

CHAPTER 3

BICYCLE DATA

CAMBRIDGE COMMUNITY SURVEY

As part of creating the Cambridge Bicycle Network Plan, an online survey was conducted during June 2014. The survey was open to anyone; although outreach about the survey was sent broadly throughout the community, most of the survey participants were people who ride bicycles regularly. Therefore, responses were not necessarily representative of the population of Cambridge or greater Boston. 733 valid responses were received.

The survey was designed to determine what kind of bicycle facilities are most comfortable for users and what will enable parents and guardians to feel that their kids can bike safely in the city. Survey questions focused on:

- + **Bicycling habits**
- + **Comfort with bicycling on different streets and various bicycle facility types**
- + **Children's bicycling habits and parents'/guardians' comfort allowing children to ride on different streets/facility types**

While a variety of important information can be taken from the results, the biggest takeaway is that people who bicycle in Cambridge would like to see more separated bicycle facilities and bicycle-friendly street designs. This applies whether the respondent rides frequently or rarely.



BICYCLIST COMFORT LEVELS

People were asked about their comfort levels riding a bicycle on a variety of different facility types -- on busy commercial streets and on non-commercial streets -- and sample photographs were shown for each condition. People were also asked a separate series of questions about bicycling with children, including similar questions about comfort levels on various road types and bicycle accommodations.

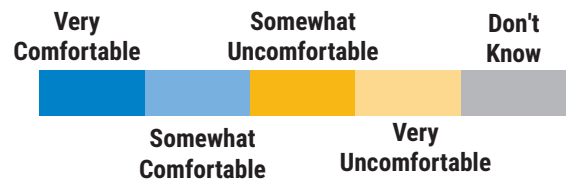
This section describes the highlights of the survey results. The full results of the survey can be found in Appendix B.

HOW DO PEOPLE FEEL BICYCLING ON COMMERCIAL STREETS?

Respondents were asked to rank how comfortable they would feel riding a bicycle on a busy commercial street based on facility type, including no accommodations at all, shared lane markings, a standard bike lane, a buffered bike lane, a separated bike lane, or raised cycle track. Protected bike lanes and raised cycle tracks both fall under the separated bike lane category, but were presented as separate facility types in the survey. Concerned bicyclists are defined as survey respondents who reported that they bike only some places or are not comfortable biking in the city.

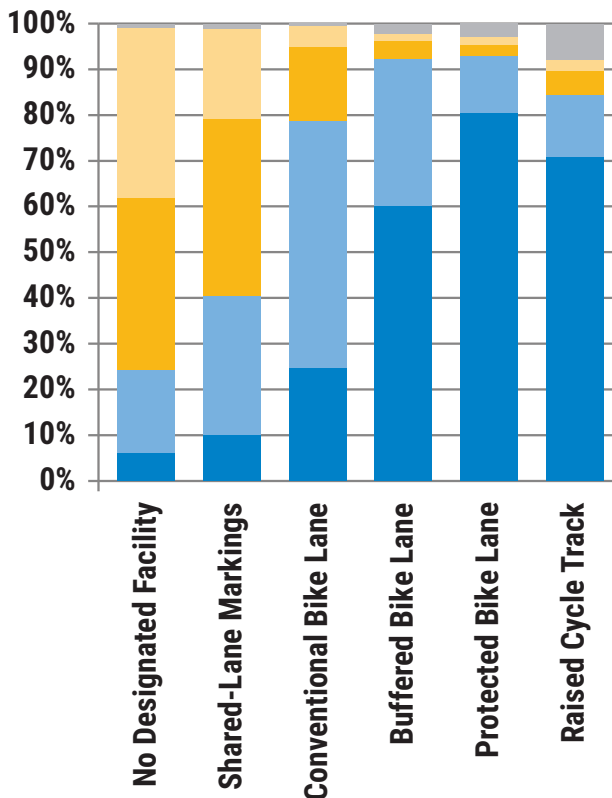
81% of all bicyclists and 68% of concerned bicyclists feel “very comfortable” on separated bicycle facilities.

Only 25% of all bicyclists and 4% of “concerned” bicyclists in the Cambridge feel “very comfortable” using conventional bicycle lanes.



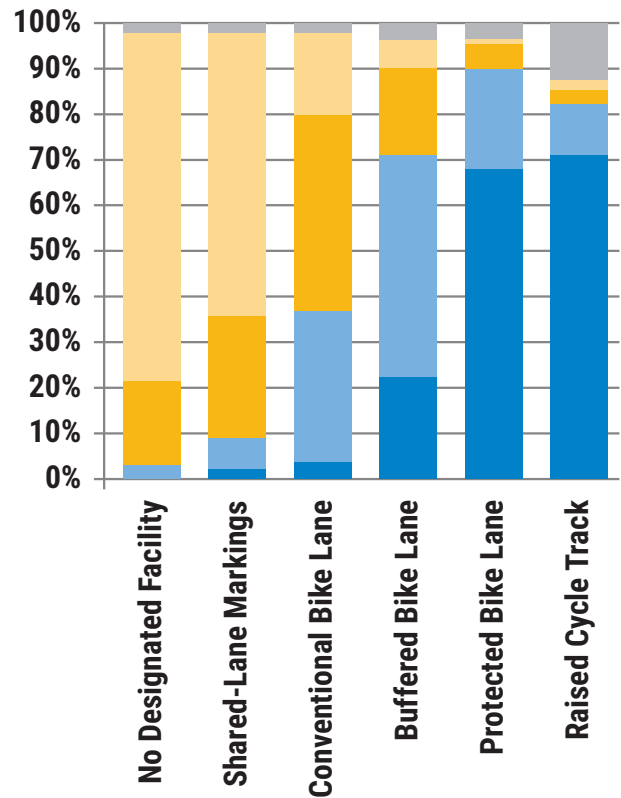
ALL RESPONDENTS

How comfortable do you feel with these bicycle facilities on busy, commercial streets?



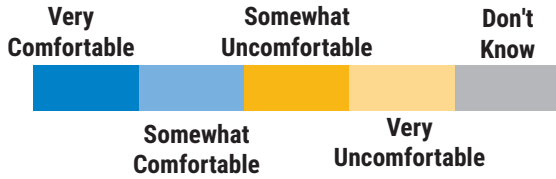
CONCERNED BICYCLISTS

How comfortable do you feel with these bicycle facilities on busy, commercial streets?

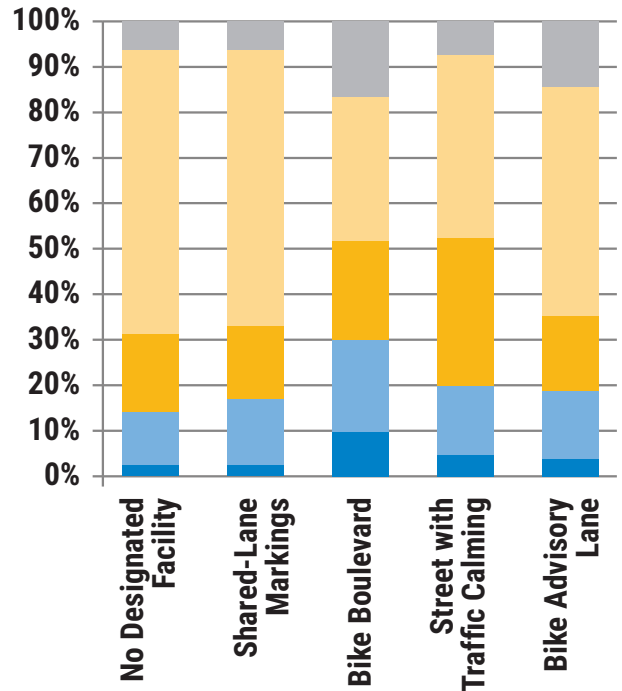


HOW DO PEOPLE FEEL BICYCLING WITH CHILDREN?

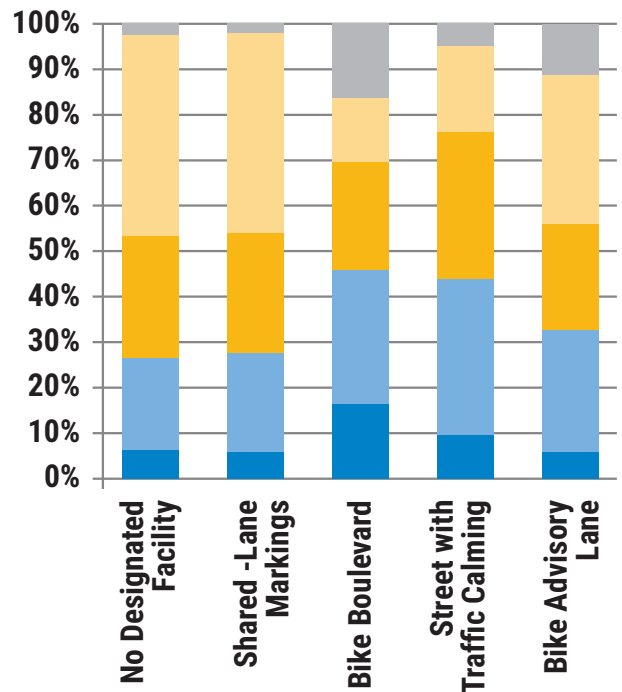
Respondents were asked about their comfort levels for children traveling on streets, either with an adult, or on their own. There is further detail in the survey that considers ages; the charts here are an overall summary.



How comfortable do you feel about your children on these bicycle facilities on non-commercial streets, **WITHOUT** an adult?



How comfortable do you feel about your children on these bicycle facilities on non-commercial streets, along **WITH** an adult?



HOW DO PEOPLE FEEL BICYCLING ON NON-COMMERCIAL STREETS?

Respondents were also asked about other street design treatments that would be relevant for noncommercial streets, such as traffic calming, bicycle priority lanes and bicycle boulevards. There was somewhat more uncertainty about some of these, primarily because of the lack of familiarity; while traffic calming is extensive in Cambridge, there are not yet bicycle boulevards or bicycle priority lanes in the city.



BICYCLE FACILITIES ON NON-COMMERCIAL STREETS



Street with shared lane markings



Street with shared lane markings



Bicycle boulevard



Bicycle boulevard



Street with traffic calming



Street with traffic calming

Figure 3.1: Examples of bicycle facilities on non-commercial streets shown to survey respondents. See Chapter 4 for details on various facility types.

Traffic calming can improve the bicycling experience by slowing vehicular speeds and making sharing the road more comfortable.

WHAT TYPES OF BIKE FACILITIES DO PEOPLE PREFER?

Survey respondents were asked to rate the importance of various bicycle facility options that they would like to see implemented in Cambridge.

Protected bicycle lanes received the highest rating, with 92% of respondents saying that implementing them in Cambridge is important, and two-thirds saying it was "very important."



What design features would you like to see implemented?

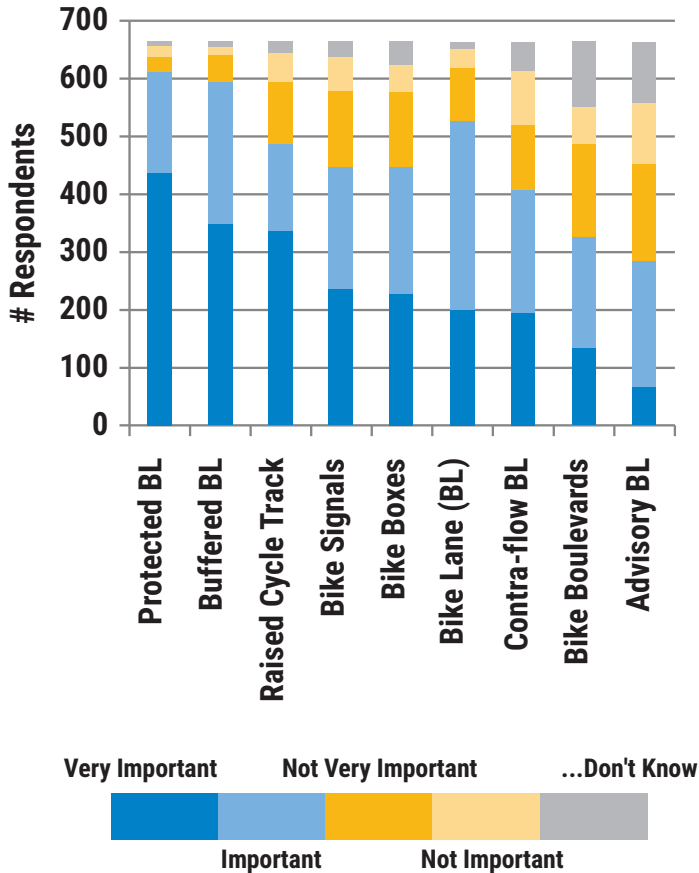


Figure 3.2: Concord Ave. separated bike lane (top)
 Figure 3.3: Vassar St. separated bike lane (middle)
 Figure 3.4: Norfolk St. contra-flow bike lane (bottom)

BICYCLE COUNTS

HOW MANY PEOPLE ARE CHOOSING TO TAKE TRIPS BY BIKE?

Cambridge has among the highest rates of walking and bicycling in the United States; almost a third of Cambridge residents walk or bicycle to work. Commute trips tend to be the focus of transportation analysis and surveys, yet they represent less than 20% of all trips taken. Other trip purposes – shopping, leisure, personal business, recreation – constitute approximately 80% of trips.

Between 2009 and 2011, Cambridge undertook a series of in-depth surveys to learn more about residents' travel patterns. Respondents used a bicycle for a trip approximately 6-9% of the time, depending upon the neighborhood and type of trip.¹ The 2011 CitySmart survey showed an average of 65% of bicycle users took a shopping trip on the survey day. The survey also found that people who use bicycles for transportation take more trips per day than users of any other mode – about 5 trips per day on average.

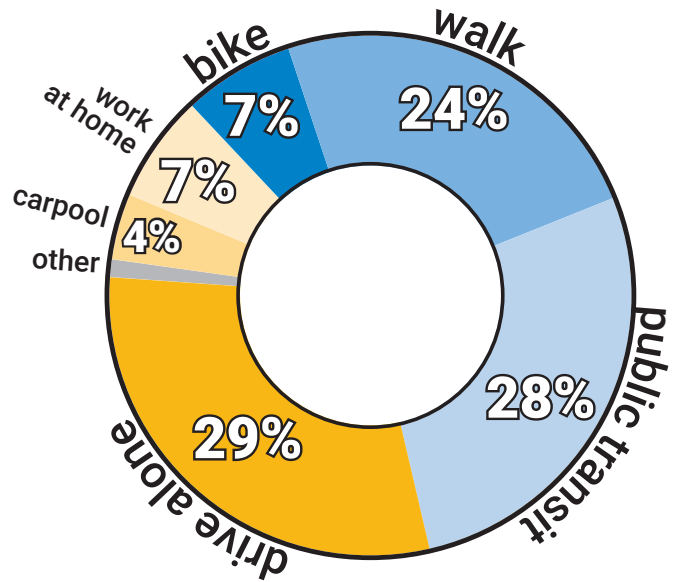


Figure 3.5:
**Mode Split for Cambridge Residents
Commuting to Work**

2011-2013 American Community Survey



Similarly, surveys of visitors to three of Cambridge's commercial districts (Porter Square, Central Square, and Kendall Square) show that a significant portion of visitors travel by bicycle. In recent surveys, 6% of visitors to Kendall Square traveled by bike, while 7% of Central Square visitors reported doing so. In Porter Square, a full 10% of respondents traveled by bicycle.

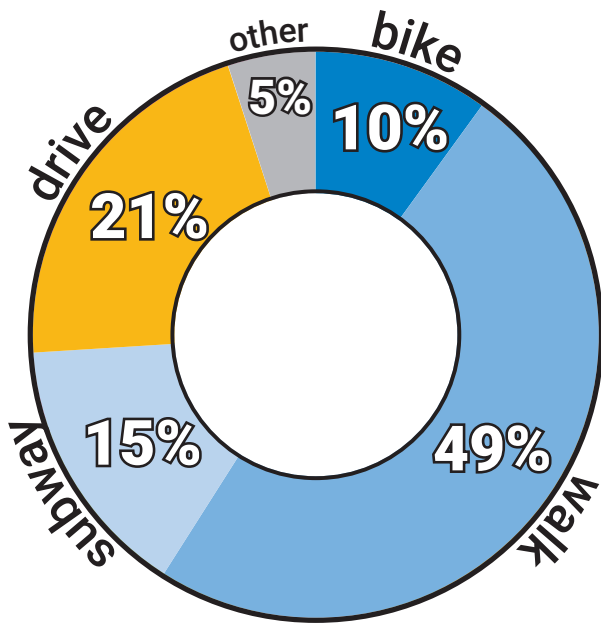


Figure 3.6:
Porter Square
Mode of Transit Survey

CitySmart 2011

HOW MANY BIKES DO WE OWN?

The 2009 CitySmart survey showed that 65% of households owned at least one bicycle and, on average, owned 2.6 bicycles. This means that for every 100 households, there were 169 bicycles.

Other studies in the U.S. also show substantial bicycle ownership rates: Florida Metro Area Study (2003): 1.4 bikes/household; Winston-Salem, NC (2005): 78% of households had at least one bike; National Household Travel Survey (2001): 1 working adult bike/household.

TRENDS IN NUMBERS

Cambridge conducts biennial counts of bicycle traffic at various intersections throughout the city. These help to illustrate trends throughout the city and how different projects have affected riders. While there has been a steady upward trend in bicycling, there was a slight decline in 2014 when compared with 2012. A closer look suggests that the extensive roadway construction on several major corridors in the city appears to be correlated with a decline in riders at affected intersections, while other intersections have seen dramatic increases in the number of riders. The charts here demonstrate some of the trends.



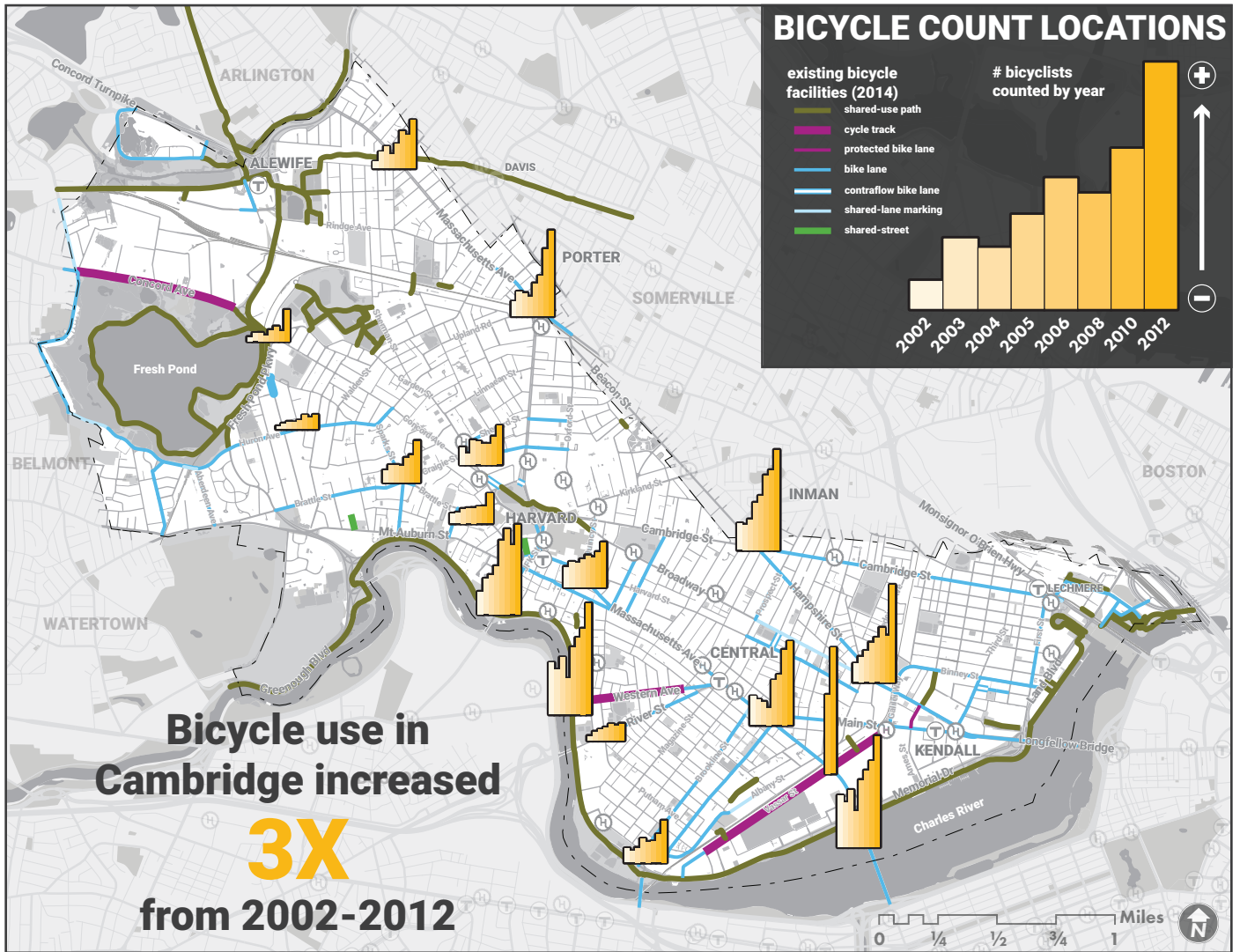


Figure 3.7: Cambridge Bicycle Count Map, 2002-2012, Combined AM and PM Peak Counts

Figure 3.8 shows the results of all of the counts the city has done since 2002. There was a drop in counts between 2012 and 2014, which was the first drop since counts began. The following section provides further analysis of the 2014 counts.

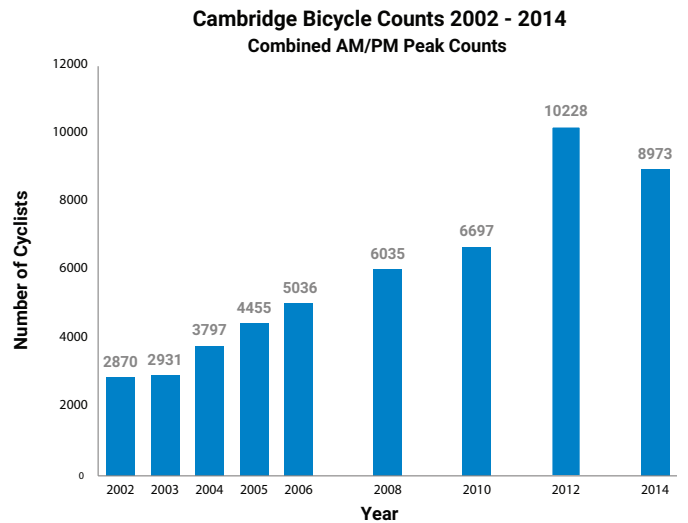


Figure 3.8: Cambridge Bicycle Count Chart, 2002-2014, Combined AM and PM Peak Counts

BIKE TRAFFIC AND CONSTRUCTION

When counts were conducted in 2014, extensive construction projects were underway throughout the city. Even if the end result of construction projects is better infrastructure and safer streets, the process of getting there can be months or even years of disruption and stressful travel.

By separating the data from the 2014 counts by streets with and without construction, we can see the impact construction has on ridership at an intersection (see Figure 3.9). Intersections with construction showed the expected drop in ridership between 2012 and 2014, while those with construction showed a continued upward trend in ridership. This analysis suggests that construction could be a factor in the overall drop

in ridership noted between 2012 and 2014 (see Figure 3.8). Pavement quality, noise, and exposure to construction are all factors bicyclists consider when choosing routes. During construction periods, some people may alter their route significantly, or they may choose another mode of transportation. When construction activities conclude, ridership numbers can be expected to rebound.

It is also important to note that a majority of intersections where counting occurred saw a net increase in bicycle traffic between 2012 and 2014. Out of seventeen counting locations, nine saw a net increase. In particular, four out of five locations along Massachusetts Ave where counts took place saw a net increase in bicycle traffic.

Impact of Construction on Bicycle Traffic

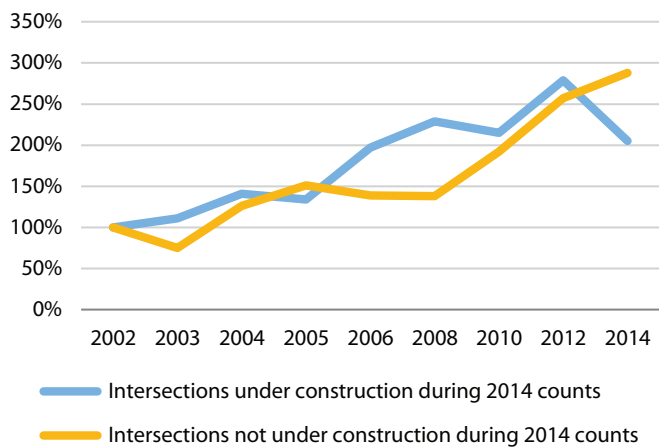


Figure 3.9: Net change in volumes at intersections with and without construction during 2014 counts.

Intersection	Net Change in Volume
Brattle St/Mason St	↓
Brattle St/Sparks St/Craigie St	↓
Broadway/Hampshire St	↓
Brookline St/Granite St	↑
Fresh Pond Pkwy/Concord Ave	↓
Huron Ave/Fayerweather St	↓
Garden St/Concord Ave	↑
Inman Square	↑
JFK St/Memorial Dr	↓
Lafayette Square	↑
Massachusetts Ave/Cedar St	↑
Massachusetts Ave/Vassar St	↑
Massachusetts Ave/Memorial Dr	↑
Porter Square	↓
Quincy Square	↑
River St/Putnam Ave	↑
Western Ave/Memorial Dr	↓

Figure 3.10: Cambridge Bicycle Counts, 2002-2014: Net Change by Count Location

MASSACHUSETTS AVE AND VASSAR STREET

Because bicycle count data only exists for the intersection of Massachusetts Ave and Vassar Street since 2010, this intersection is not included in the total counts when comparing data from before 2010. However, the number of bicyclists at this intersection has exploded, more than doubling between 2010 and 2014. One explanation for this rise is the separated bike lane on Vassar Street, which provides riders a sense of security that they do not have on other streets. Additionally, Vassar Street passes through MIT's campus to Kendall Square, both popular destinations with increasing amounts of development and concomitant jobs.

Combined Bicycle Counts at Massachusetts Ave & Vassar St

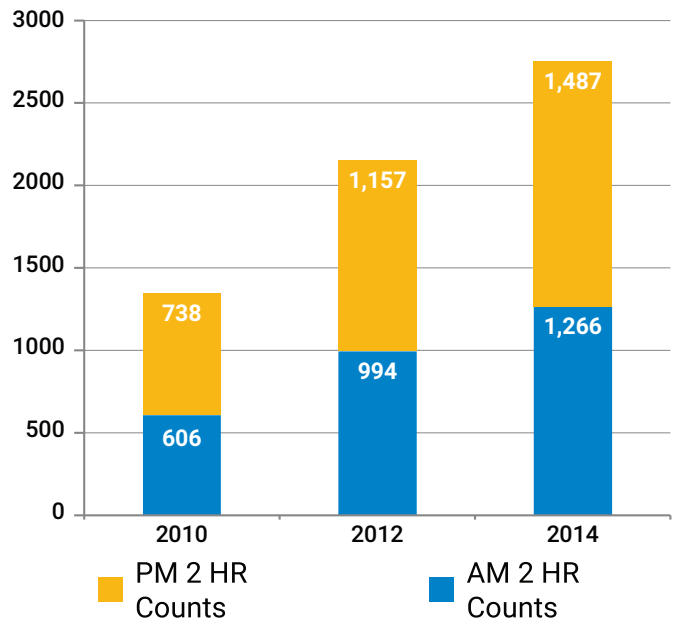


Figure 3.11: Cambridge Bicycle Counts, Massachusetts Ave and Vassar St, 2010-2014



Figure 3.12: The intersection of Vassar St and Massachusetts Ave.

COUNTING INTO THE FUTURE

In 2015, Cambridge installed a permanent bicycle counter in Kendall Square. Funded by a grant from the Helen & William Mazer Foundation, the “Eco-TOTEM”² counts bicyclists via in-ground loop detectors, and displays on the monitor how many people ride by. The counter displays daily and cumulative totals and also captures weather data to use for analytical purposes. The data can be used in many ways:

- + To publicly show how many people are bicycling and make a statement that “people who ride bikes count”
- + The 24/7 data can be used to analyze daily, weekly, monthly and seasonal patterns. This can be used to help extrapolate data from other counts
- + The data assist with determining crash rate analyses
- + Data can be viewed at: <http://eco-public.com/public2/?id=100023038>

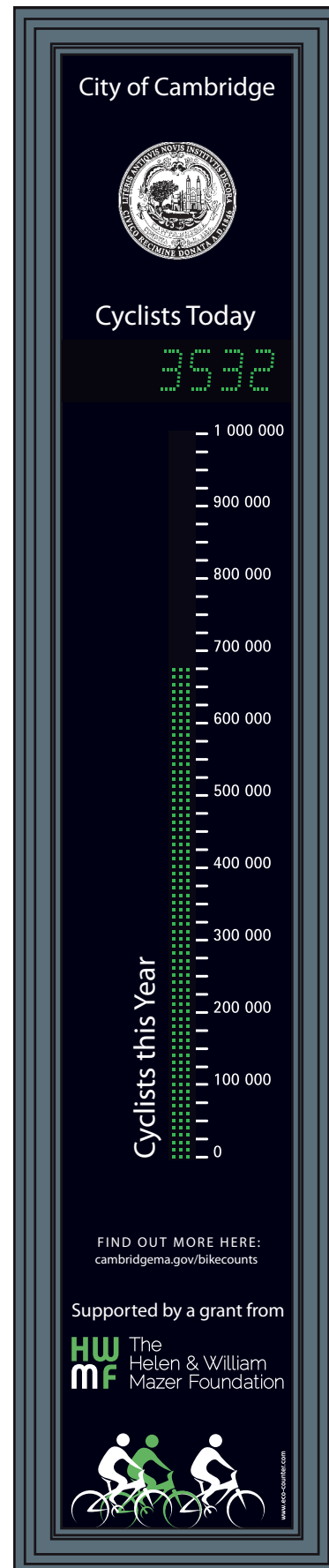


Figure 3.14: Cambridge “Eco-TOTEM” Design

BICYCLE CRASH DATA AND ANALYSIS

In the United States, bicycle crashes are generally considered to be under-reported, and few crashes that don't involve a motor vehicle are reported. There is also no reliable source of exposure data in the U.S. to really ascertain crash risk: there are no reliable statistics on how many miles people travel on bicycles each year, or how long it takes them to cover these miles, and thus how long they are exposed to motor vehicle traffic. Therefore, it is difficult to gain a comprehensive picture of bicycle crash statistics.

Since 2004 Cambridge has made a significant effort to gain a clearer picture of local crash risks for people who ride bicycles and to use that data to reduce the frequency and severity of crashes. The City's findings are included in the sections below.

DATA COLLECTION

Beginning in 2004, Cambridge has collected robust data for all reported bicycle crashes. It is recognized that this is a limited reflection of all crashes that occur. The reported crashes tend to be ones that are more severe, and those that involve a motor vehicle. In addition, these are only crashes on Cambridge streets and do not include the streets within the city under state jurisdiction, such as parkways and highways.

Nonetheless, the crash data collected in Cambridge is much more comprehensive than the data collected in many other municipalities. It includes any time any kind of incident whatsoever is reported to the police. Unfortunately, most places do not collect good bicycle crash data, and do not collect records where no injury occurred. This makes any comparisons between communities difficult.

BICYCLE COUNT AND CRASH TRENDS

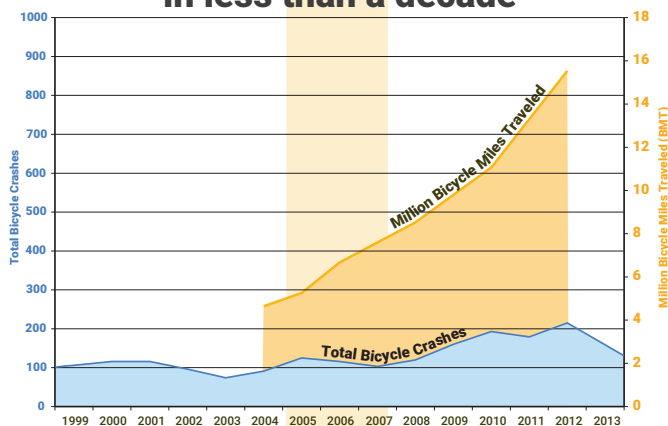
In order to match annual crash numbers with annual count numbers, the biennial count data were extrapolated to annual counts using a permanent bike count station as a reference, and national analysis standards. The Federal Highway Administration Vehicle Miles Travelled formula was applied to the annual counts to attain citywide Bicycle Miles Travelled (BMT).

As shown in Figure 1, BMT has grown from 4.6 million in 2004 to 15.5 million, an increase of 235% over nine years. Bicycle use has more than tripled in Cambridge in less than a decade.

Over the same period, reported crashes involving a bicycle have increased as well. 91 crashes were reported to Cambridge Police Department in 2004 and 215 in 2012. This represents an increase of 136%. Both bicycle and count trends are shown in Figure 1. While both are trending up, bicycle use is rising much faster than reported crashes.



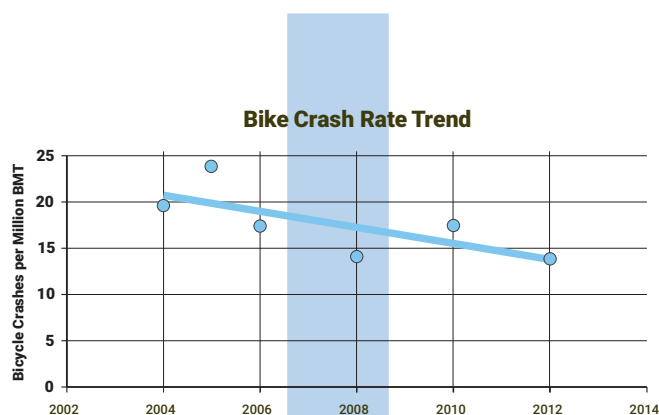
Bicycle miles traveled in Cambridge increased by 235% in less than a decade



Bicycle Miles Traveled (BMT) is an adaptation of the traditional traffic planning tool Vehicle Miles Traveled (VMT). It is an estimate of overall usage during a specific timeframe and is useful for calculating exposure to crashes. The BMT along these corridors is derived by applying national standards for estimating usage to the bicycle counts recorded throughout the city.

CRASH RATES

The best way to describe the relative change in the level of safety of travelling by bicycle is with a crash rate. A rate accounts for changes in volume of use. With this data, a rate can be shown, i.e., the number of crashes per bicycle mile traveled each year. As shown in Figure 2, the crash rate has declined from 19.6 crashes per million BMT in 2004 to 13.8 in 2012, a drop of 29%.



Bicycle crash rates have decreased in Cambridge by 29% in the same time period

The good news: The bicycle crash rate has been decreasing in Cambridge over the period of time that we have been tracking data to enable us to determine a crash rate.

Figure 3.15: CambridgeBicycleCounts vs. Crash Rate

SAFETY IN NUMBERS

The Cambridge bicycle trends correspond with international research demonstrating that as more people start riding bicycles, a person riding a bicycle is far less likely to collide with a motor vehicle or suffer injury and death. This holds for pedestrians as well. It's not necessarily because there are fewer cars on the roads, but because motorists seem to change their behavior and drive more safely when they see more bicyclists and pedestrians around. There is safety in numbers.

Studies have shown consistently that the number of motorists colliding with pedestrians or bicyclists doesn't increase equally with the number of people walking or bicycling.² For example, a community that doubles its bicycling numbers can expect a one-third drop in the per-bicyclist frequency of a crash with a motor vehicle.

One of the most rigorous and frequently cited studies on this topic concludes unequivocally that in locations where more people walk or ride bicycles, the overall injury rate due to motor vehicle collisions decreases.⁴

CRASH TYPES

Each bicycle crash is categorized by type, which helps us understand why crashes occur and how we may prevent future crashes. These types are illustrated in Figure 3.17.

Angle crashes are the leading type of bike crash, with the dooring and left hook types prevalent as well, as shown in Figure 3.18.

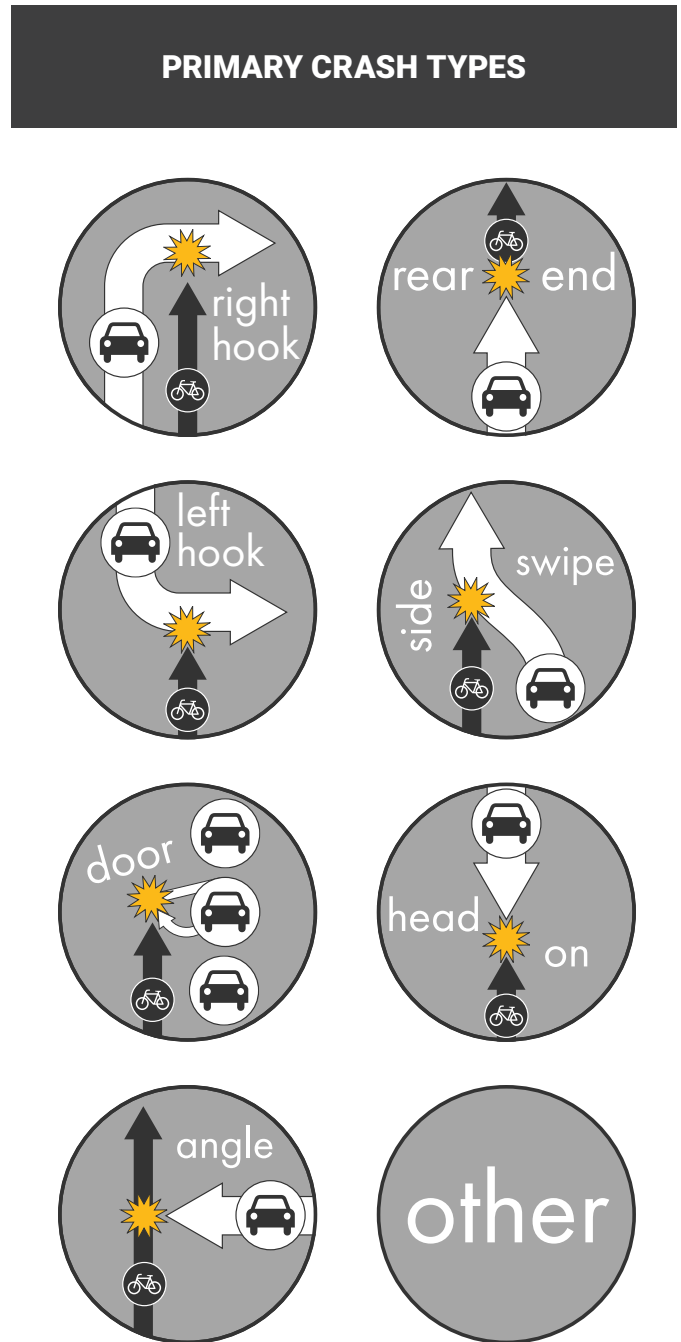


Figure 3.17: Primary Bicycle Crash Types



Figure 3.18: Bicycle Miles Traveled & Prevalent Bicycle Crash Types by Corridor

INJURY SEVERITY

The severity of the bicyclist’s injury in each crash is recorded. Most reported injuries were minor. Just 5% of reported injuries were labeled “incapacitating;” this means that the injury was such that the person was not mobile (e.g., having a broken leg or head trauma), while in 18% of crashes the bicyclist reported no injury at all. About a third of the incident reports did not indicate whether there was an injury or not; while we cannot be certain that there was no injury, those are most likely to be without injury, and unlikely to be anything in the most serious category.

Figure 3.16 shows the frequency of reported crashes according to location; this is a sum total of all crashes over the nine year period from 2004-2012, inclusive. Any one crash will show up in a light color, with darker colors representing more crashes and orange showing the most.

However, as discussed above, in order to assess risk and safety, we need to look at crash numbers together with the number of people bicycling, translated to number of miles traveled. Figure 3.18 shows the crashes per million bicycle miles traveled, together with the frequent crash types on those corridors. This helps to focus on those areas that are most in need of attention to address bicyclist safety.

The crash data provide Cambridge with information to help address the most common types of crashes occurring. As the City continues to collect and analyze data related to bicycle crashes, we can input the analysis into design and policy solutions to improve bicycle safety. The strategies will include infrastructure improvements as well as education and enforcement for all road users. These various tools are discussed in detail throughout this plan.

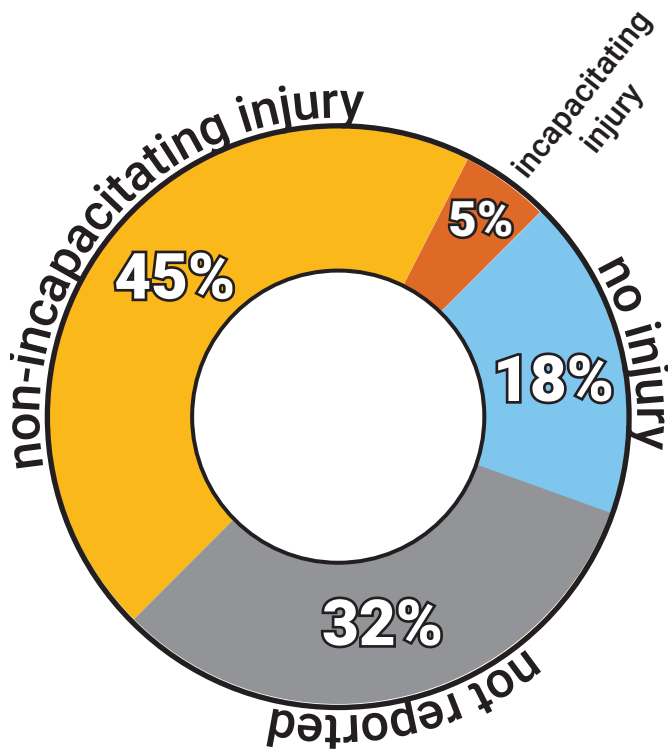


Figure 3.19: Injury severity for bicyclists involved in crashes, 2004-2012

“How do we reduce conflicts between bicyclists and buses?”



BICYCLIST SAFETY AROUND TRUCKS

Crashes involving large trucks are more likely to result in a pedestrian or bicyclist fatality than crashes involving passenger vehicles (the two fatalities of people on bicycle in Cambridge that have occurred in the past 13 years have both involved trucks). Truck crashes are also more likely to be side-impact crashes.

In order to address safety issues related to large trucks, the City is partnering with the Volpe National Transportation Systems Center on a vehicle redesign strategy that will establish recommendations for implementing truck side guards, blind spot mirrors, and other vehicle-based technologies on the City-owned truck fleet.⁵

Side guards on large trucks protect bicyclists and pedestrians from being swept underneath the vehicle in a side-impact crash. Since being required in the UK, they have helped reduce bicyclist fatalities in side-impact crashes with trucks by 61 percent and pedestrian fatalities by 20 percent. Enhanced mirrors substantially improve sight lines for drivers, particularly for cyclists riding on the right hand side of the vehicle.



Figure 3.20: Cambridge Department of Public Works employees demonstrating truck side guards on City trucks.

ENDNOTES

- 1 CitySmart Survey: www.cambridgema.gov/citysmart.
- 2 More information about the Eco Counter is available at <http://www.eco-compteur.com/en/>.
- 3 University of New South Wales (2008, September 7). A Virtuous Cycle: Safety In Numbers For Bicycle Riders. ScienceDaily. Retrieved December 4, 2008, from <http://www.sciencedaily.com/releases/2008/09/080903112034.htm>
- 4 P L Jacobsen, "Safety in numbers: more walkers and bicyclists safer walking and bicycling," Inj. Prev. 2003; 9; 205-209
- 5 Volpe National Transportation Systems Center, "Truck Side Guards Resource Page," United States Department of Transportation, 2015, <http://www.volpe.dot.gov/our-work/truck-side-guards-resource-page>