

Bike Lanes + Bike Share Program = Bike Safety

An Observational Study of Biking Behavior
in Lower and Central Manhattan

Conducted by Students at Hunter College,
The City University of New York
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Introduction

During the last decade cities and towns across the country have undertaken major initiatives to promote cycling. New York City, which boasts the largest number of cyclists for any city in the country, has been in the vanguard of this movement to encourage cycling. As of March of this year, the city had installed 573 miles of bike lanes – 200 of which were installed in just the last three years alone (New York City Department of Transportation, 2013). And on Memorial Day, May 27th, the city inaugurated the largest bike-share program in the nation with 6,000 bikes located at 330 docking stations. The city plans to expand this program to eventually include 10,000 bikes at 600 docking stations (Wall Street Journal, May 4, 2013).

There are several reasons why city officials are embracing cycling as an alternative means of transportation. They view cycling as a way to alleviate traffic congestion, to reduce both air and noise pollution, and to encourage a type of physical activity with multiple health benefits.

Yet despite these laudable objectives, the initiatives to promote cycling in the city have met with stiff resistance on the part of some New Yorkers (Goodman, November 22, 2010). Motorists, for example, complain that too much street space is being allocated to cyclists, thus making streets even more treacherous on which to drive. They also lament the elimination of parking spaces because of the installation of bike lanes and bike-share kiosks.

Part of the opposition to pro-cycling initiatives is rooted in a perception that some cyclists have a holier-than-thou attitude toward other road users, show contempt for the rules of the road, and pose a danger to drivers, pedestrians, and themselves (Goodman, September 18, 2010; Cassidy, March 8, 2011; Walsh, July 3, 2012). According to this view, a number of cyclists run red lights, traverse the wrong way down streets, ride on sidewalks, are distracted because of the use of electronic devices and, with regard to their own personal safety, don't bother wearing helmets.

Added to these motorists' laments and negative perceptions of cyclists are the safety concerns raised by some critics of the city's newly-launched bike-share program. These critics contend that the program will lead to a substantial increase in cycling-related injuries. One supporter of this view is John Pucher, a professor at Rutgers University and co-author of the book "City Cycling." According to Professor Pucher, "Safety concerns about Citi

Bike stem from frequently blocked bike lanes, poor street conditions, inexperienced bicyclists, lax enforcement of traffic regulations, and the inevitability that some users will ride on sidewalks” (Liu, June 25, 2012).

Despite the sharply divergent viewpoints expressed by pro and anti-cycling advocates, scant attention has been paid to the behavior of urban cyclists. Little inquiry has been directed at the extent to which cyclists adhere to traffic laws, use electronic devices which might reduce their concentration, or wear helmets as a protective measure. Furthermore, since the inception of the bike-share program in the city, no research (of which the authors of the present study are aware) has been carried out profiling Citi Bike cyclists or examining their riding behavior patterns. How does their profile differ, if at all, from cyclists who are not bike-share riders? And how does their riding behavior compare to other cyclists in the city?

Previous Research

One study which did address the riding behavior of cyclists was conducted by the authors of this current study (Tuckel, Milczarski, 2009). This previous research, carried out four and one-half years ago, was based on observing both the type of cyclists and their riding patterns in mid-Manhattan.^{1,2}

A key finding which emerged from this earlier study was a noticeable sex disparity in ridership. The overwhelming majority of riders (91%) were male. With respect to obeying traffic laws, the study uncovered the following: (1) approximately two-fifths of cyclists (41%) did not stop at all at a traffic light, (2) among cyclists observed at a street with a bike lane, almost one-third (33%) rode just on the street instead of the bike lane, and (3) about 13 percent of cyclists were observed riding against traffic. In terms of helmet use, less than a third of riders were observed wearing helmets. This last-mentioned figure varied considerably by type of rider. Female cyclists were far more likely to wear a helmet (51%) than either male recreational/commuter cyclists (32%) or male commercial cyclists (24%). The study also revealed that approximately 9 percent of all riders used an electronic device such as a cell phone or music player. Finally, it was noted that approximately one-third (32%) percent of commercial cyclists displayed company identification on their attire or bikes.

A principal objective of the present study is to identify what changes, if any, have occurred in both the composition and riding behavior of cyclists over the course of the last four and one-half years. During this time span the number of cyclists in New York City has continued to rise. Figures provided by the New York City Department of Transportation show that the number of cyclists entering and leaving Manhattan grew from 28,300 to 32,200 in just the three years from 2009 to 2012 (New York City Department of Transportation). Furthermore, as mentioned above, there has been a large-scale expansion in the number of bike lanes. And, of course, the inauguration of the bike-share program has added 6,000 more bikes to the city's roadways. Both the upsurge in the number of cyclists and the expansion of the biking infrastructure may have had an impact on the composition of cyclists and their riding behavior.

A second major objective of the current study is to compare the riding behavior of Citi Bike cyclists with their cycling counterparts who are not bike-share participants. Of paramount importance is to determine whether they are more or less likely than other cyclists to obey the city's traffic laws?

Methodology

The results of this study are based upon observations of 4,316 bicyclists at 98 different locations in New York City. The intersections were chosen from all intersections spanning the area from the southern tip of Manhattan up to 86th Street (south to north) and bounded from east to west by the East River and the Hudson River. This area constitutes a broad swath of Manhattan and comprises what can be thought of as lower Manhattan and a large portion of central Manhattan.

The intersections were randomly selected from four different strata encompassed within this area. The four strata consisted of: (1) streets/avenues without any bike lane, (2) streets/avenues with an unprotected bike lane, (3) streets/avenues with a protected bike lane, and (4) bikeways running alongside the East River and the Hudson River.³

All observations were carried out by Hunter College students enrolled in one of three different courses.⁴ One of the courses was a graduate-level course offered in the Department of Urban Affairs & Planning (Urban Data Analysis – two separate sections). The other two were undergraduate-level courses

offered in the Department of Sociology (two sections of Introduction to Research Methods and an Independent Studies course). Excepting the Independent Studies course which was offered in the Summer of 2013, the other three courses were offered in the Fall semester of 2013.

Students were given strict methodological guidelines in carrying out their observations. Importantly, students had to choose cyclists they observed at a given location on a random basis without employing subjective criteria and they had to remain as inconspicuous as possible.

Students were assigned to conduct observations at two randomly-selected locations within the geographic boundaries of the study.⁵ All told, students gathered data at 98 different sites. Each site was visited for a period of one hour in duration. The hours were staggered across the seven days of the week and ranged from 7:30 am to 8:30 pm.

Students were instructed to record observations for *every* cyclist who passed them by within each hour interval with a few exceptions. The exceptions were as follows: First, no more than one observation could be recorded by a student within the same minute of time.⁶ Second, for cyclists riding in parallel fashion, observations were to be carried out on the cyclist in closest physical proximity to the student. Third, no information was to be gathered on the same cyclist more than once. Fourth, no information was to be gathered on any cyclist who had an “intimidating presence.”⁷ And fifth, only adult cyclists (14 years of age or older) were to be observed.

The above methodology was designed so that intersections that had more cyclists traversing them would have greater representation in the sample. Thus, the study is based upon a self-weighted sample of observations.

With respect to biking behavior, students gathered data on the following variables: (1) stopping/pausing at a red light, (2) going in the same direction as traffic, (3) using the designated bike lane (if applicable), (4) use of a helmet, and (5) using a cell phone or other electronic device while cycling. For commercial cyclists, information was also gathered on whether they had proper identification.⁸

In addition to these variables, students collected the following demographic information on each rider: (1) his/her sex and (2) whether he/she was a commercial cyclist (e.g., a messenger cyclist, food delivery worker), a Citi

Bike rider, or a commuter/recreational cyclist who was not a bike-share cyclist.

Also, information about the site of the observations was appended to each record. Site attributes included whether the observations were carried out on a street or avenue, the number of vehicular lanes of the street/avenue, whether the street/avenue had a designated unprotected or protected bike lane, and whether the site was on a bikeway.⁹ Finally, the calendar date and day of the week on which observations were conducted were recorded.

All observations were carried out between June 10 and November 1, 2013. Slightly more than one-quarter of the observations were conducted in the months from June to August and the remainder were carried out in the period from October 7th thru November 1st, 2013.

Findings

Overall Profile of Riders

The largest segment of the riders observed were recreational or commuter cyclists who were not Citi Bike riders (56.2%). In this study, this group shall be referred to as “general” cyclists. Citi Bike riders constituted the next largest segment of riders (23.2%) followed by “delivery riders” (18.4%), with the remainder (2.2%) being riders whose status could not be determined.

As was the case in the study of cyclists in mid-Manhattan conducted four and one-half years ago (Tuckel and Milczarski, 2009), there is a sizable disparity in the sex of the riders (78.0% male vs. 21.1% female).¹⁰

While this disparity is still large, it should be noted that the “gender gap” among cyclists in the present study is considerably narrower than was found in the earlier study. *The proportion of female riders appears to have doubled in the last four and one-half years.*

This finding with respect to female ridership in part is attributable to the different geographic areas covered by the two studies. The present analysis includes three areas that were not included in the earlier study: the area from the southern tip of Manhattan to 14th Street, 59th Street to 86th Street, and the East River and Hudson River bikeways. As will be shown below, the bikeways included a disproportionately large number of female riders. If just the same geographic area employed in the earlier study is used in the

present study, the percent of female ridership is 18.5 percent. This figure still represents an increase of 9 percentage points in the number of female cyclists over the course of the last four and one-half years.

Significantly, the launch of the bike-share program may be contributing to the narrowing of the gender gap among cyclists. The data show that the female share of general cyclists is 23.6 percent whereas the female share of Citi Bike cyclists is 31.1 percent. The greater prevalence of female riders among Citi Bike cyclists is far more noticeable in the geographic areas covered in the present study that were not covered in the earlier study – particularly in the area from the tip of Manhattan to 14th Street.

Type of Cyclist Found in Different Street Environments

Pronounced differences exist between the type of rider (based on a combination of sex and commercial/non-commercial status) and the different street environments in which they are observed. Table 1 shows the relationship between the street environment and five types of riders: male commercial cyclists, male general cyclists, female general cyclists, male Citi Bike riders, and female Citi Bike riders.¹¹

Table 1: Type of Cyclist by Type of Site

		Type of Site			Total
		Street	Avenue	Bikeway	
Type of Cyclist	Male General	45.0%	40.4%	57.8%	43.9%
	Female General	15.2%	11.4%	20.4%	13.7%
	Male Citi Bike	15.7%	17.7%	12.9%	16.5%
	Female Citi Bike	9.0%	6.3%	8.6%	7.5%
	Male Commercial	15.1%	24.2%	0.2%	18.5%
Total Number		1461	2265	441	4167
Total Percent		100.0%	100.0%	100.0%	100.0%

Coinciding with expectations, both male and female general cyclists are far more likely to ride on bikeways than the other types of cyclists. Commercial

cyclists and Citi Bike riders would be expected to use “interior” routes more often than the general cyclists. The data also reveal that commercial cyclists tend to ride more often on avenues than on streets.

Notably, bike-share riders display a greater tendency to ride on more “secure” street or avenue environments than their cycling counterparts. Compared to other cyclists, Citi Bike cyclists (both male and female) are more likely to be found riding on a street or avenue with an unprotected bike lane than a street or avenue without an unprotected bike lane (see Table 2). Furthermore, Citi Bike riders to a greater extent than others are more likely to be found riding on a street or avenue with a protected bike lane than a street or avenue with just an unprotected bike lane.¹²

Table 2: Type of Cyclist by Type of Bike Lane

		Type of Bike Lane			Total
		Street/ave without a bike lane	Street/ave with unprotected bike lane	Street/ave with protected bike lane	
Type of Cyclist	Male General	42.8%	45.7%	39.1%	42.2%
	Female General	11.6%	13.7%	13.7%	12.9%
	Male Citi Bike	12.9%	15.7%	22.1%	16.9%
	Female Citi Bike	5.2%	7.1%	9.9%	7.4%
	Male Commercial	27.5%	17.8%	15.2%	20.6%
Total Number		1428	970	1328	3726
Total Percent		100.0%	100.0%	100.0%	100.0%

Stopping at Red Lights

At intersections at which there was a red light for motor vehicles and cyclists, students observed the extent to which cyclists obeyed the traffic signal. The data displayed in Table 3 shows that a third of cyclists (34.0%) do not stop or even pause at a red light. The percentage who do *not* fully stop at a red light is roughly 10 percentage points lower than the comparable

figure presented in the 2009 study in which the geographic areas are the same.¹³

Table 3: Stops at Red Light by Type of Cyclist

	Type of Cyclist					Total
	Male General	Female General	Male Citi Bike	Female Citi Bike	Male Commercial	
Stops fully at red light	28.4%	38.3%	35.3%	38.8%	21.4%	30.4%
Pauses and then goes thru red light	30.9%	35.4%	41.1%	46.3%	36.6%	35.6%
Does not stop or pause when light is red	40.7%	26.3%	23.7%	14.9%	42.1%	34.0%
Total number	580	209	224	121	290	1424
Total Percent	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

As was true in the 2009 study, female general cyclists tend to be far more law abiding than male general cyclists. *What is particularly noteworthy, though, is that male bike-share riders tend to stop fully at red lights much more so than either male general cyclists or male commercial cyclists (35% vs. 28% and 21%, respectively).*

Use of the Unprotected Bike Lane

Another facet of riding behavior observed by students was the extent to which cyclists rode on the portion of the street or avenue that was dedicated as a bike lane. The results displayed in Table 4 show that 70 percent of the cyclists rode only in the dedicated bike lane and an additional 10 percent rode in both the motor vehicle and bike lanes. About one-fifth (20.1%) rode exclusively on lanes intended for motor vehicle use. If the analysis is confined to the same geography employed in the 2009 study, the share of

cyclists who were observed riding in non-bike lanes *decreased* by 9 percentage points.

As was the case with stopping fully at a red light, the data again show a greater tendency for female general cyclists and Citi Bike cyclists (both male and female) to comply with the law by riding solely in the dedicated bike lane.

Table 4: Use of Unprotected Bike Lane by Type of Cyclist^{*}

	Type of Cyclist					Total
	Male General	Female General	Male Citi Bike	Female Citi Bike	Male Messenger	
Rides only on bike lane	64.3%	82.4%	79.2%	82.1%	64.3%	70.1%
Rides only on street/ave	24.0%	13.0%	11.0%	16.4%	24.2%	20.1%
Rides on both bike lane and street/ave	11.7%	4.6%	9.7%	1.5%	11.53%	9.8%
Total number	470	131	154	67	182	1004
Total percent	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

^{*}Excludes cases in which the bike lane was obstructed.

Rides With or Against Traffic

Overall, only 4.2 percent of cyclists were observed riding against traffic on the street and another 3.2 percent of cyclists were observed riding against traffic in the bike lane. This combined total of 7.4 percent riding against traffic was noticeably below the comparable figure recorded for 2009 (13.2%).

Use of Helmets

Almost half of the cyclists (49.8%) were observed wearing helmets. This represents a steep increase from the figure for 2009 in which only 29.9 percent of cyclists were recorded wearing helmets. Most impressive is that the use of helmets has soared for male commercial cyclists and male general

cyclists. In 2009, helmet use for these two groups was 23.6% and 32.2%, respectively. The corresponding percentage figures today stand at 72.7% and 47.8% (see Table 5).¹⁴

Table 5: Helmet Use by Type of Cyclist

		Type of Cyclist					Total
		Male General	Female General	Male Citi Bike	Female Citi Bike	Male Commercial	
Helmet use	Yes	47.8%	55.7%	31.1%	36.2%	72.7%	49.8%
	No	52.2%	44.3%	68.9%	63.8%	27.3%	50.2%
Total number		1819	569	687	312	768	4155
Total percent		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

For both male and female general cyclists helmet use becomes progressively greater as cyclists are found riding on a street or an avenue without a bike lane, to a street or avenue with a bike lane, to a bikeway.

Not unexpectedly, bike-share riders are less inclined to wear helmets than general or commercial riders. Overall, slightly less than a third of bike-share riders wear helmets. Female bike-share riders are somewhat more disposed to wearing a helmet than their male counterparts (36.2% vs. 31.1%).

Use of Electronic Devices

About 12 percent of cyclists were observed using some electronic device when riding (e.g., cell phone, music player, etc.).^{15, 16} This represents a slight increase of 3 percentage points over those who were using an electronic device in 2009. The data also show that male general cyclists and Citi Bike riders of both sexes were more disposed towards riding with an electronic device than the other types of cyclists.

Use of Apparel with Business Name by Commercial Cyclists

New York City traffic laws mandate that commercial cyclists wear “upper-body apparel with the business’ name (*sic*).” In 2009, only a minority of commercial cyclists displayed the name of their company either on their clothing or their bikes (32%). As the data in Table 6 reveal, this percent has risen sharply. Now nearly 60 percent comply with the law, even including 14.3 percent of cases where a firm determination could not be made.¹⁷

Table 6: Use of Apparel with Business
by Commercial Cyclist

	Frequency	Percent
Yes	526	59.2
No	235	26.5
Not sure	127	14.3
Total	888	100.0

Summary and Conclusions

This study has examined the riding behavior of over 4,300 cyclists in lower and central Manhattan. While the study’s results cannot be directly compared to those of a similar study conducted four and one-half years because of differing geographies, the findings from both studies strongly suggest that a change has occurred in the demographic composition of cyclists and their behavior patterns.

It appears first of all that the percent of cyclists who are female has grown significantly. If the geographic area of the present study is aligned with that of the earlier study, the share of riders who are female has increased by 9 percentage points during the last four and one-half years.

One possible reason for this narrowing of the gender gap is the launch of the bike-share program this past May. The data in this study show that females constitute 23.6 percent of the general riders but they make up 31.1 percent of Citi Bike cyclists.

The results of this study also point to a substantial increase in the use of helmets among commercial and general cyclists. Almost three-quarters of commercial cyclists (72.7%) now wear helmets. Four and one-half years ago, the number of commercial cyclists observed wearing helmets was less than a quarter (23.6%). The percent of male general cyclists who wear helmets also has climbed appreciably in the last few years. The share of male general cyclists who wear helmets today stands at 47.5 percent compared to just 32.2 percent in 2009.

As might be anticipated, bike-share riders are less inclined to use helmets. Yet even among this subgroup of cyclists, approximately one-third do so. Again, females are more likely to wear helmets than males (36.3% vs. 31.1%).

This study has also produced evidence that a larger proportion of cyclists are adhering to the rules of the road. More cyclists are stopping at red lights and fewer are riding against traffic or riding in lanes for vehicular traffic on streets with bike lanes.

To what can we attribute the greater use of helmets and greater compliance with traffic rules? One factor certainly is the efforts which have been expended by bike clubs, bike organizations, and government agencies to promote safe cycling. Bike clubs, bike advocacy groups, organizers of bike-a-thons, private foundations have all launched educational campaigns encouraging cyclists to wear helmets and engage in other safe cycling practices. The Stuart C. Gruskin Family Foundation, for example, has initiated the Pedal Pledge program in which businesses promise to train their delivery cyclists in the rules of the road. This same foundation has also spurred municipal authorities to gather more accurate data on the incidence of bicycle-pedestrian collisions.¹⁸ The New York City Department of Transportation as well has been a strong proponent of safe riding behavior and the City Council has passed several new legislative initiatives aimed at curbing unlawful behavior (particularly among commercial cyclists).

Beyond this factor it is probably the case that the increased volume of cyclists by itself (owing, in part, to the launch of the bike-share program), has created a new definition of the situation on city streets. Cyclists are no longer an anomaly. They are increasingly becoming a fixture of urban life. As the number of cyclists grows, both motorists and cyclists are becoming

more mindful of the presence of the other and the need to adjust their behavior accordingly.

Importantly, the findings from this study also shed light on why the predictions that the launch of the bike-share program would lead to a spike in the number of cycling-related injuries have not materialized. During the first five months the bike-share program has been in existence, there have been no fatalities involving Citi Bike riders and only around two dozen minor injuries (Flegenheimer, 2013; Fried, 2013; Swanson, 2013).

Explanations accounting for this positive trend have thus far focused on three factors. One factor is the “safety in numbers” argument discussed above. As motorists have become more inured to seeing cyclists on the city’s streets, they have modified their behavior.

A second factor which has been cited for the low incidence of injuries involving Citi Bikes centers on the physical characteristics of the bikes themselves. Because of their physical structure (heavy frame, wide-rimmed tires, etc.), the bikes lack the capacity to be speedy and nimble. In the now famous words of the New York City Comptroller John Liu, “The Citi Bikes come in only three speeds: slow, very slow, and ultraslow.”

A third factor mentioned is that the average distance travelled per trip by a Citi Bike cyclist is probably less than the average distance travelled per trip by other commuter or recreational cyclists. (In part, this is most likely a function of the cost of renting a Citi Bike per trip for individuals who do not have annual memberships.) The shorter distances travelled by Citi Bike riders, of course, would decrease the likelihood of incurring an injury.

Yet the findings emerging from this study would point to another critical factor which may be underlying the safe record of the Citi Bike cyclists registered thus far. The Citi Bike riders appear to be more cautious and even more compliant with traffic rules than other cyclists.

Significantly, Citi Bike cyclists are more likely to be found in “safer” street environments than either general cyclists or commercial cyclists. As the data in this study have indicated, the percent of cyclists who are bike-share riders increases progressively as the street environment changes from a street or avenue without any bike lane, to a street or avenue with an unprotected bike lane, to a street or avenue with a protected bike lane. Furthermore, on streets or avenues with an unprotected bike lane, Citi Bike

riders, along with female general cyclists, are more apt than others to ride within the confines of the bike lane.

Not only are Citi Bike riders disproportionately found in more “secure” environments, they also appear to adhere to traffic laws more so than their cycling counterparts. For example, they are considerably more likely to stop fully at a traffic light that is red than either male general cyclists or commercial cyclists.

We do not know exactly the reasons why Citi Bike riders seem to exercise both greater caution in their riding behavior and greater compliance with traffic laws than other cyclists. Several reasons could be posited. First, it may be because of the initiatives undertaken to promote bike safety on the part of the Citi Bike program’s sponsors. One such initiative includes providing annual bike share members with a booklet detailing the rules and regulations governing cycling in New York City, a map of all the bike lanes and bikeways, and a coupon which the bearer can use to purchase a heavily-discounted helmet. Another initiative includes having the city’s traffic rules visibly emblazoned on each bike kiosk.

A second reason why Citi Bike cyclists may be more safety conscious is precisely because they are traversing new, unexplored terrain and thus they are more tentative and cautious. Yet a third reason may be because they do not “own” the bike (think here of renting a car) and therefore are more guarded in their behavior. Or perhaps they are simply not familiar with the bike’s capabilities and are thus somewhat more hesitant navigating the city’s streets.

Lastly, on a more idealistic plane, the reason could be that Citi Bike riders constitute a highly visible group, are consciously aware of this group identification, and feel it is important to comport themselves in a manner that reflects positively on cyclists in general. Whatever the reason, their riding behavior appears to have contributed to their overall safety record.

The safety record compiled by the Citi Bike riders comes with no assurances that it will continue into the future. The expansion of the bike lane network, the growing awareness that there are multiple users of the city’s streets

each with legitimate rights, and the greater adherence to traffic laws by cyclists, though, increases the likelihood that safe cycling in New York city will become an enduring phenomenon.

Notes

1. The geographic scope of this earlier study included the area extending from 14th Street to 59th Street (south to north) and from 1st to 10th Avenues (east to west). This area comprises the central business district of Manhattan.
2. The authors of the present study also carried out a similar study in the Spring of 2013. This last-mentioned study was based on considerably fewer number of cases (2,521) than the present study and did not include data pertaining to bike-share riders. It is important to note, however, that the comparable findings from the Spring, 2013 study closely mirror those found in this study.
3. “Intersections” at bikeways were approximated at the point where the nearest street would bisect the bikeway were that street to extend further east or west.
4. One student from the Bronx School of Science (Ms. Ilana Shtern) also gathered observational data at two sites for this study. She undertook this work as part of an Independent study project at her school.
5. The five students enrolled in the Independent Study course offered in the Summer of 2013 were assigned a greater number of sites (ranging from 5 to 10) at which to conduct observations.
6. To comply with this guideline, students were told to record observations for every *first* cyclist who passed them after the beginning of a “new” minute on their watches/cell phones.

7. Fortunately, there were no reported cases where a student observer could not collect information due to the presence of a cyclist with an “intimidating presence.”
8. Specifically, NYC DOT regulations require businesses that use bicycles for commercial purposes to provide their delivery cyclists with “retro-reflective upper-body apparel with the business name and bicyclist’s three-digit ID number on the back.”
9. The term “unprotected bike lane” refers here to a portion of a street or avenue which is used by cyclists and is designated by two parallel lines with an image of a bicycle imprinted on the pavement. A protected bike lane is defined as a portion of a street or avenue which is used by cyclists and is separated from vehicular traffic by a physical barrier such as a raised curb or street parking. Bikeways (or greenways) are defined as paved areas that are totally separated from vehicular traffic and are used exclusively by cyclists or sometimes shared with pedestrians.
10. These figures don’t add up to 100 percent because there were a few instances in which the sex of the rider could not be ascertained (0.8%).
11. Since females constituted only a small fraction of commercial cyclists (2.3%), they were not included in this typology.
12. While male Citi Bike riders are more apt to found on an avenue with an unprotected bike lane than on an avenue without any bike lane, they are represented almost to the same degree of streets with and without an unprotected bike lane.
13. Unless otherwise stated, differences in the results reported in this study from those found four and one-half years ago are not largely attributable to the different geographic areas covered by the two studies.
14. On April 23, 2013, a new law took effect in the City of New York with the aim of strengthening existing ordinances requiring commercial cyclists to wear helmets. The implementation of this new law, however, does not appear to be the reason for the upswing in the use of helmets by commercial cyclists observed in this study. Helmet use had already attained a much higher level before these new regulations went into effect.

15. The figures pertaining to the use of an electronic device while riding are based on observations where a determination could be reasonably made that a cyclist was or was not using an electronic device. Sometimes, because of the speed with which a cyclist was passing by or attire which might have concealed an electronic device, a firm determination could not be made. Also, the figures presented here are based on a somewhat smaller sample (n = 3003) since they do not include observations gathered by this semester's undergraduate students.

16. It is permissible in New York City for cyclists to wear one earbud. Nevertheless, the City's Department of Transportation encourages cyclists not to wear earphones because it compromises their safety.

17. Often, outer garments or backpacks obscured the ability of students to determine if a commercial cyclist was wearing clothing which identified the name of his company.

18. For more information on the Gruskin Foundation and the Pedal Pledge program see www.gruskinfoundation.org

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