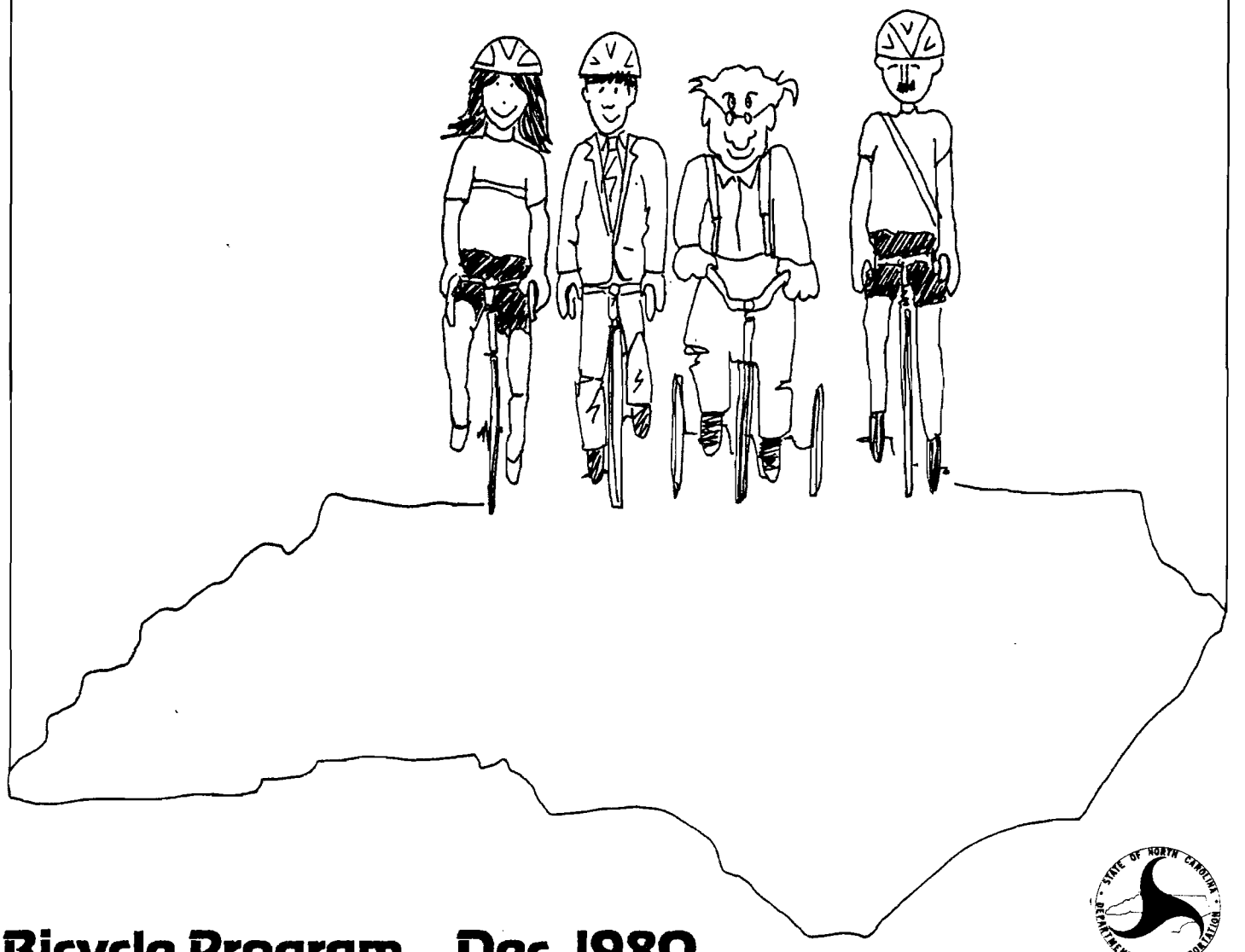
N.C. Dept. of Transportation

Characteristics of the Adult North Carolinian Who Uses A Bicycle Regularly



Bicycle Program Dec. 1980

CHARACTERISTICS OF THE ADULT NORTH CAROLINIAN WHO USES A BICYCLE REGULARLY

1977 - 1979

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Chapter 1

INTRODUCTION

Bicycle sales continue to climb in North Carolina, and many more adults are bicycling regularly. In order for the Bicycle Program of the North Carolina Department of Transportation to continue to meet the needs of these cyclists, it must assess the changes in the avid cyclist population. This study is an update of the report by Robert E. Price, "Characteristics of the Adult North Carolinian Who Uses A Bicycle Regularly," 1977. It will analyze the similarities and differences in the avid cyclists in North Carolina.

Objective of Study

The objective of the Kaplan Study on which the North Carolina study was based, was to "determine the habits of the adult bicycle rider (16 or older), who uses his bicycle on a regular basis, in order to identify characteristics of the bicyclist and his trips." Price designed his study so that "in those areas in which the North Carolina cyclist differed from the average American cyclist, a better understanding of the North Carolina cyclist could be had." The current update of the Price study seeks to identify changes in the North Carolina cyclist who uses his bicycle regularly, and to establish the present characteristics of such a cyclist.

In keeping with the Kaplan and Price studies, this study does not intend to identify qualities of the average North Carolinian who owns a bicycle. Most average bicycle owners do not use their bicycles regularly. In this study, "regular bicycle use" is defined as cycling at least three times a month during the months that the cyclist considers suitable for cycling. This study will make statements about the adult North Carolina cyclist who uses a bicycle regularly.

Chapter 2

COLLECTION OF DATA

Design of Questionnaire

The same survey questions were used for both the 1979 and the 1977 questionnaires. The requirements for respondents are also the same. Only persons 16 years of age or older were asked to respond, mainly because they were more likely to have an automobile available in addition to their bicycle. The instructions asked only the most active rider in the household to respond to the questionnaire, which caused the number of respondents to be a conservative estimate of the total number of avid North Carolina bicycle riders.

The information requested in the survey may be divided into personal and bicycling information about each cyclist; Table 1 lists this data. The questionnaire asked for additional comments, so many cyclists described their opinions about all aspects of bicycling. Comments are addressed in one of the final chapters.

Table 1

Information Requested on Both Questionnaires

Personal Information

- Age
- Sex
- City, State, and Zip Code
- Population size and topography of area where respondent lives
- Number of automobiles available for respondent's use

Bicycling Information

- Bicycle type and equipment on bicycle
- Respondent's cycling experience and riding habits with regard to rain, darkness, and temperature
- Riding activities in one year's time, including total mileage, months riden, number of trips and miles for different trip purposes, and percent of riding on weekdays
- Type of roads and topography used for cycling
- Accident experience in the last year, including location of crash and type of object collided with during the accident
- Estimate of future cycling compared to that of the present
- A "snapshot" of cycling activity during the week prior to filling out the questionnaire

*Source: Characteristics of the Adult North Carolinian Who Uses a Bicycle Regularly, by Robert Price, 1977.

A letter accompanying the questionnaire and explaining the purpose of the study may have affected the results. The letter is included in the appendix.

Administration of Survey

About 617 surveys were distributed in 1979, 42 surveys were returned undeliverable, and 407 were answered and returned to the Bicycle Program. Ten of those were completed by respondents who were not sixteen, so these were eliminated. Therefore, 393 surveys were useable, for a return rate of 63.7 percent compared with a 1977 return rate of 44.6 percent.

The Bicycle Program estimates that 50 to 75 percent of the people who responded in 1977 also completed a 1979 questionnaire. Yet, the names of the respondents to the 1977 survey were not available, so that the two sets of responses could not be matched. In order to facilitate statistical study, the two samples are assumed to be independent, and tests are done with a 95% level of confidence.*

Both the 1977 and 1979 surveys were mailed to North Carolinians who belonged to local bicycle clubs, the League of American Wheelmen, or the United States Cycling Federation. Great care was taken that the persons affiliated with more than one bicycling organization received only one questionnaire. Five local clubs, who were newly formed and without membership rosters, were sent the number of questionnaires that they requested.

Because the survey was sent only to cyclists affiliated with some type of club, the response to the question about bicycle club membership is unusual. Table 2 shows that 5 percent in 1977 and 13.2 percent in 1979 of the respondents were not a member of either a local or national bicycle club. Perhaps the club rosters are not up to date. Local bicycle club membership has maintained a fairly constant level, yet national club affiliation among avid North Carolina cyclists has increased from 1977 to 1979. This may indicate a trend toward a broader involvement in bicycling among regular cyclists. The sharp increase in no club affiliation may be discounted because it is inconsistent with the administration of the survey.

* Because the assumption of statistical independence could seriously affect confidence interval estimation, I will <u>not</u> use a proportioned difference formula such as: $(\pi_1 - \pi_2) = (P_1 + P_2) \pm 1.96\sqrt{\frac{P_1(1-P)_1}{n_1} + \frac{P_2(1-P_2)}{n_2}}$.

Instead, I have chosen a more conservative approach. Since the maximum value of $\pi(1-\pi)$ is $\frac{1}{4}$, the formula $\pi = P \pm 1.96\sqrt{\frac{\pi(1-\pi)}{n}}$ becomes $\pi = P \pm .98/\sqrt{n}$. All confidence intervals and hypothesis testing at 95% confidence are conservative.

Table 2

Bicycle Club Membership

Bicycle Club Involvement	Total Number of Memberships 1977	1979	Percent of Memberships 1977	1979
Local	121	189	45.6	48.1
National	38	33	14.2	8.4
Both	93	119	35.2	30.3
Neither	13	52	5.0	13.2
Totals	265	393	100.0	100.0

Data Processing

Each response was read, coded on the IBM coding form included in the index, and key punched. The respondents answered about accidents only when they indicated having accidents. Price had difficulty in 1977 because the cyclist seemed to believe that the question was directed toward serious accidents only. In 1979 more respondents answered the question, and this problem was eliminated. Problems with the processing are discussed in the chapter dealing with specific questions involved.

Chapter 3

COMPREHENSIVE DATA EVALUATION

Geographic and Population Group Distribution

The distribution by area population size, shown in Figure 1, is more evenly distributed than the 1977 survey. Price had difficulty dealing with the rural population of cyclists in 1977 because of the small number of rural respondents. The 1979 survey has more rural respondents, totaling 10.3% of the total respondents. At a 95% confidence level, none of the changes in the distribution of cyclists by population were statistically significant. It would be interesting to determine how the population of North Carolina shifted during this period. The shift in the cyclist population relative to the entire state population would be more conclusive.

FIGURE 1

Distribution of Respondents by Area Population Size

	Number of Responses		Percent of Total	
Area Population Size	1977	1979	1977	1979
250,000 to 1 million	61	69	23.1	18.2
50,000 to 250,000	125	190	47.3	50.0
5,000 to 50,000	60	82	22.7	21.6
Less than 5,000 (Rural)	18	39	6.8	10.3
TOTALS	264	380	99.9	100.1

The distribution of the respondents by zip code areas is illustrated in figure 2. The large metropolitan areas all gained bicyclists in absolute figures and yet only the Greensboro/High Point/Winston-Salem area showed a significant increase in the percentage of total regular bicyclists. Charlotte showed a significant decrease in avid cyclists. Raleigh showed virtually no change. The decrease in Fayetteville cycling may be attributed to the collapse of a bicycling club. Because of the method of distribution, many of these changes represent changes in local bicycle club membership. Still, the majority of cyclists continue to be in the counties in the Piedmont area.

Figure 2

Geographic Distribution of Respondents
According to Zip Code Areas

Zip Code Areas by Largest City in Area	Number of Respondents 1977	1979	Absolute Change	Percent of Total 1977	1979
Asheville	11	35	+34	4.1	9.7
Hickory	6	4	- 2	2.1	1.1
Charlotte	69	74	+ 5	27.1	20.6
Greensboro	66	129	+63	25.9	35.9
Fayetteville	23	8	-15	8.9	2.2
Raleigh	58	83	+25	22.7	23.1
Rocky Mount	12	5	- 7	4.5	1.4
Elizabeth City	1	6	+ 5	0.2	1.7
Kinston	6	4	- 2	2.1	1.1
Wilmington	11	11	0	4.1	3.1
Total	253	359	+106	101.7	99.9

The topography of the areas in which cyclists live and ride will tell more about the geographic distribution of the regular cyclist in North Carolina. Table 3 shows the crosstabulation of the topography of the area which cyclists live in compared to the topography of the area which cyclists ride in for both surveys. The bicyclists living in the flat areas showed the most change from 1977 to 1979, although none of the changes in bicycling patterns were statistically significant. The cyclists living in flat areas showed a trend to ride less in their home area and more in rolling areas. Interestingly, bicyclists from flat areas continued to shun mountainous bicycling, and the cyclists living in the mountains did not ride in the flat areas either. Bicyclists living in mountainous areas traveled to rolling or to flat areas to ride more often than cyclists from the flat or the rolling areas did. Cyclists from rolling areas rode in their home topography more often than either of the other groups. A trend may develop for bicyclists from the flat areas to cycle more in their home topography, but from 1977 to 1979 the difference was not great enough for a general conclusion.

Even if a trend for flatlanders to cycle more in the flats develops, fewer cyclists rode in the flat areas in 1979 than in 1977 as a percent of the total, because fewer cyclists from flat areas responded to the 1979 questionnaire. The surveys' results show a statistically significant difference between the number of cyclists living in the flat areas in 1977 compared with that number in 1979. Fewer avid cyclists are living in flat areas in 1979.

TABLE 3

Cross-tabulation of Cyclists by Living and Bicycling Topography

1977 Count / Row % / 1979 Count / Row %	Respondents riding in an area that is mostly: Flat		Rolling		Mountainous		Total for Living Area and %	
Flat	48	80.0	12	20.0	0	0.0	60	22.8
	48	84.2	9	15.8	0	0.0	57	14.6
Rolling	3	1.6	185	97.8	1	0.5	189	71.9
	9	3.9	289	95.1	6	2.0	304	77.9
Mountainous	0	0.0	5	35.7	9	64.3	14	5.3
	0	0.0	11	37.9	18	62.1	29	7.4
Total for Riding Area and %	51	19.4	202	76.8	10	3.8	263	100.0
	57	14.6	309	79.2	24	6.2	390	100.0

Sex and Age Distribution

Of the respondents in 1979, 82.7% were male and 17.3% were female. Compared with 84% male and 16% female regular cyclists in 1977, the 1979 respondents were tending toward a more even distribution. However, the change is not statistically significant at 95 percent confidence.

The average age of the regular North Carolinian cyclist was 32.9 years, up 1.5 years from the 1977 mean of 31.4 years. The difference in age is not significant either, and the differences in male and female ages showed no change.

Since the survey was taken two years and two months prior to the 1979 survey, the age change of one year and six months reflects in part the dependence of the two samples. The range of cyclists' ages was approximately the same, with a minimum age required to complete the survey of 16 years and a maximum of 70 years. The majority of the avid cyclists have shifted from the 16-25 year old category to a vast majority in the 26-35 year old category. Of the 44.5 percent in the 26-35 year old age group, less than one-seventh of the cyclists are female. The typical regular North Carolinian cyclists, with 39.2 percent of the total population are males from 26-35 years old.

Automobile Availability

Table 4 shows that fewer cyclists had two cars available for their use in 1979. This decrease in two automobiles is reflected in slight increases in the cyclists who have zero and one car available to them. Perhaps more cyclists are substituting bicycling for driving.

Table 4

Distribution of Respondents by Automobile Availability

Number of Automobiles Available for use	Number of Respondents 1977	1979	Percent of Total 1977	1979
0	12	31	4.5	7.9
1	113	179	42.6	45.5
2	116	146	43.8	37.2
3.	19	30	7.2	7.6
4 or more	5	7	1.9	1.8
Totals	265	393	100.0	100.0

Bicycle Type and Equipment

The respondents own almost the same distribution of bicycle types in 1979 as they did in 1977, as shown in Table 5. The overwhelming majority ride bicycles with 10 or more speeds.

TABLE 5

Distribution of Respondents by Bicycle Type

Bicycle Type	Number of Respondents 1977	1979	Percent of Total 1977	1979
One Speed	2	1	0.8	0.3
Three Speed	4	6	1.5	1.5
Five Speed	3	7	1.1	1.8
Ten or More Speed	265	379	96.6	96.4
TOTALS	274	393	100.0	100.0

Respondents' use of safety equipment is summarized in Table 6. More cyclists had a rear view mirror and wore helmets in 1979, which indicates an increasing concern for safety. This concern does not extend to nighttime bicycling, as about the same number use lights to bicycle. A startling 9.1 percent decrease in percent of registered bicycles from 1977 to 1979 for cyclists is also shown in Table 6. Bicyclists need to be aware of the importance of bicycle registration in recovering stolen bicycles; however, most avid cyclists own cycles valued from $200 to $1,500. Such expensive machines are usually not recovered by local police.

Further, cyclists with expensive finishes on their frames do not want a registration sticker on their bicycles. Cyclists should be educated as to the value of bicycle registration tags. This goal could be accomplished by sending informative leaflets to the local bicycle clubs.

TABLE 6

Response to Equipment Questions
(in percent of total respondents)

Q. Does your bicycle have a rear view mirror?

	Yes	No	
1977	25	75	N = 252
1979	38.6	61.4	N = 391

Q. Do you wear a helmet?

	Yes	No	
1977	58	42	N = 258
1979	63.6	36.4	N = 393

Q. Does your bicycle have an odometer?

	Yes	No	
1977	26	74	N = 250
1979	23.7	76.3	N = 393

Q. Do you use lights?

	Yes	No	
1977	54	46	N = 257
1979	55.2	44.8	N = 393

Q. Is your bicycle registered?

	Yes	No	
1977	47	53	N = 260
1979	37.9	61.8	N = 393

Bicycling Experience

Figure 3 shows the results of the respondents' answers to the question, "How many continuous years have you ridden your bicycle regularly?" (Regularly is defined as at least three times a month during suitable riding months.) This question was designed to eliminate responses in which the cyclist included childhood bicycling in their riding experience. The phrase "continuous years" asked for only consecutive years of bicycling.

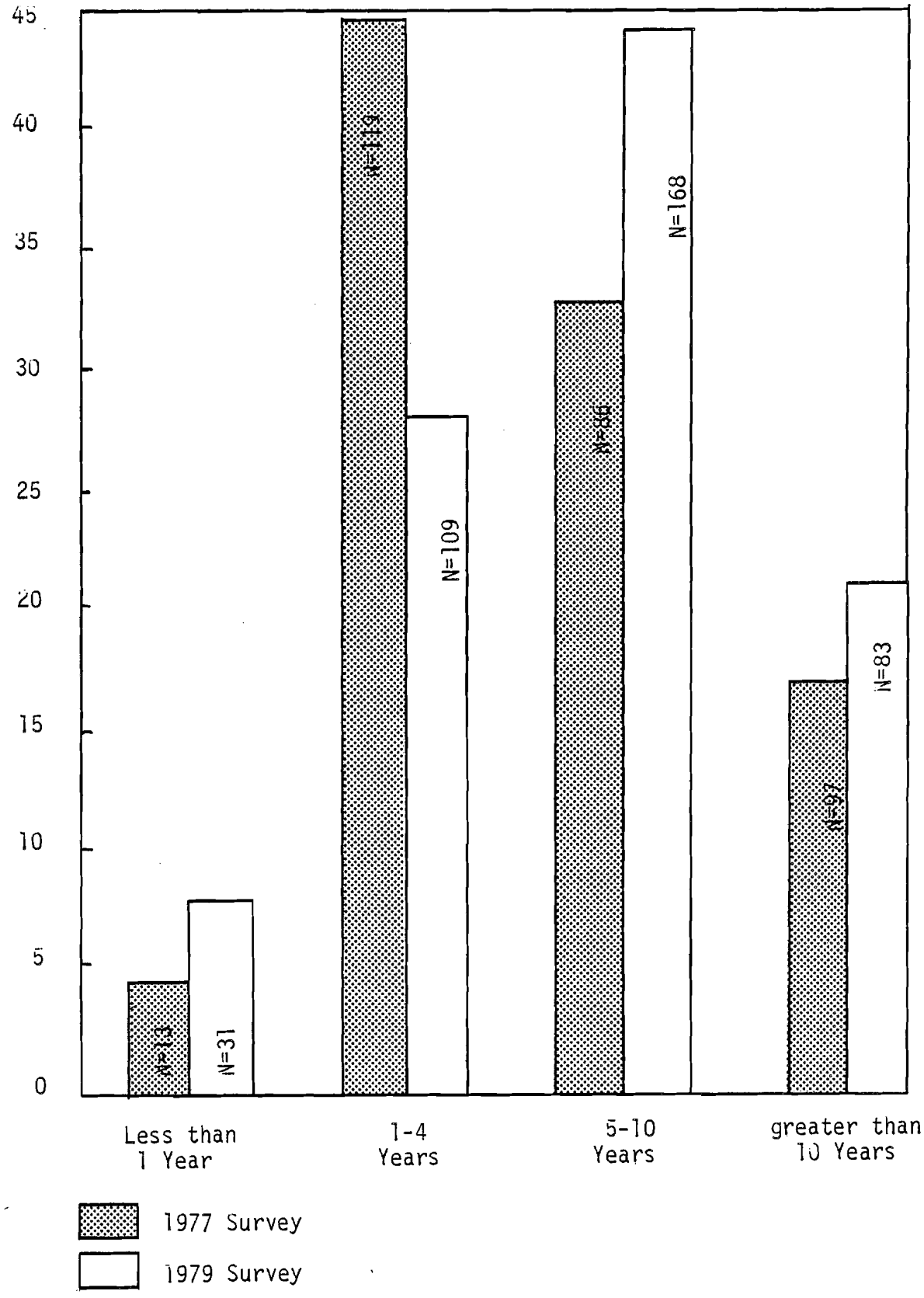
The riding experience of the bicyclists is different for the 1977 and 1979 surveys. More cyclists had ridden less than a year in 1979, and for 1-4 years and 5-10 years experience, the percentage increased steadily. The percentage of cyclists peaked at 5 to 10 years experience in 1979, while the peak for the 1977 data was 1 to 4 years experience. Both of these peaks correspond to the 15.2 million bicycles sold in 1973 at the peak of sales before the dip during the recession of 1974 -1975.* Therefore, it is logical that the 1977 survey would show a great percentage of bicyclists with 1 to 4 years experience and 1977 data would show most cyclists with 1 to 10 years experience.

Note that the confidence interval is computed on the assumption that the samples are independent, and this conclusion states that the two samples should be dependent. Insufficient data neccesitates the assumption of independence for confidence intervals, but many of the 1977 and 1979 respondents are probably the same.

The exciting part of this shift is that the persons who bought bicycles are continuing to ride them. The difference between the two peaks is not significant at a 95% confidence level, so that the cyclists who were riding bicycles in 1977 are continuing to ride them in 1979. This shows the consistent interest and enthusiasm for bicycling in North Carolina. Bicycling is not a fad sport; the regular cyclists in 1977 maintained regular cycling habits into 1979.

* The United States bicycle market peaked at 15.2 million bicycles sold in 1973, dipping to 7.3 billion bicycles sold in 1975. Figures are furnished by Bicycle Manufacturing Association, Incorporated, April 30, 1980.

Figure 3
Distribution of Respondents by Continuous Riding Experience



Annual Mileage

The average number of miles cycled in a year decreased from 3,108 miles in 1977 to 1,745.1 miles in 1979. This difference is not easily explained, due to the lack of data from the 1977 survey. Chapter 4 contains a more indepth study of mileage. The average avid cyclists in 1977 rode 10.3 months out of the year, while the 1979 bicyclist rode 9.5 months. This difference is not significant.

An examination of the distribution of cyclists by annual mileage in increments of 1000 miles yields no significant changes from 1977 to 1979. Table 7 shows that the majority of the respondents who averaged 0-1000 miles cover 30 percent of the cyclists in both surveys. More cyclists have average annual mileages between 1000 and 2000 in the 1979 study, which may help explain the difference in the total mean mileage.

Price indicated that North Carolina has many more racing cyclists and touring cyclists than the nation does. He classified this group as traveling more than 5000 miles annually. North Carolina still has about the same percentage of cyclists who travel more than 5000 miles in a year (19.3 in 1977 and 19.8 in 1979).

TABLE 7

Percent Distribution by Annual Mileage

Annual Mileage	Number of Respondents		Percentage of Total	
	1977	1979	1977	1979
0-1000	91	117	34.5	31.0
1001-2000	45	83	17.0	22.0
2001-3000	32	44	12.1	11.7
3001-4000	29	30	11.0	7.9
4001-5000	16	28	6.1	7.4
5001-6000	14	20	5.3	5.3
6001-7000	7	16	2.6	4.2
7001-8000	12	8	4.5	2.1
8001-9000	6	6	2.3	1.6
9001+greater	12	25	4.5	6.6
Totals	264	377	99.9	99.8

Cyclist responses to the question, "How much bicycling do you think you will do in the current year as compared to last year?" are cataloged in Table 8. Only 5.7 percent of the 1979 cyclists planned to ride less than they had in the previous year, and these bicycle riders generally gave illness or upcoming operations as their reason. The only statistical difference in the two surveys here is the number of cyclists who planned to ride more or much more that year. While 52.8 percent of the avid cyclists indicated great projected riding in 1977, 60.1 percent of the 1979 respondents planned to ride more compared to the previous year. More avid cyclists expressed a deepening commitment to bicycling in 1979.

TABLE 8

Distribution by Projected Bicycling

Projected Bicycling	Number of Cyclists 1977	1979	Percent of Total 1977	1979
Much less	4	6	1.5	1.6
Less	20	15	7.5	4.1
About the Same	101	126	38.1	34.2
More	100	139	37.7	37.8
Much More	40	82	15.1	22.3
Totals	265	368	100.0	100.0

Riding facilities were classified as major streets, minor streets, on-street facilities such as bike routes or bike lanes, and off-street facilities such as bike paths. Cyclists recorded the number of miles that they travel annually on each type of facility, and Table 9 shows that data. On-street facilities showed an increase from 1977 to 1979. The bicycling done on major streets decreased slightly, while minor street bicycling decreased 10 percentage points. Apparently the number of bicycle lanes and bicycle routes increased from 1977 to 1979, or else the awareness of existing routes and lanes increased. More cyclists are traveling on the routes and lanes specified for bicycle travel; bicycle facilities are decreasing the bike traffic on major and minor streets. Off-street facilities such as bicycle paths are still relatively rare in North Carolina, and therefore bicyclists continue to use off-street facilities infrequently. Bicycle travel on bike paths did not increase significantly. It would be interesting to investigate the relative increase in the number of bicycle facilities across the state during this same time period.

Although there was a significant increase in bicycle travel on bicycle facilities, still over half (54.4 percent) of the annual bicycling mileage of North Carolina avid cyclists is traveled on minor streets. Secondary road improvements such as filling potholes, smoothing and grading surfaces, widening roads and adding shoulders aid bicyclists by improving their road system. Although cyclists travel more frequently on the minor, secondary roads with low traffic counts, 36.6 percent of their mileage is accumulated on major streets. It is interesting to note that although commuter traffic and commuter accidents have increased dramatically, bicycle travel on both major and minor streets has actually decreased. Cyclists are making an effort to travel safely on bicycle facilities, but even so the bicycle accidents are increasing.

TABLE 9

Percent of Annual Mileage Ridden on Each Type of Facility

	Major Street	Minor Street	On-Street Facility (Lane,Route)	Off-Street Facility (Path)	Total*
NC 1977	38.7	64.0	1.9	1.3	105.9
NC 1979	36.6	54.4	5.3	2.0	98.3

* Because the totals do not equal 100, figures and comparisons are approximate.

Attitude Questions

Cyclists' responses to the question, "At what temperature is it usually too cold for you to ride your bicycle?" are recorded in Table 10. Although the scale was not specified on the survey, the answers seemed to be based on the Fahrenheit scale for the most part. The mean temperature that cyclists believed was too cold for riding was 27.2 degrees as compared to 28.1 degrees in 1977. The range was great in both cases; apparently some cyclists reported the temperature that they felt was too hot for bicycling. While 41.1 percent of the 1977 respondents would not bicycle at sub-30 degree temperatures, only 35.1 percent of the 1979 cyclists would refrain from riding if the mercury registered a temperature below 30 degrees.

Concerning climate, bicyclists reported the number of months that they felt were suitable for cycling in their area and also the number of months that they actually bicycled. Table 11 shows the percent of respondents by the number of months that they indicated. Again, some cyclists may have misunderstood the question and recorded the number of months that they found unsuitable for bicycling, but there are not an unreasonably number of low responses. The mean number of months that cyclists actually rode did not decrease significantly but the number of cyclists that would ride year round decreased sharply. While 50.9 percent of the 1977 respondents believed that their climate was suitable for cycling year round and 53.4 percent rode year round, only 39.6 percent of 1979 cyclists said that their climate was suitable for riding year round and even fewer 36.0 percent actually bicycled twelve months. A large number of 1979 cyclists believed that their weather was suitable for cycling nine or ten months a year, and as many actually rode 8 to 10 months a year as rode year round.

TABLE 10

Distribution of Cyclists by Minimal Riding Temperatures

Temperature in Degrees Fahrenheit	Number of Cyclists 1977	Number of Cyclists 1979	Percent of Total 1977	Percent of Total 1979
0 - 9	23	10	8.7	3.1
10 - 19	29	33	10.9	10.2
20 - 29	57	71	21.5	21.8
30 - 39	77	108	29.1	33.2
40 - 49	48	78	18.1	24.0
50 and over	31	25	11.7	7.7
Totals	265	325	100.0	100.0

TABLE 11

MONTHS OF RIDING

Number of Months	Percent of Respondents Finding Riding Suitable 1977	1979	Percent of Respondents Actually Riding 1977	1979
2	0.0	0.0	0.0	0.5
3	0.0	0.3	1.5	0.8
4	0.4	0.0	1.1	2.1
5	0.4	0.0	2.7	2.9
6	0.4	1.8	4.2	8.1
7	3.0	2.6	1.5	6.0
8	7.5	9.3	8.4	13.1
9	17.4	19.0	10.3	12.1
10	16.6	18.5	13.0	13.4
11	3.4	9.0	3.8	5.0
12	50.9	39.6	53.4	36.0
TOTAL	100.0 N=265	100.0 N=389	100.0 N=262	100.0 N=381

1977	1979
Mean = 10	Mean = 9.5
3 - 12 months	2 - 12 months

Respondents were questioned about the frequency that they rode in the dark and the rain. Cyclists in 1977 and 1979 answered approximately the same; at 95 percent, there were no significant differences in any of the answers. Over half said that they rode occasionally in the dark, while closer to two-thirds of the cyclists reported riding in the rain occasionally. In regard to the safety of bicyclists riding in the dark, 85.7 percent of the cyclists riding in the dark frequently did use lights. It would be interesting to discover whether or not the bicyclists riding frequently in the rain did wear helmets.

TABLE 12

Do You Use Lights?

Dark	Yes	No	ROW	Percents
Never	20.9 N=28	79.1 N=106	134	35.2
Ocassionally	70.1 N=129	29.9 N=55	184	48.3
Frequently	85.7 N=54	14.3 N=9	63	16.5
			381	

Accident Experience

While 31.6 percent of the 1977 respondents reported accidents, 29.0 percent of the 1979 respondents reported having at least one accident. About 30 percent of the avid cycling population had at least one accident or serious fall in 1977 and in 1979. The survey format only left room for a detailed report of the cyclist's most recent accident.

Note that in both survey years, some cyclists neglected to record their accidents in the original question on accidents, and yet they answered other questions about the accidents. My best estimate, based on the number of respondents who commented about an accident at all, is that 114 total accidents were incurred by the respondents of the 1979 questionnaire.* About 89 of these were recent accidents, which means that the 1979 survey has detailed information about 89 accidents.

Based on a total mileage of 1,079,024 miles** for 393 respondents in 1979, the accident rate was 105.7 accidents per million bicycle miles traveled, compared with 136.5 for 1977. (1977 had 820,508 total miles and 264 respondents.)

This accident rate includes bicycle damage and minor scrapes, which accounted for 57.0 percent of the accidents in 1979. However, 74.4 percent of all accidents were minor in 1977. Professional treatment was required on only 25.3 percent of the accidents in 1977, while 43.0 percent of the 1979 accidents required doctor or hospitalization. Although the accident rate has decreased, the accident sererity has increased.

Price estimated the serious accident rate between 25.6 and 41.0 per million bicycle miles traveled. I will use the average of these two figures, 33.3, for the comparisons in this analysis. North Carolina was a dangerous cycling state in 1977, but the serious accident rate has increased to 45.4 serious accidents per million bicycle miles traveled in 1979. A special section will examine several categories of avid cyclists and their serious accident rate to investigate this increase.

More about accidents will be included in Chapter 4.

*Each of the categorical accident rates will not reflect a total of 114 accidents; these figures are computed based on the information available from the specific question.

**Due to inadequacies of the SPSS language, this total is the average mileage multiplied by the total number of respondents. The error should be approximately equal to zero.

Chapter 4

MORE DETAILED EXAMINATION OF MILEAGE AND ACCIDENT RATES

Mileage Analysis

While Price had one respondent who did not answer the mileage question, all 393 respondents recorded their mileage in the 1979 survey. Assuming that the one cyclist did not ride at all that year, Price adjusted his average annual mileage from 3,168 to 3,096 for the following analysis. The average annual mileage for regular cyclists in 1979, as stated previously, is 2,745.6 miles.

The difference in mean annual mileage between 1977 and 1979 deserves further investigation. The 1977 cyclists rode 350.4 more miles in a year on average than the 1979 cyclists did. Perhaps by examining various breakdowns of the regular North Carolina bicycle rider, the reason for the difference will be clear.

Sex

The males rode more than the females in both surveys although the women's average annual mileage was closer to the men's in 1979, as Table 13 indicates.

TABLE 13

Annual Mileage by Sex

	Male	Female
1977	3,300 N=222	1,639 N=42
1979	2,951.9 N=311	1759.5 N=65

The difference in mileage for males and females can also be explained by the fact that the questionnaire was directed at the most active cyclists in the household. Often a woman who did travel many miles by bicycle could not respond because a male in the household rode even further. In addition, the estimates of characteristics and attitudes of the avid North Carolina cyclists may be distorted because only one cyclist from each household could respond.

Age

Price discovered that 16-25 year olds had an annual mileage of about 1000 miles greater than all the other respondents.

Topography

TABLE 14

Annual Mileage by Topography

Riding Primarily in Area that was:	1977	1979
Flat	2,393	2331.0
Rolling	3,315	2882.9
Mountainous	1,581 n=10	1740.8 n=24

The cyclists riding in an area that was primarily rolling showed the largest change in annual mileage from 1977 to 1979. Bicycle riders who cycled in rolling terrain decreased their mean mileage 432.1 miles, and yet this group maintained the highest mean mileage of the three categories. Cyclists that rode in the mountains rode the least number of miles annually, probably because of the rugged topography and relatively poor road conditions. Also, the riding season is shorter in mountainous areas. Price stated that his low mileage for mountain cyclists was tenuous because he had only 10 respondents in that group; with 24 respondents riding mainly in the mountains in 1979, the updated figures are slightly more accurate. In general, cyclists who ride primarily in rolling areas bicycle more than cyclists who ride in flat areas, and rolling cyclists probably cycle more than mountainous cyclists.

Area Population

Table 14 shows that cyclists living in large metropolitan areas of 250,000 to 1 million people increased their mileage, while cyclists in all other areas decreased their annual mileage. Charlotte is the only city in North Carolina with more than 250,000 people, and although the number of respondents from Charlotte increased by four, the number of Charlotte cyclists answering the survey decreased as a percent of the total North Carolina cyclists. Although the number of cyclists in Charlotte did not change significantly within the city itself, the cyclists continued to increase their bicycling. Commuter traffic increased; these cyclists may be cycling to work.

TABLE 15

Annual Mileage by Area Population

Population	1977	1979	
250,000 - 1 million	2,588	2,958.6	(n=66)
50,000 - 250,000	3,278	2,512.0	(n=181)
5,000 - 50,000	2,955	2,741.4	(n=79)
less than 5,000	4,189 (n=18)	3,717.4	(n=39)
Total	n=264 Total	n=380	

Note that cyclists recorded the population of their area themselves. Some may have recorded the wrong population, and some may have considered the popultion of their area, such as Raleigh/Durham, and reported a larger population.

Respondents living in an area of 50-250,000 recorded the largest drop in annual mileage, and these areas also had the largest increase in cyclists. Greensboro, Winston-Salem, and Raleigh are included in this city size, and the number of cyclists from these areas increased. Cyclists in these areas decreased their mean mileage from 3,278 in 1977 to 2,512.0 in 1979. Respondents from areas of 5,000 to 50,000 population also decreased their mileage, but not as sharply as the cyclists from areas of 50,000 to 250,000 population.

Price had difficulty with the low number of rural cyclists; for 18 respondents from areas less than 5,000, he found a mean mileage of 4,189. The 1979 survey confirms his finds, with 39 rural respondents. These cyclists recorded an average annual mileage of 3,717.4 in 1979. Although this mean is smaller than the 1977 figure, rural cyclists still traveled many more miles than respondents from the other population sizes. If these rural cyclists are pedaling to work, they might ride more miles than city cyclists. It would be interesting to know whether or not these cyclists are commuters.

Years Experience

The cyclists responding to the survey in 1977 and in 1979 indicated the same annual mileage patterns when compared with their years experience. Both showed an increase on bicycle mileage up to ten years experience, and then a decrease in annual mileage beyond ten years cycling experience. The category of riders with less than a year's bicycling experience reported low mileage figures, but these cyclists were recording the number of miles that they had traveled in a time span of less than one year. Therefore, their reported mileage was misrepresentative of their total annual mileage.

TABLE 16

Annual Mileage by Years of Bicycling Experience

Years of Bicycling Experience	1977	1979
1 - 4 years	2,829 (n=119)	2,304.3 (n=105)
5 - 10 years	3,647 (n=86)	3,295.9 (n=160)
Greater than 10 years	3,244 (n=47)	2,942.2 (n=79)
	n=252	n=391

Auto Availability

Price did not include automobile availability in his study because of the low number of respondents having a number of cars other than one or two. In the 1979 results the same phenomenon occurred; 83 percent of the cyclists had one or two cars available for their use. The bicycle riders with one car available traveled nearly 200 miles more per year than did the cyclists with two cars available. Although this is not conclusive, the national study conducted by Jerrold Kaplan in 1975 found that the fewer automobiles a cyclist had available, the more miles he traveled by bicycle. The bicycle might be used to substitute for the automobile on some trips.

Monday-Friday Riding

The percentage of cycling Monday through Friday, illustrated in Table 17, was closer to one-half of the total cycling mileage in 1979. Of the 1979 respondents, 47.8 percent traveled at least half of their total mileage Monday through Friday on average, while 65.7 percent of the 1977 avid cyclists traveled more than half of their miles during the week. A decrease in the number of miles traveled during the week might indicate a decrease in the number of commuting cicyclists, or it may suggest a shift from utility to recreational bicycling. Both of these alternatives do not agree with the findings of the remainder of the 1979 study.

TABLE 17

Annual Mileage by Percentage of Monday-Friday Riding

Percentage	1977	1979
0 - 25	981 n=45	1,825.6 n=76
26 - 50	2,002 n=46	2,383.2 n=121
51 - 75	4,230 n=104	3,753.2 n=100
87 - 100	3,491 n=70	2,902.2 n=80

Accident Analysis

This section will attempt to examine the causes for a decrease in the accident rate and yet an increase in the serious accident rate. A serious accident is defined as an accident requiring professional treatment or hospitalization.

Cause of Accidents

Price discounted the 1977 accidents for several reasons that are not characteristic of the 1979 survey. Some of the 1979 cyclists had more than one serious accident, yet most of the accidents were spread over the 1979 cyclists. The sample of serious accidents is larger in 1979 as well. Further, the cause of most recent accidents indicates a jump in the number of bicycling accidents caused by moving motor vehicles. As Table 18 indicates, the number of such accidents increased from 12.4 to 26.2 percent of all accidents. Because the condition of a bicyclist and a moving motor vehicle colliding would be likely to cause serious harm to the cyclist, this may help to explain the increase in serious accidents.

Bicycle fatalities for 1977 and 1979 were not available. However, according to Price, bicycle fatalities are higher in North Carolina than they are in the nation.

Table 18

Cause of Respondent's Most Recent Collision or Fall

Cause	Number of Accidents		Percent of Total Recent Accidents	
	1977	1979	1977	1979
Moving Motor Vehicle	16	22	17.4%	26.2%
Stationary Motor Vehicle	0	1	0.0	1.2
Another Bicycle	13	11	14.1	13.1
Dog	13	11	14.1	13.1
Bicycle Mechanical Failure	9	5	9.8	5.9
Curb	3	4	3.3	4.8
Slick Road	1	7	1.1	8.3
Railroad Tracks	2	2	2.2	2.4
Other*	35	21	38.1	25.0
TOTALS:	92	84	100.0	100.0

*The category "Other" is large because the 1977 data was not complete. Some of the percents of total recent accidents from the 1977 survey in this category are holes in the road (3.35%), gravel (8.7%), loose sand (4.3%), and edge of road (4.3%). Some of the percents of total recent accidents in the "Other" category from the 1979 survey are shoulder (8.7%), and general falls (12.0%).

A large number of cyclists had accidents involving dogs in both 1977 and 1979. The dogs in North Carolina are a menace to avid cyclists. The footnote explains the "other" category on both surveys. Many of the 1977 accidents in this category involved hazardous road conditions such as gravel, potholes, and uneven shoulders. In 1979, some cyclists had accidents due to dangerous shoulder conditions. Cyclists did more than half of their cycling on minor, secondary roads in 1979; perhaps the Department of Transportation could earmark some bicycling funds for improving and widening secondary roads.

Distribution of Accidents

Table 19 shows the types of roads on which accidents occurred in both 1977 and 1979. Just as more than half of the cycling occurs on minor streets and roads, about half of the accidents occur there. Although both major and minor street accidents appear to have risen while accidents on bicycle lanes, routes and paths seem to have fallen, actually this is not true. At a 95% confidence level, none of the changes is statistically significant. Therefore, the accident distribution according to the location of the accident has not changed.

Classifying accidents according to trip purpose produces more interesting results. The accidents on work or school trips, "commuter" trips, have increased 20.4%, from 15.7% of all accidents in 1977 to over one-third of all accidents (36.4%) in 1979. This startling figure shows the lack of understanding of commuters and the lack of facilities that commuting cyclists need. As more people commute to work, the level of awareness must be raised about the commuter's presence, and better planning and facilities must be provided. The number of accidents reported in each other type of bicycling trip seems to have decreased, but no other area is statistically significant.

Apparently more bicyclists are commuting to work and to school without adequate safety protection. This problem is specific to commuting cyclists, because the accident rate did not change significantly for any other trip purpose. The Bicycle Program needs to address the safety needs of commuting cyclists.

Table 19
Distribution of Accidents According to Location

Location of Accident	Number Reported 1977	1979	Percent of Total 1977	1979
Major Street	25	32	30.9	32.3
Minor Street	45	59	55.6	59.6
On-Street Bicycle facility (lanes, Routes)	5	2	6.2	2.0
Off-Street Bicycle facility (Paths)	6	99	7.4	6.1
TOTALS	81	99	100.1	100.0

Table 20

Distribution of Accidents According to Trip Purpose

Trip Purpose at Time of Accident	Number Reported 1977	1979	Percent of Total 1977	1979
Work/School	13	39	15.7	36.4
Recreation/Touring	27	31	32.5	29.0
Utility	7	4	8.4	3.7
Exercise	10	9	12.0	8.4
Racing	26	24	31.3	22.4
TOTALS	83	107	99.9	99.9

Sex and Age

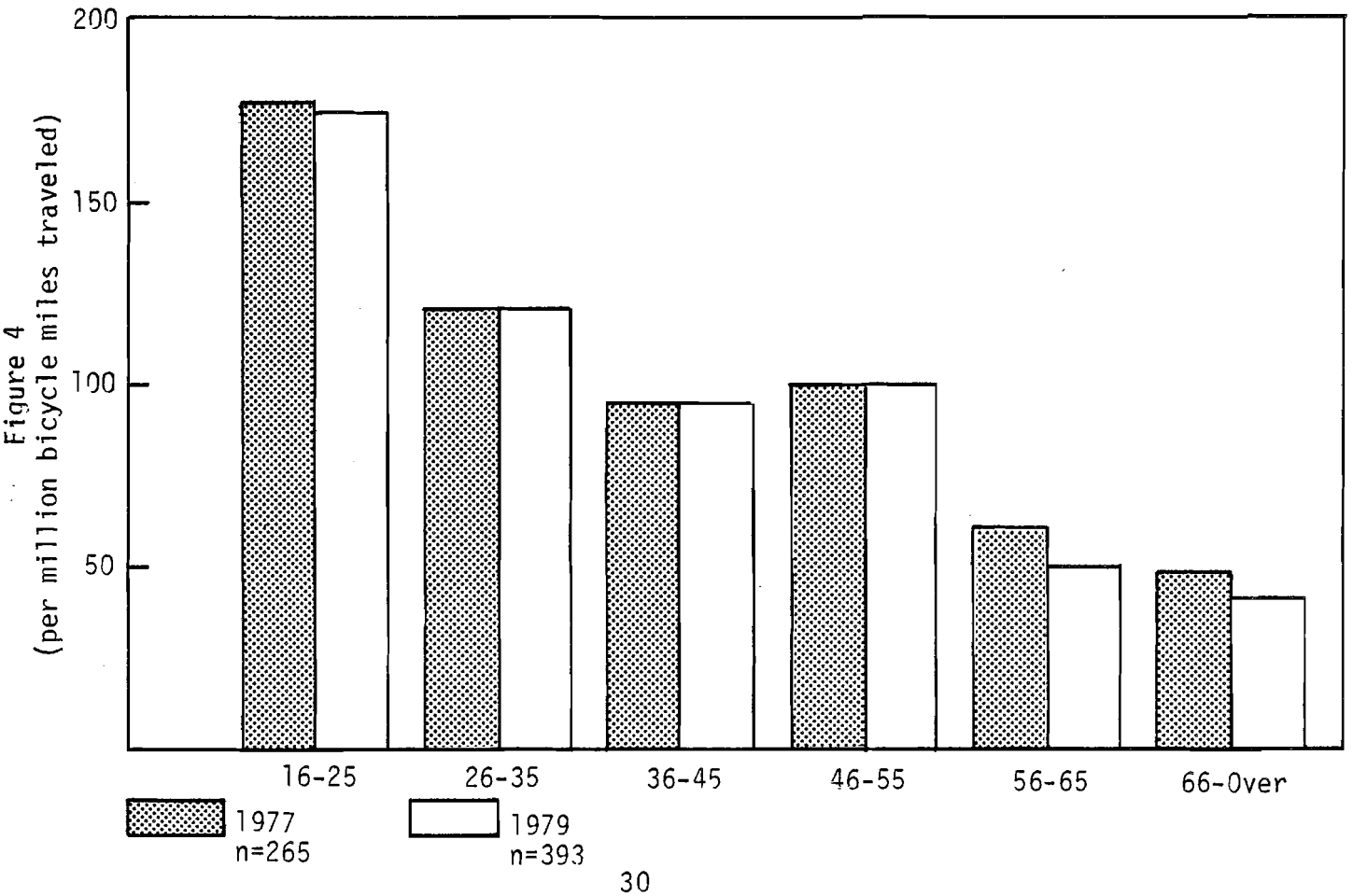
The female accident rate decreased more sharply than the male accident rate from 1977 to 1979. The accidents for females dropped 17 percent more, from 145.2 to 91.1 accidents per million bicycle miles. This figure is tenuous, however, because only 18 of the total accidents were incurred by females. Six women had a serious accident, so one third of the total accidents for women were serious. No conclusions may be drawn from such a small sample.

Table 21

Accident Rate by Sex

Accident Rate (Per million bicycle miles traveled)	Male	Female
NC 1977	137.2 n = 22	145.2 n = 42
NC 1979	109.3 n = 91	91.1 n = 18

Figure 4
Accident Rate by Age Group



Topography

The accident rate in terms of the topography where cyclists live and ride was not possible to calculate because the number of miles traveled in flat, rolling, and mountainous terrain was not available. Further, the questionnaire did not request the topography of the area of the location of the accident.

Cycling Experience

The accident rate was affected by the number of years of bicycling experience. The 1977 accident rates by experience look too large; however, the 1977 data was not available for checking. The 1979 data may be more accurate. The 1979 cyclists with less than a year of riding experience have a low 58.7 accident rate. Maybe this is the result of caution on the part of the novice; however, both the 1977 and 1979 figures seem extreme. According to the 1979 data, the accident rate does not vary significantly if the cyclist has more than one year's experience riding.

Table 22
Accident Rate by Years Experience

	Years Experience							
n=Accident Rate	Less than one		One to Four		Five to Ten		More than Ten	
NC 1977	13	280.8	119	124.7	86	127.5	47	163.9
NC 1979	5	58.7	29	96.9	55	119.2	25	109.7
	31		109		168		83	

Equipment

Both the rear view mirror and the bicycle helmet are relevent to improved safety for a cyclist. A rear view mirror should help a bicycle rider avoid collisions, and in Table 23 both surveys show that cyclists who use mirrors have a lower accident rate than those who do not. Although a helmet would not prevent the accident, a helmet would prevent injuries given a cyclist that has an accident. Still, cyclists in 1977 and in 1979 who used helmets had lower accident rates than those who did not. Perhaps the cyclist who buys and wears a helmet has a higher awareness of safety.

Table 23
Accident Rate by Use of Safety - Related Equipment

Accident Rate (per million bicycle miles traveled)	Uses Mirror	Does Not Use Mirror	Uses Helmet	Does Not Use Helmet
NC 1977	80.8 n=64	160.4 n=188	144.8 n=150	123.5 n=108
NC 1979	115.5 n=151	100.2 n=240	115.1 n=250	89.1 n=143

For the 1979 survey only, the degree of accident severity and cause of accident was examined. Rear view mirror users had fewer serious accidents than those who did not, however, cyclists who used helmets had 4 times the number of serious accidents than those who did not. It would seem that, if helmets help prevent head injury, then cyclists who wear helmets would have fewer serious accidents. (Recall that a serious accident implies a doctor visit or hospitalization.)

Table 24 shows a breakdown of the degree of severity of accidents sustained by cyclists who or do not use rear view mirrors and helmets. Rear view mirror users require slightly fewer doctor visits and hospitalizations, than non users while helmet users have significantly more doctor visits and hospitalizations. There are several possible explanations for this. First, the sample size may not be large enough. Also, the survey does not ask whether or not the cyclist was wearing a helmet at the time of his accident. He may have purchased a helmet after the accident. Also, cyclists who wear helmets may cycle in more dangerous areas or situations.

Table 24

Degree of Accident Severity by Use of Safety - Related Equipment

Degree of Severity	Does Cyclist Use Rear View Mirror?		Does Cyclist Use Helmet?	
	Yes	No	Yes	No
No Damage	1	8	6	3
Bike Damage	5	8	9	4
Minor Injury	20	23	27	16
Doctor Visit	9	12	17	4
Hospitalization	1	2	3	0
TOTALS	36	53	62	27

Riding Conditions

Table 25 shows the variation of the accident rate by the willingness of cyclists to ride in the dark or rain. Cyclist who traveled occasionally in the rain (1979) had a much lower accident rate than those who traveled in rainy conditions either never or occasionally. This is inconsistent with the 1977 results, and no logical explanation is apparent. The accident rate increased consistently in both 1979 and 1977 as the frequency of cycling in the dark increased. The more likely a cyclist was to travel in the dark, the more likely he was to have an accident.

Table 25

Accident Rate by Frequency of Travel in the Dark and in the Rain

Accident Rate (per million bicycle miles traveled)	How often the bicyclist rode in the rain: Never	Occasionally	Frequently
NC 1977	146.2 n=63	151.3 n=172	101.6 n=26
NC 1979	124.4 n=79	96.2 n=286	132.6 n=17

Accident Rate (per million bicycle miles traveled)	How often the bicyclist rode in the dark: Never	Occasionally	Frequently
NC 1977	115.5 n=100	146.4 n=123	156.8 n=40
NC 1979	81.5 n=134	116.8 n=184	133.0 n=63

A cross tabulation accident severity with the frequency that a cyclist rides in the dark and in the rain did not produce any significant results. Neither riding in the dark or in the rain can explain a cyclist's accident severity.

Chapter 5

RESPONDENTS' COMMENTS

In both surveys, the respondents were asked to make comments in the last section. Most of the respondents made some sort of comment. The relevant comments were cataloged according to Table 26 for 1979; the 1977 comments will be compared with the 1979 statements in the following paragraph. Note that comments are voluntary, highly subjective reactions of the respondents.

TABLE 26

Respondents' Comments

Category	1979
Riding Facilities for Cyclists	17
Separate Bikeways	43
Oppose Separate Bikeways	3
Bicycle Education/Awareness	41
Improved Bicycle Parking	2
Bicycle Registration	4
Laws Relevant to Bicycling	5
Bicycle Racing	4
Bicycle Touring	10
Bicycle Commuting	22
Bicycle Safety	45
	n=196

There were comments on 26.0 percent of the 1979 surveys, as opposed to comments on 50.0 percent of the 1979 surveys. While the 1977 comments pertaining to facilities were evenly split between wanting separate facilities and object to them, 43 of 46 comments concerning facilities favored separate bicycle lanes and paths in 1979. This is a startling figure, and it is liable to error because of different definitions of separate bicycle facilities. The Bicycle Program should consider the public conception of separate facilities in planning bicycle traffic facilities in the future.

Both surveys had a high percentage of respondents who requested improving bicycle safety through education and awareness programs. This was the greatest concern of the 1979 respondents by far. Forty-three point nine percent of the comments concerned some form of safety and/or education. Bicyclists and motorists need to be more conscious of safe traveling.

Twenty-two people volunteered comments about bicycle commuting. These cyclists were concerned with the disregard of automobile drivers for adults bicycling to and from work. Again, education of both motorists and cyclists would improve the plight of commuting bicyclists.

Chapter 6

CLASSIFICATION OF CYCLISTS

This study attempts to draw conclusions about the type of cyclists that bicycle on a regular basis. From the responses to Question 12, cyclists are categorized by the type of bicycling that they cycled the most. Question 12 was the most misunderstood question on the survey, and this analysis attempts to make conclusions from the often nonsensical data received from number 12. This classification of the cyclists by the type of riding that they engage in most frequently is unique to the 1979 study.

The broad categories of type of bicycling used to label the respondents are work/school, recreation/touring, utility/shopping, exercise only, and racing. By placing each respondent in one category according to the type of cycling that he did most per month, the cyclists are classified in. Forty-one percent of the North Carolina regular cyclists are recreational riders. This group would probably benefit from bicycle facility development, and they would probably use the North Carolina Bicycling Highways more than the other type of bicyclists. A large percentage of regular North Carolina bicyclists riding primarily for recreation and touring indicates a need for more bicycle routes and bicycling maps for North Carolina.

More than a third of the respondents (32.6%) rode their bicycles primarily to work or to school. This group might be labeled "commuters", and as the public attempts to conserve energy (here gasoline) and keep physically fit, the percentage of commuting bicyclists will probably rise. The Bicycle Program of North Carolina needs to address the needs of bicyclists who bicycle to work and to school.

Bicyclists who ride primarily for exercise constitute 10.7% of the total cyclist population. Racing cyclists as a class make up 9.4 percent of the avid cyclists in North Carolina. Persons who bicycle primarily to shop called "Utility Cyclists," were the lowest percentage of the cyclist, with 6.4% of the total. Since many trips made by automobile are 1-3 miles, which many consider an acceptable cycling distance, this population should be targeted for increased bicycle use. However, since the survey was mailed only to local and national bicycle clubs', bicyclists who ride primarily to and from the store would not necessarily ride with a club. The low number of utility/ shopping cyclists may not accurately indicate the proportion that exists in North Carolina.

Table 28 continues the analysis of bicyclists by the type of cycling in which they engage most frequently by examining specific characteristics of the groups. Seventy-five percent to 85 percent of all the categories are male cyclists, except the racing category. Ninety-seven and two-tenths percent of the racers in North Carolina are men. The bicycle racers are substantially different from the other cyclists due to the rigorous training required of bicycle racers. The mean age of a racer is 26.7 years, and racers averaged 5,024.6 miles in 1979.

The "commuters" (work/school) were about the same age as the recreational cyclists, although the commuters traveled 301.9 miles per year more on average,

or 1,325.6 miles per year. The cyclists who rode for utility purposes, such as shopping, were older, their mean mileage was also higher. It would seem that utility riding would constitute fewer miles; perhaps the utility riders actually ride their bicycles very regularly. Yet, a commuter could travel at least the same number of miles.

Table 27

Distribution of Cyclists by the Type of Riding that they Do Most Frequently

Classification of Cyclist	Number Reported	Percent of Total Cyclists
Work/School	128	32.6
Recreation/Touring	162	41.2
Utility	24	6.1
Exercise	42	10.7
Racing	37	9.4
TOTALS	393	100.0

Table 28

Characteristics of Cyclists by Type

Classification of Cyclists	Percent of Total Males	Percent of Total Females	Mean Age	Mean Total Mileage
Work/School	80.5	19.5	33.1	1325.6
Recreation/Touring	79.0	21.0	32.7	1023.7
Utility	75.0	25.0	38.0	1795.4
Exercise	85.7	14.3	35.1	1898.1
Racing	97.2	2.8	26.7	5024.6

Table 29 shows the number of collisions with moving vehicles that different types of riders sustained. Of the 91 total accidents, 21 of the victims could be classified. Commuting cyclists had 11.0 percent of the total accidents, which indicates that commuting cyclists need to be protected. Many measures could help increase the awareness and safety of automobile drivers and bicycle riders; the accidents with moving motor vehicles cause the greatest concern.

Table 29

Classification by Collision with Moving Motor Vehicle

Classification Cyclist	Moving Motor Vehicle
"Commuter" Work	11.0% n=10
Shopper	n=0
Tourist	6.6% n=6
Racer	3.3% n=3
Exercise	2.2% n=2
Total	21 percent of the total accidents (n=91) occured with a moving motor vehicle.

Chapter 7
Conclusions

This 1979 update of the study of avid cyclists in North Carolina implies many generalizations about regular adult cyclists in the state. The return rate improved from 44.6% to 63.7% in 1979, so that the 1979 survey results should be more reliable. However, the problem of dependence of the samples cannot be disputed; as the survey was mailed to bicycle club members in both years. Many of the same poeple probably responded to both the 1977 and 1979 surveys. This statistical could not be avoided, and the conservative tests probably accounted for some of the dependence. Furthermore, sample dependence in this survey means that cyclists who were riding regularly in 1977 were continuing to cycle in 1979.

Characteristics Of The Cyclists

*National bicycle club affiliation increased from 1977 to 1979.

*Fewer avid cyclists live in flat areas.

*The Greensboro/High Point/Winston-Salem area showed a 10.0 percent increase in avid cyclists.

*Charlotte registered a 6.5 percent decrease in avid cyclists. (It would be interesting to investigate the difference in the numbers of surveys mailed to each area. Perhaps this could be estimated by the number and size of bicycle clubs in each area.)

*The regular North Carolina cyclist is still about 32 years of age.

*The male/female ratio is constant; 83 percent of the cyclists are male while 17 percent are female. [Because the survey was completed by only the most active cyclist in the household, this is probably a low estimate of the number of avid female cyclists.]

*39.2 percent of the 1979 avid North Carolina cyclists are males from 26-35 years of age.

*The majority of avid cyclists have shifted from the 16-25 year old category in 1977 to the 26-35 year old category in 1979. This probably means that the samples are dependent; cyclists who were riding in 1977 are continuing to ride in 1979.

*Experience confirms the trend of sample dependence. More cyclists have 5-10 years experience, as opposed to a majority having 1-4 years experience in 1977.

*9.1 percent fewer cyclists had their bicycles registered in 1979. The bicycle registration program needs to be examined for effectiveness, and if it is a functional, useful program, then cyclists should be encouraged to register their bicycles.

*Fewer avid cyclists had a car available for their use in 1979. Cyclists may be substituting the bicycle for the automobile as a regular transportation mode.

Mileage Of The Cyclists

*The total average mileage decreased from 3,108 miles per year in 1977 to 2,745.61 miles per year in 1979. In all categories, the annual mileage simply decreased; no special causal factor can be suggested here. A regular cyclist is defined as one who rides at least three times per month in the months that he deems suitable for cycling. Perhaps more cyclists are riding casually, for recreation, exercise, or utility.

*More cyclists in 1979 (60.1 compared with 58.8 percent in 1977) planned to ride more in the coming year.

*Cyclists continued to travel over half of their mileage on minor streets. [A minor street can be considered a "Secondary road" in most cases.] The Department of Transportation could improve the safety of cyclists by identifying secondary and primary roads that have heavy bicycle traffic and widening or upgrading these thoroughfares.

*Travel on bicycle facilities such as bicycle lanes and bicycle routes increased slightly. This increase is probably closely correlated with the increase in the number of bicycle facilities in North Carolina. Travel on facilities increased as the facilities available increased.

*93.5 percent of the voluntary comments that pertained to separate bicycle facilities favored separate bicycle lanes and paths.

*Cyclists who rode in the "rolling" areas maintained the highest number of annual miles. Apparently, North Carolina cyclists, for whatever reasons, find the Piedmont the most desirable area in which to do their riding. (The majority of the avid cyclists continue to live in the Piedmont.)

*Annual urban cycling increased, while cyclists riding in areas under 250,000 population decreased their annual mileage. This increase in urban cycling miles points to an increase in commuting among cyclists.

*However, rural cyclists, living in areas of less than 5,000 people, traveled the highest number of miles in 1979. This is consistent with the 1977 results. The 39 rural riders in 1979 traveled 3,717.4 miles on average annually.

*All parts of this study indicate that more cyclists were commuting in 1979, save the questions about Monday through Friday riding. The results of this question said that while 65.7 percent of the cyclists rode at least half of their bicycling miles during the week in 1977 only 47.8 percent of the cyclists did most of their bicycling during the week in 1979.

Accidents Of The Cyclists

*The accident rate decreased from 136.5 accidents in 1977 to 105.7 accidents per million bicycle miles traveled in 1979.

*The use of safety equipment rose as more cyclists reported using helmets and rear view mirrors.

*However, the serious accident rate climbed from about 33.3 serious accidents to 45.4 serious accidents per million bicycle miles traveled in 1979.

*The number of accidents caused by moving motor vehicles increased from 17.4 in 1977 to 26.2 percent of all accidents in 1979.

*Accidents on work or school trips ("commuter" trips) have increased from 15.7 percent of all accidents in 1977 to over one-third of all accidents (36.4 percent) in 1979.

*Furthermore, the "commuter" accident rate is twice as high as the accident rate for any other class of cyclist. Commuters, as a class, had an accident rate of 229.8 accidents per million bicycle miles traveled.

*Of the commuters who suffered accidents, 90.3 percent of them had their accidents on major or minor streets. Bicyclists are not restricting their travel to bicycle routes, lanes or paths. Commuting cyclists are riding on streets with auto traffic, and they are having a large number of accidents.

Apparently, more bicyclists are commuting to work and to school without adequate safety protection. Since cyclists are using more safety equipment, the Department of Transportation needs to address the safety of commuters by educating both bicyclists and motorists and by improving roads with heavy bicycle travel. Bicycle commuting has increased, and the Department needs to respond to the needs of these cyclists.

*The majority of the voluntary comments concerned the need for bicycle education and awareness of both cyclists and motorists in North Carolina.

Chapter 8

SUGGESTIONS FOR SURVEY IMPROVEMENT

Respondents had difficulty understanding and answering question 12. The question results were dealt within two different ways, and the more conclusive seemed to be classifying each cyclist according to the type of cycling that they did the most (see chapter 6). Cyclists had problems estimating the average round trips that they made per month and the average number of miles that they cycled per month for each of five different types of bicycling. Perhaps the question could be broken down, or a simpler amount of information requested.

Question 17 concerned the source of the respondent's most recent collision or fall. Many cyclists reported falls due to many problems such as road condition, animals, and weather. Perhaps the question could list some options that pertain specifically to these causes of falls.

For the accident data, a useful fact would be the time of day that the collision or fall occurred.

Question 21 needs a temperature scale.

Although the survey was technically distributed only to bicyclists affiliated with some sort of bike club, a significant number were not in either a local or national club. Perhaps Question 23 concerning club membership could include a blank for neither club affiliation.

Because the instructions asked for the most active rider in each family to respond, this estimate of active North Carolina cyclists will be low. It is difficult, and certainly beyond the scope of this survey, to determine how many avid cyclists have other regular cyclists in their family. By de-fining a regular bicyclist as one who rides at least three times monthly during the season that he finds suitable for riding, the family members of a regular cyclist probably are missed quite often. A question that asks how many other cyclists there are in the family, and the age, sex, and mileage of those cyclists might report more accurate results.

If the survey is conducted again, computerized cross tabulations between the 1979 and future data set would be available. Because the 1977 data set was lost, any cross tabulations in this survey had to be completed by hand. This led to problems of accuracy and insufficient data. Both Dottie Ellis and Curtis Yates should have the 1979 data set.

Appendix

Questionnaires

Coding Forms

CHARACTERISTICS OF THE ADULT NORTH CAROLINIAN
WHO USES A BICYCLE REGULARLY
Bicycle User Questionnaire

Instructions: Respondents must be 16 years of age or older. The most active bicycle rider in the family over 16 should respond. Please indicate the following by blackening circle or filling in blank:

1. Age_____ 2. Sex: ○ Male ○ Female

3. Zip Code: _____

City: _____

4. What is the size of the area where you live?

○ Greater than 250,000 population
○ 50,000 to 250,000 population
○ 5,000 to 50,000 population
○ Rural (less than 5,000)

5. What is the TOPOGRAPHY like in the area where you live?

○ Mostly flat
○ Mostly rolling
○ Mostly steep hills or mountains

6. What is the TOPOGRAPHY like where you do most of your riding?

○ Mostly flat
○ Mostly rolling
○ Mostly steep hills or mountains

7. What type of bicycle do you ride the most?

○ 1 speed
○ 3 speed
○ 5 speed
○ 10 spped

8. Do you and/or your bicycle have the following equipment?

	Yes	No
Rear View Mirror	○	○
Helmet	○	○
Odometer	○	○
Lights	○	○
Bicycle Registration	○	○

9. From your own experience, how many months is the climate where you live suitable for cycling?

_____months

10. How many continuous years have you ridden your bicycle regularly? (Regularly is defined as at least 3 times a month during suitable riding months.)

○ Less than 1 year
○ 1-4 years
○ 5-10 years
○ more than 10 years

11. In 1979, how many months did you ride regularly?

_____months

12. During the months that you rode in 1979, approximately how many roundtrips per month (average), and miles per month (average) did you ride for:

	Average Roundtrips/Mo	Average Miles/Mo
A. Work and/or School trips	_____	_____
B. Shopping, personal business, etc. . .	_____	_____
C. Recreation, Touring .	_____	_____
D. Non-track racing (including training)	_____	_____
E. Exercise Only	_____	_____

13. For the one activity in question #12 that you listed as having the greatest number of roundtrips, show approximately what percentage of riding was done on:

A. Major streets/highways (moderate or heavy traffic) excluding signed Bicycle Facilities _____%
B. Minor streets/roads (light traffic/residential streets, county roads) excluding Signed Bicycle Facilities _____%
C. Special ON-street bicycle facilities _____%
D. OFF-street _____%

14. Have you had a collision or serious fall in the last year on your bicycle?

○ Yes How many? _____
How many reported to police? _____
○ No (If no, skip to Question #18)

15. How serious was your most recent collision or fall?

○ No damage to bicycle or injury to rider
○ Bicycle damage only, no personal injury
○ Minor scrapes and bruises
○ Required emergency room/doctor visit
○ Overnight hospital stay or continual doctor visits

16. At the time of your most recent collision or fall, in what activity were you participating, and on what type facility?

ACTIVITY:
○ Work and/or school
○ Shopping, Personal Business, etc.
○ Recreation
○ Racing
○ Exercise

FACILITY:
○ Major street or highway
○ Minor street or highway
○ Special on-street facility
○ Not on street

17. In your most recent collision or fall, did you collide with:

○ A moving motor vehicle
○ A stationary motor vehicle
○ Another bicycle
○ A pedestrian
○ Other (explain) _____

18. How many total miles did you ride in 1979?

(best estimate) _____

19. What percentage of this was on weekdays? _____ %
weekends? _____ %

20. Do you ride: after dark or in the rain?

	after dark	in the rain
Never	O	O
Occasionally	O	O
Frequently	O	O

21. At what temperature is it usually too cold for you to ride your bicycle? _____ degrees

22. How much bicycling do you think you will do in the current year as compared to the past year?

- O much less
- O less
- O about the same
- O more
- O much more

23. Do you belong to a local and/or a national club?

- O Local
- O National
- O Both

24. How many automobiles do you have available for your use? _____.

25. Did you ride your bicycle in January?

- O Yes — How many round trips _____
- O No — Why not? _____

26. Any comments?

0	none
1	riding facilities for cyclists
2	desire separate bikeways
3	are opposed to separate bikeways
4	want maps of NC roads suitable for cycling
5	bicycle education/awareness
6	improved bike parking
7	NC is a good cycling state
8	NC roads are too rough to ride on
9	bike registration
10	laws relavent to biking
11	bike racing promotion
12	bike touring promotion
13	bike (as a transportation means) promotion
14	like the NC "Bicycle Highways Mountains to Sea" route
15	accident accounts
16	bike safety