Survey of North American Bicycle Commuters
Design and Aggregate Results

WILLIAM E. MORITZ

Although interest exists in promoting bicycle commuting to help meet air quality and commuter-trip reduction goals, there are virtually no data on bicycle commuters. A comprehensive survey, distributed over the Internet and by mail, of such commuters has been conducted, with 2,374 responses received from all regions of the United States and Canada. Information was gathered in seven categories: about your commuting; about the facilities you use; about your bike; about your motivation; about safety/accidents; about your health; and about you and your household. Comments were also collected. Although the average bicycle commuter is a 39-year-old male professional with a household income in excess of $45,000 per year who rides 10.6 months per year, nearly one in five respondents was female. Average annual bicycle-commuting distance was 3100 km, although these same cyclists rode an average of 5500 km for all trip purposes. Just under 10 percent reported having an accident in the previous 12 months. A relative danger index (*RDI*) for various bicycle facilities that relates accident frequency to distance traveled on each facility type is presented. A higher number indicates greater danger. Based on the data in this sample, major streets without bicycle facilities have an *RDI* of 1.26; minor streets, an *RDI* of 1.04; streets with bike lanes or bike routes, an *RDI* of 0.50; bike paths, an *RDI* of 0.67 and sidewalks, an *RDI* of 5.30. With the 7.3 million km of bicycle commuting reported, an annual accident rate of 37.1 per million km was calculated. The results of this survey should be of interest to policy makers, businesses, and advocates interested in promoting the use of the bicycle for transportation purposes.

Several factors have caused a revival of interest in bicycling as a transportation mode in the 1990s. One is that our urban areas are experiencing ever-increasing congestion brought on by continued sprawl. In many parts of the country there is a lack of resources and public support for major new highway projects. The phrase "we can no longer build our way out of congestion" seems to have become the new mantra of transportation officials across the country. Attention is turning to using existing roadways more efficiently.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) mandates that cycling must be integrated into required transportation plans. Each state department of transportation must have at least a part-time bicycle-pedestrian coordinator. Bicycle projects may now compete for funding across the spectrum of programs offered under ISTEA. The National Transportation Enhancements Clearinghouse has reported that, through February 1996, more than 2,950 nonmotorized transportation projects valued in excess of $1.1 billion have been awarded funding under the ISTEA Enhancements Program (*1*). Because cycling is virtually pollution-free, it can help meet air-quality standards. Under the federal Clean Air Act Amendments of 1991, nonattainment areas are required to develop specific plans to achieve compliance with the act. Several states also have similar clean-air acts. Growth management acts that link land use and transportation have been adopted in many parts of the country with the goal of containing urban sprawl. This has spawned interest in focusing new development in urban villages where jobs, housing, and services are all located within a short distance from one another. Shorter trips are more conducive to cycling.

Commuting trip reduction programs are another attempt to reduce vehicular traffic volumes during the peak hours. Although the average one-way commuting trip is approximately 16 km in length, almost half of all trips are 5 km or less. Such distances are well within bicycling range for most adults in this country. (*2*) One consequence of our reliance on automobiles and the time we spend commuting in them is that the amount of physical activity most adults get is woefully inadequate to maintain good health. The lack of physical activity is one of the major risk factors leading to cardiovascular and other diseases. Some people are now realizing that bicycle commuting provides the opportunity to get high-quality aerobic exercise while also traveling to and from work. Recently there have also been several policy initiatives adopted to encourage greater use of cycling and walking. For example, the National Bicycling and Walking Study, released by FHWA in 1994, set a goal "to double the percentage of total trips made by bicycling and walking in the United States from 7.9 to 15.8 percent" (*3*). The study contains numerous action items for all levels of government. In addition, 24 case studies were developed as part of the study that deal with a wide range of subjects.

Estimates of the number of bicycle commuters in the United States range from 0.5 to 2.8 million or approximately 0.4 to 2.3 percent of the total number of commuters. (*2*,*3*) These numbers are derived from census data and information contained in the Nationwide Personal Transportation Study (NPTS). Some cities have substantially higher rates of bicycle commuting (ranging from 2 to 10 percent or more). Examples include Seattle, Washington (2.3 percent); Palo Alto (2.6 percent) and Davis (25 percent), California; Boulder, Colorado (9.3 percent); Eugene, Oregon (8.0 percent); and Madison, Wisconsin (11.0 percent) (*4*). Although all of these cities have major universities that clearly contribute to more cycling, it is not just students (who may have no other choice) who turn to the bicycle to meet their commuting needs. The census and the NPTS can at best provide gross participation rates for bicycle commuting. They provide precious little else that might help understand who commutes by bike, how far and often they ride, why they choose to do so, and what their experiences are. It was an interest in just such questions that led to this first-ever attempt to survey bicycle commuters in North America. Canadian bike commuters were invited to participate to see how their experiences compared with those from the United States.

SURVEY LIMITATIONS AND GOALS

Surveys at best represent the responses of those who agree to participate. If the participants are properly selected, it may be possible

University of Washington, Seattle, Wash. 98195.

to extrapolate their responses to a larger population. Any national survey requires a means to locate the study population and deliver or administer the survey instrument. Given a virtually nonexistent budget, this method differs from that normally associated with the national surveys. The survey presented here was an attempt to develop yet another estimate of the number of bicycle commuters. This would have required the use of a statistical sample of the entire population, which was beyond the scope of what could be accomplished. Nor was it intended to characterize the mythical "average" bicycle commuter. For this study a selection of a random sample of bicycle commuters was desired. The problem is locating such commuters across the country. In contrast to motorists and automobiles, which must be licensed, there is no practical way to identify even people who own bicycles, let alone those who might use them for commuting.

To further appreciate the problem of surveying a random sample of even 1,000 bicycle commuters, consider these numbers. An optimistic 25 percent response rate would require placing a survey in the hands of 4,000 such cyclists. Because only 0.3 percent of the commuters use bicycles, more than 1.33 million commuters (4,000 divided by 0.003) would have to be contacted to gather data on 1,000 bicycle commuters. Without even considering how those commuters would be identified, the costs associated with such a large sample made it impossible to consider that approach. The goal of this study was to locate as many bicycle commuters in North America as possible using the least costly methods to distribute the survey and retrieve the responses. Further, as much information as practical from those who used their bicycles on a regular basis, nominally at least once a week, to travel to and from work or school was desired.

STUDY METHOD

Survey Requirements

Surveys such as this can be done using several formats: in-person interviews, telephone interviews, or questionnaires filled in by the respondents. It was decided to use either an electronic or printed questionnaire, with the latter limited to one sheet, but using both sides. The survey was developed in the early spring of 1995 and released in May. Participants were asked to report on their bicycle commuting during the preceding 12 months. Because responses were accepted only until June 1, 1996, the data should cover the period from approximately May 15, 1995, through May 31, 1996. Because the goal was to characterize "regular" bicycle commuters, what constituted regular had to be decided. It was further recognized that in some parts of the continent weather conditions (either winter cold, snow, and ice or summer heat and humidity) might make year-round bicycle commuting difficult or impossible. Thus, to qualify, a minimum of one day of bicycle commuting each week for at least 6 months in the previous year was required. Once the survey was drafted it was sent electronically to a bicycle commuters mailing list on the Internet with a request that they evaluate the questions for clarity and the survey itself for completeness. Approximately 20 bicycle commuters offered helpful and constructive suggestions that resulted in several minor changes to the original draft.

Survey Distribution

For budgetary reasons, the Internet was selected as the initial method for distributing the survey. The same bicycle commuter mailing list provided access to one group of potential participants. Recipients on that list were in turn asked to forward the survey to other bicycle commuters or lists or forums where bicycle commuters might be found. That approximately 2,000 of the respondents received the survey electronically indicates such an approach was able to reach a large group. No attempt was made to catalog all the sites in cyberspace where the survey was either posted or mentioned. People interested in participating could also send a self-addressed, stamped envelope to receive a printed copy. These respondents were then also required to mail back the completed survey. Approximately 24 percent of the responses came from regular mail requests.

Announcements concerning the survey were also placed in several cycling publications. Some bicycle clubs ran articles informing their members of the survey in their newsletter. Adventure Cycling (formerly BikeCentennial) published a brief article about the survey, as did the League of American Bicyclists (formerly League of American Wheelmen) in their respective magazines. The May 1996 issue of *Bicycling* magazine, which was on the newsstands in March, carried a small notice about the survey. This generated between 650 and 800 additional responses prior to the June 1 cut-off date. One of the major benefits of *Bicycling*'s coverage was to draw responses from sections of the country that had been difficult to reach.

SURVEY DESIGN

The survey is shown in Figure 1. Information was requested in seven categories: about your commuting; about the facilities you use; about your bike; about your motivation; about safety/accidents; about your health; and about you and your household. A comment space was provided at the end of the survey. The most likely answers to multiple choice questions were provided and assigned numerical codes to facilitate data entry and analysis. Yes and no responses were entered as 1 and 0, respectively. The form was designed to facilitate data entry. The electronic version contained exactly the same questions but was prepared as straight ASCII text to be readable by all types of computer systems. In this case, the readers were asked to replace the asterisk to the left of each question with their responses. Thus, all the answers would appear in the leftmost columns, facilitating data entry. The seven categories were designed to elicit the following information:

1. About your commuting. The interest here was to learn how many years the respondents had been commuting by bicycle, how many commuting trips per week they made, and what was their usual commuting mode. Data were then requested on commuting distance and time as well as total bike commuting miles in the past year. (Miles were used rather than kilometers because that is still the most common unit used by the public in the United States.) Three additional questions dealt with how they commuted before they started cycling, why bicycle commuting was not their primary commuting mode, and how many months each year they did not choose to ride because of the regional climate where they lived.
2. About the facilities you use. This section sought information on the type of public infrastructure used during the respondents' bicycle commute as well as the support facilities that were provided at their destination site. Under infrastructure were listed the principal types of on- and off-street facilities most likely to be encountered. Destination facilities included bicycle parking, showers, and clothes lockers.
3. About your bike. Data on the types of bicycles used for commuting and the kinds of equipment that people have was solicited.

SURVEY OF REGULAR BICYCLE COMMUTERS
July, 1995

This survey seeks data on bicycle commuting (to either work or school/college). For the purposes of this survey, a 'regular' bike commuter uses a bicycle at least 1 day per week, 6 months a year. If you do not bike commute at least this much, please pass on this survey to someone who does.

All identifying information will be removed upon receipt and the results will be tabulated so that individual replies will not be identifiable and only summaries of the responses received will be reported. Answers should be based on the all bicycle commuting you did during the last complete 12 month period, unless otherwise stated. **Place your answer in the space provided. Where a series of choices is given, use the number assigned to your particular choice.**

Please share this with other regular bike commuters you know; we are looking for the widest possible distribution. Thank you for taking the time to complete this survey.

ABOUT YOUR COMMUTING.

Unless otherwise stated, **trip** refers to your typical, ONE-WAY commute trip. A round trip (e.g. home-work-home) should be treated as TWO one-way trips.

1. How many years have you been regularly commuting by bicycle? _____1

2. How many ONE-WAY trips do you make per week? _____2

3. During the past year, what was your USUAL (>50%) commute mode? _____3

   car=1, van/carpool=2, transit=3, motorbike=4, bike=5, walk=6, other=7

4. What is your ONE-WAY commute distance and time for your USUAL mode?

   a. miles _____4a b. minutes _____4b

5. What is your BICYCLE ONE-WAY commute distance and time?

   a. miles _____5a b. minutes _____5b

6. Total miles of bike commuting in the past 12 months. _____6

7. How did you commute before you started using your bicycle? _____7

   car=1, van/carpool=2, transit=3, motorbike=4, bike=5, walk=6, other=7

8. If 100% of your commute trips are NOT by bike, what is the PRIMARY reason for not bike commuting on these occasions ? _____8

   need car at work=1, roads too dangerous=2, personal safety=3, lack of facilities at work=4, weather conditions=5, darkness=6, family reasons (i.e. drop off/pick up children)=7, other (please specify)=8

9. How many months in a year do you NOT commute by bicycle because of your regional climate (bad weather)? _____9

ABOUT THE FACILITIES YOU USE.

10. What percentage of your BICYCLE commute trip is made on...
    a. major or arterial roads (w/no specific bike facilities)?_____10a

    b. minor streets (w/ no specific bike facilities)? _____10b

    c. on-street facilities (bike lanes)? _____10c

    d. signed bike route (only signs - no bike lanes)? _____10d

    e. bike paths / trails (off street bike facilities) ? _____10e

    f. other? (Please specify:_____) _____10f
    TOTAL 100%

FIGURE 1 Bicycle commuter survey instrument. (*continued on next page*)

FIGURE 1 (*continued*)

11. Are any of the following facilities provided at your destination for bicycle commuters? (No=0, Yes=1)

a. Bicycle locker ___11a b. Bike racks ___11b

c. Locked room/cage ___11c d. Showers ___11d

e. Clothes storage ___11e f. Others: _____ 11f

12. What facilities not provided at your destination would you most like to see?

_____

ABOUT YOUR BIKE.

13. What type of bicycle do you use MOST for commuting? road/racing=1, mountain=2, hybrid=3, touring=4, recumbent=5, other (please specify _____)=6 ___13

14. Do you have a second commuting bike for bad weather conditions? ___14 Answer No=0, or use key above from Q. 13.

15. a. Total MILES ridden (all purposes), in the past 12 months. Indicate what percentage of these MILES were: ___15a

b. commuting: ___% 15b

c. utility/non-commute (i.e. shopping) ___% 15c

d. recreation / touring / exercise ___% 15d

TOTAL 100%

e. Are responses based on odometer readings? (No=0, Yes=1) ___15e

The following questions (16-21) are concerned only with the bicycle you MOST REGULARLY use for commuting...

16. How much did it cost? $___16

17. Do you regularly carry or use the following on your commute? (No=0, Yes=1)

a. mirror ___17a b. odometer/"computer" ___17b

c. bags/panniers ___17c d. pump and patch kit ___17d

e. spare tube/tire ___17e f. comprehensive tool kit ___17f

g. front light(s) - NOT flasher ___17g h. total watts for lights in g. ___17h

i. front flasher(s) ___17i j. rear light(s) - NOT flasher ___17j

k. rear flasher(s) ___17k l. reflectors/reflective tape ___17l

m. bell / horn ___17m

18. Do you own a cycling helmet? (No=0, Yes=1) ___18

19. Percentage of commute trips do you use your helmet? ___% 19

(*continued on next page*)

FIGURE 1 (*Continued*)

20. Amounts spent (total dollars) in the **LAST 12 MONTHS** on...

NOTE: When considering yearly costs, assign each cost item to one category only, e.g. do not assign home repair costs to 'consumables' & 'repairs'.

a. bicycle purchase $____20a b. accessories w/bike purchase $____20b

c. upgrades after bike purchase $____20c d. consumables (chains/tires) $____20d

e. clothing $____20e f. bike shop repairs/service $____20f

g. tools/supplies for HOME repairs/service $____20g h. bike parking $____20h

i. any other costs not included above (specify:_____) $____20i

21. What percentage of repairs do you do yourself (as opposed to taking your bike to a bike shop)? ____%21

ABOUT YOUR MOTIVATION.

22. Does your employer/school encourage bike commuting by: (No=0, Yes=1)

a. Loaner or free bikes ____22a b. Cash incentives ____22b

c. Prizes/awards ____22c d. Guaranteed ride home ____22d

e. Ride companions ____22e f. Education program ____22f

g. New facilities ____22g h. Other (specify) ____22h

23. Did any of these play a part in your decision to bike commute? (No=0, Yes=1)

a. Car parking costs/availability ____23a b. Gas price/tax ____23b

c. Congestion ____23c d. Better public bicycle facilities ____23d

e. Moved closer to work ____23e f. Environmental concerns ____23f

g. Health/fitness ____23h

ABOUT SAFETY / ACCIDENTS.

24. Regarding SERIOUS accidents that you have been involved in WHILE COMMUTING BY BICYCLE in the last 12 months (count only those incidents in which injuries or property damage in excess of $50 resulted):

a. How many have you been involved in? ____24a

b. Estimate TOTAL property damage for these accidents. $____24b

c. Estimate TOTAL medical costs for these accidents. $____24c

25. How many of these accidents (Q. 24): a. were reported to the police?____25a

b. resulted in legal action? ____25b

26. How many of these accidents (Q. 24) involved: a motor vehicle? ____26a

other cyclists? ____26b pedestrians? ____26c

animals? ____26d no-one else? ____26e

27. How many of these accidents (Q. 24) required a:

a. doctor &/or emergency room visit? ____27a b. hospital stay? ____27b

(*continued on next page*)

FIGURE 1 (*continued*)

28. How many of these accidents (Q. 24) occurred on a:

a. major street / highway? ___28a b. minor street? ___28b

c. bike lane / bike route? ___28c d. bike path? ___28d

e. another type of facility? (Name:_____) ___28e

ABOUT YOUR HEALTH.

29. Your general health since you started bicycle commuting? ___29

improved greatly=1, improved somewhat=2, not improved=3, deteriorated=4

ABOUT YOU AND YOUR HOUSEHOLD.

30. Age _____30 31. Gender (Female=1, Male=2) _____31

32. Total Household Income per year. _____32

0-$15K=1, $15-$30K=2, $30K-$45K=3, $45-60K=4, More than $60K=5

33. Occupation. _____33

Student=1, Clerical=2, Professional=3, Administrative=4, Academic/Teacher=5, Managerial=6, General/Skilled Labor=7, Sales=8, Other=9

34. a. How many motor vehicles do you own? _____34a

b. If ZERO, is this by choice? (No=0, Yes=1) _____34b

35. City _____ 36. Zip / Postal Code. _____36

Comments:

Thank You!

Please complete and return this survey to:

Professor William E. Moritz
Human Powered Transportation
University of Washington
Box 352500
Seattle, WA 98195 - 2500 USA

by e-mail to...moritz@u.washington.edu

by fax to... 206-543-3842

A question was inserted regarding total cycling miles per year both as a cross-check on the commuting miles reported earlier and also to see if high or low annual mileage cyclists evidenced any significant differences when compared to the average bicycle commuter. Additional questions asked about the cost of the commuting bicycle and amounts spent on cycling in the past year. Finally, data on helmet ownership and use were requested.

4. About your motivation. Two multipart questions attempted to assess, first, what encouragement if any the respondent was receiving from his or her employer and, second, what other factors contributed to the decision to commute by bicycle.

5. About safety/accidents. The number of bicycle fatalities and to some extent the more serious injuries are reported each year by the federal government (5). However, the vast majority of cycling

accidents are relatively minor and thus are never reported to the authorities. Bicycling accident rates (per kilometer) are virtually nonexistent because mileage or kilometer figures are very hard to get. These questions were designed to permit such a calculation, as well as to compare rates between facility types. To eliminate the more minor crashes, a threshold for reporting accidents of $50 or more of personal injury or property damage expenses was set. The respondent was asked to indicate who or what else was involved in the crash.

6. About your health. A single question attempted to get a general assessment of whether bicycle commuting might be contributing to overall improvements in health. (Clearly a multitude of other factors may also be at work here and this question was not intended to be definitive.)

7. About you and your household. Finally, a series of questions were asked regarding age, sex, income, occupation, and the number of automobiles owned. The city and postal zip code were also requested.

A space for comments was provided for any additional information the respondent wished to provide.

SCREENING RESPONSES AND DATA ENTRY AND CHECKING

Screening

Responses to several questions were considered mandatory to qualify for entry into the study. These included the years of bicycle commuting, number of trips/week, usual commuting mode, commuting distances and times for both the usual and bicycle mode, total bicycle-commuting miles (Questions 1–6), and the fractional use of the various bicycle facilities (Question 10). Age, gender, and postal zip code (Questions 30, 31, and 36) were also required. In the case of incomplete E-mailed surveys, a message requesting the missing data was sent back to the respondent. Surveys for which it was not possible to secure the missing information were rejected. To be included in the analysis, all of Questions 24–28 had to be completed. Once these screens were passed, each remaining survey was assigned a serial number. The E-mail address associated with each electronic response was placed in a file and that data was processed to detect and remove multiple responses from the same person.

Data Entry and Checking

A Lotus 1-2-3 file was created to record the responses with each surveyed respondent assigned to a single row. There were 101 fields per survey and each row also contained the associated serial number as well as the method of return (E-mail, E-mail-mailed, hard-copy-mailed). With practice, and on forms with the answers where they were requested, it would typically take about 2 to 3 min per survey to complete the data entry. When the answers appeared in unexpected places or were difficult to decipher, it might increase the data entry time to as much as 5 min or more.

Additional checking was carried out following data entry. First, obvious entry errors were usually detected when a result was clearly out-of-bounds (e.g., maximum age = 120). Next, the analysis spreadsheet would verify that there was a response to each of the mandatory questions identified above. Other checks were also performed. For example, the commuting speeds for both usual and bike modes were calculated (Questions 4 and 5). The form was rejected if the bicycle commuting speed exceeded 40 km/hr or the usual (nonbicycle) mode speed exceeded 80 km/hr. Similarly, if they answered that cycling was their usual mode (Question 3), and the answers to Questions 4 and 5 were not the same, the entire form was rejected. Another check was done on the fractional use of facilities. The total reported percentages had to be between 90 and 110 percent. (Only 3.3 percent of the responses did not total exactly 100 percent.) The same limits were placed on the fractional breakdown of bicycle trip purposes (Question 15). One last check involved comparing the reported total bicycle-commuting distance per year with that calculated using the total bicycle miles and the reported fraction of those miles that were commuting. The form was rejected if there was greater than a ±20 percent deviation between these two numbers.

ANALYSIS

Several types of analysis were applied to the final data set. For questions with numerical responses (e.g., years of bicycle commuting and age) the highest, average, median, and lowest values were calculated. In some of these cases, distributions were determined as well, with the results expressed as percentages of the total for each bin (e.g., 32 percent reported having commuted by bicycle for between 1 and 3 years). One derived parameter of particular interest was a measure of the relative danger of the various facilities used to reach work or school, called the relative danger index (*RDI*). Here, the percentage of all of the accidents reported on a particular facility type was divided by the fraction of miles traveled on that facility. An answer greater than 1 would indicate a facility with a greater incidence of accident than might be expected based on miles of use.

For questions in which one choice from a set was requested (e.g., Question 7), the fraction of each response was calculated. In addition, all multiple responses (e.g., walk + transit) were recorded in a single category. Further, for those questions that were not mandatory, nonresponses were tallied. In the case of questions with several possible parts (e.g., Question 11), affirmative responses were totaled and expressed as a percentage of the total number of respondents. Thus, for example, just over 69 percent reported having a bicycle rack available. Finally the postal zip codes were grouped into 10 regions and the percentage of respondents in each region was calculated. Although such groupings are somewhat arbitrary, geographic proximity as the creation of regions containing approximately the same numbers of respondents guided the groupings. This effort resulted in seven, each containing from 6 percent to just over 9 percent. The Pacific and Northwest regions both generated about 20 percent of the responses, however.

RESULTS

The aggregate results are presented by category. Additional analyses are planned (e.g., are there statistical differences based on the sex or age of the respondent?). Space does not permit a presentation of all of those results and the analysis is ongoing. The results that follow should not be interpreted as representing all bicycle commuters in North America. The results reported represent only those who became aware of the survey and took the time to acquire it, fill it out, and return it. It is believed that, at the very least, it provides a fairly detailed picture of this one group of bicycle commuters.

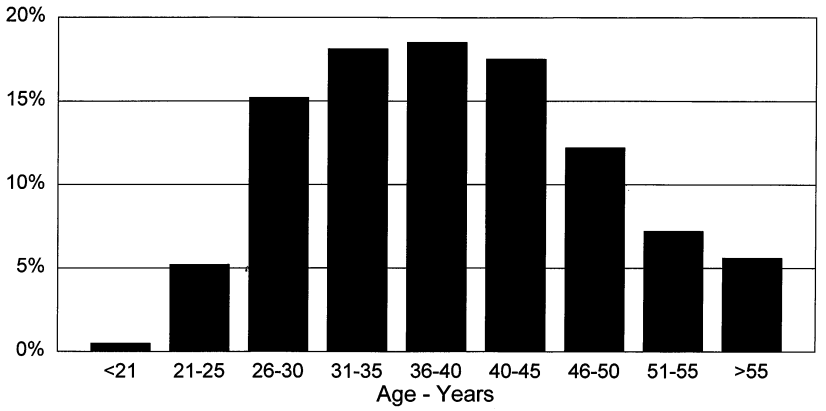

FIGURE 2 Distribution of respondents' ages.

Number and Method of Responses

More than 2,700 responses were received during the 13 months the survey was open. About 10 percent were found to be incomplete or duplicates, leaving a total of 2,445 that were entered into the data base. An additional 71 (2.5 percent) failed to pass the screening and data checking. Thus, the final data set contained 2,374 responses. Of the 2,374 final responses, 66.4 percent were returned electronically by E-mail over the Internet. An additional 9.9 percent were printed versions of the electronic form that were mailed in. The remaining 23.7 percent were the one-sheet form shown in Figure 1 that was mailed out and returned. (Several of both formats were returned via fax, although no record was kept of how many were sent by this method.)

Bicycle Commuters' Profiles (Questions 29 to 36)

The average bicycle commuter in this sample is a 39-year-old male professional who lives in a household with an income exceeding $45,000 per year. He is most likely to own one car; over 12 percent claim to not own a car. Of this latter group 90 percent say such a status is by choice. Women made up 18.5 percent of the respondents. Ages ranged from 15 to 71 years with a median of 38 years and a mean of 39.1 years. (Women were just slightly younger than the men, with an average age of 37 versus 39.6 years for the men.) Figure 2 displays the age distribution of the entire sample population.

Annual household incomes were reported as follows: less than $15,000, 4.5 percent; $15,000 to $30,000, = 11.0 percent; $30,000 to $45,000, 17.5 percent; $45,000 to $60,000, 19.2 percent; and more than $60,000, 43.9 percent. The 3.9 percent nonresponse rate to this question was the highest of any question in the survey because several people specifically considered this information "none of your business." With respect to occupations 57.5 percent classified themselves as professionals, which, along with academics (9.8 percent), students (7.9 percent) and managers (7.4 percent), accounted for all but 18 percent of the respondents. The relatively high incomes and the high proportion of professionals are probably due in large part to the use of the Internet as a primary distribution medium.

Table 1 shows the fraction of the responses by region. The Northwest and Pacific regions generated quite large responses. Meanwhile, Canadians sent in 74 responses, although several noted the difficulty of obtaining U.S. postage stamps to put on the return envelopes requesting surveys. More than a quarter of the respondents (27.8 percent) said that their health had improved greatly since they started bicycle commuting, and more than half (54.3 percent) checked the somewhat improved choice (Question 29). Only 1.4 percent thought they were less healthy, but many of those were long-time commuters who added notes saying that after age 50 they were simply getting old.

Bicycle Commuters' Habits (Questions 1 to 9)

Although one person claimed to have commuted by bicycle for 42 years, the average length of time reported was 8.3 years, with a median of 5 years. Figure 3 shows the distribution of experience, which reveals that about 55 percent have been commuting by bicycle for 6 years or less. Fully 70.3 percent of the respondents declared that cycling was their usual commuting mode, with the automobile at 20.0 percent and transit at 4.5 percent. The average number of one-way commuting trips per week was 8.1 (median = 8).

One-way commuting distances by the usual mode averaged 12 km (range = 0.4 to 100 km, median = 10 km), and the average time spent commuting was 26.4 min (range = 2 to 180 min, median = 20 min). The average usual mode commuting speed was just under 28 km/hr. Bicycle commuting distances also averaged 12 km each way (range = 0.5 to 83 km, median = 10 km), and the average time spent bicycle commuting was 30.7 min (range = 2 to 200 min, median = 25 min). The average bicycle commuting

TABLE 1 Distribution of Responses by Geographic Region

REGION	STATES/PROVINCES	PERCENT
NE	ME, NH, VT, MA, RI, CT	8%
NYNJPA	NY, NJ, PA	8%
ATLANTIC	DE, DC, MD, VA, WV, NC, SC, KY	9%
SOUTH	GA, FL, AL, TN, MS, OK, LA, AR, TX	6%
GREAT LAKES	OH, IN, IL, MI	9%
MIDWEST	IA, WI, MN, SD, ND, MO, KS, NE	6%
MTN + WEST	MT, CO, WY, UT, NM, AZ, NV, AK	8%
NW	WA, OR, ID	21%
PACIFIC	CA, HI	20%
CANADA	All	3%
TOTAL		100%

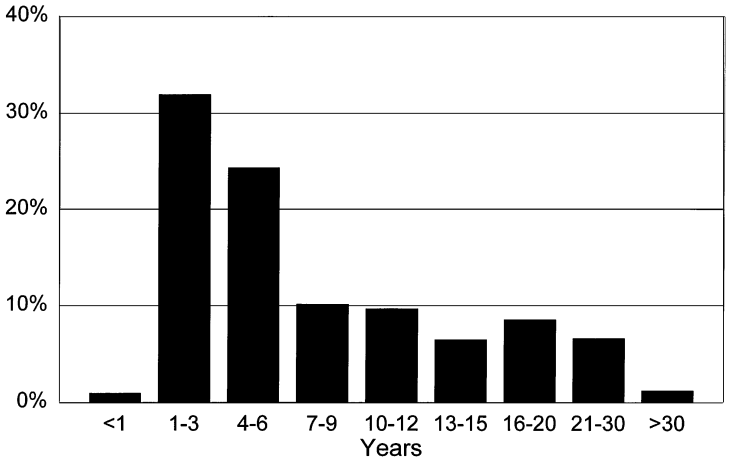

FIGURE 3 Distribution of years of bicycle commuting experience.

speed was 23.5 km/hr. In the aggregate, these riders reported in excess of 7.3 million km of bicycle commuting in the past 12 months (with an average of 3100 km, range = 170 to 20 000 km, and median = 2500 km). Figure 4 shows the distribution of commuting kilometers in 1000-km bins.

As to how these respondents commuted before cycling, the automobile was the most common mode (53.5 percent), with transit (15.9 percent) and walking (12.3 percent) being the two next most used. Interestingly, 6 percent checked bike, implying that they had always commuted by bicycle. (This indeed was confirmed by several people who added comments to that effect.) The most common reasons given for not using the bicycle to commute more were, in decreasing order: weather, 38.8 percent; other, 13.9 percent; need a car at work, 7.7 percent; multiple responses, 5.8 percent; and family responsibilities, 5.6 percent. There were no consistent themes in the other category. The average respondent commuted by bicycle about 10.6 months out of 12. Almost 54 percent did so year-round, whereas only 4.3 percent rode just 6 months of the year.

Bicycling Facilities En Route and at Destination (Questions 10 to 12)

The fraction of the bicycle-commuting miles reported on each type of facility is shown in Table 2. Note that the other category was usually indicated as sidewalks or parking lots. At the destination, 15.2 percent reported having bicycle lockers; 69.1 percent, bicycle racks; and 18.5 percent, a locked room or cage in which to store their bicycles. In addition, 56.9 percent said that they had a shower available, and 44.1 percent indicated that clothing storage was available.

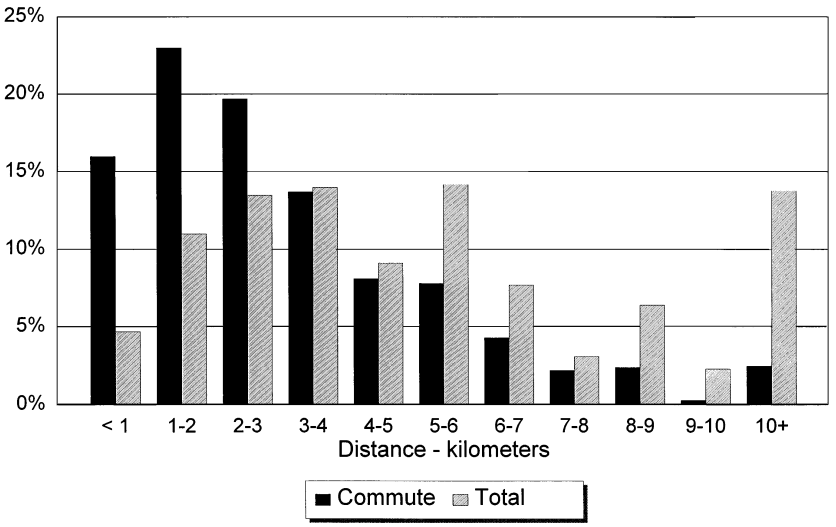

FIGURE 4 Distribution of annual cycling distances ridden for both commuting and all trip purposes.

TABLE 2 Relative Danger Associated with Various Bicycle Facilities

FACILITY TYPE	FRACTION OF COMMUTING KM	FRACTION OF CRASHES	RELATIVE DANGER +
Major street *	35.4%	44.6%	1.26
Minor street *	31.0%	32.1%	1.04
Bike lane/route #	18.4%	9.2%	0.50
Bike path	14.4%	9.6%	0.67
Other &	0.8%	4.4%	5.30
TOTALS	100.0%	100.0%	

NOTES: + - Fraction of crashes/fraction of commuting km.
* - No specific bike facilities provided.
# - Bike lane and bike routes combined.
& - Most frequently sidewalks.

Fully 61 percent indicated that they would like to see additional or improved facilities, with the most common responses being better parking, showers, and clothing storage.

Commuters' Bicycles, Riding, and Equipment (Questions 13 to 21)

Mountain bikes (29.7 percent) barely edged out road bikes (28.1 percent) as the most popular commuting bike, followed by hybrids (17.9 percent) and touring models (17.4 percent). Having a second, bad-weather bike was reported by 35 percent of the respondents. This group reported a total of 13 million cycling kilometers in the 12 months before filling out the survey. The average distance cycled was almost 5500 km (range = 170 to 30 000 km, median = 4350 km). Figure 4 shows the distribution of total cycling kilometers in 1-km bins. Just under 14 percent of these respondents claim to ride more than 10 000 km per year. Commuting represented 60.6 percent of the total distance ridden, with recreation contributing 32.0 percent, and utility trips comprising the balance (7.3 percent). As another internal check, multiplying the reported commute fraction by the average total kilometers ($0.606 * 5500$), yielded 3333 km, which agrees reasonably well with the average answer to Question 6 of 3100 km. The majority of respondents (77.7 percent) indicated that their answer to this question was based on odometer readings.

The average commuting bicycle was reported to have cost $687 (range = free or gift to $7,000, median = $500). The most commonly reported accessories were reflectors (80.0 percent), rear flashers (78.7 percent), pump (77.0 percent), front light (75.9 percent), and panniers or bags (71.7 percent). With respect to helmets, 98.2 percent reported owning a cycling helmet, with only 0.3 percent not responding. Of those having a helmet, 86.5 percent said that they wore it every time they rode, with another 5.3 percent indicating they used their helmet between 90 and 99 percent of the time. Only 3.1 percent of those owning a helmet said that they never wore it while bicycle commuting. The respondents reported spending an average of $714 on bicycle-related purchases in the past 12 months (for a total of $1.7 million). Bicycles ($308), upgrades ($102), and clothing ($89) were the three top expense categories. With respect to doing their own repairs, this group was reasonably self-reliant. Almost half (46 percent) said that they did at least 90 percent of the repairs on their bicycles. The average response was 68 percent, with the median at 80 percent.

Bicycle Commuters' Motivation (Questions 22 and 23)

Based on their responses, this group of bicycle commuters has not received much in the way of support from their employers or schools. Facilities was checked by 15.0 percent followed by a guaranteed ride home (10.7 percent), with education, prizes, and other each being indicated by about 9.5 percent. With respect to the factors contributing to their decision to commute by bicycle, nearly 95 percent said that health and fitness were important. This was followed by concern for the environment (81.6 percent) and congestion (51.7 percent). The cost of gasoline and car-parking costs and availability were checked by 45.6 percent and 34.0 percent, respectively. Several respondents included a note saying one of their major motivations had not been included—fun.

Bicycle-Commuting Safety and Accidents (Questions 24 to 28)

A total of 271 crashes while bicycle commuting in the previous 12 months were reported by 232 respondents (9.8 percent). One person claimed to have been involved in four crashes, 5 people said they had three, and another 26 reported two crashes each. Median property and medical damages were each $100. The averages, $339 and $1,120, respectively, were biased upward substantially by a handful of very expensive crashes. Indeed, one person had one accident that produced both the highest property damage ($10,000) and the highest medical expenses ($20,000) reported. Seven claimed property-damage totals ranging from $2,000 to $5,300. A total of three had medical expenses of $20,000 and seven more were in the range from $10,000 to $14,000 in this category. Nearly two in five victims (38.2 percent) reported their crashes to the police, whereas only 12.9 percent of the accidents resulted in legal action. More than half (56.6 percent) required a visit to the doctor or emergency room, but only 5.5 percent involved a hospital stay. By far the most common type of crash involved a motor vehicle (58.3 percent). Nearly 30 percent involved only the cyclist, most likely a fall. Other cyclists contributed just 6.3 percent of the total, and pedestrians and animals accounted for 3.3 percent and 2.2 percent, respectively.

Relative Danger of Various Facilities

Arguments have raged for years about the relative safety of the various on- and off-street facilities used by cyclists (*6*). There has, however, been very little information upon which to assess accident rates because it is almost impossible to gather the distances traveled on each facility type. This survey provides just such data and represents one of the major findings.

Responses to Questions 10 (fractional use of facilities) and 28 (accident location) can be combined to develop an indication of relative danger. The results appear in Table 2. Major streets without bicycle facilities accounted for 35.4 percent of the commuting kilometers traveled in the past year, yet had 44.6 percent of the crashes. Thus, relative to the distance ridden on them, major streets had 26 percent more accidents [or a relative danger index (*RDI*) of 1.26]. Meanwhile, minor streets exhibited an *RDI* of 1.04, indicating that such streets experience crashes very nearly in proportion to the distances traveled on them. Streets with bicycle lanes or marked bicycle routes appear to have less than half the risk of local streets, and bicycle paths, often maligned, were also substantially safer than even local streets. An error was made in preparing the survey in that in Question 28 bicycle lanes and bicycle routes were combined into a single category, whereas in Question 10 they were listed separately.

In the present analysis the fractional use-results from Question 10 for these two types have been combined. The other category, although contributing less than 1 percent to the total kilometers ridden, had 4.4 percent of the accidents for an *RDI* of 5.3, by far the highest of any facility. In the vast majority of cases, respondents indicated that the Other type was a sidewalk. The results obtained here confirm the view that riding on sidewalks is extremely dangerous, even for commuters who are often considered the best cyclists (*6,7*).

Accident Rates

An overall accident rate can be calculated as follows: 271 reported crashes while bicycle commuting a total distance of 7.3 million km yields a rate of 37.1 crashes per million km. Stated another way, these cyclists experience an accident once every 27 000 km. Thus, if these cyclists continue bicycle commuting at their current rates (3100 km/yr), they should experience one accident every 8.7 years, on average.

Comments

Almost 34 percent of the respondents took the time to add comments at the end of the survey. Although these have not yet been cataloged, some common themes were appreciation that someone was finally doing such a survey; requesting the results; explaining various answers; suggesting additional questions; relating "war stories from the street"; and in many cases, providing uplifting testimonials to the fun, freedom, and physical benefits they receive as a result of their commuting by bicycle.

CONCLUSION

This first-ever national survey of bicycle commuters has generated a wealth of information. Although much analysis remains to be done, it is clear that this group includes a wide spectrum of individuals from all regions of the country. The results presented here should assist policy makers, businesses, and advocates to better understand the needs and characteristics of those who choose to forsake the automobile and enjoy their commutes. As one respondent said when contemplating his daily bicycle commute, "We are truly blessed. How many people riding in their cars would say that about their commute?"

ACKNOWLEDGMENTS

Daniel Booth assisted the author in drafting and testing the survey as part of his project in the author's Human Powered Transportation class at the University of Washington. Adventure Cycling and the League of American Bicyclists, as well as *Bicycling* magazine, made their members or readers aware of the survey and generated several hundred responses each. Bret Pudists assisted in data entry. But clearly those most responsible for the success of this project are the thousands who took the time to fill out and return the survey and the several dozen who took the initiative to make others aware of the study.

REFERENCES

1. *Transportation Enhancement Financial Summary*. Rails-to-Trails Conservancy, Washington, D.C., Feb. 1996.
2. *National Personal Transportation Survey 1990*. Bureau of Transportation Statistics, U.S. Department of Transportation, 1990.
3. Zegeer, C., M. Cynecki, J. Fegan, et al. *The National Bicycling and Walking Study*. Final Report FHWA-PD-94-023, FHWA, U.S. Department of Transportation.
4. Goldsmith, S. A. *National Bicycling and Walking Study, Case Study No. 1: Reasons Why Bicycling and Walking Are and Are Not Being Used More Extensively as Travel Modes*. FHWA-PD-92-041 FHWA, U.S. Department of Transportation, 1993.
5. *Traffic Safety Facts, 1994*. NHTSA, U.S. Department of Transportation, Aug. 1995.
6. Forester, J. *Effective Cycling*, 6th ed. MIT Press, Cambridge, Mass. 1993.
7. Wachtel, A., and D. Lewiston. Risk Factors for Bicycle-Motor Vehicle Collisions at Intersections. *ITE Journal*, Sept. 1994, pp. 30–35.

Publication of this paper sponsored by Committee on Bicycling.