state agencies, program coordinators may want to consider other sources such as private foundations or local businesses, particularly when working in large, high-population areas where intense campaign delivery is needed to saturate the target audience with the program messaging.

Program champion: Having a stable, long-term community champion is essential. NCDOT, in concert with UNC-HSRC staff, served this purpose in 2012-2013 and has committed to launch the program statewide in 2014, but long-term plans are still uncertain. Not only do the program champions need to have the interest in pedestrian and bicycle safety and knowledge of effective practices, they also need to be supported by their organization(s) and be given a dedicated role in organizing such an effort in order to implement a successful program. In future efforts, it is recommended that agencies at the state and local level form stronger partnerships with the Governors Highway Safety Program, who may be in a unique position to "house" such a program, as they do with similar efforts like "Click it or Ticket" and "Booze it and Lose it."

Adherence to best practices/evidence: With limited funding available, programs need to be as efficient as possible in the allocation of resources. Understanding and adhering to best practices from the traffic safety and public health field is key to achieving success. This includes developing a program that takes a multi-faceted, multi-level approach; targets specific, "changeable" behaviors; and intervenes in a way and time that is appropriate for the target audience. More research is needed to build this evidence-base, and programs should be encouraged to document their intervention activities, evaluate results, and publish the literature so that more information is available to support future efforts.

Quality data and evaluation: Having pedestrian and bicycle crash data was instrumental in “making the case” to potential local partners and in supporting the decision-making throughout the program development. In particular, such quantitative data was useful to bringing law enforcement agencies on board and in helping develop more targeted safety messages. Stakeholder input on the key safety issues and opportunities for engaging the community in the program was also critical. Not only was baseline data important, but data regarding short- and longer-term program outcomes is also key. Having evidence of positive effects is as important as the ability to show no negative consequences of the program (such as negative media attention, complaints from the public, or the court dismissal of tickets). Again, this underscores the importance of thoroughly evaluating programs so that the necessary data is available.

Partner coordination and commitment: Throughout this effort, UNC-HSRC team members have generated literally hundreds of partner contacts from a variety of organizations. Each partner brought a different set of assets to the project that contributed to the successful development, implementation, and evaluation of the Watch for Me NC intervention (see Table 18).

Table 18. Common community partner assets.

Partner Type	Common Partner Assets
City/ Regional Planners	<ul style="list-style-type: none"> • Access to meeting space • Knowledge of community calendar • Access to key city officials and city council agendas • Expertise in transportation issues • Access to communication/public affairs staff • Possible source of funding
Advocacy groups or walk/bike clubs	<ul style="list-style-type: none"> • Knowledge of community leaders • Perspective on key pedestrian issues and danger areas • Access to community listservs and grassroots outreach channels • Source of volunteer support for events and outreach
Public Health Professionals	<ul style="list-style-type: none"> • Knowledge of best practices in health education and injury prevention • Access to meeting space • Knowledge of community calendar • Access to communication/public affairs staff • Possible source of funding
Law Enforcement Staff	<ul style="list-style-type: none"> • Ability to perform targeted traffic safety operations • Knowledge of road safety concerns and danger areas • Ability to assist with community education and outreach • Knowledge of community and business leaders
Research or University Staff	<ul style="list-style-type: none"> • Ability to collect and analyze data • Knowledge of best practices • Connections with students or volunteer support
Local Businesses	<ul style="list-style-type: none"> • Source of funding for events or campaign activities

In addition to having a diverse set of partners, formal commitments by partner groups (including resolutions passed through 10 municipal city councils) helped ensure accountability and a “steering committee” helped provide structure and continuity to program activities.

While the combination of funding, leadership, data resources, and local partners helped advance the Watch for Me NC effort, several obstacles or limitations were also noted.

Large scope: Above all, the nature of the Triangle area, a community of more than a million people spread across three counties, was an obstacle to achieving the saturation needed to see significant changes in behaviors and other outcomes. Such a dispersed population and a large geographic area required an immense amount of resources not fully available to the program coordinators. Future programs with limited funds may consider a smaller geographic scope or more closed population group, such as work on a specific campus environment or smaller town. That said, there were economies of scale utilized by working at the regional level, primarily in the development of a singular program message and theme, and larger-scale operations have the potential to affect a greater number of people, and thus reduce a larger share of pedestrian and bicycle crashes, in the long-run.

Difficult social conditions: Challenging social and public health issues were apparent in all the communities in which crash analyses were performed. Significant proportions of the crashes occurred in underserved neighborhoods with high rates of crime, building vacancies, and poor infrastructure. Homelessness, domestic violence, and substance abuse were evidenced in many crash report narratives reviewed. These issues, while larger than pedestrian and bicycle safety, can often contribute to pedestrian and bicycle crashes and injuries but are not easily addressed. Future efforts should aim to address the “low hanging fruit” to effectively use limited resources, but should also remain cognizant of larger social issues and consider ways in which to ensure that program delivery is equitable and underlying factors affecting pedestrian crashes are being addressed.

Need for supportive infrastructure: Infrastructure improvements are an important complement to any education and enforcement program. As noted in the evaluation discussion, the physical conditions of the roadway, including speed limit and crossing facility placement, may influence road user behaviors and strongly impact pedestrian and bicycle safety. This program was intended to supplement ongoing efforts to improve the infrastructure (such as efforts to implement NC’s Complete Streets policy), but future efforts could be more comprehensive and inclusive in considering infrastructure improvements or the policies that drive such infrastructure decisions.

Conclusion

In conclusion, the incidence and associated costs of pedestrian and bicycle injuries and fatalities resulting from motor-vehicle collisions are a significant public health burden. This study utilized a comprehensive set of measures, including intervention implementation records, self-report, and observational behavior, to evaluate a community-wide, evidence-based pedestrian and bicycle safety program.

The results of this study provide evidence of the effectiveness and the possible limitations of community-based, comprehensive pedestrian and bicycle interventions that will aid decision-makers at both the state and local level in determining the need for further investment in such programs. Ultimately, information about the effectiveness of targeted interventions can assist in guiding future improvements that both prevent unintentional injury and help promote the use of active transportation and the myriad of public health co-benefits that active transportation offers.

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Appendix A: Watch for Me NC Year 2 Program Recommendations



Watch for Me NC Year 2 Program Recommendations

Overview and Program Goals

North Carolina, and the Triangle area in particular, routinely ranks as one of the most dangerous places for pedestrians and bicyclists. In 2012, in collaboration with many local partners, NCDOT launched the Watch for Me NC campaign aimed at reducing the number of pedestrians hit and injured in crashes with vehicles. The campaign consists of safety messages directed toward drivers and pedestrians, educational messages to better inform drivers and pedestrians about pedestrian safety laws, and an enforcement effort by area police to crack down on some of the violations of pedestrian safety laws. Campaign partners originally included Capital Area Metropolitan Planning Organization (CAMPO), Durham Chapel Hill Carrboro (DCHC) Metropolitan Planning Organization, area universities (including Duke, NCCU, NCSU, and St. Augustine), and planning, engineering, transportation, and police departments in Raleigh, Durham, Chapel Hill and Carrboro. NCDOT is now seeking to extend the campaign to include bicycle safety messages and to pilot the campaign in the Triangle area before campaign materials are made available statewide. The overall aim of the program is to reduce both the frequency and severity of pedestrian and bicycle crashes.

Key Crash Issues

From 2006-2010, there were about 180+ police reported bike crashes per year in Orange, Durham, and Wake Counties combined, for a total of 918 reported crashes. See Appendix D for more detail. Key crash trends include:

High Frequency Crash Times of Day, Week, and Month

Day: Peaks occurred from 3 to 6pm on weekdays, and from noon to 4pm on weekends.

Week: No single “high crash” day—crashes are spread throughout the week; 78% on weekdays

Month: May to September (55% of all crashes)

- **Age Groups:** Teens and younger adults are most frequently involved in vehicle-bicycle crashes. More than 50% of all crash-involved bicyclists were < 30 years of age, and more than 20% of vehicle-bicycle crash-involved drivers were < 30.

Gender: Predominantly male (> 80%). However, the gender of **bicycle crash-involved drivers** is more evenly distributed (46% male; 40% female).

Race/Ethnicity: A disproportionate percentage of black bicyclists were involved in crashes.

Crash Type Summary: About 56% of crashes occurred at or near intersections. Nearly 40% of crashes occurred on non-intersections. Another 6% occurred on non-roadways. It is unclear what may precipitate many crashes (i.e., low driver/cyclist competency, misjudgment of gaps, low-light conditions, distraction, ignorance of the law, etc.). Overtaking and turning movements (on the part of motorists); and ride-outs and turning movements (on the part of bicyclists) appear to constitute the majority of documented vehicle-bicycle crashes in Orange, Durham, and Wake counties.

Top Vehicle-Bicycle Crash Types in Orange, Durham, and Wake Counties

Crash Type	Number	Percent
Motorist turning at intersections or out of driveways/alleys	234	28%
Motorists driving straight at intersections	182	22%
Motorist overtaking	117	14%
Bicyclist ride out/through at intersection	96	12%
Bicyclist ride out (from driveway or midblock)	68	8%
Non-roadway or backing vehicle	58	7%
Bicyclists turning left	44	5%
Bicyclist overtaking (passing on right)	16	2%
Head on	7	1%
Total	822	99%

Key Target Audiences

Persons involved in vehicle-bicycle crashes tend to be **younger** (< 30 years of age). High schools and universities offer promise in reaching high-risk audiences. Distraction and adolescents' inherent impulsivity (particularly true among males) are likely to play a significant role. Based on the crash data analysis, four key audience groups to reach in Year 2 include:

- Male bicycle riders—both recreational and commuters
- Child bicyclists aged 6-18
- Young adult bicyclists aged 19-30
- All age drivers, but in particular those age 16-30 years

Recommended Program Components

Component	Needed Materials	Noteworthy Examples	Comments
Enforcement	<ul style="list-style-type: none"> • Law enforcement curriculum (Peter Flucke to provide) • Summary “laws” reference for officers • Variable message sign to increase police operation visibility • “Template” press release for officers 	Gainesville, FL has good example of message boards and enforcement intensity benchmarks;	Enforcement needs to be higher intensity and visibility, with officer training; can include intersections or other locations
Media/ Outreach	<ul style="list-style-type: none"> • Bus ads—6 for bikes • Gas tank toppers—how many? • Radio spot—new or reuse? • Earned media—update press releases • Press events/releases • Social media--strategic 	See table in Appendix B	
School-based Component	<ul style="list-style-type: none"> • Letter to caregivers? • Bookmarks with safety messages? • Helmet or light giveaways? 	See bookmark examples and kids coloring book	Want to connect with child safety curriculum that will be piloted and possibly Walk/Bike to School events
University Component	<ul style="list-style-type: none"> • Materials for new student orientation: brochures, guidebooks, etc. • Bike helmet/light giveaways 	See New Jersey example and Stanford program	Should also consider tapping into existing groups to have bike ambassador program or peer-to-peer education
Environmental “nudge” Components	<ul style="list-style-type: none"> • Stage a better blocks event to kickoff the campaign • Install “look” stencils at high crash sites • Install roadway sign with yielding rate (if high enough to show a norm) 	See http://betterblock.org for examples. NYC and Chicago have stencil examples. Gainesville has “sign” example for driver yielding.	

Recommended Focus of Safety Materials

Based on a review of crash data (Appendix D) and existing campaign literature (Appendix A), the following topics are recommended as a focus for campaign materials (to be designed and distributed using various media, including ads, brochures, etc.).

Target Audience	Key Message (Generic Placeholder Wording)	Relevant Data	Legal Considerations	Notes
Adult Bicyclists	Wear a helmet. It could save your life.	Helmet use won't prevent crashes but could reduce the severity of a crash; majority of severe crashes involve some level of head trauma.	None for adult bicyclists.	
Child Bicyclists or adult caregivers	A helmet can save your child's life.	55% of parents usually or always have their children wear helmets when riding their bike.	State law requires helmets for riders under 16 and city statutes may require more riders to be helmeted.	
Bicyclists	Use a light when bicycling at night and be as visible as possible.	Small percentage of crashes at night but widespread observation that this is an issue, particularly on campuses.	Law supports using a light and rear reflector at a minimum.	
Bicyclists	Ride in the direction of traffic. Drivers may not be looking for you if you are riding the wrong way.	Crash data does not indicate "wrong way" riding specifically but it could be an issue at driveways and other areas.	Law supports riding in the direction of traffic.	
Bicyclists	Obey signs and signals.	Crash data shows issues with not following signals.	None.	
Bicyclists	Use all your senses, watching and listening for cars, particularly at intersections and driveways. Bicycling with earphones is not the norm.	Distraction may be an issue with bicyclists riding out or turning; low prevalence of cell phone/headphone use.	None.	
Motorists	Pay attention at intersections and driveways and always scan for bicyclists.	Distraction or not looking may be an issue.	None.	
Motorists	Bicyclists are vehicles and may take the full lane if needed.	May relate to crashes involving overtaking or parallel paths through intersections.	Law supports cyclists taking full lane if needed (but riding as far to the right as practical).	
Motorists	Give bicyclists a wide berth when passing, and change lanes if you can.	Crash data shows improper overtaking is a key issue.	2-ft law is only a minimum, not a guideline.	

Reinforcement of Safety Messages Through Law Enforcement Action

Some of the above safety messages are based on common sense, while others have legal backing and could be further supported through law enforcement action. See Appendix E for a full list of statutes related to bicycling.

- **Enforceable traffic violations involved in frequently occurring crash types, include:**

- Motorists overtaking bicyclists too closely (*§ 20-149*).
- Bicyclists distractedly/recklessly riding through specific sign-controlled intersections (those equipped with “yield right-of-way” signs) (*§ 20-158.1*).
- Bicyclists failing to use hand signals when turning
- Bicyclists failing to equip their bicycles with a “lighted lamp visible up to three hundred feet in front when used at night and must also be equipped with a taillight or rear reflector that is red and visible for up to two hundred feet from the rear when used at night” (*§ 20-129 (c)*).

- **Safety- and courtesy-based recommendations (not necessarily enforceable) include:**

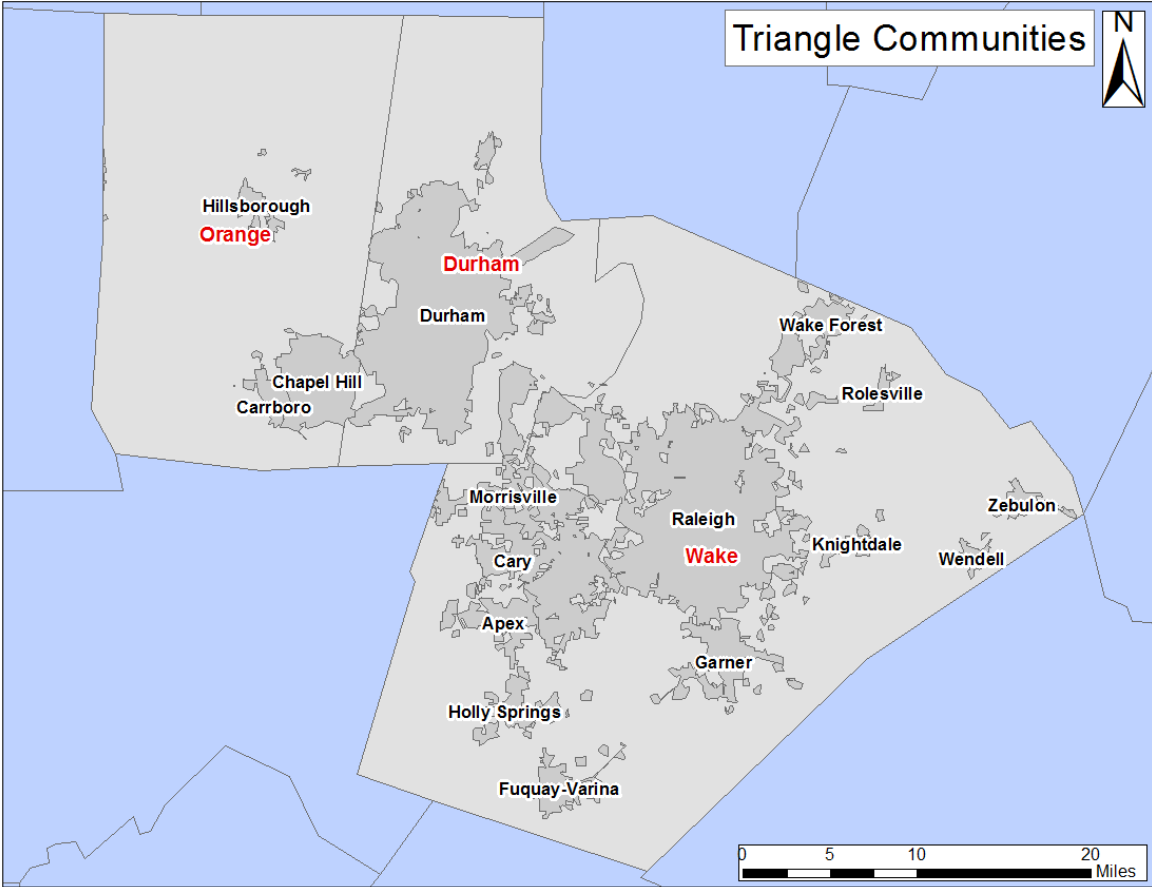
- Motorists scanning for bicyclists when driving out into sign-controlled intersections, driveways and alleys, and signalized intersections
- Bicyclists remaining alert when riding out in roadway midblock, through various intersections, and driveways
- Motorists scanning for bicyclists making left and right turning movements
- Bicyclists remaining alert when making left turning movements

Appendix A: Triangle Region Bicycle Crash Trends



Triangle Region

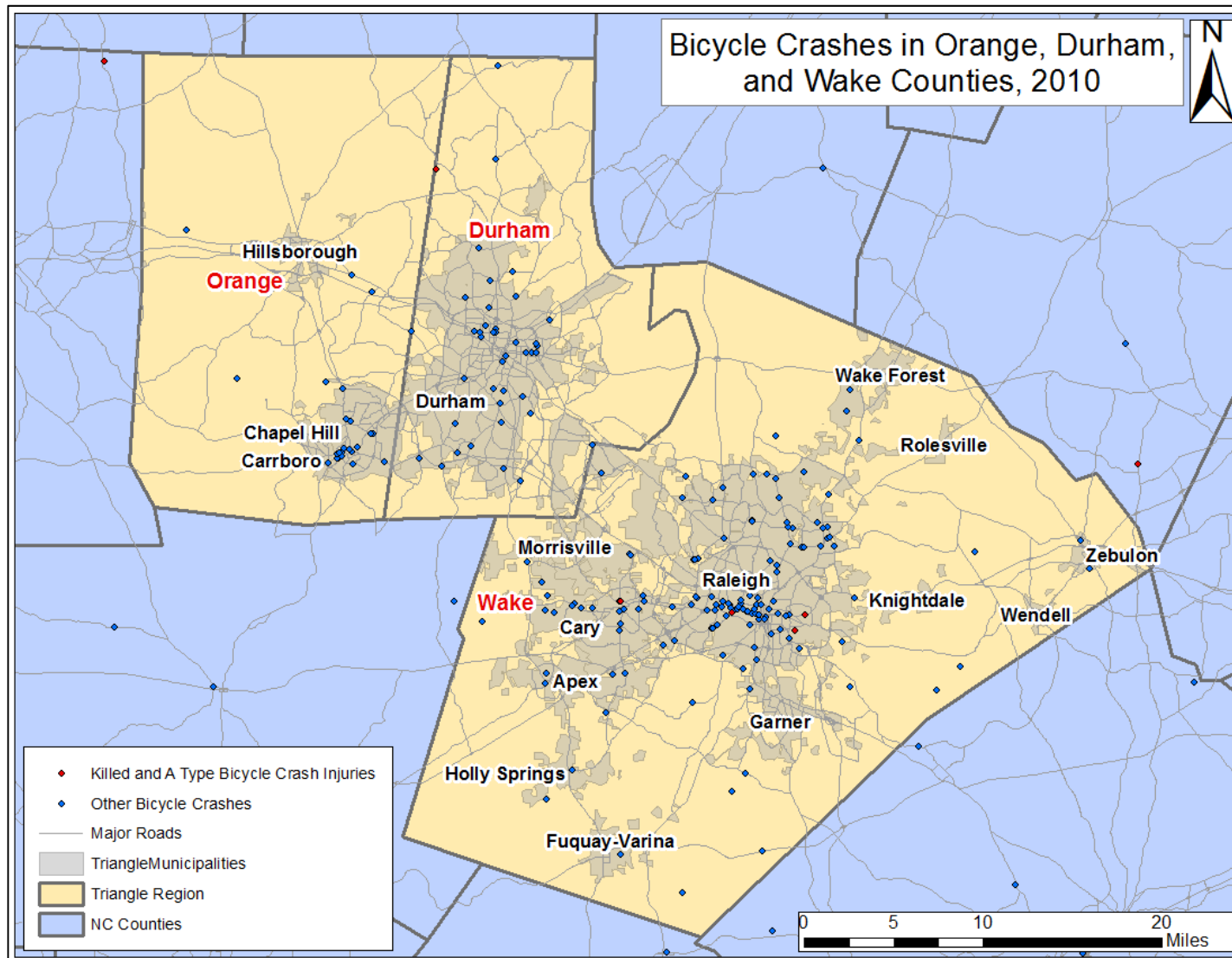
- Orange County
- Durham County
- Wake County



Crash Analysis

- Analyzed bicycle crashes from 2006-2010 for Orange, Durham, and Wake Counties (n=917)
- Examined bicycle crashes from 2006-2010 for all of North Carolina as well (n=4842)
- 2010 bike crashes were geo-coded and crash-typed
- Police-reported crashes only
- Developed heat maps and other spatial analyses

Bicycle Crash Trends – Triangle Region



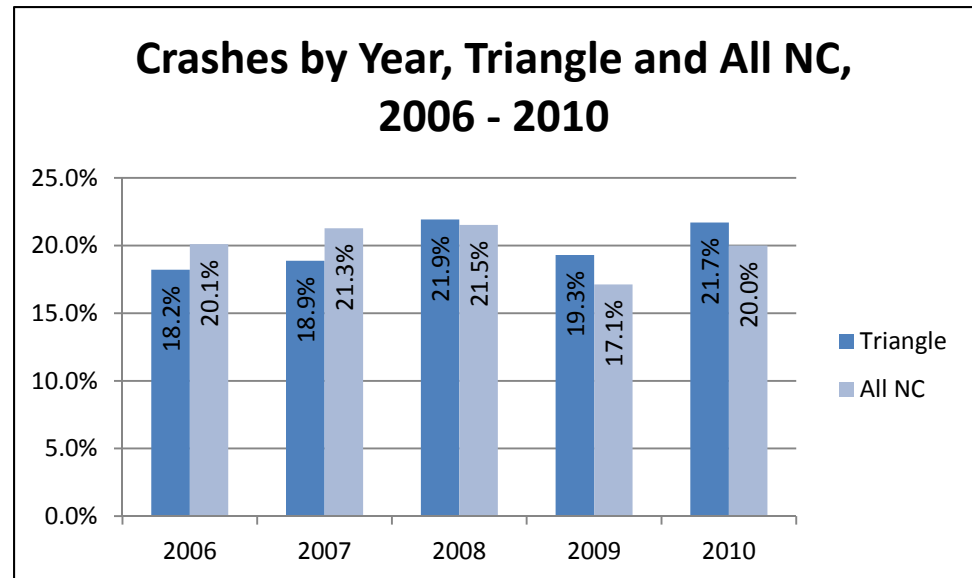
Bicycle Crashes by Year

Triangle Region (Orange, Durham,
and Wake)

Year	Number	Percent
2006	167	18.2%
2007	173	18.9%
2008	201	21.9%
2009	177	19.3%
2010	199	21.7%
Total	917	100.0%

North Carolina

Year	Number	Percent
2006	973	20.1%
2007	1030	21.3%
2008	1042	21.5%
2009	829	17.1%
2010	968	20.0%
Total	4842	100.0%



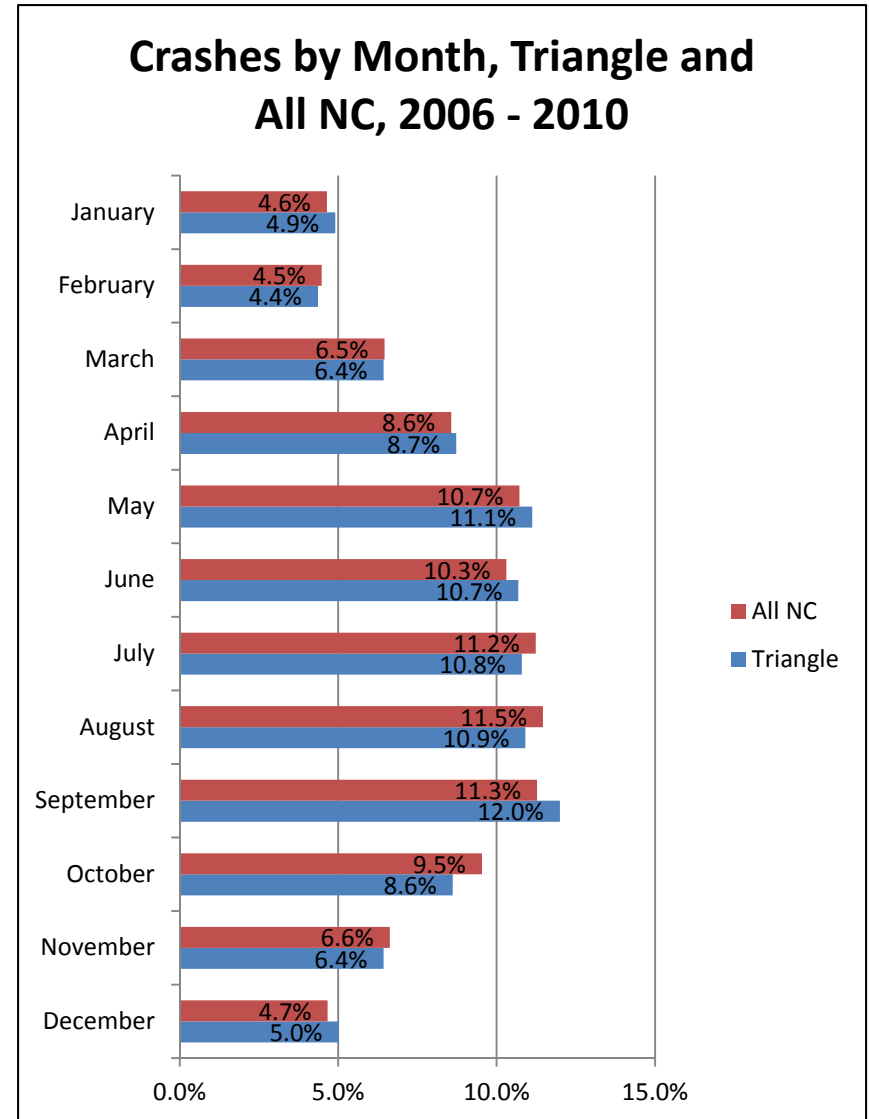
Bicycle Crashes by Month

Triangle Region (Orange, Durham, and Wake)

Month	Number	Percent
January	45	4.9%
February	40	4.4%
March	59	6.4%
April	80	8.7%
May	102	11.1%
June	98	10.7%
July	99	10.8%
August	100	10.9%
September	110	12.0%
October	79	8.6%
November	59	6.4%
December	46	5.0%
Total	917	100.0%

North Carolina

Month	Number	Percent
January	225	4.6%
February	217	4.5%
March	313	6.5%
April	415	8.6%
May	519	10.7%
June	499	10.3%
July	544	11.2%
August	555	11.5%
September	546	11.3%
October	462	9.5%
November	321	6.6%
December	226	4.7%
Total	4842	100.0%



Bicycle Crashes by Day

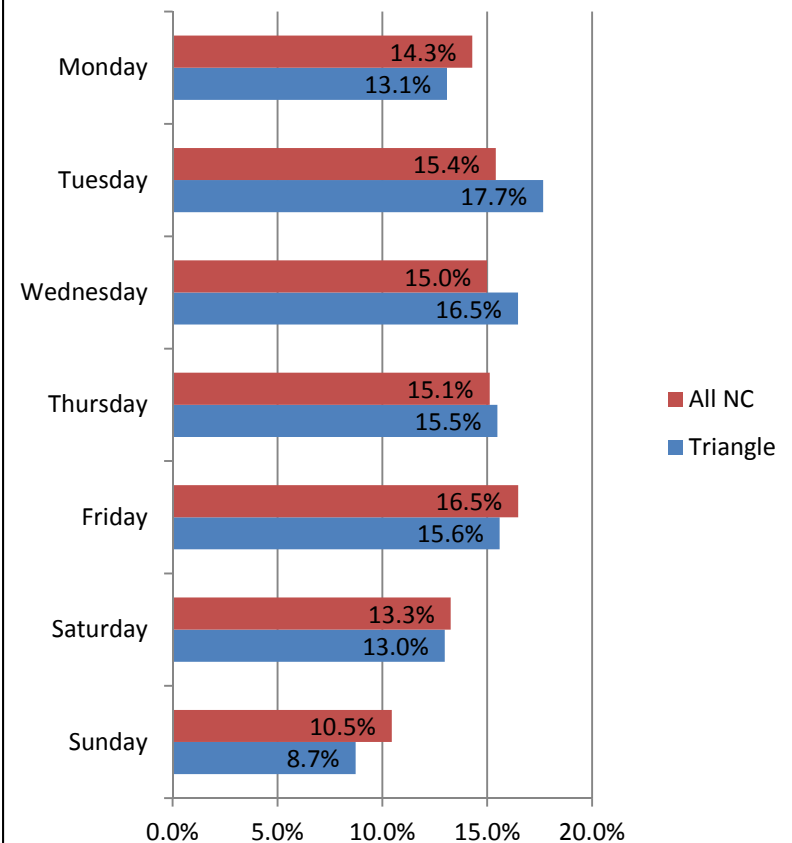
Triangle Region
(Orange, Durham,
and Wake)

Day of Week	Number	Percent
Monday	120	13.1%
Tuesday	162	17.7%
Wednesday	151	16.5%
Thursday	142	15.5%
Friday	143	15.6%
Saturday	119	13.0%
Sunday	80	8.7%
Total	917	100.0%

North Carolina

Day of Week	Number	Percent
Monday	692	14.3%
Tuesday	746	15.4%
Wednesday	726	15.0%
Thursday	732	15.1%
Friday	798	16.5%
Saturday	642	13.3%
Sunday	506	10.5%
Total	4842	100.0%

Crashes by Day, Triangle and All NC, 2006 - 2010



Bicycle Crashes by Hour

Orange, Durham, and Wake Counties

Weekday

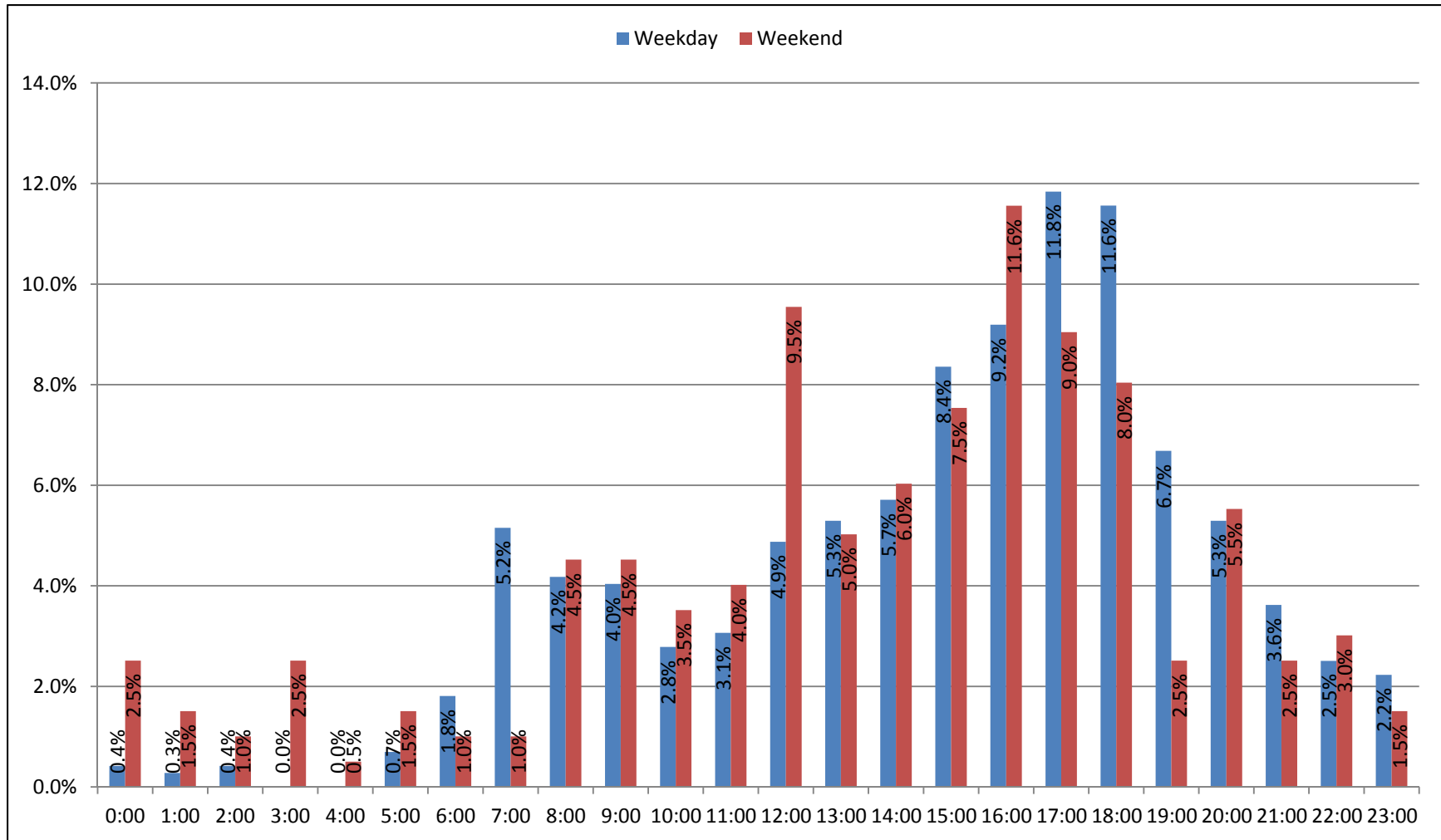
Hour of Day	Number	Percent
0:00	3	0.4%
1:00	2	0.3%
2:00	3	0.4%
3:00	0	0.0%
4:00	0	0.0%
5:00	5	0.7%
6:00	13	1.8%
7:00	37	5.2%
8:00	30	4.2%
9:00	29	4.0%
10:00	20	2.8%
11:00	22	3.1%
12:00	35	4.9%
13:00	38	5.3%
14:00	41	5.7%
15:00	60	8.4%
16:00	66	9.2%
17:00	85	11.8%
18:00	83	11.6%
19:00	48	6.7%
20:00	38	5.3%
21:00	26	3.6%
22:00	18	2.5%
23:00	16	2.2%
Total	718	100.0%

Weekend

Hour of Day	Number	Percent
0:00	5	2.5%
1:00	3	1.5%
2:00	2	1.0%
3:00	5	2.5%
4:00	1	0.5%
5:00	3	1.5%
6:00	2	1.0%
7:00	2	1.0%
8:00	9	4.5%
9:00	9	4.5%
10:00	7	3.5%
11:00	8	4.0%
12:00	19	9.5%
13:00	10	5.0%
14:00	12	6.0%
15:00	15	7.5%
16:00	23	11.6%
17:00	18	9.0%
18:00	16	8.0%
19:00	5	2.5%
20:00	11	5.5%
21:00	5	2.5%
22:00	6	3.0%
23:00	3	1.5%
Total	199	100.0%

Bicycle Crashes by Hour

Orange, Durham, and Wake Counties



Bicycle Crashes by Hour

All North Carolina

Weekday

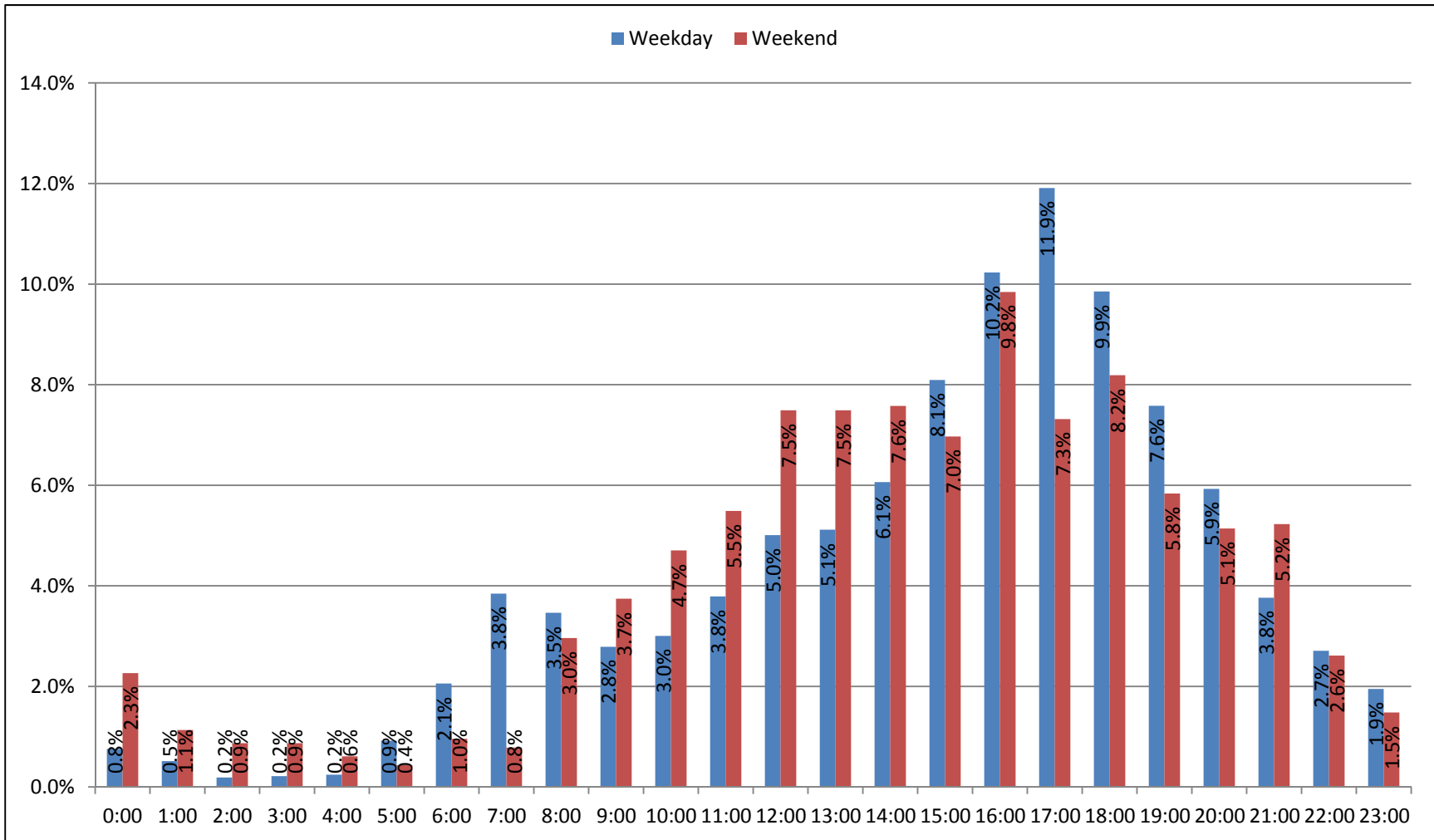
Hour of Day	Number	Percent
0:00	28	0.8%
1:00	19	0.5%
2:00	7	0.2%
3:00	8	0.2%
4:00	9	0.2%
5:00	34	0.9%
6:00	76	2.1%
7:00	142	3.8%
8:00	128	3.5%
9:00	103	2.8%
10:00	111	3.0%
11:00	140	3.8%
12:00	185	5.0%
13:00	189	5.1%
14:00	224	6.1%
15:00	299	8.1%
16:00	378	10.2%
17:00	440	11.9%
18:00	364	9.9%
19:00	280	7.6%
20:00	219	5.9%
21:00	139	3.8%
22:00	100	2.7%
23:00	72	1.9%
Total	3,694	100.0%

Weekend

Hour of Day	Number	Percent
0:00	26	2.3%
1:00	13	1.1%
2:00	10	0.9%
3:00	10	0.9%
4:00	7	0.6%
5:00	5	0.4%
6:00	11	1.0%
7:00	9	0.8%
8:00	34	3.0%
9:00	43	3.7%
10:00	54	4.7%
11:00	63	5.5%
12:00	86	7.5%
13:00	86	7.5%
14:00	87	7.6%
15:00	80	7.0%
16:00	113	9.8%
17:00	84	7.3%
18:00	94	8.2%
19:00	67	5.8%
20:00	59	5.1%
21:00	60	5.2%
22:00	30	2.6%
23:00	17	1.5%
Total	1,148	100.0%

Bicycle Crashes by Hour - Weekend

All North Carolina

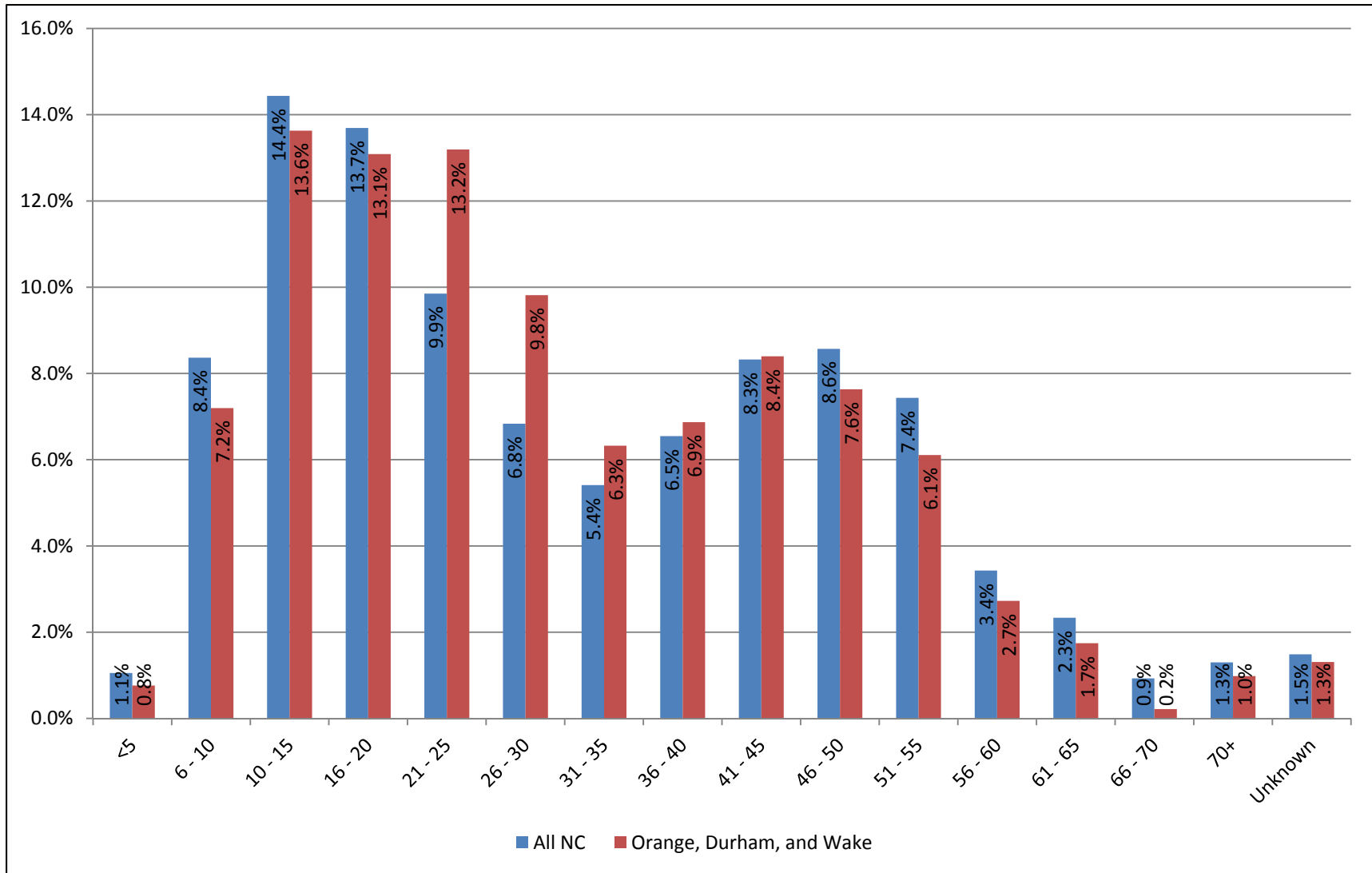


Bicycle Crashes by Age Group

All NC and Orange, Durham, and Wake Counties

Age Groups	All NC Number	All NC Percent	Orange, Durham, and Wake Number	Orange, Durham, and Wake Percent
<5	51	1.1%	7	0.8%
6 - 10	405	8.4%	66	7.2%
10 - 15	699	14.4%	125	13.6%
16 - 20	663	13.7%	120	13.1%
21 - 25	477	9.9%	121	13.2%
26 - 30	331	6.8%	90	9.8%
31 - 35	262	5.4%	58	6.3%
36 - 40	317	6.5%	63	6.9%
41 - 45	403	8.3%	77	8.4%
46 - 50	415	8.6%	70	7.6%
51 - 55	360	7.4%	56	6.1%
56 - 60	166	3.4%	25	2.7%
61 - 65	113	2.3%	16	1.7%
66 - 70	45	0.9%	2	0.2%
70+	63	1.3%	9	1.0%
Unknown	72	1.5%	12	1.3%
Total	4842	100.0%	917	100.0%

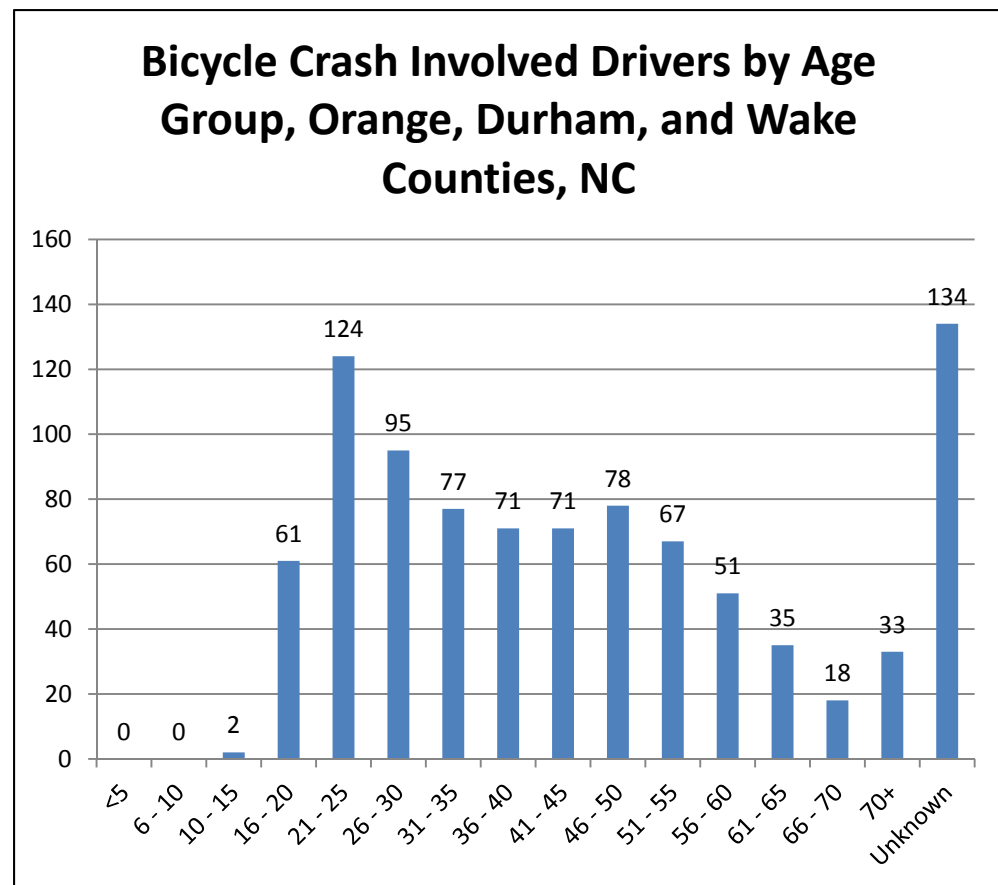
Bicycle Crashes by Age Group



Bicycle Crashes by Driver Age

Orange, Durham, and Wake Counties

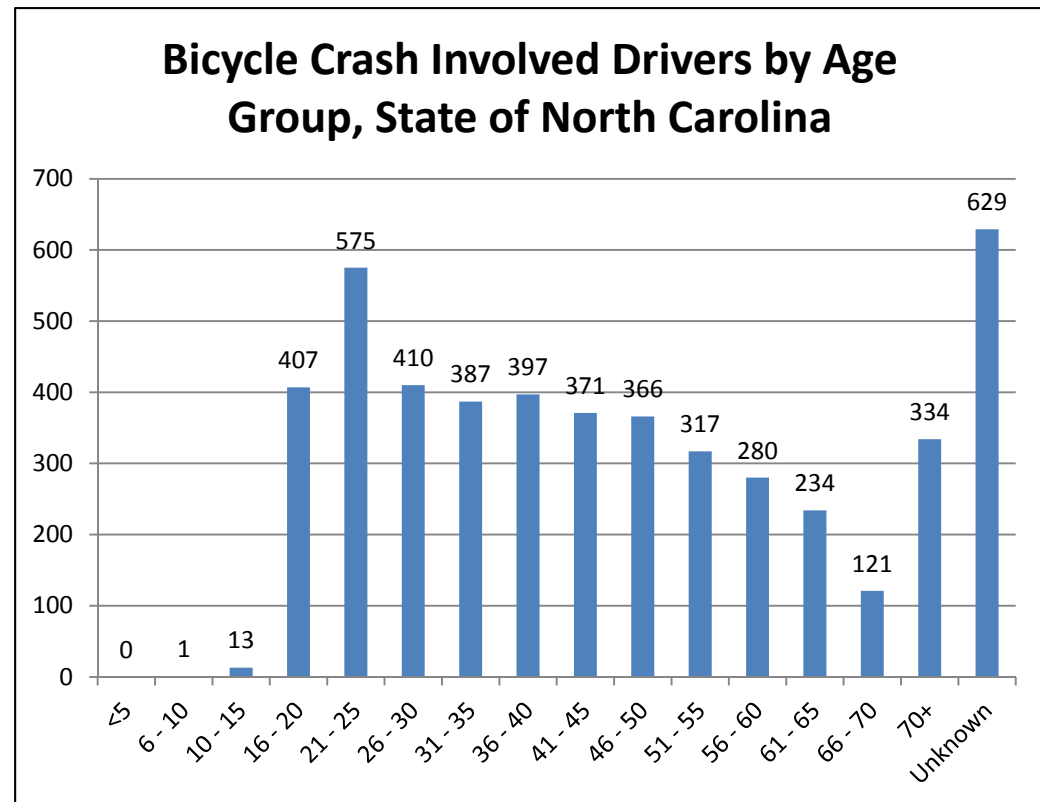
Age Groups	Number	Percent
<5	0	0.0%
6 - 10	0	0.0%
10 - 15	2	0.2%
16 - 20	61	6.7%
21 - 25	124	13.5%
26 - 30	95	10.4%
31 - 35	77	8.4%
36 - 40	71	7.7%
41 - 45	71	7.7%
46 - 50	78	8.5%
51 - 55	67	7.3%
56 - 60	51	5.6%
61 - 65	35	3.8%
66 - 70	18	2.0%
70+	33	3.6%
Unknown	134	14.6%
Total	917	100.0%



Bicycle Crashes by Driver Age

All of North Carolina

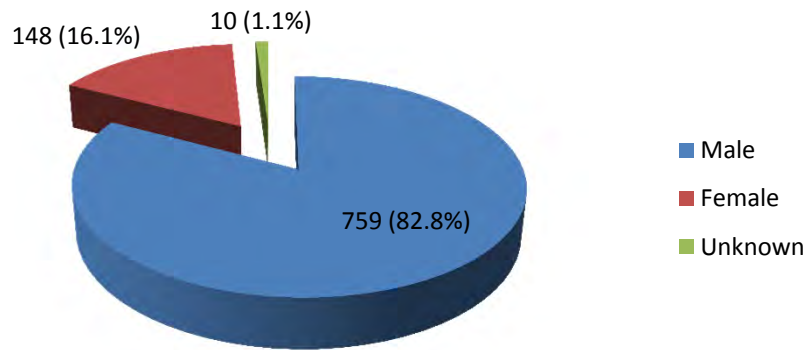
Age Groups	Number	Percent
<5	0	0.0%
6 - 10	1	0.0%
10 - 15	13	0.3%
16 - 20	407	8.4%
21 - 25	575	11.9%
26 - 30	410	8.5%
31 - 35	387	8.0%
36 - 40	397	8.2%
41 - 45	371	7.7%
46 - 50	366	7.6%
51 - 55	317	6.5%
56 - 60	280	5.8%
61 - 65	234	4.8%
66 - 70	121	2.5%
70+	334	6.9%
Unknown	629	13.0%
Total	4842	100.0%



Bicycle Crashes by Gender

Orange, Durham, and Wake

Bicycle Crashes by Gender, Orange, Durham, and Wake Counties, NC

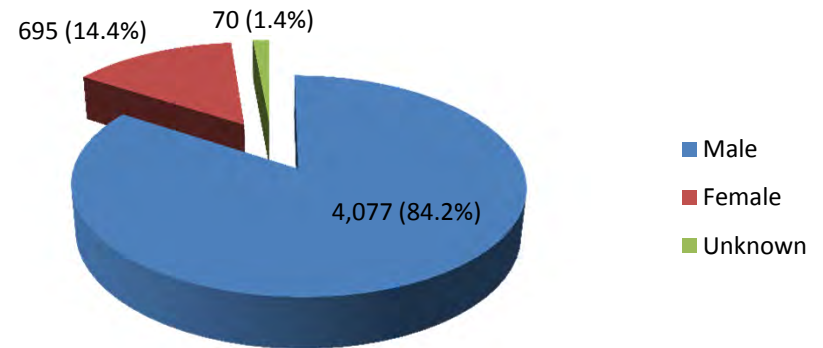


Bicyclist Gender	Number	Percent
Male	759	82.8%
Female	148	16.1%
Unknown	10	1.1%
Total	917	100.0%

All North Carolina

Bicyclist Gender	Number	Percent
Male	4,077	84.2%
Female	695	14.4%
Unknown	70	1.4%
Total	4,842	100.0%

Bicycle Crashes by Gender, State of North Carolina

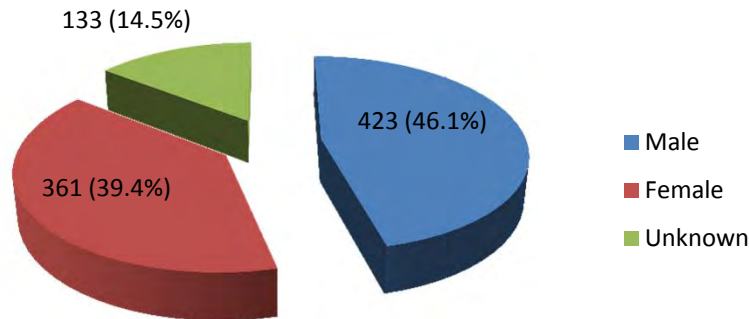


Bicycle Crash Involved Drivers by Gender

Orange, Durham, and Wake

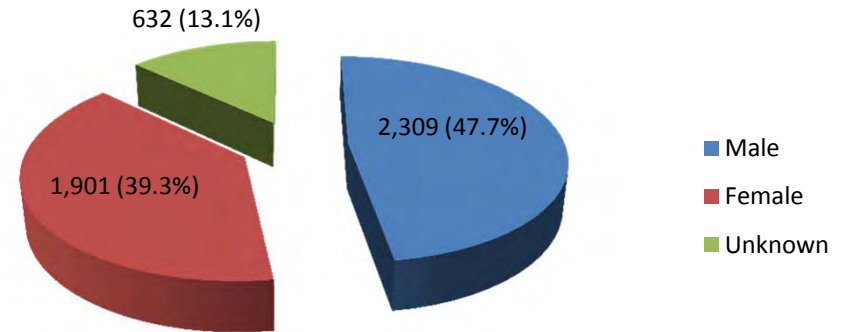
Driver Gender	Number	Percent
Male	423	46.1%
Female	361	39.4%
Unknown	133	14.5%
Total	917	100.0%

Bicycle Crash Involved Drivers by Gender, Orange, Durham, and Wake Counties, NC



All North Carolina

Bicycle Crash Involved Drivers by Gender, State of North Carolina



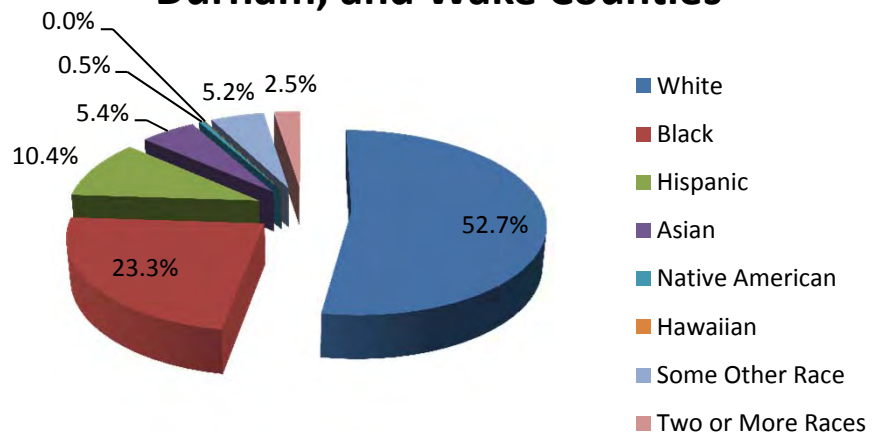
Driver Gender	Number	Percent
Male	2,309	47.7%
Female	1,901	39.3%
Unknown	632	13.1%
Total	4,842	100.0%

Bicyclist Crashes by Race

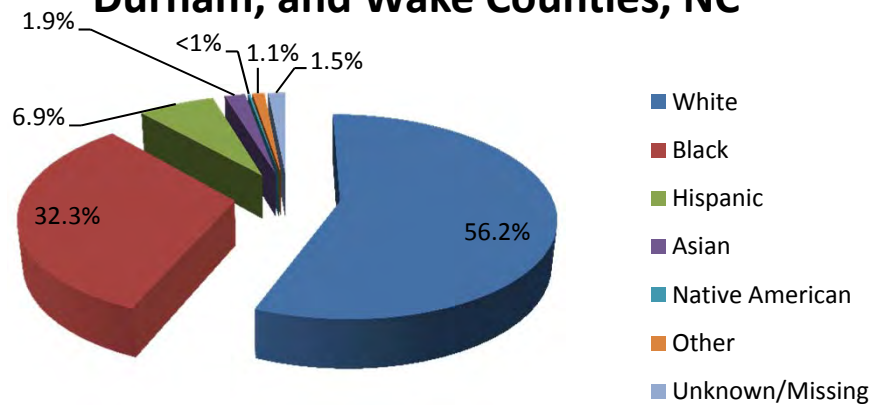
Orange, Durham, and Wake

Bicyclist Race	Number	Percent
White	515	56.2%
Black	296	32.3%
Hispanic	63	6.9%
Asian	17	1.9%
Native American	2	0.2%
Other	10	1.1%
Unknown/Missing	14	1.5%
Total	917	100.0%

Racial Demographics, Orange, Durham, and Wake Counties



Bicyclist Crashes by Race, Orange, Durham, and Wake Counties, NC



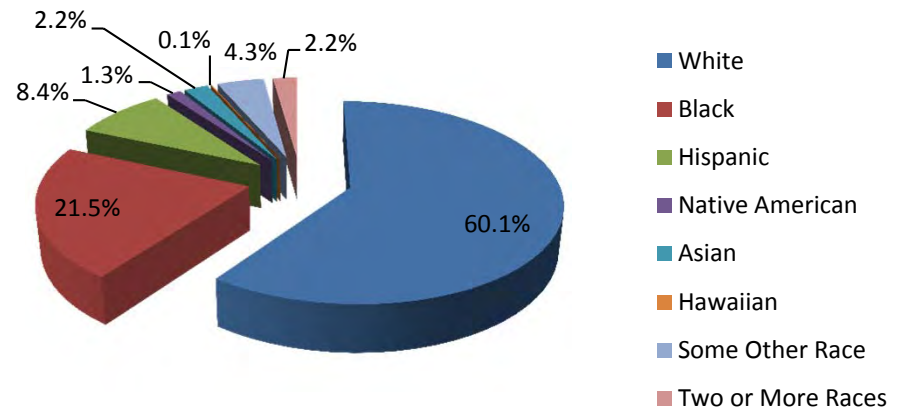
Race	Number	Percent
White	686,299	52.7%
Black	304,015	23.3%
Hispanic	135,016	10.4%
Asian	69,854	5.4%
Native American	6,412	0.5%
Hawaiian	600	0.0%
Some Other Race	67,363	5.2%
Two or More Races	32,822	2.5%
Total	1,302,381	100.0%

Bicyclist Crashes by Race

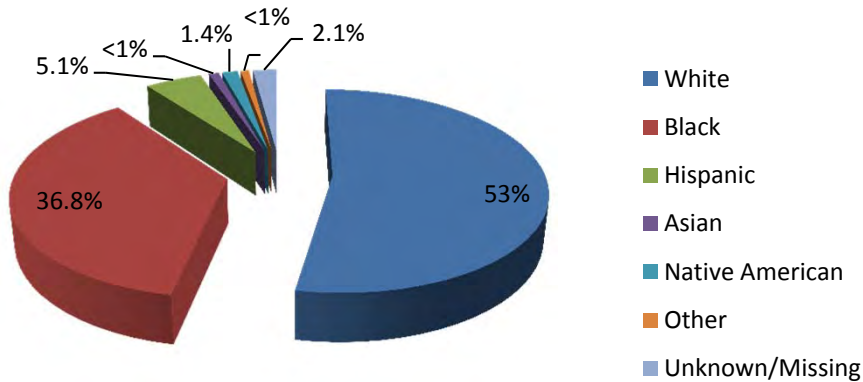
All North Carolina

Bicyclist Race	Number	Percent
White	2,566	53.0%
Black	1,780	36.8%
Hispanic	246	5.1%
Asian	44	0.9%
Native American	68	1.4%
Other	36	0.7%
Unknown/Missing	102	2.1%
Total	4,842	100.0%

Racial Demographics, All North Carolina



Bicyclist Crashes by Race, State of North Carolina

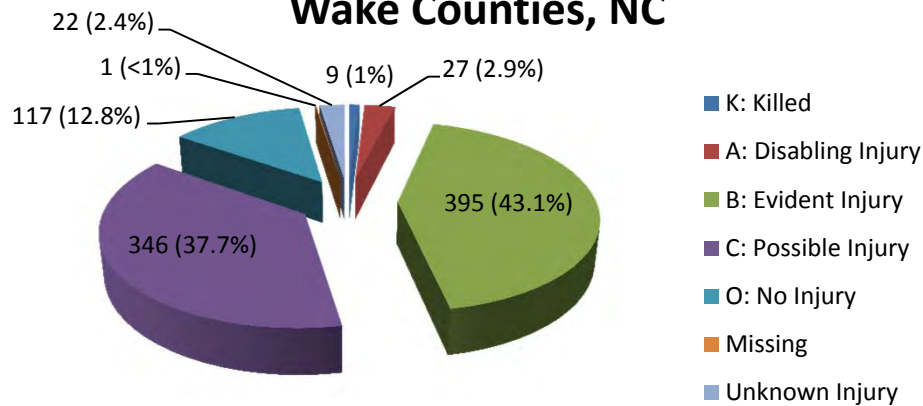


Race	Number	Percent
White	5,728,830	60.1%
Black	2,048,628	21.5%
Hispanic	800,120	8.4%
Native American	122,110	1.3%
Asian	208,962	2.2%
Hawaiian	6,604	0.1%
Some Other Race	414,030	4.3%
Two or More Races	206,199	2.2%
Total	9,535,483	100.1%

Bicycle Crashes by Injury

Orange, Durham, and Wake

Bicyclist Injury, Orange, Durham, and Wake Counties, NC

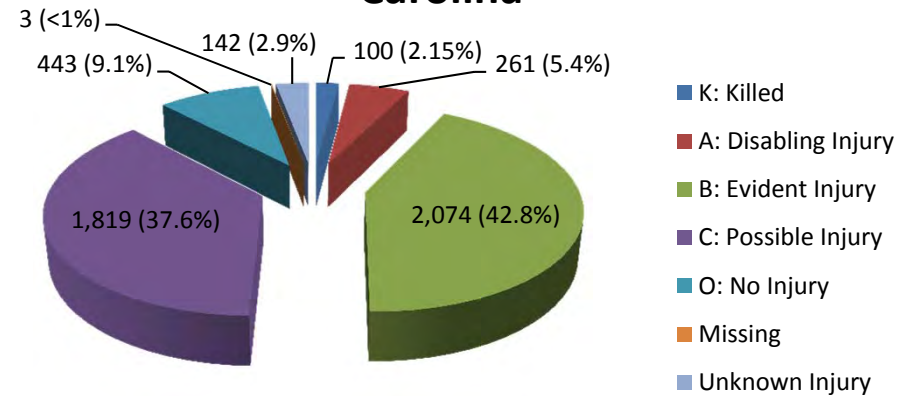


Bicyclist Injury	Number	Percent
K: Killed	9	1.0%
A: Disabling Injury	27	2.9%
B: Evident Injury	395	43.1%
C: Possible Injury	346	37.7%
O: No Injury	117	12.8%
Missing	1	0.1%
Unknown Injury	22	2.4%
Total	917	100.0%

All North Carolina

Bicyclist Injury	Number	Percent
K: Killed	100	2.1%
A: Disabling Injury	261	5.4%
B: Evident Injury	2,074	42.8%
C: Possible Injury	1,819	37.6%
O: No Injury	443	9.1%
Missing	3	0.1%
Unknown Injury	142	2.9%
Total	4842	100.0%

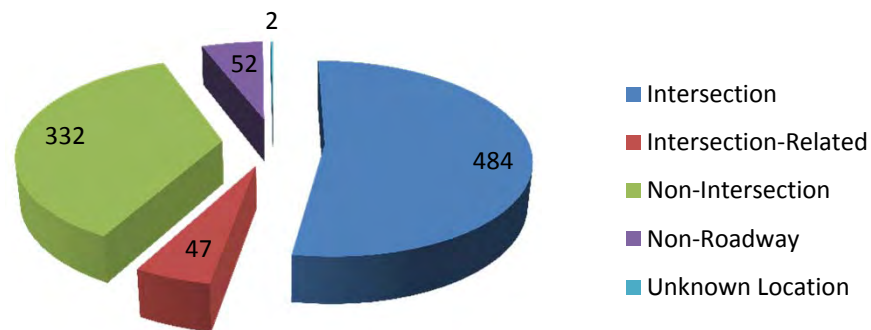
Bicyclist Injuries, State of North Carolina



Bicycle Crash Locations

Location	Number	Percent
Intersection	484	52.8%
Intersection-Related	47	5.1%
Non-Intersection	332	36.2%
Non-Roadway	52	5.7%
Unknown Location	2	0.2%
No Data	0	0.0%
Total	917	100.0%

Bicycle Crash Locations, Orange, Durham, and Wake Counties, NC

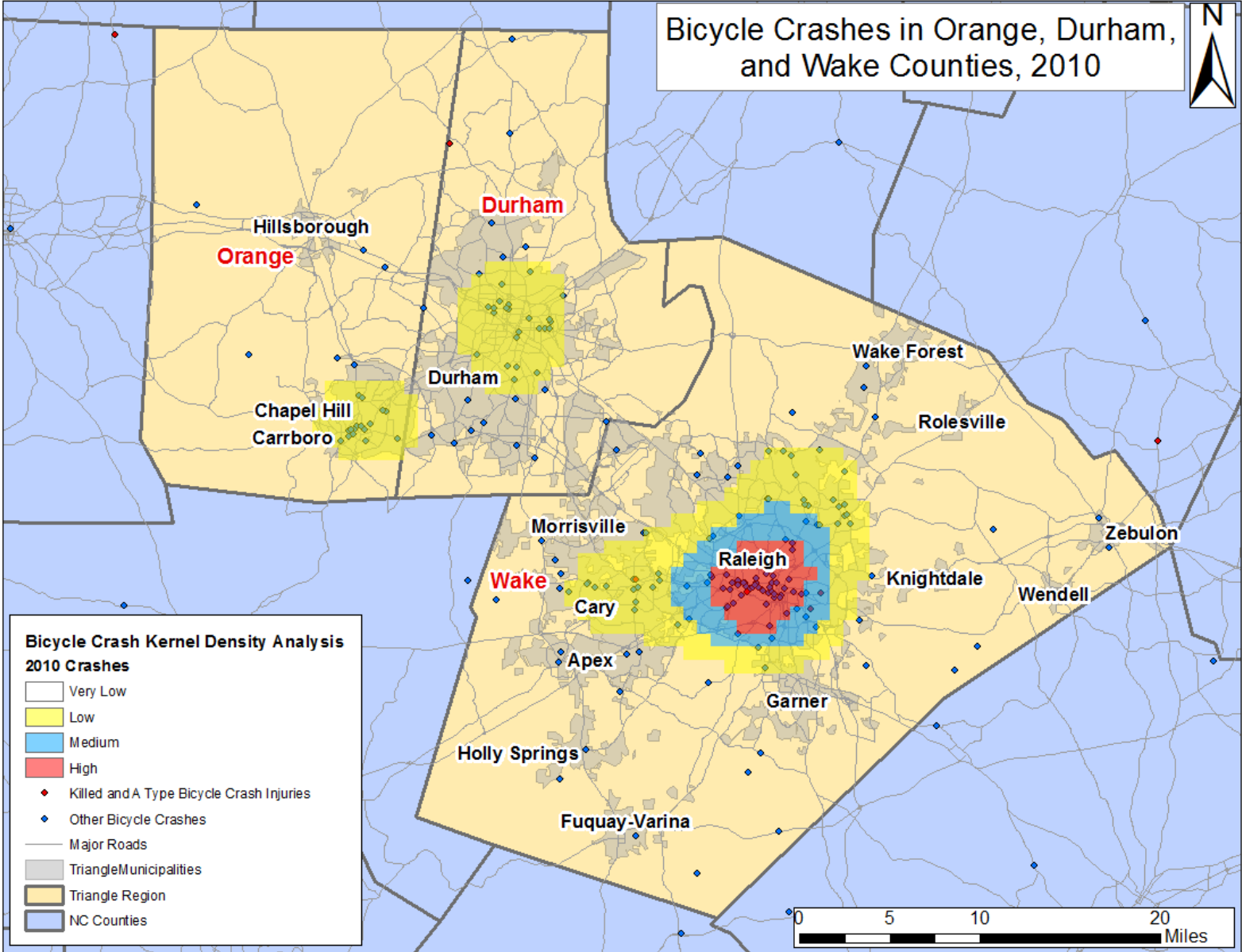


Bicycle Crash Types, Orange, Durham, and Wake Counties

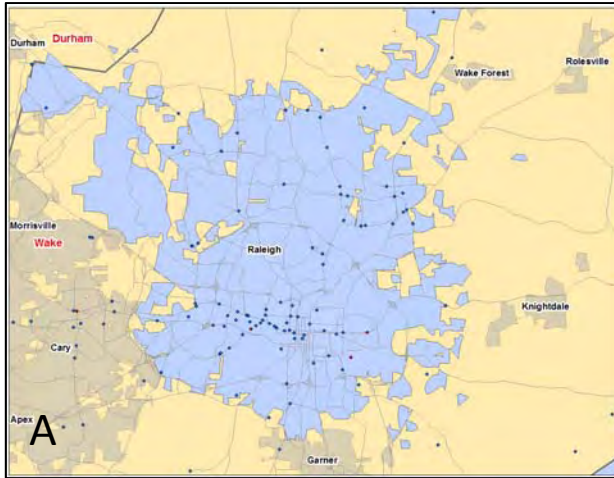
Crash Type	Number	Percent
Motorist Drive Out - Sign-Controlled Intersection	106	11.6%
Motorist Left Turn - Opposite Direction	92	10.0%
Non-Roadway	52	5.7%
Motorist Overtaking - Other / Unknown	51	5.6%
Motorist Right Turn - Same Direction	50	5.5%
Bicyclist Ride Through - Sign-Controlled Intersection	42	4.6%
Motorist Drive Out - Commercial Driveway / Alley	39	4.3%
Motorist Overtaking - Misjudged Space	35	3.8%
Bicyclist Left Turn - Same Direction	34	3.7%
Motorist Drive Out - Right Turn on Red	29	3.2%
Bicyclist Ride Out - Midblock - Unknown	25	2.7%
Bicyclist Ride Through - Signalized Intersection	24	2.6%
Signalized Intersection - Other / Unknown	18	2.0%
Motorist Overtaking - Bicyclist Swerved	18	2.0%
Crossing Paths - Intersection - Other / Unknown	18	2.0%
Bicyclist Ride Out - Sign-Controlled Intersection	16	1.7%
Bicyclist Ride Out - Signalized Intersection	14	1.5%
Motorist Overtaking - Undetected Bicyclist	13	1.4%
Motorist Drive Out - Signalized Intersection	12	1.3%
Bicyclist Ride Out - Residential Driveway	12	1.3%
Sign-Controlled Intersection - Other / Unknown	11	1.2%
Bicyclist Ride Out - Commercial Driveway / Alley	11	1.2%
Bicyclist Ride Out - Other Midblock	11	1.2%
Motorist Left Turn - Same Direction	11	1.2%
Bicyclist Left Turn - Opposite Direction	10	1.1%
Bicyclist Overtaking - Other / Unknown	10	1.1%
Bicyclist Ride Out - Parallel Path	9	1.0%
Parallel Paths - Other / Unknown	9	1.0%
Crossing Paths - Uncontrolled Intersection	8	0.9%
Motorist Right Turn - Opposite Direction	7	0.8%
Head-On - Bicyclist	7	0.8%
Motorist Drive Out - Residential Driveway	6	0.7%
Backing Vehicle	6	0.7%
Bicyclist Overtaking - Passing on Right	6	0.7%

Motorist Drive Out - Right Turn on Red	29	3.20%	234	28%
Motorist Left Turn - Opposite Direction	92	10.00%		
Motorist Right Turn - Same Direction	50	5.50%		
Motorist Drive Out - Commercial Driveway / Alley	39	4.30%		
Motorist Left Turn - Same Direction	11	1.20%		
Motorist Right Turn - Opposite Direction	7	0.80%		
Motorist Drive Out - Residential Driveway	6	0.70%		
Motorist Drive Out - Sign-Controlled Intersection	106	11.60%	182	22%
Motorist Drive Out - Signalized Intersection	12	1.30%		
Signalized Intersection - Other / Unknown	18	2.00%		
Crossing Paths - Intersection - Other / Unknown	18	2.00%		
Sign-Controlled Intersection - Other / Unknown	11	1.20%		
Crossing Paths - Uncontrolled Intersection	8	0.90%		
Parallel Paths - Other / Unknown	9	1.00%		
Motorist Overtaking - Other / Unknown	51	5.60%	117	14%
Motorist Overtaking - Misjudged Space	35	3.80%		
Motorist Overtaking - Bicyclist Swerved	18	2.00%		
Motorist Overtaking - Undetected Bicyclist	13	1.40%		
Bicyclist Ride Through - Sign-Controlled Intersection	42	4.60%	96	12%
Bicyclist Ride Through - Signalized Intersection	24	2.60%		
Bicyclist Ride Out - Sign-Controlled Intersection	16	1.70%		
Bicyclist Ride Out - Signalized Intersection	14	1.50%		
Bicyclist Ride Out - Residential Driveway	12	1.30%	68	8%
Bicyclist Ride Out - Midblock - Unknown	25	2.70%		
Bicyclist Ride Out - Commercial Driveway / Alley	11	1.20%		
Bicyclist Ride Out - Other Midblock	11	1.20%		
Bicyclist Ride Out - Parallel Path	9	1.00%		
Non-Roadway	52	5.70%	58	7%
Backing Vehicle	6	0.70%		
Bicyclist Left Turn - Same Direction	34	3.70%	44	5%
Bicyclist Left Turn - Opposite Direction	10	1.10%		
Bicyclist Overtaking - Other / Unknown	10	1.10%	16	2%
Bicyclist Overtaking - Passing on Right	6	0.70%		
Head-On - Bicyclist	7	0.80%	7	1%
TOTAL	822			99%

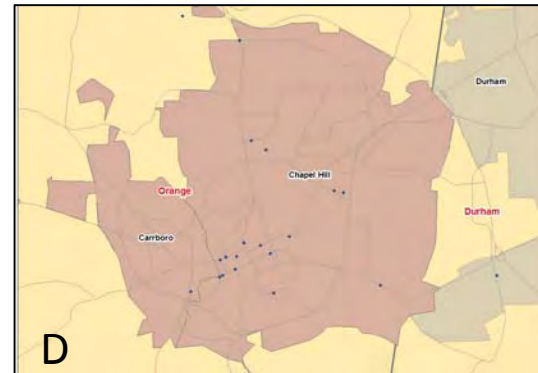
Kernel Density Analysis for Bicycle Crashes, Orange, Durham, and Wake Counties, NC



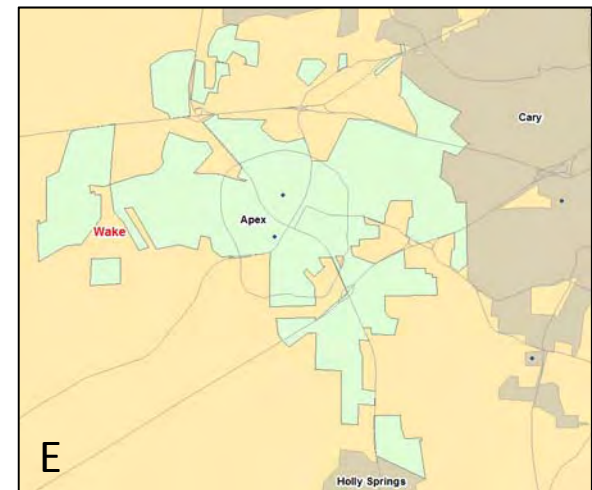
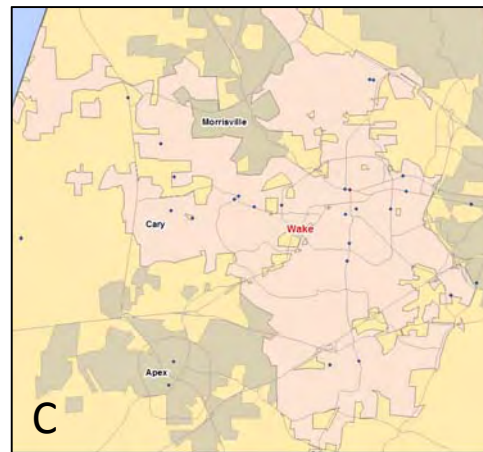
Severity by Triangle Region City



Severity	Raleigh	Durham	Cary	Chapel Hill	Carrboro	Apex
K: Killed	4	0	0	1	0	1
A: Disabling Injury	10	5	5	3	1	0
B: Evident Injury	150	80	41	36	11	8
C: Possible Injury	163	75	27	31	7	7
O: No Injury	70	20	11	0	3	0
Unknown Injury	13	3	2	2	0	0
Total	410	183	86	73	22	16



- A: Raleigh
- B: Durham
- C: Cary
- D: Chapel Hill/ Carrboro
- E: Apex



Triangle Region Crash Analysis Findings

- Crash hotspots: downtown areas
- Smaller percent of killed or type A crashes in the triangle than the State of North Carolina



www.pedbikeimages.org / Laura Sandt



www.pedbikeimages.org / Dan Burden

- 55% of crashes between May and September
- 78% of crashes on weekdays
- 40% of crashes involved bicyclists aged 10 to 25
- 83% of crashes involve male bicyclists
- 58% occurred at intersections or were intersection related

Appendix B: Summary of Existing Programs

A growing number of cities and states are implementing outreach programs aimed at educating pedestrians, bicyclists, and motorists about transportation safety. Some of these are leveraging behavior change theories (described in Appendix C), while others seem less influenced by behavioral science. Following is a summary of a number of existing community-wide, adult-oriented programs and the elements involved in each campaign.

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
<i>Campaigns Targeting Pedestrians, Bicyclists, and Drivers</i>							
Pima County, Arizona <i>Pima County DOT</i>	Share the Road (Pima County Bicycle and Pedestrian Program) ¹	<ul style="list-style-type: none"> • Educational campaign • Bike Ambassador classes • Bike/ped training for law enforcement • Legislation for bike/ped rights • Construction of facilities 	Improve safety, facilities, and access for peds and cyclists	Motorists, bicyclists, pedestrians	Print media (brochures, guides, bookmarks, magazines); PSAs; incentives	<ul style="list-style-type: none"> • Website • Events • Bike Ambassadors 	<ul style="list-style-type: none"> • Jaywalking • Failure to yield to peds and bikes • Wrong way biking • Helmet use • Use of lights • Running stop signs and red lights • Speeding
California <i>CA Dept. of Public Health, CA Office of Traffic Safety</i>	It's Up to All of Us ²	<ul style="list-style-type: none"> • Educational campaign through advertising, media relations, and outreach • Poster contest • Community events • Bilingual materials • Enforcement • 	Address irresponsible behavior, lack of awareness/alertness, lack of shared responsibility	Motorists, pedestrians, community as a whole Secondary audiences: Leaders, Law Enforcement, Traffic Planners, Public Health Officials	Printed materials (brochures, posters); videos; Pole banners; signs; postcards; safety flashers; helmets	<ul style="list-style-type: none"> • Internet and social media • Internal and stakeholder communications • Community outreach 	<ul style="list-style-type: none"> • Texting and driving • Making eye contact • Helmet use

¹ <http://bikeped.pima.gov/>

² www.cdph.ca.gov/allofus

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
Boulder, Colorado <i>City of Boulder, Community Cycles</i>	Safe Streets Boulder (Go Boulder) ³	<ul style="list-style-type: none"> Educational campaign New crosswalk rules Bicycle ambassadors Enforcement Engineering countermeasures Evaluation (collision data) 	Encourage use of bike light accessories; Increase knowledge of crosswalk laws	Motorists, cyclists, pedestrians	Discounted and free bike accessories; printed materials	<ul style="list-style-type: none"> Bicycle Ambassadors 	<ul style="list-style-type: none"> Stopping at crosswalks Bicycles in crosswalks Pedestrians using flashing crosswalks
Washington, DC metropolitan area <i>DDOT and state, county, and local agencies</i>	Street Smart ⁴	<ul style="list-style-type: none"> Educational campaign Evaluation (pedestrian surveys) Local enforcement and police outreach Innovative strategies like curb markings Emphasis on high-incidence areas and high-density Hispanic areas 	Increase public awareness of ped/bike/bus safety issues; Inform audiences of increased law enforcement	<p>Primary audience: motorists</p> <p>Secondary audiences: cyclists, pedestrians, driver's ed providers, judicial agencies, law enforcement, tourists, males 14-44</p>	Print media (posters, flyers, brochures), paid and earned media (media releases, PSAs)	<ul style="list-style-type: none"> Police Transit Movie theaters Variable message boards Radio Newspaper 	<ul style="list-style-type: none"> Pedestrian-related risky behaviors such as jaywalking and drivers not yielding to pedestrians at crosswalks
Campaigns Targeting Bicyclists and Motorists							
San Francisco, California <i>SF Dept of Parking & Traffic, SF Bicycle Coalition</i>	Coexist Campaign ⁵	<ul style="list-style-type: none"> Educational campaign Bike light giveaway 	Encourage greater respect between bicyclists and motorists; safer roads for all users; remind audiences that cyclists can use full lane	Motorists, bicyclists	Print media (pamphlets, flyers, posters); permanent signs	<ul style="list-style-type: none"> Buses Transit shelters Permanent locations Website 	<ul style="list-style-type: none"> Safe passing behavior Install and use bike lights
Campaigns Targeting Pedestrians and Motorists							

³ http://www.bouldercolorado.gov/files/Transportation/GO_Boulder/Safe_Street_Boulder_Report.pdf

⁴ <http://bestreetsmart.net/>

⁵ <http://www.sfbike.org/?coexist> and <http://www.sfmta.com/cms/bsafe/3828.html>

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
Honolulu, Hawai'i <i>NHTSA</i>	Walk Wise Hawai'i ⁶	<ul style="list-style-type: none"> • Education • Enforcement (stings) • Broad-based media campaign • Proactive outreach with community and religious organizations • Public-private partnerships 	Reduce pedestrian injuries and death	Pedestrians, motorists	PSAs, print media (ads, brochures), signs, paid and earned media	<ul style="list-style-type: none"> • Movie theaters • "Hot spot" street corners • Media • Community organizations • Private businesses • Visitors' guides 	<ul style="list-style-type: none"> • Pedestrian-related safety behaviors and awareness
Chicago, Illinois <i>NHTSA, Chicago DOT</i>	It's Up to You ⁷	<ul style="list-style-type: none"> • Educational campaign • Innovative "nudge" strategies • Enforcement • Evaluation (ped crash analysis) • Pedestrian Plan 	Raise awareness of volume of pedestrian crashes at intersections and high-crash locations; Improve driver and pedestrian behaviors	Motorists, pedestrians	No-slip sidewalk stickers/stencils; crosswalk flags; posters; mannequins; graphically compelling media	<ul style="list-style-type: none"> • High-crash areas • Buses and city trash compactors 	<ul style="list-style-type: none"> • Driver and pedestrian safety behaviors and awareness
Minnesota <i>Minnesota DOT</i>	Share the Road ⁸	<ul style="list-style-type: none"> • Education • Enforcement • Events at crosswalks in 5 cities 	Provide materials, information, and resources; Encourage audiences to share the road	Motorists, pedestrians	Print media (posters, infographics, window clings, fact sheets, brochures, pocket cards, billboards, banners); t-shirts; Event toolkit; news releases	<ul style="list-style-type: none"> • Bars & restaurants • News media • Events 	<ul style="list-style-type: none"> • Stopping for peds at crosswalks • Watching for peds • Distracted driving and walking • Looking before crossing • Visibility

⁶ HAWAII REF HERE

⁷ <http://chicagopedssafety.org/>

⁸ <http://www.dot.state.mn.us/sharetheroad/ped/index.html>

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
North Carolina <i>NHTSA, NCDOT</i>	Watch for Me NC ⁹	<ul style="list-style-type: none"> • Education campaign • Paired with enforcement • Evaluation 	Raise awareness of pedestrian concerns in high-crash locations; Improve driver and pedestrian behaviors, knowledge, and compliance; Reduce crashes	Motorists, pedestrians	Print media (brochures, posters, ads, bumper stickers, gas tank toppers, banners); earned media	<ul style="list-style-type: none"> • Website • Radio • Bus ads • Workshops with police 	<ul style="list-style-type: none"> • Drivers yielding to peds in crosswalks
New Mexico <i>NHTSA, NMDOT</i>	Look for Me	<ul style="list-style-type: none"> • Education campaign • Paired with enforcement • Spring “Pedestrian Safety Blitzes” • Pedestrian Awareness Month • Evaluation 	Improve pedestrian and driver behaviors; Raise awareness; Reduce ped/motorist crashes	Motorists, pedestrians	PSAs, Print media (signs, brochures)	<ul style="list-style-type: none"> • Radio • News conferences • Law enforcement and community advocates 	<ul style="list-style-type: none"> • Motorist failure to yield • Blocking crosswalks • Improper turns in crosswalks • Failure to obey “No Turn on Red” with peds present
<i>Campaigns Targeting Pedestrians and Motorists</i>							

⁹ www.watchformenc.org

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
Burnsville, Minnesota <i>City of Burnsville</i>	I Brake for People ¹⁰ (Slow Down Traffic Safety Program)	<ul style="list-style-type: none"> • Educational campaign • Enforcement focused on ped safety (monitor trouble spots, record license plate numbers, mail warnings) • Installed and changed traffic signals and enforcement lights • City worked with schools, businesses, and neighborhoods on traffic concerns • Evaluation of resident attitudes and of intersections/trouble spots 	Educate drivers with the state's crosswalk law; reduce speeds and crashes; improve overall safety on City streets	Motorists	Print (brochures, newsletter messages), TV ads and videos, press releases	<ul style="list-style-type: none"> • City water bills • City newsletters • City cable channel • Local newspapers 	<ul style="list-style-type: none"> • Following state laws at crosswalks • Motorists slowing down for children
Milwaukee, Wisconsin <i>NHTSA, WisDOT</i>	StreetShare ¹¹	<ul style="list-style-type: none"> • Education campaign • Partnering with local organizations • StreetShare pledge • Awareness week • Crosswalk safety demonstrations 	Remind drivers to allow pedestrians to cross the street at a crosswalk, to drive within the speed limit and to share the road with bicyclists and other users; Encourage drivers to commit to StreetShare pledge	Motorists	Electronic media; Bumper stickers	<ul style="list-style-type: none"> • Website • Events 	<ul style="list-style-type: none"> • Stopping for peds at crosswalks • Driving within the speed limit • Sharing the road

¹⁰ http://service.govdelivery.com/docs/MNBURNSV/MNBURNSV_5/MNBURNSV_5_20080731_en.pdf, <http://www.ci.burnsville.mn.us/DocumentCenter/Home/View/1330>, and <http://www.ci.burnsville.mn.us/DocumentCenter/Home/View/2102>

¹¹ <http://www.streetshare.org>

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
Portland, Oregon <i>Oregon DOT, City of Portland Office of Transportation, TriMet</i>	I Brake for People ¹²	<ul style="list-style-type: none"> Education campaign 	Improve crossing safety	Motorists	Print media (ads, bumper stickers), PSAs, "Living Billboard"	<ul style="list-style-type: none"> Buses, benches, shelters Radio Kickoff event Non-profits Businesses Neighborhood associations Local groups 	<ul style="list-style-type: none"> Stopping for pedestrians
University-based Campaigns							
Boston University, Boston, MA <i>Boston University Bike Safety Committee</i>	BU Safety Campaigns ¹³	<ul style="list-style-type: none"> Educational campaign 	<ul style="list-style-type: none"> Increase bike helmet use Increase motorists' awareness of bicyclists' presence (especially when turning) Increase pedestrians' awareness of bicyclists' presence Increasing bicyclists' use of 'U-locks' Increasing bicyclists' adoption of safe bicycling behavior (wearing helmets, passing on left, riding with traffic, stopping at stop lights, etc.) 	Motorists, Bicyclists, pedestrians	Print media (posters, brochures)	<ul style="list-style-type: none"> Website Newspapers Campus poster-canvassing Bike safety messages in parking violation mailings Printable posters available to download Social media 	<ul style="list-style-type: none"> Bicyclists wearing helmets, stopping at lights, yielding to pedestrians, signaling when turning, and riding with traffic Motorists slowing down when passing bicyclists, avoiding right-hooks

¹² <http://bikeportland.org/2007/10/15/pdot-to-launch-pedestrian-safety-campaign-5564>

¹³ <http://www.bu.edu/bikesafety/safety-campaigns/>

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
University of Minnesota, Minneapolis, MN <i>University of Minnesota Parking and Transportation Services</i>	Safety is Easy. The Pavement is Hard ¹⁴	<ul style="list-style-type: none"> Educational (awareness) campaign 	<ul style="list-style-type: none"> Increase awareness of simple safety measures that could potentially save lives. 	Motorists, bicyclists, pedestrians	Print and electronic media (posters); Campus poster-canvassing	<ul style="list-style-type: none"> Website 	<ul style="list-style-type: none"> Motorists slowing down in presence of bicyclists and pedestrians Reducing red light-running All road users looking left and right Pedestrians waiting for walk signal Reducing texting while driving Reducing bicyclists distraction Preventing bicyclists from riding on sidewalks

¹⁴ <http://www1.umn.edu/prepared/safety-is-easy.html>

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
Purdue University, West Lafayette, IN <i>Purdue Police, Purdue Student Security Patrol</i>	Bicycle Safety Campaign ¹⁵	<ul style="list-style-type: none"> Enforcement campaign 	<ul style="list-style-type: none"> Increase pedestrians', bicyclists', and motorists' awareness of traffic laws Increase bicyclists compliance with traffic lights and stop signs, and preventing travel on one-way streets Increase bicyclists' use of headlights and taillights, as well as bright clothing and helmets 	Bicyclists (primarily), motorists and pedestrians (secondarily)	Online information regarding bicycling-related city ordinances	<ul style="list-style-type: none"> Website 	<ul style="list-style-type: none"> Bicyclists yielding to pedestrians in crosswalks Using headlights and taillights Wearing bright clothing and helmets Avoiding riding on sidewalks

¹⁵ <http://www.purdue.edu/newsroom/releases/2012/Q3/purdue-again-urges-bicycle,-pedestrian-safety.html>

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
University of Pennsylvania, Philadelphia, PA <i>Penn Division of Public Safety, Philadelphia Police Dept,</i>	Share the Road ¹⁶	<ul style="list-style-type: none"> Educational campaign 	<ul style="list-style-type: none"> Increase pedestrians' and bicyclists' sharing of common University paths Increase Pedestrians', bicyclists', motorists' successful negotiation of right-of-way at intersections Increase bicyclists' use of appropriate hand signals Increasing proportion of bicyclists riding with traffic and yielding to pedestrians Increasing proportion of motorists yielding to pedestrians and bicyclists 	Bicyclists	Print media (brochure); video on bike helmet use; One campaign event during beginning of the academic school year	<ul style="list-style-type: none"> Website Newspapers 	<ul style="list-style-type: none"> Bicyclists' using hand signals Using lights and reflectors Yielding to pedestrians Wearing helmets Riding with traffic

¹⁶ <http://www.publicsafety.upenn.edu/bicycle-safety-information/>

Location (Sponsor)	Name	Key Elements	Objectives	Audiences	Materials	Channels	Targeted Behaviors
Virginia Commonwealth University Richmond, VA <i>Drive Smart Virginia, Bike Virginia, Richmond Police, Virginia Commonwealth University Police Dept, Richmond Ambulance Authority</i>	Bicyclist and Pedestrian Awareness Week/Share the Road Campaign ¹⁷	<ul style="list-style-type: none"> Educational campaign Enforcement operations Companies are solicited to become “safety partners” and spread messaging 	<ul style="list-style-type: none"> Improve understanding and create awareness of ways to reduce roadway injuries and fatalities. 	Motorists, bicyclists	Print media (ads, brochures, posters); Toolkit (leadership letter, email messages, and PPT presentation on spreading ‘Share the Road’ messaging)	<ul style="list-style-type: none"> Website Newspapers Business-based diffusion Social media 	<ul style="list-style-type: none"> Motorists slowing down before passing pedestrians and bicyclists Allowing at least 3 feet between bike and vehicle Looking for hand signals from bicyclists Stopping for pedestrians in crosswalks Bicyclists riding with traffic Using flashing lights and wearing bright clothing Yielding to pedestrians in crosswalks

¹⁷ <http://drivesmartva.org/current-projects/share-the-road/bicyclist-and-pedestrian-awareness-week>

Appendix C: Summary of Program Effectiveness and Best Practices

Evaluating campaigns to make sure that they have effectively changed behavior is important. However, few campaigns have the resources, time, or staff in order to conduct evaluations, which makes it difficult to disentangle the effects of educational campaigns from other initiatives. Of the campaigns identified in the table above, only one, Street Smart (Washington, DC), has published findings directly evaluating its campaign. According to the Street Smart website (<http://bestreetsmart.net/about.php>):

“Street Smart has conducted pre- and post-campaign surveys on all campaigns since 2002. This research is used to measure issue awareness and attitudes among drivers, cyclists and pedestrians. It also surveys awareness of the Street Smart campaign and its messages. Measurements were taken pre- and post-campaign in order to gauge the effectiveness of the spring 2012 campaign.

For the evaluation, surveys were used of drivers, pedestrians and cyclists in a broad geographic area around the metro region. Research concentrated on the particular target of 18- to 34-year old males, as this group is particularly high risk in their driving and pedestrian behaviors.

A summary of survey results shows:

1. There was a 10% increase in enforcement awareness from pre- to post-surveys – from 32% to 42%. Males 18-34 showed sustained high awareness from pre- to post-surveys, indicating the long-term effect of a consistent enforcement message over several campaigns.
2. Media message awareness increased 7% over the campaign, and the brand awareness of Street Smart related to pedestrian safety showed a significant increase of 16 points among males 18-34.
3. 81% of survey respondents among the general and target audiences recalled and retained the pedestrian enforcement message.”

Among the other campaigns listed, a small number used other types of evaluation data in order to track pedestrian and bicycle safety outcomes, such as crash data or resident satisfaction surveys. However, from this type of data, we cannot make conclusions about the specific contribution of the educational campaign to a change in safety outcomes.

Data from other intervention studies do point to the effectiveness of some approaches that are currently in use. In Shoreline, Washington, Nee and Hallenbeck (2003) evaluated the motorist and pedestrian behavioral changes that resulted from several countermeasures, including changes in the roadway environment, traffic enforcement activities, and a public information campaign. The behaviors measured before and after the improvements were pedestrian use of crosswalks and driver-yielding behavior at crosswalks. Field observations were collected before and after the countermeasures. The combination of these countermeasures was effective in changing pedestrian behavior to make use of a median refuge, rather than crossing randomly north and south of the intersection. The countermeasures were associated with improvements in vehicle compliance from no compliance to 50-70 percent. Although the specific contribution of the information campaign was not assessed, this combination of measures in tandem demonstrates the importance of multi-modal interventions.

In order to specifically evaluate the effectiveness of safety campaigns in increasing knowledge and safety behaviors, Huang and Petritsch conducted an evaluation of educational campaigns in Missoula, Savannah, and Washington, DC, (2006). The findings suggest the importance of message recall and media visibility on behavior change. The Missoula campaign’s message focused on self-efficacy, i.e., “You have the Power. Stop for pedestrians,” an approach supported by the Theory of Planned Behavior and Social Cognitive Theory, as self-confidence that one can perform the behavior predicts behavior change. The

Savannah, GA, approach was focused on knowledge of safety rules, such as, “Stop for me – it’s the law,” but did not use posters or PSAs as the other campaigns did. The Washington, DC campaign used FHWA materials “as-is,” including posters and PSAs that said, “Stop for pedestrians. Think of the impact you can make.”

- Pedestrians and motorists in Missoula remembered hearing the message more after the campaign, while those in Savannah and Washington, DC, did not. This suggests that a campaign may be more effective in a smaller, more contained city such as Missoula, and perhaps that a self-efficacy based messaging approach may be more memorable.
- Missoula’s campaign was effective in reminding pedestrians to look before crossing the street, and increasing the number of right turning motorists who yielded to pedestrians.
- Washington, DC, increased pedestrian understanding of walk indicators, while the campaign in Savannah did not. This suggests that the increased media visibility of the campaign was a key to the campaign’s effectiveness in this regard.
- Along with increases in message recall, Missoula also had an increase in safety behaviors, specifically that more pedestrians looked for vehicles before they crossed the street.

Effective educational campaign strategies

Personal commitments

In particular, evidence suggests that pedestrian safety may be improved by asking individuals for a personal commitment to safe behavior. This approach fits in the framework of theories such as the Stages of Change theory (i.e. moving from preparation to action) and Theory of Planned Behavior (i.e. stating behavioral intention increases the likelihood of performing the behavior). The use of commitment “promise cards” or pledges can be effective and have long-lasting effects in some cases. The effectiveness of this approach is thought to be due to self-imposed consequences, such as social disapproval, that come from self-imposed commitment; therefore consequences are felt without the presence of law enforcement. In a large state university setting, a six-week campaign encouraged staff and students to sign promise cards to use crosswalks when crossing campus roads and to yield to pedestrians in crosswalks when driving (Boyce & Geller, 2000). By signing, participants were entered into a raffle. Over 11,000 cards were distributed and 2,322 were signed. Along with the promise cards, the campaign had a visual presence with a logo, print materials, buttons, and t-shirts, and it began with a kickoff event and news coverage. The low-cost campaign was developed for \$10,000 and had one paid staff member. Baseline data were collected prior to the campaign at 5 sites across campus. The study found that crosswalk use increased during the campaign from 58% to 68%, and driver-yielding behavior increased significantly from 23% to 44% for 2 weeks after the campaign and publicity ended. While one year after the campaign, pedestrian crosswalk use had returned to near baseline (61%), a substantially higher number of drivers continued to yield (53%). An example of commitment pledges in use in adult audiences is the StreetShare program in Milwaukee, Wisconsin, as described in the summary above.

Nudges and other “Cues to Action”

Behavior change is best supported by cues in the environment that make the safety behavior the default choice, such as many traffic calming measures that are part of engineering countermeasures. Yet environmental cues also include messaging and other health communication approaches, such as “Slow Down” yard signs in Dane County, Wisconsin, which, when paired with law enforcement, speed boards, and pace cars, were effective in dramatically reducing speeding.

Results showed that the effect did not last after the yard signs had come down, even though residents were aware of the signs during the campaign. This finding indicates that short-term campaigns can raise awareness, but awareness itself is not sufficient for long-term behavior change (<http://www.publichealthmdc.com/family/safetyAndInjuryPrevention/documents/yardSign.pdf>).

Long-term solutions, such as permanent signs (for example – New York’s “LOOK” campaign, which painted permanent signs on crosswalks), may be more effective. Another example is an education campaign in Gainesville, Florida, which used a \$94,000 federal grant in order to erect signs to educate drivers about pedestrian laws and notify them about how many drivers were yielding to pedestrians. This approach is supported by social norms theory as described earlier. The campaign was effective in increasing compliance from 20% to 66%, surpassing the City’s goal of 60%. This suggests that funds spent on permanent signage may be more cost-effective than materials that are only visible during a short-term campaign (<http://www.howwedrive.com/wp-content/uploads/2010/05/bilde.jpg>).

Several other pedestrian-focused campaigns are also in place and are being evaluated as part of a NHTSA demonstration project. These include programs in North Carolina, New Mexico, Florida, and Chicago, IL. The results of these campaigns should be available in late 2013.

Common Campaign Strengths

As evidenced by the tables above, there are some consistent elements of existing pedestrian and bicycle safety campaigns. Even with limited quantitative evaluation data available, several empirical factors may support the effectiveness of these campaigns. Common strengths included:

1. **Multi-modal:** Most of the campaigns examined aimed messages at multiple audiences, including drivers and pedestrians or bicyclists. This approach is likely more cost effective (as opposed to running separately branded campaigns for different modes) and also may be needed in order to attain buy-in and support from the media and local partners. Campaigns that target only one population (such as pedestrians) can open themselves up to criticism for “picking on” one group and ignoring other road user concerns.
2. **Multi-level:** The majority of the campaigns included several “E’s” in each campaign, including education, enforcement, engineering changes, and policy-change or advocacy to improve laws. This approach, in step with the socio-ecologic framework, has been shown to be more effective than campaigns that focus exclusively on education. Especially worth noting are the campaigns that incorporated quick, inexpensive environmental changes to “nudge” a specific behavior at a point of choice, such as looking before crossing the street (see Figure 1).



Figure 1. “Look” Stencil as part of NYC Safety Campaign

3. **Small-scale:** Most campaigns were typically housed at the city or community level as opposed to state or nationwide. Because staff resources are limited and safety programs not often well-funded, the larger the scope or intended reach of the program, the more diffuse the messaging and other efforts will be and the less likely it will be to reach the tipping point needed for population-wide behavior change. Smaller reach areas allow for more intensive targeting of resources.
4. **Partnership-driven:** Successful programs require extensive partnerships between many stakeholders in the community, including public health professionals, communications and human relations staff, planning and engineering staff, law enforcement, advocacy groups, and others.
5. **Peer-led:** Several innovative campaigns leveraged social learning theories by having peer-to-peer methods for exchanging information about health or safety behaviors. Others utilized social marketing approaches to communication. Grassroots style communication is typically more cost effective and well-received by the public than other forms.
6. **Specific:** Most of the campaigns targeted specific and defined behaviors, such as driver yielding to pedestrians or bicyclist helmet use. These are considered superior to programs that advocate that road users “be safe” or “street smart” or other vague messages. Education programs should aim to intervene on specific, modifiable, habitual behaviors and try to bring them to a higher state of consciousness.
7. **Well-funded:** Well-funded campaigns are more likely to succeed. Available funding sources that existing programs have utilized include: 402 funds through state Highway Safety Programs; direct state funds from state legislatures; 410 funds (Alcohol-Impaired Driving Countermeasure Incentive Grant) on

Impaired Road Users are applicable to programs addressing alcohol issues; Safe Routes to School funds; Safety funds; State Planning and Research (SPR) funds; and STEP funding for specific safety corridors.

8. **Normative:** Programs such as the Portland “I brake for people” campaign (see Figure 2) include social norms elements that are supported by behavior-change theory.



Figure 2: Bumper sticker from Portland Safety Campaign.

Common Campaign Weaknesses

Other factors may limit the effectiveness of the above campaigns. Less-effective campaigns can be the result of problems that occur during campaign development or the campaign implementation. These could include:

1. **Failure to address the actual concern:** For example, many pedestrian safety campaigns develop messaging with a “shotgun approach” without consideration of the common crash trends or specific behaviors that should be targeted.
2. **Overly simplistic:** Campaigns that only attempt to increase a person’s perception of risk, without acknowledging or addressing environmental or social factors that support behavior change, have little chance of effective, long-term behavior change. For example, campaigns that involved only websites or brochures or posters stating the problem were unlikely to draw attention, much less encourage changes in behavior.
3. **Unappealing graphic design:** Some campaigns included artwork that limited or countered the effectiveness of the messaging. For example, research has shown that “scare-tactic” or “fear-based” imagery used to get the attention of the viewer actually can have the reverse effect (SWOV, no date). Message design for visual campaign materials should incorporate best practice principles of advertising/marketing in order to be eye-catching (not necessarily flashy or cute), understandable, and memorable.
4. **Short duration:** Many of the campaigns were only active a few weeks or months out of the year or were conducted for one time only, which limits the opportunity for the campaign messages to be seen and to have a meaningful impact on the target population. This problem may relate to limited funding and/or partnerships available to support the campaign.

5. **Limited saturation:** Even for programs that are sustained for months and years, limited funding resources often prohibit the campaigns from being implemented at the scale needed to reach a significant portion of the target population. This problem may be compounded by the size of the city; as stated earlier, smaller communities may be easier to saturate than larger, geographically spread ones.
6. **Failed to perform an evaluation**—In the scan conducted, few campaigns offered robust evaluations. This may be due to limited funding available to design and conduct an adequate study. Or it may be due to the complexity of performing such evaluations, which may require large sample sizes to detect a change, long data collection periods to measure such change, and measures of safety that are often difficult to ascertain.
7. **Stand-alone**—None of the campaigns reviewed were integrated into larger traffic safety programs, such as long-standing speed or alcohol or distraction campaigns run by Traffic Safety Programs. This lack of coordination between other traffic safety programs means that stand-alone programs have to have additional, separate funding (which may be difficult to come by) or they may be overlooked.

Appendix D: Summary of Behavior Change Theory

Several books, articles, and texts were reviewed from the behavioral science field and a summary of key points and issues relevant to pedestrian and bicycle education is provided below. In the later section summarizing existing programs, there is additional commentary on how behavioral-change literature has been applied in interventions to promote transportation safety.

Ecological Models of Health Behavior Change

Educational campaigns and programs (including visual/audio messaging, slogans, public outreach efforts) can complement changes to the environment and further support behavior change, but these efforts alone (i.e., without a supportive environment) rarely result in significant behavior change (Wallack, 1981). Unfortunately, many pedestrian and bicycle campaigns have aimed primarily at intervening on the individual with safety messages, without considering the broader physical and social environments in which that person lives, and with little effect. However, ecological models are considered the most effective and broad-reaching approaches for changing health behaviors. This is because health behaviors do not occur in a vacuum: individual behaviors are influenced not only by individual characteristics (such as knowledge, attitudes, or perceived risk) but also by interpersonal factors (such as social networks and peer influences), the environment (including roadways, land use, climate, etc.) and broader socio-cultural factors (such as policies, political, economic, and other contexts).

The socio-ecological model (see Figure 3) is commonly cited to demonstrate the complex factors that affect behavior (Northridge, 2003; Sallis, Owen, & Fisher, 2008; Sallis et al., 2006). These multiple levels of influence on health behavior interact across levels. The practical implication of the socio-ecological models is that multi-level interventions are the most effective in changing health behavior. At the same time, ecological models are most effective when they are behavior-specific. For example, campaigns aimed at promoting jogging may not translate to promoting walking at work (Sallis et al., 2008).

A similar ecological approach is demonstrated by the CDC's Health Impact Pyramid (Frieden, 2010) as shown in Figure 4. This model shows that interventions and campaigns have an increasing population impact as they reach broader system structures. While educational interventions may be the only ones available, they must be applied consistently and repeatedly to have a tangible impact. Changing the context for public health (e.g., safer roads and vehicle design; designing communities to promote increased physical activity; enacting policies that encourage public transit, bicycling, and walking instead of driving; enforcing laws mandating helmet use) requires less individual effort and has a greater population impact than individual education (e.g., counseling and public education to avoid drinking and driving and encourage compliance with traffic laws). Such contextual changes are considered by the CDC to be the most effective public health actions. However, these changes can be more controversial if they depend on government action. What is needed is the support of government and civil society in order to develop the partnerships needed for change.

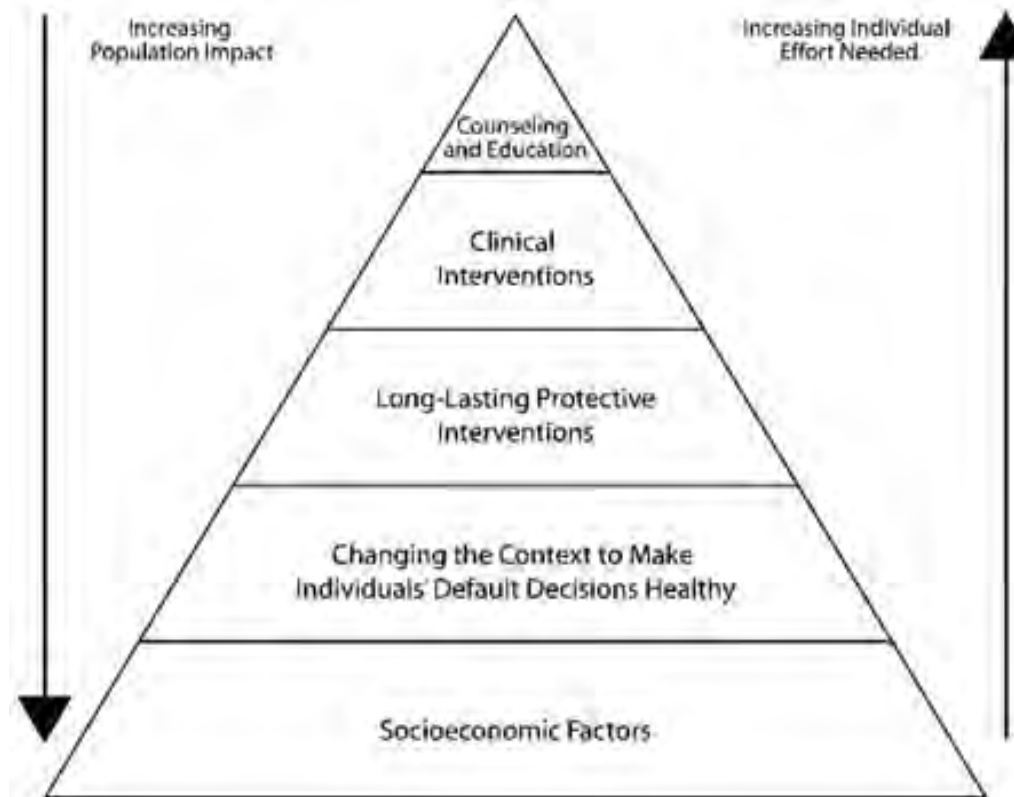


Figure 4. Health Impact Pyramid (Frieden, 2010).

The implication for pedestrian and bicycle safety campaigns is that messages targeted at individuals must be supported by a policy and physical environment that makes the safe option the default option. Recently, key advances in transportation safety have resulted from a multi-level approach. Modifying policies

(e.g., stricter seatbelt laws) or physical environment (e.g., safer pedestrian facilities) enables and reinforces the health behaviors targeted by individual education and outreach programs. For example, in addition to the “Click it or Ticket” educational/media campaign, officials passed and enforced stricter seatbelt laws, and vehicle manufacturers began installing automatic auditory alerts to notify drivers if they failed to buckle up. Over the years, this multi-level, comprehensive approach has dramatically increased seatbelt use and reduced the number of fatalities that resulted from vehicle ejection (Aldana, 2012).

Individual Behavior Change: Making Change a Habit

Given the ecological framework, practitioners must recognize that on an individual level, human behaviors and decisions are complex and not easily changed. Because individual behavior depends on environmental factors, sustained behavior change, i.e. moving from conscious change to habit, is a key challenge for pedestrian and bicycle safety campaigns. According to dual-processing mode of cognition theories (Evans, 2008), human behaviors often fall into one of two categories:

1. **Habitual behaviors:** These are often decisions that are fast, automatic or based on mind/muscle memory, and are not fully conscious. Sometimes these behaviors can be a spontaneous reaction. Most driving or travel behaviors (such as looking behavior, speeding, obeying signals, etc.) are considered habitual.
2. **Planned behaviors:** These are slower, fully conscious behaviors that involve conscious decision-making, such as choosing a route, buying food, deciding to go to the gym, etc. These behaviors are based not only on rational decision-making, but also on social influences, as mirrored by the Theory of Planned Behavior and Social Cognitive Theory (see below).

Education campaigns aim to intervene on habitual behaviors and bring them to a higher state of consciousness (Gladwell, 2005). For example, a campaign may aim to get drivers to consciously scan an intersection for pedestrians before turning. Another common goal is to make a conscious behavior so routine that it becomes habitual, such as putting on a seatbelt or strapping on a bike helmet before riding.

Behavior Change Theories as Applied to Pedestrian and Bicycle Campaigns

In order to make conscious behaviors routine, effective campaigns should be grounded in an appropriate theory or model of behavior change. Some theories and models that help us to understand the behavior underlying pedestrian and bicycle safety are described below. Some of these theories have been at work in existing safety campaigns; other theories have been more fully applied in other health behavior campaigns but have potential to inform future pedestrian and bicycle safety campaigns.

Generally, one must have a positive intention to perform a behavior (as suggested by the Stages of Change Theory or the Theory of Planned Behavior). Environmental constraints discourage a behavior, while cues or “nudges” in the environment make it easier (as suggested by the Ecological Framework). A person should believe that the benefits outweigh the costs, and feel more positive about it than negative. A person must also feel that the behavior is consistent with his or her self-image. Social norms influence personal behavior when there is more social pressure to do something than to not do something. Lastly, as suggested by Social Cognitive Theory, the person must possess (and believe that he/she possesses) the skills to do the behavior under a number of

circumstances (Lee & Kotler, 2011). For a campaign to be effective in modifying behaviors, practitioners must implement it in an appropriate setting and must enable these precursors to behavior change.

Individual Level Change

Stages of Change Theory (“Transtheoretical model”): This theory describes each stage of the continuum of motivation and readiness for personal behavior change:

1. Pre-contemplation (no intention of change),
2. Contemplation (thinking about taking action),
3. Preparation (planning to take action),
4. Action (change lasting less than six months),
5. Maintenance (change lasting for more than six months), and
6. Termination (change with no threat of relapse).

The goal of education campaigns based on the Stages of Change is to move people to the next stage of change (Prochaska, DiClemente, Velicer, & Rossi, 1993). Transportation Demand Management programs commonly incorporate this theory when they seek to inform drivers about driving alternatives (such as car-pooling or transit use) and shift them from pre-contemplation to contemplation phases or beyond with financial incentives or other approaches to encourage action. Campaigns with “pledge-card” elements may also be informed by this theory as they seek to support planning to take action through commitment-building.

Health Belief Model: This model explains personal behavior change as influenced by the perceived susceptibility and severity of a health risk, the perceived benefits and barriers to taking action, and internal or external “cues to action” that prompt one to take action (Champion & Skinner, 2008). Many of the existing pedestrian and bicycle campaigns, such as the Street Smart ad in Figure 5 below) build on this model by aiming to educate the public about the magnitude of the problem and the risk and cost of pedestrian and bicycle crashes. However, little is known about the effectiveness of such an approach if the general underlying perception of risk is low or not in sync with the messaging of the campaign. For example, with the campaign below, the messaging was severely criticized in the press as not in line with the public perception of the problem: <http://greatergreaterwashington.org/post/9799/pedestrian-safety-ads-feature-damage-to-cars-not-people/> .



Figure 5. Street Smart Ad.

Theory of Planned Behavior: This theory states that personal behavior change is driven by an intention to act. People are more likely to act when they have a positive attitude toward a behavior, believe that others who are important to them would approve of them acting, and that they will be successful in their actions (Ajzen, 1991). The NHTSA “Be a Roll Model” campaign (<http://www.nhtsa.gov/Driving+Safety/Bicycles/Be+a+Roll+Model>) is example of a campaign that builds on this theory, as child, youth, and parent “pledges” encourage an intention to act on a set of safety behaviors and build social acceptance of such behaviors through peers and role models (see Figure 6).

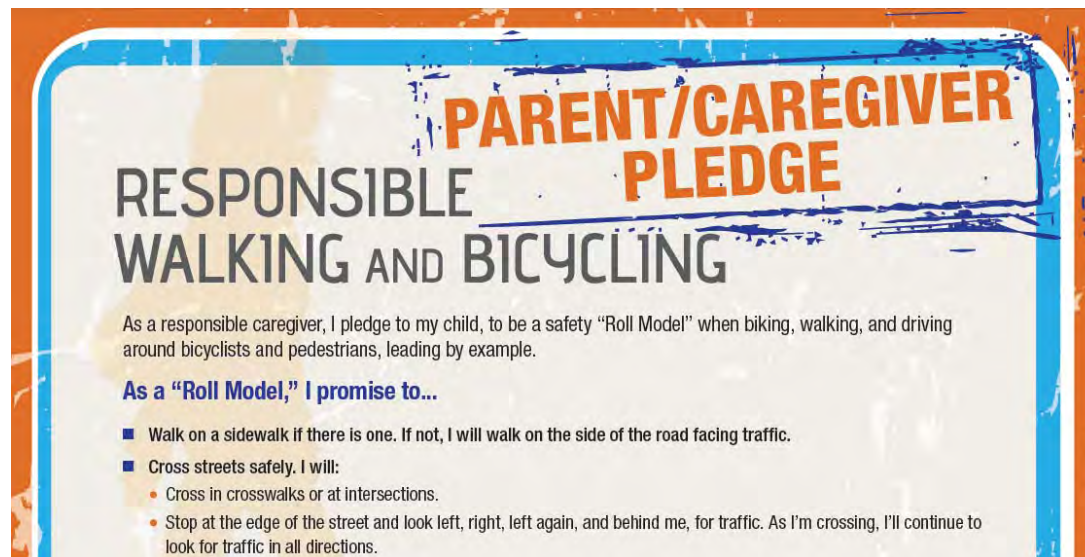


Figure 6. NHTSA “Roll Model” Pledge Program.

Deterrence Theory: This theory is based on the notion that people avoid illegal behaviors if there is a perceived: 1) threat of being caught and 2) a consequence. Campaigns that apply this theory must work to increase the perception that for a particular behavior there is a consequence AND getting caught is imminent. There are many traditional traffic safety campaigns that have operated under this theory, including *the Booze it and Lose it* and *Click it or ticket* NHTSA campaigns. A strong enforcement presence has been key to the effectiveness of such campaigns. Most recently, a pedestrian safety effort in Gainesville, FL has utilized deterrence theory when raising awareness of the law requiring drivers to yield to pedestrians in crosswalks. Bus wraps and high-visibility media messages reiterate the consequence of ticketing if drivers fail to yield (see Figure 7 below).



Figure 7. Gainesville Bus Wrap Concept (source: Direct Media, Inc.).

Interpersonal Level Change

Social Cognitive Theory (“Social Learning”): This theory is based on the notion that people learn behaviors and skills by observation of others. Two major factors influence how likely it is that one will perform a behavior: a belief that the benefits outweigh the costs, and a sense of self-efficacy, i.e. confidence that one has the skills necessary. These skills are learned, in part, by observing others, but also by practicing the behavior and receiving reinforcement to continue the behavior (Bandura, 1986). For example, in Pima County, Arizona, an important part of the “Share the Road” campaign were classes by “Bike Ambassadors” – peers who taught other adults the skills needed to ride safely. The NHTSA “Roll Model” campaign mentioned above is also an example of a social learning-based approach, whereby children can be models to teach behaviors to adults and others, and vice versa. An even more simple approach to role modeling is demonstrated by San Francisco’s “Coexist” campaign, which showed people doing the right safety behaviors in dangerous situations in their visuals.

Closely related to SCT is **social norms theory**, which holds that if a person believes a behavior is the norm, regardless of how accurate this belief is, he or she is more likely to engage in that behavior (Linkenbach & Perkins, 2003). This suggests that one strategy for changing behavior is to correct misperceptions about perceived versus actual norms. Campaigns grounded in this theory focus on showing that a behavior is normative. Figure 8 shows a sign in Gainesville, Florida, that shows that over half of drivers yield to pedestrians as part of a broader pedestrian safety program. What this theory also suggests is that campaigns that highlight that high numbers of people perform a *risky* behavior may unintentionally encourage this behavior by reinforcing this norm.



Figure 8: Gainesville Driver Yielding Sign.

A study conducted in Berkeley, California, found that “information on peer compliance of pedestrian laws had a stronger influence on pedestrian safety behavior than information on the law, citation rates, or accident statistics” (Gaker, 2010). Social norms programs focus on sharing a fact about the norm; this requires data or evidence that such behavior IS the norm. Thus, if a behavior is not clearly already the norm, then the appeal of this type of approach is limited. Examples of this approach include the *4 out of 5 Campaign* (an alcohol campaign at UNC: http://www.hsrb.unc.edu/safety_info/alcohol/UNCSocialNormProject.pdf), and the *9 out of 10 Campaign* (a young driver cell phone use campaign in NC: <http://www.hsrb.unc.edu/9outof10/about.cfm>).

Environmental or Population Level Change

Diffusion of innovation model: The diffusion of innovations is the spread of adoption of new behaviors through a population. The implication for education campaigns is that if a behavior is considered new or innovative (such as using a new type of safety device or facility), efforts that would appeal to “innovators” or

“early adopters” would be different from efforts that would appeal to those more reluctant to “join the bandwagon” (Rogers). An example of this type of campaign is one that utilizes “Bike Ambassadors” as early adopters of behaviors such as helmet use to encourage helmet use by others. Another example is the Better Blocks program (<http://betterblock.org/>), which seeks to educate elected officials and the general public about opportunities to improve roadway safety through a highly- innovative program of temporary roadway improvements (see Figure 9). This program is also an example of innovative environmental changes (short or longer term) that can be made to support or encourage safety behaviors by road users.



Figure 9. Before and After Images from a Better Blocks Program in San Antonio, TX.

Communications Approaches Used in Developing Campaigns

Behavioral theory can inform the underlying concepts behind an educational campaign. At the same time, practitioners must also ground campaigns in real-world insights. One such way to leverage both theory and audience insight is the use of health communication and social marketing approaches. These approaches go beyond simply seeking to educate by giving information and building skills; they aim to encourage sustained behavior adoption.

In particular, **social marketing** is a systematic planning process that focuses on audience insights and marketing strategies in order to change behavior for social good (Lee and Kotler, 2011). For example, with a social marketing approach, messages are based on audience insights about key benefits and barriers to behavior change, and strategically targeted at a specific audience segment. Social marketing has been used for injury prevention that affects pedestrian and bicycle safety, such as preventing drinking and driving and preventing head injuries, as well as encouraging physical activity in order to prevent chronic disease, and preventing air pollution from automobiles.

Appendix E: Legal Issues and Considerations

Legal issues pertaining to the operation of a bicycle vary from state to state. Below are three areas of North Carolina law that need clarification.

- Bicycling on Interstate or fully controlled limited access highways, such as beltlines, is prohibited by policy, unless otherwise specified by action of the Board of Transportation. Currently, the only exception to the policy is the US 17 bridge over the Chowan River between Chowan and Bertie Counties.
- There is no law that requires bicyclists to ride single file, nor is there a law that gives cyclists the right to ride two or more abreast. It is important to ride responsibly and courteously, so that cars may pass safely.
- **There is no law that prohibits wearing headphones when riding a bicycle; however, it is not recommended. It is important to use all your senses to ensure your safety when riding in traffic.**
- Bicycle Helmet Law In 2001, the North Carolina General Assembly enacted the Child Bicycle Safety Act requiring bicyclists under the age of 16 to wear helmets. Although the new law does not require adult bicyclists to wear helmets, they are strongly encouraged to do so. Some localities within the state have enacted ordinances requiring cyclists to wear helmets.

Laws for Drivers

Relevant law/statute	Key Issues/Frequent Crash Types
<p>§ 20-138.1. Impaired driving.</p> <p>(a) Offense. – A person commits the offense of impaired driving if he drives any vehicle upon any highway, any street, or any public vehicular area within this State:</p> <p>(1) While under the influence of an impairing substance; or</p> <p>(2) After having consumed sufficient alcohol that he has, at any relevant time after the driving, an alcohol concentration of 0.08 or more. The results of a chemical analysis shall be deemed sufficient evidence to prove a person's alcohol concentration; or</p> <p>(3) With any amount of a Schedule I controlled substance, as listed in G.S. 90-89, or its metabolites in his blood or urine.</p> <p>(e) Exception. – Notwithstanding the definition of "vehicle" pursuant to G.S. 20-4.01(49), for purposes of this section the word "vehicle" does not include a horse.</p>	<p>Alcohol not found to play a large role in crashes.</p>
<p>§ 20-140. Reckless Driving</p> <p>(a) Any person who drives any vehicle upon a highway or any public vehicular area carelessly and heedlessly in willful or wanton disregard of the rights or safety of others shall be guilty of reckless driving.</p> <p>(b) Any person who drives any vehicle upon a highway or any public vehicular area without due caution and circumspection and at a speed or in a manner so as to endanger or be likely to endanger any person or property shall be guilty of reckless driving.</p>	

Relevant law/statute	Key Issues/Frequent Crash Types
<p>§ 20-149. Overtaking a vehicle.</p> <p>(a) The driver of any such vehicle overtaking another vehicle proceeding in the same direction shall pass at least two feet to the left thereof, and shall not again drive to the right side of the highway until safely clear of such overtaken vehicle. This subsection shall not apply when the overtaking and passing is done pursuant to the provisions of G.S. 20-150.1.</p> <p>(b) Except when overtaking and passing on the right is permitted, the driver of an overtaken vehicle shall give way to the right in favor of the overtaking vehicle while being lawfully overtaken on audible signal and shall not increase the speed of his vehicle until completely passed by the overtaking vehicle. Failure to comply with this subsection:</p> <ol style="list-style-type: none"> (1) Is a Class 1 misdemeanor when the failure is the proximate cause of a collision resulting in serious bodily injury. (2) Is a Class 2 misdemeanor when the failure is the proximate cause of a collision resulting in bodily injury or property damage. (3) Is, in all other cases, an infraction. 	<p>Motorist Overtaking - Other / Unknown (4th most frequent vehicle-bicycle crash types – 5.6% of these crashes)</p> <p>Motorist Overtaking - Misjudged Space (8th most frequent – 3.8% of crashes)</p> <p>Motorist Overtaking - Bicyclist Swerved (13th most frequent – 2% of crashes)</p>
<p>§ 20 173 (c).</p> <ul style="list-style-type: none"> • The driver of a vehicle emerging from or entering an alley, building entrance, private road, or driveway shall yield the right of way to any pedestrian, or person riding a bicycle, approaching on any sidewalk or walkway extending across such alley, building entrance, road, or driveway. 	<p>Motorist Drive Out - Commercial Driveway /Alley (7th most frequent vehicle-bicycle crash type – 4.3% of these crashes)</p>

Laws for Bicyclists

Relevant law/statute	Key Issues/Frequent Crash Types
<p>North Carolina traffic laws require bicyclists to:</p> <ul style="list-style-type: none"> Ride on the right in the same direction as other traffic Obey all traffic signs and signals Use hand signals to communicate intended movements Equip their bicycles with a front lamp visible from 300 feet and a rear reflector that is visible from a distance of 200 feet when riding at night. 	<p>Bicyclist Left Turn - Same Direction (9th most frequent – 3.7% of crashes)</p>
<p>the Child Bicycle Safety Act of 2001 § 20-171.9 requires that:</p> <ul style="list-style-type: none"> All bicycle operators under 16 years of age must wear a bicycle helmet on public roads, public paths and public rights-of-way All child passengers under 40 pounds or 40 inches must be seated and secured in a child seat or a bicycle trailer. 	
<p>§ 20-129 (c). Required Lighting Equipment of Vehicles.</p> <ul style="list-style-type: none"> Lamps on Bicycles. Every bicycle shall be equipped with a lighted lamp visible up to three hundred feet in front when used at night and must also be equipped with a taillight or rear reflector that is red and visible for up to two hundred feet from the rear when used at night. 	
<p>§ 20-158.1 Erection of "Yield Right-of-Way" Signs</p> <ul style="list-style-type: none"> Bicyclists must yield the right-of-way before entering or crossing any main-traveled or through highway if the roadway they are on is posted with a "yield right-of-way" sign. 	<p>Bicyclist Ride Through - Sign-Controlled Intersection (6th most frequent crash type – 4.6% of these crashes)</p> <p>Bicyclist Ride Out - Midblock – Unknown (11th most frequent – 2.7% of crashes)</p> <p>Bicyclist Ride Through - Bicyclist Ride Out - Sign-Controlled Intersection (16th most frequent crash – 1.7% of crashes).</p>

Appendix F: Resources and References

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Resources

1. Communication Resources
 - a. Communication for Pedestrian Safety: <http://www.cdph.ca.gov/HealthInfo/injviosaf/Documents/Master%20Risk%20Com%20Workbook%20Final%206%2023%2010.pdf>
 - b. General Traffic Marketing/Advertising Guidance: <http://www.trafficsafetymarketing.gov/TOOLS/Branding>
 - c. Social Norms Marketing Guidance/Evaluation: <http://www.mostofus.org/>
 - d. Public information campaign best practices: http://www.swov.nl/rapport/Factsheets/UK/FS_Public_information.pdf
 - e. A useful reference on behavior change theories is *Theory at a Glance*: <http://www.cancer.gov/cancertopics/cancerlibrary/theory.pdf>

- f. A helpful resource on health communication strategies is the “Pink Book” by the National Cancer Institute, available at:
<http://www.cancer.gov/cancertopics/cancerlibrary/pinkbook/page1>.
- 2. Laws and Bicycle Training
 - a. Bicycle safety training (by Steve Goodridge): <http://humantransport.org/nccbd/?cat=4>
 - b. NCDOT Summary of Laws: <http://www.ncdot.gov/bikeped/lawspolicies/>

Appendix B: Law Enforcement Data Collection Form

POLICE DEPARTMENT STATS REPORTING FORM

UNC Highway Safety Research Center needs your help in monitoring and evaluating the effectiveness of the Watch for Me NC pedestrian and bicycle safety education and enforcement program. **Please provide the following information for each enforcement activity conducted by your department:**

Date of operation: _____ Total Number of Officers Involved: _____
 Officer in charge/contact person: _____ Unit/District: _____
 Site of enforcement (intersection or nearby crossroads): _____
 Time active enforcement began: _____ Time active enforcement ended: _____

Motorist violations issued:

	Verbal Warnings	Written Warnings	Citations	Total Contacts
Failure to yield to pedestrian in crosswalk				
Speeding				
Failure to yield to cyclist or pedestrian when turning				
Unsafe passing				
Aggressive/reckless driving				
Alcohol-related offenses				
Other				

Warnings issued to pedestrians (please list type of violation and number given): _____

Citations issued to pedestrians (please list type of violation and number given): _____

Warnings issued to bicyclists (please list type of violation and number given): _____

Citations issued to bicyclists (please list type of violation and number given): _____

Describe the measures used to raise public awareness of the operation (i.e., use of sandwich board signs, public postings, media advisories/press releases, etc.): _____

Number of materials distributed during operation:

Brochures	Bike Lights	Bracelets	Other

Please return completed forms to Laura Sandt at sandt@hsrc.unc.edu or contact her at 919-962-2358 to arrange collection by HSRC staff.

Appendix C: Watch for Me NC Community Event List

Community	Event Name	Dates	Audience	Expected Reach	Description/ Materials distributed
Apex	Downtown Enforcement	8/15/13-8/16/13	General public	NO INFO	Handed out fliers at pedestrian crosswalk
Apex	Apex Community at Beaver Creek	8/20/13-8/22/13	General public	NO INFO	Handed out fliers at pedestrian crosswalk
Apex	Apex Olive Chapel Road School	8/27/13-8/28/13	General public	NO INFO	Handed out fliers at pedestrian crosswalk
Apex	Downtown Enforcement	8/6/13-8/8/13	General public	NO INFO	Handed out fliers at pedestrian crosswalk
Apex	Apex Night Out		Adults	100	fliers and hung banner
Carrboro	UNC Week of Welcome	22-Aug-13	UNC Students	n/a	Tables were set up in Polk Place and students could stop at them as they walked by; all materials distributed except bike lights
Carrboro	Schools Open House (general and McDougle)	Sep-13	Two elementary schools (plus a middle school)	n/a	Distributed posters to McDougle and Carrboro Elementary. Also, a citizen who is a parent at McDougle Elementary volunteered to have the school make all materials available at the open houses for McDougle Elementary and Middle Schools. Posters are up at Carrboro and McDougle Elementary
Carrboro	Cruiser ride and bike light giveaway	Nov. 14, 2013	Local cyclists	15-30	Bike lights, rack cards, 1-2 posters
Carrboro/ Chapel Hill	Bike Summit	10/18 to 10/20	Summit attendees (planners, engineers, advocates)	175	All materials available on table except lights and bracelets
Cary	Orange Star Criterium	8/10/2013	Novice to professional riders and spectators	140 riders; 500-1000 spectators	Rack cards and LED wrist bands
Cary	Walk to School event at Laurel Park Elementary	September	Elementary students/parents, and staff	n/a	Distributed rack cards, LED wristbands and sandwich boards
Chapel Hill	Festifall	10/6/2013	children, adults	NO INFO	All the bracelets
Chapel Hill	Crosswalk Awareness Campaign (Franklin@ Columbia)	10/8/2013	General public	NO INFO	
Chapel Hill	Crosswalk Awareness Campaign (Cameron@ Columbia)	10/9/2013	General public	NO INFO	
Chapel Hill	Project Homeless Connect table on bike/ped safety	10/10/2013	General public	250	Officers distributed lights to wear or attach to bicycle
Chapel Hill	Crosswalk Awareness Campaign (MLK near Town Hall)	10/16/2013	General public	NO INFO	
Chapel Hill	Crosswalk Awareness Campaign (Franklin@ Henderson)	10/25/2013	General public	NO INFO	
Durham	National Night Out	8/6/2013	General public	n/a	
Durham	Durham Bicycle and Pedestrian Advisory Commission Meeting	8/20/2013	Advisory Board Members	n/a	
Durham	South Durham Farmer's Market	9/28/2013	General public	n/a	Rack cards, bumper stickers

Community	Event Name	Dates	Audience	Expected Reach	Description/ Materials distributed
Durham	Latino Festival	9/28/2013	Youth and adults	n/a	Rack Cards (English and Spanish), Bumper Stickers)
Durham	City of Durham Bike Commuter Meeting	10/2/2013	adult bike commuters and bike police officers	11	rack cards, bumper stickers, lights
Durham	Youth Council Conference	10/3/2013	Youth	n/a	
Durham	ATT Trail Celebration Event	10/12/2013	Youth and adults	n/a	Rack Cards, Bumper Stickers
Durham	Inter-Neighborhood Council Traffic Enforcement Committee	10/16/2013	Committee members	12	Rack Cards, Posters, Bumper Stickers
Durham	Watch for Me NC Session of Durham School Crossing Guards	10/23/2013	Crossing guards	11	Posters
Durham	NC East Coast Greenway Committee	10/25/2013	Adults	20	Rack Cards, Posters, Bumper Stickers
Durham	Project Safe Neighborhood's FaithActs Event	10/26/2013	Church groups	NO INFO	Presentation and distribute church bulletin insert
Durham	Durham Taxi Driver Training	10/28/2013	Taxi drivers	30	Bumper stickers, rack cards, and posters
Durham	BPAC Orientation	10/29/2013	Adults	4	Bumper stickers, rack cards, and posters
Durham	2014 governors highway safety symposium in Concord, NC	Jan 13 - Jan 17 2014	Police officers	600	Flyers, Bike lights, Wristbands
Durham	Annual CenterFest Arts Festival	Sept 21-22, 2013	Youth and adults	n/a	Rack cards, bumper stickers, hung small posters
Durham	Durham PAC (Partners Against Crime) meetings	September	PAC members	n/a	Rack cards, bumper stickers
Fuquay-Varina	Town Board Public Meeting	6/18/2013	General public	NO INFO	Presented about the WFM campaign
Knightdale	Knightdale Station Park Grand Opening	9/19/2013	adults, children, elected officials	1000	Bumper stickers
Knightdale	Fire Department Open House	10/19/2013	General public	200+	Bumper stickers
Raleigh	BPAC Meeting	8/19/2013	adults	20	rack cards, banners, posters, bumper stickers, brochures
Raleigh	Leesville Back to School Safety Day	8/24/2013	children, adults	150	rack cards, banners, posters, bumper stickers, brochures
Raleigh	Transportation Bond Referendum Meetings	Sep-13	adults	n/a	
Raleigh	Powell Walk to School Day	10/9/2013	children, adults	50	rack cards, banners, posters, bumper stickers
Wake Forest	Good Neighbor Day	9/15/2013	children, adults	1000+	Bumper stickers and rack cards
Wake Forest	National Public Lands Day - Reservoir Trail Clean-up	9/28/2013	children, adults	100+	Bumper stickers and rack cards
Wake Forest	Halloween Spooktacular	10/24/2013	children, adults	800+	Rack cards, bracelets, and bumper stickers
Duke University	Engineering School Fair	8/22/2013	graduate students	40	rack cards, bumper stickers
Duke University	International House Presentation on "Getting around Durham"	10/9/2013	graduate students and post-docs	7	rack cards, bumper stickers, bike/ped safety presentation
Duke University	Duke Health System New Employee Orientation	12/2/2013	nurses, doctors, social workers, and other hospital staff	170	Rack cards

Community	Event Name	Dates	Audience	Expected Reach	Description/ Materials distributed
Duke University	Duke University New Employee Orientation	12/10/2013	Duke faculty and staff	25	Rack cards
Duke University	Duke Health System New Employee Orientation	12/16/2013	new nurses, doctors, social workers, and other hospital staff	150	Rack cards
Durham Tech	Welcomania	9/4/2013	Students, faculty, staff	300-400	Flyers, bumper stickers, cards handed out along with basic safety and crime prevention information
NC State	International Student Fair	8/15/2013	New international students	300	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	Campus Crawl	8/20/2013	New students	1,000	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	Graduate Student Orientation	8/20/2013	New graduate students	500	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	Packapalooza	8/24/2013	Faculty, staff, students, community members	1000	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	Commuter Appreciation Breakfast	9/5/2013	Faculty, staff, students	100	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	Wolfline Rider Appreciation Day	9/19/2013	Faculty, staff, students	500	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	Wolfline Rider Appreciation Day	9/20/2013	Faculty, staff, students	100	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	Commuter Appreciation Breakfast	10/9/2013	Faculty, staff, students	100	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	NCSU Health and Wellness Fair	10/18/2013	Faculty, staff, students	300	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	NCSU Open House	10/19/2013	Faculty, staff, students, community members	1000	Pedestrian bumper stickers; bicyclist bumper stickers; posters
NC State	New Student Orientation	July-August 2013	New students and parents	1500	Pedestrian bumper stickers; bicyclist bumper stickers; posters
UNC	UNC Employee Appreciation	10/18/2013	Faculty, staff	1000	NO INFO
UNC	Tar Heel Bike Kick Off	10/25/2013	Faculty, staff, students	NO INFO	NO INFO
UNC	UNC Wellness Center Health & Wellness Fair	11/2/2013	Faculty, staff, students	NO INFO	NO INFO
Wake Tech	Main Campus Open House--table with literature	8/24/2013	Students and parents	1000	Cards, posters and lights
Wake Tech	North Campus Student Government Association gathering - booth with literature	9/3/2013	students	1500-2000	Cards, posters and lights
William Peace University	Pacer Camp	Aug-13	New incoming students and parents	900	
William Peace University	Fall Orientation	Aug-13	New incoming students and parents	400	
William Peace University	Welcome Week	Sep-13	Students, faculty, staff	1000+	

Appendix D: Law Enforcement Workshop Evaluation Questionnaire

PRE-WORKSHOP QUESTIONNAIRE

For questions 1-4, please circle only ONE answer from the choices available.

1. A motorist approaching a person stepping off a curb at an uncontrolled intersection should:
 - A. Slow down or stop until the pedestrian crosses to the other side of the roadway
 - B. Honk his/her horn to alert the pedestrian of their presence
 - C. Change lanes, if possible, to get around the pedestrian
 - D. Alert the local police to safety issues posed by jaywalkers
 - E. I don't know

2. When is it legal for a pedestrian to cross a street mid-block?
 - A. Never
 - B. When there is enough room for cars to slow down for them
 - C. When they do not impede traffic and are not crossing between two adjacent signalized intersections
 - D. When they're in a school zone or a commercial district
 - E. I don't know

3. Which of the following statements is NOT a North Carolina Law?
 - A. When a sidewalk is available, pedestrians must use the sidewalk instead of walking on the roadway
 - B. When a vehicle is stopped for a pedestrian, motorists approaching from the rear may overtake and pass the stopped vehicle if the adjacent lane is clear
 - C. Motorists must yield the right-of-way to pedestrians when making a right turn on red
 - D. Pedestrians cannot impede the regular flow of traffic by willfully standing, sitting, or lying on the roadway
 - E. I don't know

4. What best describes the current pedestrian safety operation plans in your department/unit?
 - A. We have been performing pedestrian safety operations regularly for MORE than 6 months
 - B. We have been performing pedestrian safety operations regularly for LESS than 6 months
 - C. We intend to perform a pedestrian safety operation in the next 6 months
 - D. We intend to perform a pedestrian safety operation in the next year
 - E. We have no plans for conducting pedestrian safety operations in the next 6 months
 - F. I don't know or not applicable

For questions 5-20, please state your level of agreement or disagreement with each statement by circling one of the numbers on the right, using the scale below.

Disagree Completely	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Completely
1	2	3	4	5	6

5. I am familiar with the laws protecting pedestrian safety in North Carolina.	1	2	3	4	5	6
6. Motorists who do not follow traffic laws pose a serious threat to pedestrian safety.	1	2	3	4	5	6
7. Keeping pedestrians safe is an important part of my job.	1	2	3	4	5	6
8. Pedestrian laws are difficult to enforce.	1	2	3	4	5	6
9. My colleagues/ I have adequate resources to use toward making our community safer for pedestrians.	1	2	3	4	5	6
10. I have the support of my command staff to perform pedestrian safety operations.	1	2	3	4	5	6

Disagree Completely	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Completely
1	2	3	4	5	6

11. There is NOT enough pedestrian-focused training available that can help me do my job better.	1	2	3	4	5	6
12. My department/unit could perform a pedestrian crossing operation.	1	2	3	4	5	6
13. Enforcing pedestrian safety is a worthwhile endeavor.	1	2	3	4	5	6
14. On an average shift, I do not have time to enforce laws to protect pedestrians.	1	2	3	4	5	6
15. If I enforce pedestrian safety laws, more drivers will yield to pedestrians in marked crosswalks.	1	2	3	4	5	6
16. I can help prevent crashes by enforcing pedestrian/motorist laws.	1	2	3	4	5	6
17. Pedestrian safety does not need routine enforcement.	1	2	3	4	5	6
18. I have been thinking that my unit should work on planning a crosswalk enforcement operation within the next 6 months.	1	2	3	4	5	6
19. During the next 6 months, I plan to routinely enforce drivers yielding at crosswalks.	1	2	3	4	5	6
20. It is likely that my unit/department will enforce pedestrian laws regularly during the next 6 months.	1	2	3	4	5	6

21. How long have you been in law enforcement? _____

22. What is your rank or class title? _____

23. Do you have the authority to make decisions regarding whether or not to perform pedestrian safety enforcement (please circle one)?

Yes No

24. Are you currently part of a (please circle all that apply):

Bicycle Squad Motorcycle Squad Vehicle Squad Other (specify): _____

25. What setting do you work in (please circle one):

University/Campus Municipality County Other (specify): _____

26. What other pedestrian-focused enforcement training have you received before this workshop (please circle all that apply)?

The course last year at NCSU None Another course (specify): _____

POST-WORKSHOP QUESTIONNAIRE

For questions 1-4, please circle only ONE answer from the choices available.

1. A motorist approaching a person stepping off a curb at an uncontrolled intersection should:
 - A. Slow down or stop until the pedestrian crosses to the other side of the roadway
 - B. Honk his/her horn to alert the pedestrian of their presence
 - C. Change lanes, if possible, to get around the pedestrian
 - D. Alert the local police to safety issues posed by jaywalkers
 - E. I don't know

2. When is it legal for a pedestrian to cross a street mid-block?
 - A. Never
 - B. When there is enough room for cars to slow down for them
 - C. When they do not impede traffic and are not crossing between two adjacent signalized intersections
 - D. When they're in a school zone or a commercial district
 - E. I don't know

3. Which of the following statements is NOT a North Carolina Law?
 - A. When a sidewalk is available, pedestrians must use the sidewalk instead of walking on the roadway
 - B. When a vehicle is stopped for a pedestrian, motorists approaching from the rear may overtake and pass the stopped vehicle if the adjacent lane is clear
 - C. Motorists must yield the right-of-way to pedestrians when making a right turn on red
 - D. Pedestrians cannot impede the regular flow of traffic by willfully standing, sitting, or lying on the roadway
 - E. I don't know

4. What best describes the current pedestrian safety operation plans in your department/unit?
 - A. We have been performing pedestrian safety operations regularly for MORE than 6 months
 - B. We have been performing pedestrian safety operations regularly for LESS than 6 months
 - C. We intend to perform a pedestrian safety operation in the next 6 months
 - D. We intend to perform a pedestrian safety operation in the next year
 - E. We have no plans for conducting pedestrian safety operations in the next 6 months
 - F. I don't know or not applicable

For questions 5-20, please state your level of agreement or disagreement with each statement by circling one of the numbers on the right, using the scale below.

Disagree Completely	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Completely
1	2	3	4	5	6

5. I am familiar with the laws protecting pedestrian safety in North Carolina.	1	2	3	4	5	6
6. Motorists who do not follow traffic laws pose a serious threat to pedestrian safety.	1	2	3	4	5	6
7. Keeping pedestrians safe is an important part of my job.	1	2	3	4	5	6
8. Pedestrian laws are difficult to enforce.	1	2	3	4	5	6
9. My colleagues/ I have adequate resources to use toward making our community safer for pedestrians.	1	2	3	4	5	6
10. I have the support of my command staff to perform pedestrian safety operations.	1	2	3	4	5	6

Disagree Completely	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Completely
1	2	3	4	5	6

11. There is NOT enough pedestrian-focused training available that can help me do my job better.	1	2	3	4	5	6
12. My department/unit could perform a pedestrian crossing operation.	1	2	3	4	5	6
13. Enforcing pedestrian safety is a worthwhile endeavor.	1	2	3	4	5	6
14. On an average shift, I do not have time to enforce laws to protect pedestrians.	1	2	3	4	5	6
15. If I enforce pedestrian safety laws, more drivers will yield to pedestrians in marked crosswalks.	1	2	3	4	5	6
16. I can help prevent crashes by enforcing pedestrian/motorist laws.	1	2	3	4	5	6
17. Pedestrian safety does not need routine enforcement.	1	2	3	4	5	6
18. I have been thinking that my unit should work on planning a crosswalk enforcement operation within the next 6 months.	1	2	3	4	5	6
19. During the next 6 months, I plan to routinely enforce drivers yielding at crosswalks.	1	2	3	4	5	6
20. It is likely that my unit/department will enforce pedestrian laws regularly during the next 6 months.	1	2	3	4	5	6

Please provide any other comments or feedback regarding the law enforcement training course or your plans to conduct pedestrian safety operations:

Thank you for your time in attending this training and completing this form!

Appendix E: Pedestrian Data Collection Procedures and Forms

Motorist Yielding Data Collection Procedures and Protocol

Adapted from original source material developed by Ron Van Houten¹

When and Where to Collect Data

Data will only be collected on weekdays during dry conditions (i.e., no wet pavement) and clear visibility. Ideal data collection times are during peak travel times: 8:00-10:00AM, 11:30-1:30PM, and 3:00-5:00PM. A specific schedule of sites and times will be provided, as well as a range of dates in which data collection can occur.

Materials to Bring

When collecting data, data collectors will bring the following with them to each site:

- Measuring wheel
- 2 traffic cones for marking dilemma zones
- Protocols and data collection forms (Appendix A)
- Pens and pencils
- Clipboard (or something to write on)
- Watch
- Cell phone
- Photo identification
- Copy of study information sheet (Appendix B)
- Hat/Sunglasses or sunscreen if necessary
- Cash or coins for parking (if needed)
- Camera and/or video recording device (optional)
- Maps/GPS to navigate you to sites (optional)
- Lunch and plenty of water

Data collectors should wear normal, comfortable attire and comfortable shoes with closed toes and heel (i.e., no flip-flops). Neutral colored clothing is recommended. Some sort of “distraction” (i.e. a newspaper, book, cellphone) may be helpful for less busy or city crosswalks may be helpful in making staged pedestrian look more natural.

Calculation of the Dilemma Zone

Before collecting data, the research team will calculate the dilemma zone for each crosswalk site. Calculating the distance beyond which a motorist can safely stop for a pedestrian is essentially the same problem as calculating the distance in advance of a traffic signal that a motorist driving the speed limit can stop if the traffic signal changes to red. Traffic engineers use the signal-timing formula (Institute of Transportation Engineers, 1985), which takes into account driver reaction time, safe deceleration rate, the posted speed, and the grade of the road to calculate this interval for the amber indication. This formula will be used to measure the distance beyond which a driver could easily stop for a pedestrian by multiplying the time by the speed limit, and a landmark will be placed at this distance on each side of each crosswalk by placing a traffic cone near the curb or edge of the road. Be sure the cone does not create an obstacle for pedestrians on the sidewalk. Anyone inside the calculated distance may not have sufficient distance to safely stop for a pedestrian in the crosswalk and therefore is not scored as not yielding (though the can still be scored as yielding). Anyone who has not yet passed the traffic cone is assumed to have sufficient distance to safely stop before the crosswalk.

¹ <http://homepages.wmich.edu/~s9crowle/SCOPE%20OF%20WORK-2.pdf>

The formula for the calculating the dilemma zone is $Y = t + V/(2a+2Ag)$ where:

Y= Yellow clearance interval in seconds

t= reaction time (use 1 second)

V= approach speed in ft/sec (use posted speed limit)

a= deceleration rate of a vehicle (use 10 ft/sec/sec)

A= Acceleration due to gravity (use 32.2 ft/sec/sec)

g= percent grade in decimal form (+for upgrade,- for downgrade; this is unknown but considered to be 0).

When the data collectors arrive at a site, they will measure the dilemma zone from the outside edge of the crosswalk line closest to approaching traffic and then mark the end of the zone with a traffic cone. Data collectors will check to make sure that the cone is visible to them from the marked crosswalk. Depending on the posted speed limit, the dilemma zone will be:

- 40 MPH Posted speed: 231 ft
- 35 MPH Posted speed: 183 ft
- 30 MPH Posted speed: 141 ft
- 25 MPH Posted speed: 104 ft
- 20 MPH Posted speed: 72 ft

If the speed is not posted, the data collectors will use the dilemma zone for a 35MPH speed limit. No sites are posted at higher than 35 MPH. However, if you feel that traffic is traveling at significantly higher speeds than the posted speed limit, then use caution and use the 40MPH dilemma zone distance (231 ft). Note the dilemma zone distance used on the data collection form at every visit.

Observer Positioning on Site

Two people will collect data at each site. One will serve as the person staging pedestrian crossings while the other will record all behavioral measures. The recorder will try to set up in a location with a clear view of traffic in both directions but far enough away from the crossing to not raise the attention of passing traffic or pedestrians. The person staging crossings will stand away from the crossing (so as to not display intent to cross) until the conditions are right to follow the staged crossing procedure below.

Staged Crossing Procedure for Uncontrolled Crosswalks

The pedestrian protocols used to collect motorist yielding data will be consistently followed to ensure a standard and safe crossing procedure at uncontrolled crosswalks. These protocols have been selected to provide a standard way of crossing that is compliant with the uniform vehicle code and to ensure the safety of the pedestrian crossing the street. The following protocol will be employed at uncontrolled crosswalks (marked crosswalks that are not controlled by a traffic signals or stop sign). This protocol has been employed in other studies to measured motor vehicle-pedestrian conflicts (a crash surrogate measure) and has not been associated with conflicts.

1. Step with one foot into the crosswalk when an approaching vehicle is **just beyond** the marked dilemma zone (the dilemma zone is the measured distance for the vehicle speed limit and road grade, which ensures a safe stopping distance for vehicles traveling at the posted speed). Make sure that all traffic coming from the opposite direction is beyond the traffic cone. Observer should make note of opposite side traffic location so as to score correctly. If there is on-street parking or a bicycle lane it will be necessary to walk to and stop at the lane line to view approaching traffic and so drivers of approaching vehicles can see the pedestrian. Pedestrians shall not cross into the travel lane until the driver significantly slows or stops his or her vehicle to allow the pedestrian to safely cross.
2. If the vehicle makes no attempt to stop, do not proceed to cross and score the vehicle as not yielding. Also, score subsequent vehicles that do not stop as not yielding.
3. On multilane roads, if the vehicle clearly begins to yield and the next lane is free, begin crossing. **Always stop at the lane line for the second travel lane and make sure the next lane is clear before proceeding.** Score the vehicle that slowed or stopped as yielding. Do not score any vehicles traveling behind the yielding vehicle as they were forced to yield.
4. If a vehicle in the second lane makes no attempt to slow and stop, let it pass and score it as not yielding.
5. If the vehicle yields or there is a large gap in traffic, proceed to the median (if applicable) or finish crossing to the other side of the street to begin to measure yielding for the other direction of traffic. Do not create a situation where you will be trapped in the centerline if there is no median—be sure you will be able to cross the full street safely.
6. If a vehicle yields that is **inside** the marked dilemma zone, score the driver as yielding, but if they do not yield, do not score them at all. **All vehicles that have not yet entered the marked dilemma zone when you are halfway across the 2nd travel lane that do not slow or stop to allow you to cross should be scored as not yielding.**

These procedures will be carefully adhered to in order to gather enough data to calculate motorist yielding rates at each location. A minimum of 25 staged crossings will be performed at each site. If possible, data collectors will also gather data on any natural crossings observed during the 2-hour time period. When staged crossings are completed, the staged pedestrian can begin collecting data on natural crossings at the same time as the other recorder gathers data. The data collectors should note on the forms when they are both collecting data at the same time, and should avoid comparing decisions or talking about the data during this time—the data collection should be independent.

Measures

The following measures will be recorded using the data collection shown in Appendix A.

Driver yielding to pedestrians

Observers will score the percentage of motorists yielding and not yielding to pedestrians. A motorist will be scored as yielding if he or she stops or slows to allow the pedestrian to cross. A motorist will be scored as not yielding if he or she passes in front of the pedestrian but would have been able to stop when the pedestrian arrived at the crosswalk. We will use the formula used by traffic engineers to determine whether a driver could have safely stopped at a traffic signal that was presented under the calculation of dilemma zone to determine

whether the driver could have stopped for a pedestrian. Motorists who have passed this landmark when a pedestrian enters the crosswalk can be scored as yielding to pedestrians but not as failing to yield, because they have passed a point in which there was sufficient time to yield. Motorists beyond the landmark when the pedestrian entered the crosswalk can be scored as yielding or not yielding because they have sufficient distance to safely stop. When the pedestrian first starts to cross, only drivers in the first half of the roadway will be scored for yielding. Once the pedestrian approaches within a half lane of the median, the yielding behaviors of motorists in the remaining lane(s) will be scored.

Conflicts between motorists and pedestrians

A conflict between a motorist and a pedestrian will be scored whenever a motorist suddenly stops or swerves to avoid striking a pedestrian or whenever a pedestrian jumps, runs, or suddenly steps or lunges backward to avoid being struck by a vehicle. Because pedestrians will be following the safe crossing protocol these types of incidents should be rare events. They may be more likely to occur when observing natural crossings.

Driver passed or attempted to pass stopped vehicle

A driver is recorded as passing a stopped vehicle if they passed a vehicle that was yielding to the pedestrian. A driver is recorded as attempting to pass a stopped vehicle if they did not yield until after they were alongside, or past, a yielding vehicle and hence then seeing the pedestrian, or if the driver behind a yielding vehicle changed lanes to go around but then yielded.

Car behind yielding car performs rapid deceleration (Hard Brake)

A car is recorded as performing rapid deceleration if they were behind a yielding car and the front-end of the car was observed taking a sudden movement to the ground.

Car braking closely to the crosswalk (Close Stop)

A car is recorded as braking closely to the crosswalk if they brake within 10 feet of the crosswalk. The data collection team should measure off the distance 10 feet from the edge of the crosswalk closest to approaching traffic and place a marker (tape, a rock, sidewalk chalk, etc) there to help them gauge if cars stopped or yielded closer than this distance.

Pedestrian trapped at median or centerline

A “trapped” situation may occur if a pedestrian makes it to the center of the road but vehicles coming from the other side do not yield, leaving the pedestrian stranded in the median or at the centerline. A centerline trapping should not occur with staged crossings, but could be observed in natural crossings. A median trapping situation will not be applicable unless a median is present.

Pedestrian outside the crosswalk

For natural observations, record any instances where a pedestrian walks more than 10 feet outside either edge of the crosswalk.

Entering Recorded Data

Once data has been collected, data will need to be transferred from the paper forms into raw and aggregate tables using Microsoft Excel. Upon returning to the office with completed data forms, follow these steps to ensure data is entered accurately and consistently.

1. Scan completed data forms into PDF format
2. Open the Raw Data Excel File and use a copy of the Template worksheet to enter each data form. Be sure to transfer all fields from the paper form into the template, including any relevant notes. Once complete, rename the worksheet using the following structure:

First Letter of City-Major Road Name-Month Number-Day Number

3. Once all Raw Data has been entered, transfer the data from each new worksheet into the Aggregate Data Excel File. For each visit, there will be one row for Staged Crossings and one row for Natural Crossings. Transfer the number of vehicles yielding and not yielding, as well as the date, observer name, pedestrian name, and all other conflicts observed.
4. Once all data entry is complete, review both the Raw Data and Aggregate Data tables against the original forms to ensure consistency. When all fields have been checked, email scanned forms, Raw Data, and Aggregate Data tables to Dan Gelinne (gelinne@hsrc.unc.edu).

Inter-observer Agreement

A subset of the data collected will be used to calculate inter-observer agreement and procedural integrity. A measure of inter-observer agreement will be computed by dividing the number of times both observers agreed on the occurrence of each driver behavior by the number of times they agreed plus the number of times they disagreed on its occurrence. Inter-observer agreement will also be computed for the treatment integrity measure described below. A measure of inter-observer agreement will be computed at least once at each site, using the data collected by both recorders of natural crossings, after all staged crossings have been performed. For this reason, during the recordings of natural events, data collectors should not discuss the data they are collecting.

Description of Roadway Settings

Each crosswalk setting has already be described in terms of number of lanes, stop control, speed, intersection configuration, crossing type, and other surrounding factors such as significant landmarks, parked cars and bus stops. At the bottom of the tally sheet, data collectors will record any unusual circumstances that may have impacted data collection or the behaviors observed, including construction, congestion, events, obstructions, law enforcement or crossing guards present, etc.

General Safety

Data collectors will be standing near roadway intersections to collect data. Use caution traveling to the locations, including crossing roadways near the sites. Follow traffic laws at all times. Maintain a constant awareness of your surroundings, including traffic conditions and social situations, and ensure that data collection does not interfere with your attention to safety. If you feel unsafe, uncomfortable, or threatened at any time, stop data collection and move to a safer location.

Appendix A: Data Collection Form

Intersection or midblock crossing name: _____

Weather: _____ Date: _____ Observer name: _____

Data collection start time: _____ end time: _____ DZ measure: _____

Event	Yield	NO Yield	Conflict	Attempted to Pass	Hard Brake	Close Stop	Trapped Ped	No X-walk use	Notes (number of vehicles, distraction, etc.)
Staged Pedestrian Crossings: NAME OF STAGED PEDESTRIAN _____									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
Natural Pedestrian Crossings									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Other notes (construction, events, weather, traffic conditions, etc.):

Appendix B: Study Information Sheet

July 3, 2012

Data collectors, working on behalf of the UNC-Chapel Hill Highway Safety Research Center, are conducting studies of driver and pedestrian behavior at marked crosswalk throughout the Triangle area as a part of a project to evaluate a campaign (funded by the National Highway Traffic Safety Administration and the North Carolina Department of Transportation) to improve pedestrian safety. No personal or vehicle identifying information is being collected. Data collection will occur on weekdays throughout the months of July 2012 through February 2013. Locations for data collection include:

- In Durham:
 - University @ Chapel
 - Gregson Near Main (at Brightleaf)
 - Anderson @ Yearby
 - Lamond @ Gregson
 - Fayetteville @ Peekoe
 - Tobacco Trail Near Riddle
- In Raleigh:
 - Wilmington between Hargett and Martin
 - Wilmington near New Bern (by Capitol)
 - Blount Street between Martin and Hargett
 - Martin @ State
 - Martin @ Bloodworth
 - South near Fayetteville (between Wilmington and Salisbury)

If you have any questions about the data collection procedures or how the data will be used, please contact the project's Principle Investigator: Laura Sandt at sandt@hsrc.unc.edu or 919-962-2358.

Appendix F: Bicyclist Data Collection Procedures and Forms

Bicyclist Data Collection Procedures and Forms

When and Where to Collect Data

Data will only be collected on weekdays during dry conditions (i.e., no wet pavement). Visibility conditions may differ in order to gauge the use of bicyclist lights. Ideal data collection times are during peak bicycle-commute travel times: 8:00-10:00AM and 5:00-7:00PM. A specific schedule of sites and times will be provided, as well as a range of dates in which data collection can occur.

Materials to Bring

When collecting data, data collectors will bring the following with them to each site:

- Protocols and data collection forms (Appendix A)
- Pens and pencils
- Clipboard (or something to write on)
- Watch
- Cell phone
- Measuring Tape to determine bike lane width
- Photo identification
- Copy of study information sheet (Appendix B)
- Hat/Sunglasses or sunscreen if necessary
- Cash or coins for parking (if needed)
- Camera and/or video recording device (optional)
- Maps/GPS to navigate you to sites (optional)
- Snacks and plenty of water

Data collectors should wear normal, comfortable attire and comfortable shoes with closed toes and heel (i.e., no flip-flops).

Observer Positioning on Site

One person will collect data at each site, recording all behavioral measures. The recorder will try to set up in a location with a clear view of bicycle traffic in both directions but far enough away from the road to not raise the attention of passing traffic, bicyclists or pedestrians. They will set up at the same location on each site for every subsequent observational session, at a similar time of day.

These procedures will be carefully adhered to in order to gather enough data on all measures at each location. The observations will occur over a range of 2-hour time periods.

Measures

The following measures will be recorded using the data collection shown in Appendix A.

Helmet Use

Observers will score the percentage of bicyclists wearing or not wearing a helmet. A bicyclist will be scored as wearing a helmet if he or she has a protective device on their head. There will not be a determination regarding whether the helmet adequately fits the rider or is buckled. A bicyclist will be scored as not wearing a helmet if he or she has nothing on their head, or if they are only wearing a hat, scarf, or other type of non-protective headwear.

Device Use

The use of a device will be scored whenever a bicyclist is observed using a cellular phone, head phones, an ear piece, or other type of electronic device. They will be scored as not using a device if the bicyclist is not using these devices. If headwear or other factors disable the observer from noting the use of a device, it will be recorded as "Unknown/missed."

Use Appropriate Turning Hand Signals

A bicyclist is recorded as using appropriate hand signals if they perform the adequate hand signals regarding their intended path. Adequate means using an extended left arm to designate a left turn and a perpendicular upward-facing left arm to designate a right turn. The bicyclist will be recorded as 'Attempt' if he or she used a hand motion, but the motion was wrong (i.e. he or she used their right arm) or inappropriate for the intended direction of travel. The bicyclist will be recorded as no if there was no use of hand signals, even though the direction of travel warranted using a signal. The bicyclist will be recorded as 'N/A' if it was not necessary to signal based on the direction of travel or the site.

Direction of Travel

The direction of travel of each bicyclist will be noted by the observer. The bicyclist will be recorded as travelling 'With traffic on road' if he or she is riding the same direction as traffic on the road or (if available) the bicycle lane. The bicyclist will be recorded as travelling 'With traffic on sidewalk' if he or she is riding the same direction as traffic but is on the sidewalk. The rider will be recorded as "Against traffic on road" if they are travelling on the roadway against the indicated flow of traffic, and "Against traffic on sidewalk" if they are travelling on the sidewalk on the side of the street that is against the indicated flow of traffic. If the bicyclist moves from the road to the sidewalk, they will be counted as travelling on the sidewalk.

Obeys Traffic Signals

The observer will note whether the bicyclist observes all applicable traffic signals relating to the intended direction of travel. A bicyclist will be recorded as adhering to traffic signals if he or she follows the necessary traffic signals. They will be recorded 'no' if there was no attempt to stop at the intersection. They will be recorded as "N/A" if they did not travel through the intersection.

Bike Light Use

A bicyclist will be scored as using a headlamp, a tail lamp, both, or none. A 'yes' will be recorded if the bicyclist is using both a headlamp and a tail lamp. If one only, the observer will note in the column of 'one only' an 'h' (for head lamp) or 't' for tail lamp. The recorder will score the bicyclist as 'none' if no light is being used, even though conditions merit the use of such lights. The observer will record 'N/A' if conditions are clear and the amount of daylight does not merit the use of lights.

Recording Lighting and Weather Conditions

Additionally, lighting and weather conditions will be observed and recorded. The lighting will be defined as either 'bright/clear' if the conditions were clear and/or sunny or 'cloudy/flat' if the lighting conditions were cloudy and/or otherwise flat. The weather conditions were recorded as 'sunny,' 'cloudy,' 'overcast,' 'partly sunny,' 'mostly sunny,' or 'partly cloudy.' Additionally, a range of temperatures is estimated, narrowed to a degree of 10 (i.e. 40s, 50s, etc.).

Entering Recorded Data

Once data has been collected, data will need to be transferred from the paper forms into raw and aggregate tables using Microsoft Excel. Upon returning to the office with completed data forms, follow these steps to ensure data is entered accurately and consistently.

1. Scan completed data forms into PDF format, and save to the S Drive "Bicycle Collection Data" folder within the Evaluation folder.
2. Aggregate data into a single form, "Bicycle Data Entry Form," based on the observation data from each site visit.
3. Once all data entry is complete, review the Aggregate Data tables against the original forms to ensure consistency.

Description of Roadway Settings

The locations chosen each have a bicycle lane, an adjacent sidewalk, a traffic signal, and the observation is occurring at an intersection where the bicyclist has the option to continue straight or turn. However, each site has some unique characteristics:

- Cameron at Pittsboro: The intersection is a T, with Pittsboro originating at the location. Pittsboro is a one way street heading south. Most bicycle travelers are heading east on Cameron toward UNC's campus. The sidewalk is high above and separated from the road on both sides of Cameron. Cameron is two-lanes (one in each direction) to the west of Pittsboro, but to the East it is 4-lanes, with one lane for travel east, two lanes for travel turning left to Pittsboro, and one lane for travel west. The traffic light for those heading west away from campus on Cameron is continually green, except when pedestrians actuate the signal to cross Cameron. Often there are traffic flow gaps for those travelling West from Cameron to Pittsboro, due to signal timing at Cameron and Columbia. The bicycle lane is approximately 3.5' wide in each direction. The speed limit is 25 MPH.
- Hillsborough at Horne: The intersection is a 4-way intersection, with Horne Street a one way street heading south toward campus. There are pedestrian refuge islands between traffic on Hillsborough Street, and crosswalks in all locations. Traffic signals are longer for travel on Hillsborough than for those traveling on Horne. There are bicycle lanes on Hillsborough in both directions, though no bicycle lanes designated on Horne. Substantial bicycle travel occurs on Founders Drive running parallel to Hillsborough Street. These riders were counted when observed, with N/A recorded for the "Obeys Traffic Signals" measure. The bicycle lane is approximately 5' wide, and the speed limit was not posted.
- Campus at Anderson: The intersection is a 4-way intersection, with most bicycle travel heading east away from Duke's West campus. The bicycle lane ends approximately 100 yards before the intersection for those travelling east, and there is a lane designated for left-turns or straight travel. The striping of the lanes is worn and difficult to identify. The bicycle lane is approximately 4' wide. The speed limit is 25 MPH.

General Safety

Data collectors will be standing near roadway intersections to collect data. Use caution traveling to the locations, including crossing roadways near the sites. Follow traffic laws at all times. Maintain a constant awareness of your surroundings, including traffic conditions and social situations, and ensure that data collection does not interfere with your attention to safety. If you feel unsafe, uncomfortable, or threatened at any time, stop data collection and move to a safer location.

Attachment A: Data Collection Form

Bicycle Data Sheet

Location: _____ Date: _____ Light Conditions (bright, clear, cloudy, flat): _____ Time Period: _____ AM / PM
 Collector's Name: _____ Weather Conditions (cloudy, sunny, etc. and approximate temperature: _____

Helmet Use		Device Use		Use Appropriate Turning Hand Signals				Direction of Travel				Obeys Traffic Signals			Bike Light Use (Headlamp AND Tail lamp)				
Yes	No	Yes	No	Yes/All	Some	No	N/A	With traffic on road	With traffic on sidewalk	Against traffic on road	Against traffic on sidewalk	Yes	No	N/A	Yes	One only	None	N/A (daylight)	
Unknown/missed : :		Unknown/missed : :		Unknown/missed:				Unknown/missed:				Unknown/missed:			Unknown/missed:				
Sub-totals: -Yes: -No: -Unknown:		Sub-total: -Yes: -No: -Unknown:		Sub-total: -Yes/All: -Some: -No: -Not Applicable: -Unknown:				Sub-total: -With traffic on road: -With traffic on sidewalk: -Against traffic on road: -Against traffic on sidewalk: -Unknown:				Sub-total: -Yes: -No: -Not Applicable: -Unknown:			Sub-total: -Yes: -One only: -None: -Not Applicable: -Unknown:				
Total:		Total:		Total:				Total:				Total:			Total:				

Notes for the field:

1. For each bicyclist that passes, you should code a tally in all 6 “behavior” columns
2. Make tallies in the columns when you can ID a behavior; mark a tally in the “unknown” if you don’t have time to observe or if you can’t tell what column to put them in.
3. Deal with the “subtotals” and “totals” later
4. Ideally, the “totals” in each column will be the same and will be a way to check if you captured all 6 behaviors for every bicyclist
5. You can make notes on strange observations or events on the back page

Attachment B: Study Information Sheet

August 1, 2013

Data collectors, working on behalf of the UNC-Chapel Hill Highway Safety Research Center, are conducting studies of bicyclist behavior along main commuter corridors throughout the Triangle area as a part of a project to evaluate a campaign (funded by the North Carolina Department of Transportation) to improve bicyclist behavior. No personal or vehicle identifying information is being collected. Data collection will occur on weekdays throughout the months of August through November 2013. Locations for data collection include:

- In Durham:
 - Campus Drive at Anderson St
- In Raleigh:
 - Hillsborough Road at Horne St
- In Chapel Hill:
 - Cameron Blvd. at Pittsboro Road

If you have any questions about the data collection procedures or how the data will be used, please contact the project's Principle Investigator: Laura Sandt at sandt@hsrc.unc.edu or 919-962-235