Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 1

Summary of the District-wide Telephone Survey

November, 1974

Note: This memorandum is bound under a separate cover and entitled "Survey on Bicycling Activity in the District of Columbia"

A District-wide telephone survey was conducted by the A. C. Nielsen Company as an information source for the Bikeway Planning Study. The actual telephone interviewing began on November 9, 1974, and was completed on November 27, 1974. Working with the Citizens Advisory Committee and the Technical Advisory Committee, a questionnaire was developed to determine:

1. The estimated number of bicyclists in the District.
2. The age of bicycle users and non-users.
3. The purposes of bicycling.
4. The frequency of bicycling by purpose.
5. The magnitude of bicycle theft and accidents.
6. The factors that encourage and discourage the bicyclist from bicycling more and the non-bicyclist from bicycling at all.

The survey consisted of 500 interviews with bicycling households and 500 interviews with non-bicycling households. The sample used was designed using a random-digit dial selection process. This, together with the fact that 99.3% of all households in the District have telephones, assures that a cross-section of the population was interviewed.[1] In addition, the District was divided into five geographic sub-areas to more accurately portray the locational aspects of bicycle use, user characteristics, attitudes, deterrents to cycling, and potential cycling demand.

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1. Source: Chesapeake and Potomac Telephone Company
Press Relations Department

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 2

Summary of the Bicycle Accident Experience in the District of Columbia

February 17, 1975

The contents of this memorandum address bicycle/motor vehicle accidents that have occurred and have been recorded in the past two and a half years. The data has been taken from the records of the Metropolitan Police Department and the "Survey on Bicycling Activity in the District of Columbia".[1]

Introduction

The two sources of data for the study of bicycle accidents were the Police Department records and a District-wide telephone survey. For purposes of comparison, these two sources will be examined individually.

Part One will examine the trends and variations illustrated in the Detailed Accident Reports of the Metropolitan Police Department. Not all of the District's bicycle accidents are reported to the police department. Usually, only those accidents causing $100 of damage or some personal injury are recorded. Nevertheless, these recorded accidents provide specific data concerning the characteristics of these accidents.

Part Two summarizes the accident and use results of the A. C. Nielsen Co. report on the District-wide telephone survey conducted during October and November, 1974. This data is the expansion of a distributed sample of 500 bicycling and 500 non-bicycling households throughout the District. Consequently, this data is not as detailed as that of Part One, but it presents a better overall indication of bicycle accidents and use. (For further information on the survey and other data derived from it, see Memorandum 1.)

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1. See Memorandum 1, "Survey on Bicycling Activity in the District of Columbia", conducted by the A. C. Nielsen Co., 1974

Part One - Summary of the Metropolitan Police Department Records

The study of bicycle accidents involved the collection of basic data on all such collisions within the District of Columbia between January 1972 and December 1973. Partial data was also obtained for 1974 and 1971. This information was then analyzed to highlight significant characteristics for inclusion in this memorandum. Other data evaluated but not contained in this report include the highest accident frequency and cost locations within the District, and traffic volume data for many of the streets and arterials in the District. The data was furnished by the District of Columbia Department of Highways and Traffic from police bicycle accident detail reports. Supplementary data was supplied by the Metropolitan Police Department for the years 1971 through 1974.

The topics to be covered in this section include: a summary of nationwide bicycle accident trends, a summary of bicycle accident trends in the District of Columbia, the seasonal variation in bicycle accidents, the daily peak accident hours, an accident victim analysis, and a summary of causes leading to accidents.

Caution should be exercised when reviewing the data summarized in this report. The figures can be misleading due to the lack of bicycle ridership estimates for the different time periods considered. This means that no accident rates based on person-miles or person-trips can be determined. Rates developed on a per capita basis are also inapplicable due to the accelerating increase in cyclists in the past decade. Once the number of person-miles by bicycles is found, then the accident statistics can be used to determine accident rates. Therefore, the increases in the absolute numbers of accidents must be considered along with an unknown but ever increasing number of cyclists and bicycle-miles travelled.

Existing Bicycle Trends

According to factors presented by the Bicycle Institute of America (BIA), one in every three persons in the United States owns a bicycle, and the number of actual cyclists is even greater. Using BIA's factors and the 750,000 population total in the District of Columbia, there are approximately 250,000 bicycles and 285,000 cyclists within the District. This compares with an estimated 100 million bike riders across the country. The bicycle manufacturing industry reports that 12 million bicycles were sold in 1974 with fifty percent of these sold for adult usage. Again, using factors from the BIA, there will be an additional 25,000 new adult cyclists on Washington streets in 1975.

Along with the recent increase in bicyclists, there has also been an increase in bicycle accidents. The National Safety Council (NSC) reports 1100 fatalities and 40,000 disabling injuries to bicyclists in 1972. The NSC also reports that the death toll for cyclists has climbed from 2.8 deaths per million population in 1960 to 5.4 per million in 1972. Again, these figures are misleading because they do not take into account the number of cyclists, but only the overall national population. The national trend in bicycle accidents is also reflected in Washington, D. C. The number of bicycle accidents reported in the District of Columbia has doubled since 1971. The data in Table 1 indicates a 18 percent increase in accidents for 1974 over 1973. The increases shown can be attributed to three factors: an increase in the number of cyclists, an increase in the proportion of accidents to cyclists and better bicycle accident reporting. Any combination among these three rationale can explain the apparent accident increases.

In 1974, there were 712 bicycle accidents reported, a much smaller percentage increase than in previous years. However, the total is only a fraction of the total number of bicycle accidents. The National Safety Council reports that only 5 percent of all bicycle accidents are with moving vehicles. Accidents as defined by the NSC includes skidding, falling or losing balance, and colliding with obstacles. Further statistics state that in 69 percent of all bicycle accidents, the bicyclist hit an immovable object; and in another 15 percent, the bicyclist collided with other bicycles. If the NSC bicycle-motor vehicle collision figures are valid, there will be nearly 16,000 bicycle accidents of all types in the District of Columbia in 1974.

TABLE 1
RECENT BICYCLE ACCIDENT TRENDS IN THE DISTRICT OF COLUMBIA

Year	Total Number	Percent Increase 1 Year	2 Year	3 Year
1971	259			
		45.5		
1972	377		134.0	
		60.7		174.9
1973	606		88.9	
		17.5		
1974	712			

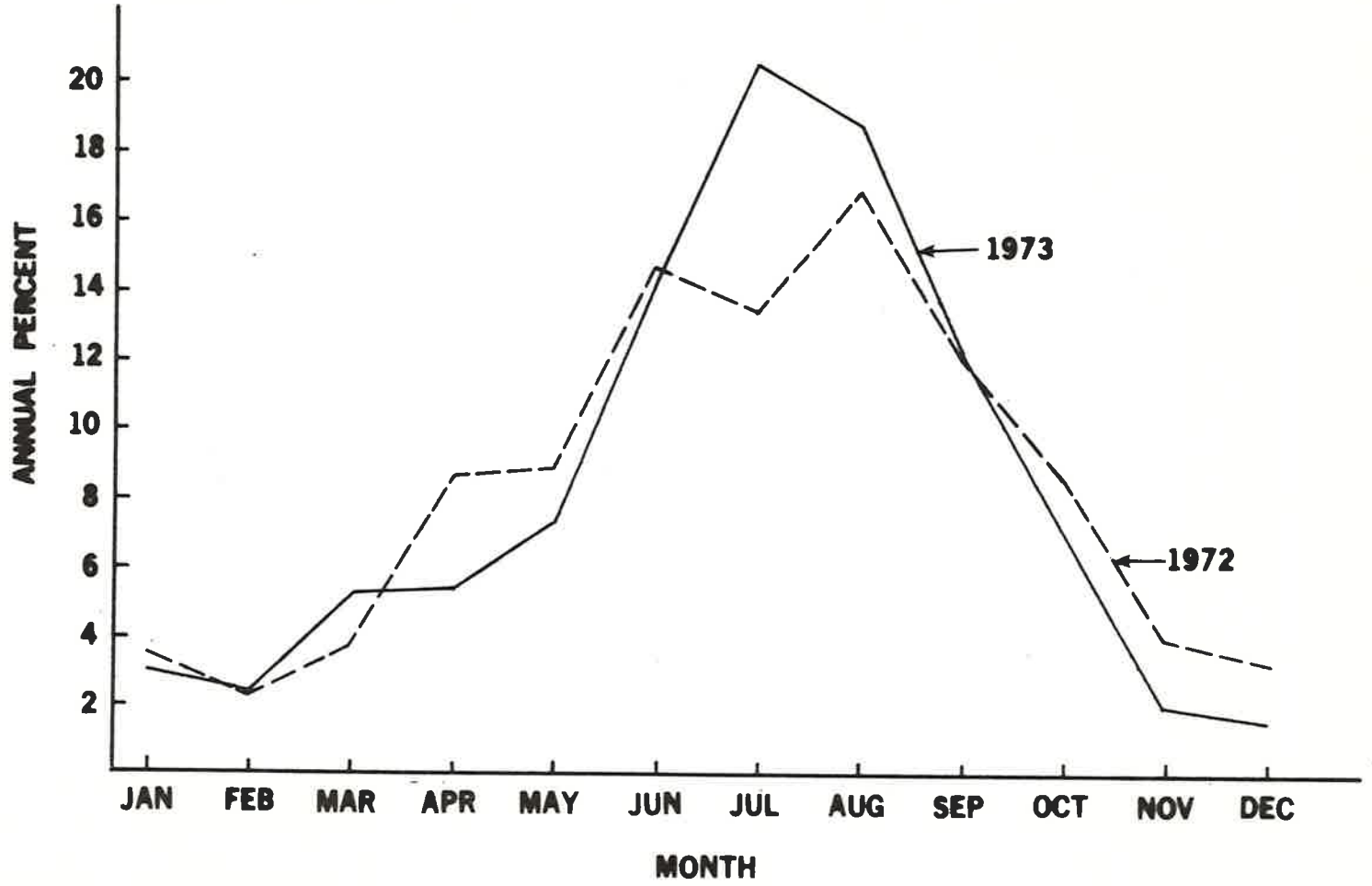
Seasonal Variation in Bicycle Accidents

As can be seen from Table 2 and Figure 1, the majority of all reported bicycle accidents occur during one season--summer. This is due to the prepondence of bicyclists at this time of year resulting from the more favorable weather conditions. This characteristic of bicycle accidents is emphasized by the fact that nearly half of all bicycle accidents occur in the summer months, and half in the remaining three seasons combined. The increase in summer ridership is probably also attributable to a larger number of school age cyclists during the summer. The Bicycle Institute of America indicates that adults do more bad weather cycling than do children. Correspondingly, a much larger percentage of the reported bicycle accidents involved adults during the non-summer months than during the summer months.

TABLE 2
BICYCLE ACCIDENTS BY MONTH AND SEASON IN THE DISTRICT OF COLUMBIA 1972-1973

Month	Number	Seasonal Variation		
January	31			
February	23	99	10.1%	Winter
March	45			
April	64			
May	77	282	28.8%	Spring
June	141			
July	175			
August	177	471	48.2%	Summer
September	119			
October	77			
November	27	126	12.9%	Autumn
December	22			
TOTAL	978	978		

FIGURE 1



BICYCLE ACCIDENT DISTRIBUTION BY MONTH IN THE DISTRICT OF COLUMBIA 1972-1973

Hourly Variation of Bicycle Accidents

Figures 2 and 3 indicate the time of day a bicycle accident is most likely to occur. An obvious relationship between the amount of traffic on the streets and the manner of bicycle accidents is illustrated by the data. The weekday incidence of accidents peaks around 5:00PM. The weekend accident totals peak at two different times, at 4:00PM and 7:00PM. This reflects the peak accident hours for the two days, Sunday and Saturday, respectively. There is a morning accident peak at 8:00AM which indicates the number of commuter accidents as opposed to the afternoon peak hours when there are more children cycling for non-school trip purposes. Another interesting point about the data is the unusual number of accidents on Monday and Friday, which is considerably higher than the daily average. Also of note is that four of the five bicycle accident fatalities in 1972 and 1973 occurred during off-peak hours.

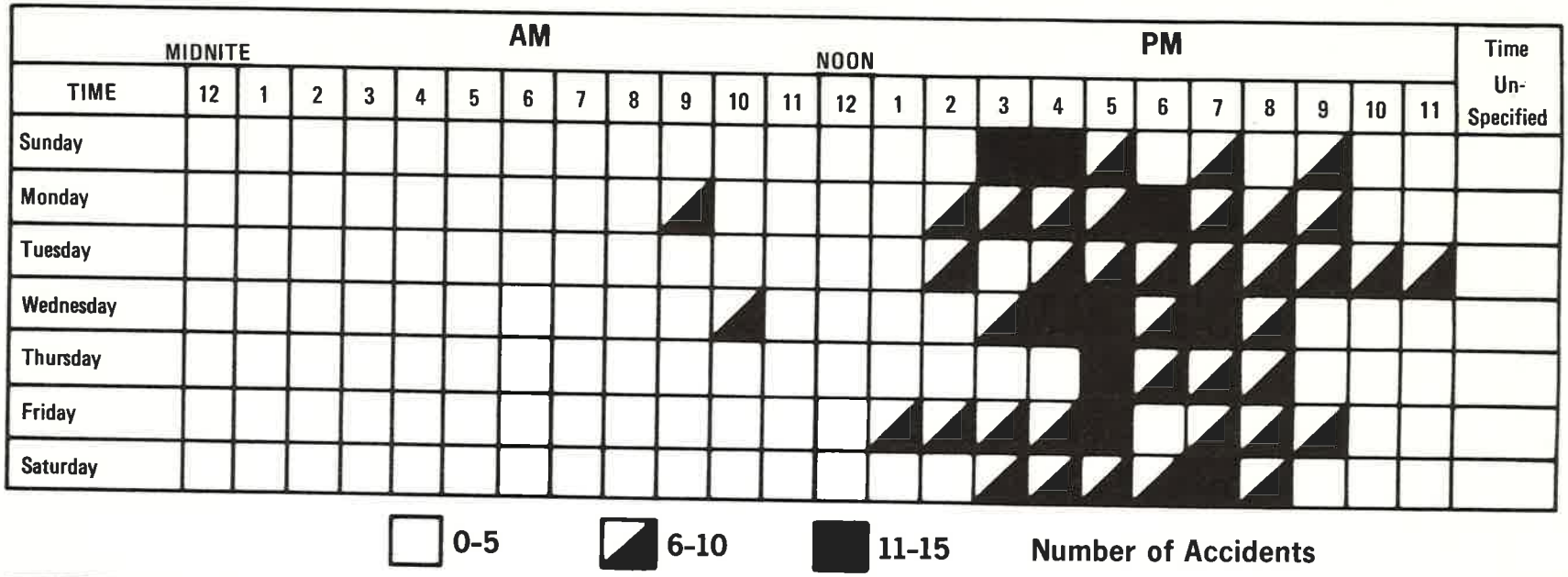
Accident Victim Analysis

Four of the seven fatalities to bicyclists occurring during the three year period, 1972-74, were persons 16 years of age or older. The National Safety Council reported in 1972 that 50 percent of all bicycle fatalities were children. Although this is a small sample size, this deviation may be indicative of a shift towards more adult riders. In the District of Columbia, 53 percent of the cyclists involved in accidents in 1972 were of primary school age as compared with 42 percent in 1973 (Figure 4). The same figures for the 16-23 age group were 29 percent in 1972 and 40 percent in 1973. This trend can only be verified by further research, but it is apparent that bicycle safety is not a problem limited only to children in the District of Columbia.

Geographical Distribution of Accidents

Nearly 90 percent of all bicycle accidents in the District of Columbia occur along a thoroughfare handling 10,000 or more vehicles per day. There are also concentrations of accidents at particular locations such as Mt. Vernon Square, Benning Road and Minnesota Avenue, and Florida and 14th Street, N.W. The pattern of accidents is relatively dispersed throughout the city with slight concentrations near major intersections, the central business district, and around schools. Areas that have been relatively accident-free are the upper northeast quadrant and the area to the west of Rock Creek.

FIGURE 2

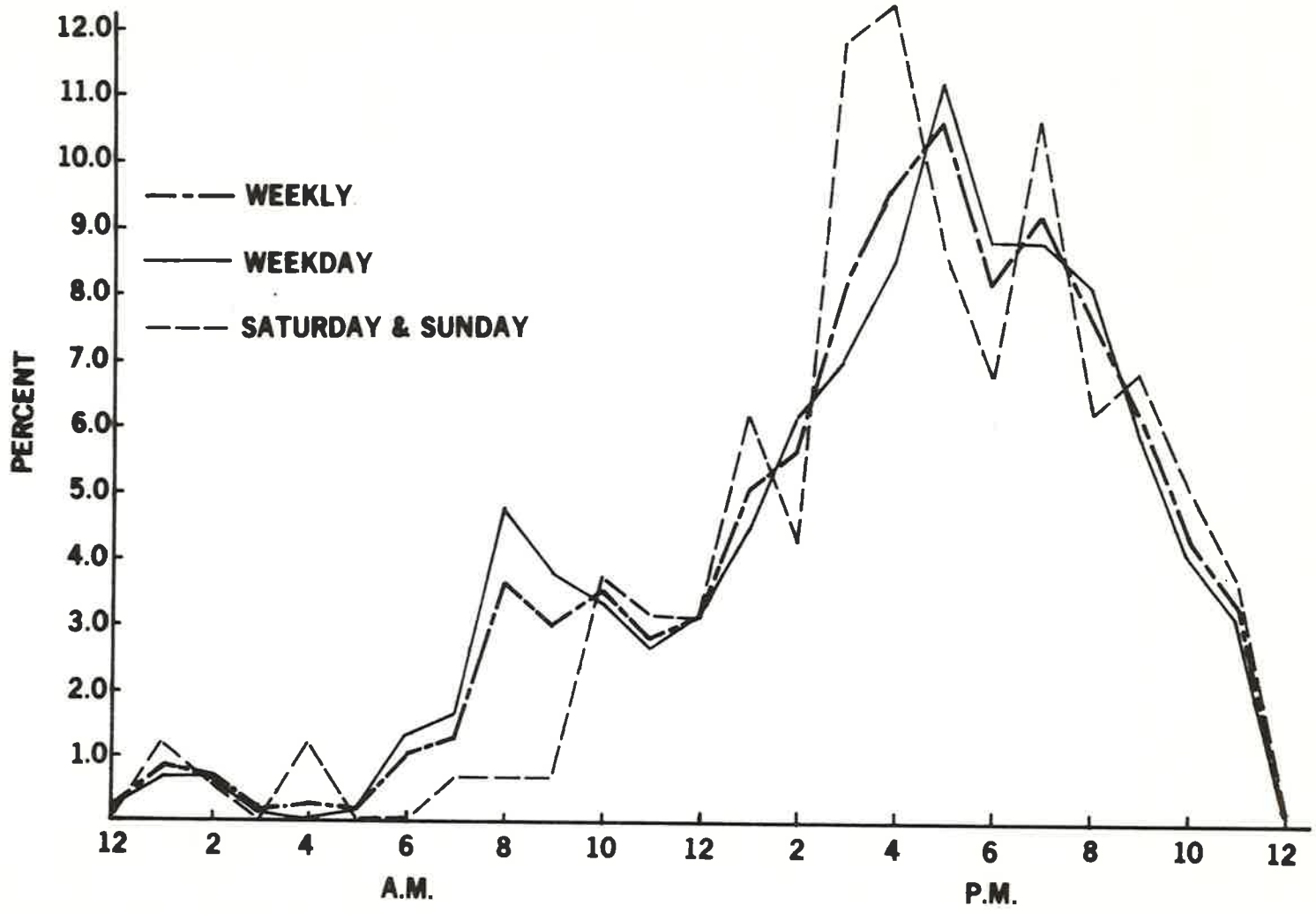


																									TOTAL
Sunday		2			2				1		3	2	3	5	3	10	11	6	4	7	4	6	4	1	1	75
Monday		1		1		1		1	4	6	2	4	4	5F	6	6	8	8	11	9	9	8	4	2	2	102
Tuesday	1	2	2				1	4	4	2	1	1	1		9	4	7	7F	8	6	6	6	6	6		84
Wednesday							1		5	2	7	3	2	4F	3	9	11	10	6	11	6	2	2	2	2	88
Thursday			1					1	4	5	2	3	5	4	2	5	5	11	9	6	6	2	3	2		76
Friday							4	1	4	2	3	1	2	7	7	7	7	14	5	7	9	8	3	2	2	95
Saturday			1					1		1	3	3	2	5	4	9	9	8	7	10	6	5	5	5	3F	86
TOTALS	1	5	4	1	2	1	6	8	22	18	21	17	19	30	34	50	58	64	50	56	46	37	26	20	10	606

Note: **F** indicates 1 fatality.

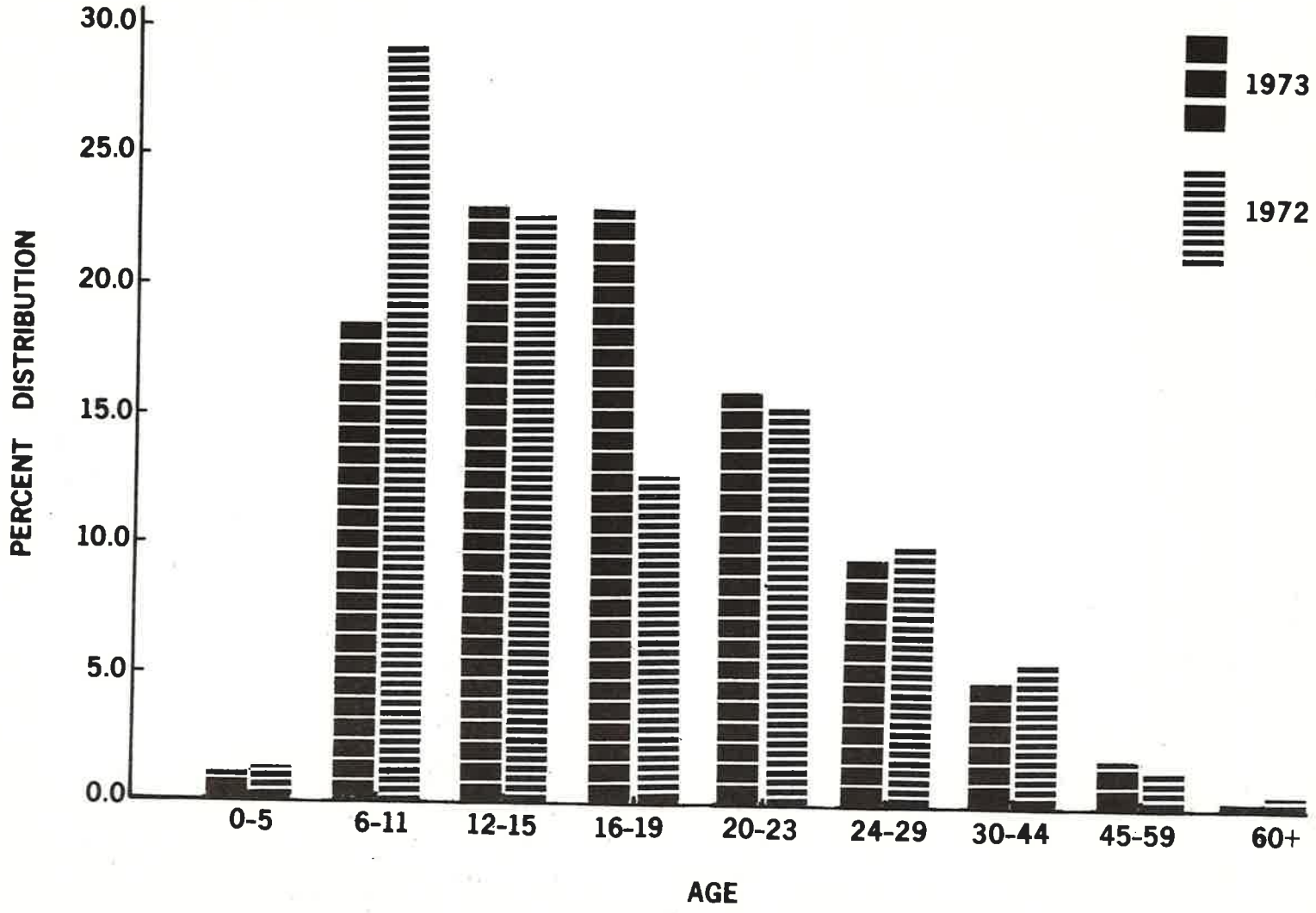
1973 BICYCLE ACCIDENTS IN THE DISTRICT OF COLUMBIA

FIGURE 3



1973 BICYCLE ACCIDENTS IN THE DISTRICT OF COLUMBIA HOURLY DISTRIBUTION

FIGURE 4



BICYCLE ACCIDENTS BY AGE OF CYCLIST IN THE DISTRICT OF COLUMBIA 1972 - 1973

Analysis of Accident Characteristics

Table 3 indicates the location of accidents in 1972-73. Many of the accidents (42.3 percent) occurred at intersections which have no traffic control devices (i.e. signals, flashing beacons, and stop signs). Thus, the bicycle accidents at locations with no traffic controls present are probably due to the lack of observance of right-of-way guidelines. They can also be attributed to inattentiveness and misjudgement of motor vehicle and bicycle speeds.

TABLE 3
BICYCLE RELATED ACCIDENT LOCATIONS IN THE DISTRICT OF COLUMBIA

	1972	Percent	1973	Percent
At intersection	251	67.4	387ff	63.8
Mid-block	87	23.4	186ff	30.7
Within 100' of intersection	32f	8.6	25	4.1
Other	2	0.5	8	1.3
TOTALS	372	100.0	606	100.0

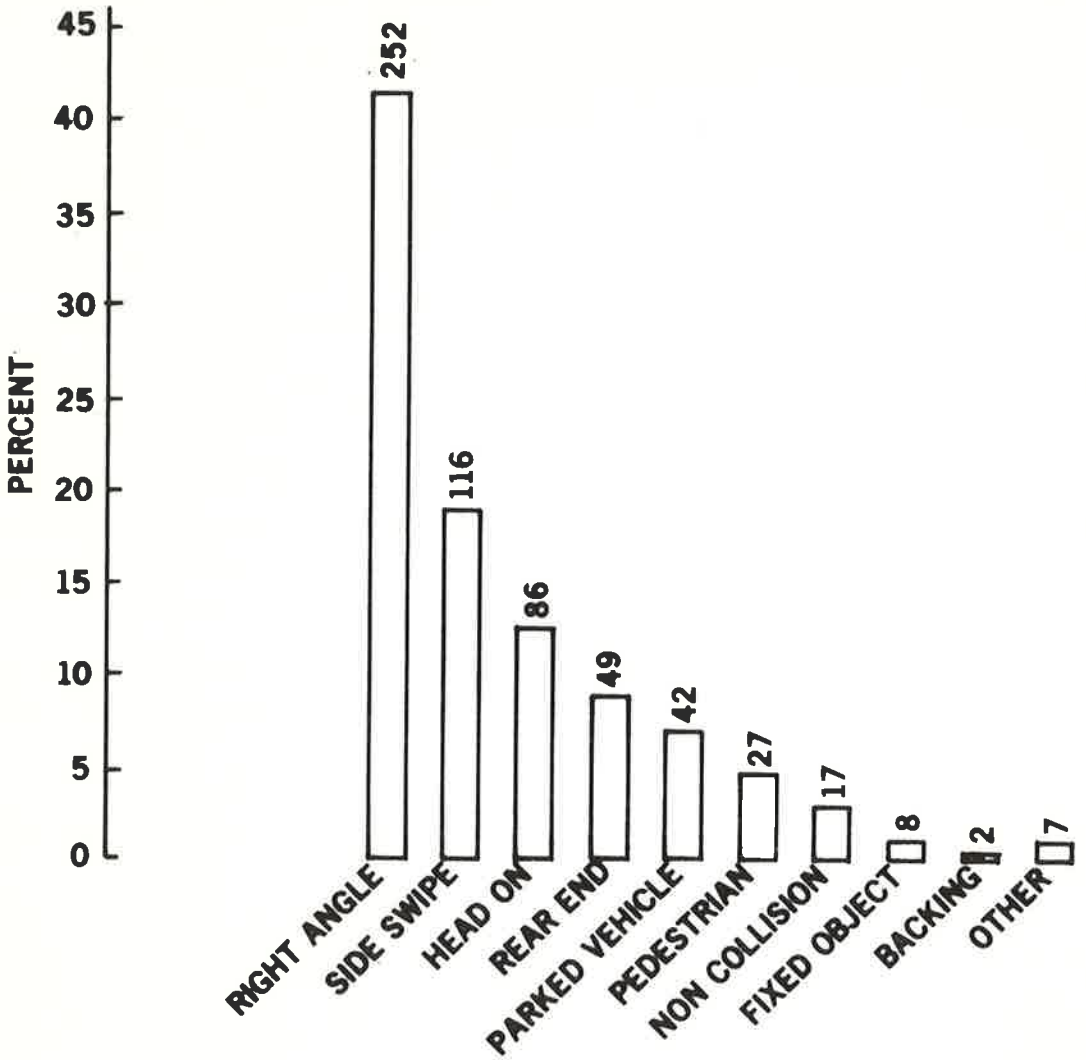
Note: each f indicates one fatality

There were a large number of right-angle collisions which accounted for 42 percent of all collisions (Figure 5). Many of these right-angle collisions occurred at mid-block locations. The cause of these accidents is largely the carelessness of a motorist pulling out of a driveway or parking space, or a cyclist's lack of attention when entering the street.

Another predominate mid-block collision is the sideswipe. These are largely due to a cyclist's veering into the path of the motorist or a motorist not allowing sufficient space for the cyclist to travel.

The third most predominate collision type is the head-on collision. Nearly half of all head-on collisions occur at mid-block locations, which usually designates the cyclist as the violator, travelling against the flow of traffic. Those occurring at intersections are attributable to right-of-way encroachments.

FIGURE 5



BICYCLE ACCIDENTS IN THE DISTRICT OF COLUMBIA BY COLLISION TYPE 1973

In 36 percent of all bicycle-motor vehilce accidents, no one was charged with fault. Therefore, no cause can be determined to explain or correct the factors leading to these accidents. In 1973, the cyclist was at fault in 63 percent of the accidents where fault was determined. This approximates the 70 percent figure given by national organizations (BIA, NSC). However, the national figure includes all accidents, whether or not fault was determined. For all accidents in the District of Columbia, the cyclist was responsible for only 41 percent.

TABLE 4
1973 BICYCLE ACCIDENTS
WHO WAS AT FAULT

	Percent Where Charge Was Levied	Percent All Accidents
Cyclist Only	56.3	36.0
Motorist Only	35.9	22.9
Pedestrian Only	0.5	0.3
Cyclist & Motorist	6.2	4.0
Cyclist & Pedestrian	1.0	0.6
Undetermined	-	36.1
TOTAL	100.0	100.0

TABLE 5
BICYCLE ACCIDENTS BY AGE OF CYCLIST IN THE DISTRICT OF COLUMBIA - 1973

	Number	Cyclist Responsible	Percent
0- 5	8	2	25.0
6-11	110	57	51.8
12-15	139	61	43.9
16-19	139	59	42.4
20-23	95	33	34.7
24-29	58	18	31.0
30-44	30	4	13.3
45-59	11	3	27.3
60+	1	1	100.0
No age given	15	8	53.3
TOTAL	606	246	40.6

Note: Cyclist was the only person at fault in 36 percent of all accidents

The most serious violation is the hit and run. This violation accounted for 6.4 percent of all apparent violations and one fatality in a head-on collision. Another serious violation is that of defective brakes, especially on bicycles. The bicyclist's main advantage in traffic is his maneuverability. This maneuverability is lost when the brakes are not operating properly. The National Safety Council estimates that defective brakes on bicycles led to 25 percent of all accidents nationwide. Only 1.3 percent of the bicycle accidents in the District of Columbia were attributed to a defective brake violation by the cyclist.

1973 BICYCLE ACCIDENTS IN THE DISTRICT OF COLUMBIA

Type of Violation

Type of Collision	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Totals
Parked Vehicle	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	28	4	1	3	0	3	0	0	0	0	2	43
Fixed Object	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	1	0	0	0	0	0	0	0	0	1	8
Pedestrian	0	0	0	0	7	0	0	0	0	0	0	0	1	1	1	0	0	0	11	0	0	1	0	0	0	0	0	0	3F	25
Right Angle	0	3	1	28	0	2	0	14	0	0	17	2	0	3	2	1	1	0	146F	9	0	19	0	0	0	0	0	0	6	254
Side Swipe	0	1	2	5	0	2	0	0	0	0	1	1	6	0	0	0	0	0	68	14	4	7	0	0	0	0	0	0	2	113
Rear End	0	1	7	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	25	6F	0	8	0	0	0	0	0	0	1	52
Head On	0	1	0	13	0	2	0	0	0	0	1	0	0	3	8	0	1	0	48	4	0	1F	0	0	0	0	0	0	3	85
Non-collision	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	2	0	0	0	0	0	0	0	0	1	17
Other	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	4	0	0	0	0	1	0	0	0	0	0	9
TOTALS	2	8	11	48	7	6	0	14	0	0	19	4	8	7	13	3	4	0	345	40	5	39	0	4	0	0	0	0	19	606

Note: F indicates one fatality

APPARENT VIOLATION CODES

01 Speeding
02 Defective brakes
03 Following too close
04 Right-of-way to auto
05 Right-of-way to pedestrian
06 Improper turn
07 Yield sign
08 Red light
09 Flashing light
10 Directional light
11 Stop sign
12 Drunk driving
13 Improper passing
14 Wrong way one way street
15 Wrong side of street
16 Improper starting or backing
17 Defective vehicle or equipment
18 Pedestrian violation
19 No charge or going to court
20 Failure to pay full time and attention
21 Changing lanes without caution
22 Hit and run
23 Failure to set hand brake
24 Open door to traffic
25 Driving under the influence of drugs
26 Drunk driving, refused alcohol test
27 Drunk pedestrian, refused alcohol test
28 No snow tires or chains during snow emergency
29 Other

Part One - Summary, Conclusions, Recommendations

The conclusions and recommendations made here are based on the data from the Metropolitan Police Department. The National Safety Council estimates that only five percent of all bicycle accidents involve conflicts with motor vehicles. The accidents in this memorandum are primarily (90.3 percent) those in which there was a conflict with motor vehicles, since no report is made by the police unless there is $100 damage or personal injury. Therefore, the reader should be aware of the limitations of the data presented herein and the subsequent limitations of the conclusions drawn from the data.

1. The increasing number of bicycle accidents indicate the existance or emergence of a problem in the District of Columbia.

2. Sixty-five percent of all reported bicycle accidents occur at intersections. Bikeways that pass through intersections should be provided with special treatment to insure the safety and the continuity of travel for the cyclist.

3. Nearly fifty percent of all reported bicycle accidents occur in the summer.

4. Forty-six percent of reported bicycle accidents is rising between the hours of 3:00PM and 8:00PM.

5. The median age of cyclist's involved in accidents is rising.

6. Twenty-eight percent of all reported bicycle accidents occur at mid-block locations. These are accidents which may be eliminated with the provision of separate and exclusive right-of-ways for bicycles.

7. The National Safety Council reports that faulty brakes on bicycles accounted for twenty-five percent of all bicycle accidents. Mandatory bicycle inspections would prevent many of the bicycle accidents resulting from faulty equipment.

8. Recent and future changes in motor vehicle patterns and new construction (e.g., METRO) afford the opportunity to incorporate good design measures to insure bicycle safety.

9. Accident detail reports should be more carefully prepared and more factually reported in order to more properly determine the causes of bicycle/motor vehicle accidents.

10. Forty-three percent of all reported bicycle accidents are attributable to a specific violation. Therefore, regulations regarding bicycle use and bicycle right-of-way on streets should be strictly enforced.

11. The concentration of accidents in several radial corridors suggest the need for bikeways to improve safety conditions. However, it should be noted that most accidents occur at intersections where the effectiveness of the bikeway is reduced.

Part Two - Summary of Accidents Data from the "Survey on Bicycling Activity"

A telephone survey was conducted in the District from November 9 to November 27, 1974 to collect information on cycling activity and characteristics. Both cycling and non-cycling households were interviewed to determine the differing characteristics of the two groups. This part of the memorandum is concerned with the cycling households. The distribution of the cycling households throughout the District is shown by Table 6 and Figure 6. The statistical validity of the results was insured through careful "quality" and "control" techniques.* However, it should be kept in mind that the survey sample was only 0.3% of all households within the District. Yet, through random sampling and distribution, the validity of the survey results was maintained.

The households were questioned about their cycling habits in the past year. Several questions were asked to determine use and accident characteristics, which is the subject of this section.

Existing Bicycle Trends in the District of Columbia

According to the telephone survey, there are approximately 186,000 bicyclists in the District of Columbia. This represents 26% of the estimated 1974 population of 712,814. Thirty-four percent of all households (88,000) were found to have at least one member who had bicycled in the past year.

From this figure of the number of cyclists, it is estimated that there are between 100,000 and 130,000 bicycles in the District.* This compares with a September figure of 44,200 bicycles registered by the Metropolitan Police Department. The telephone survey determined that the household rate of bicycle ownership is about 1.1 to 1.5 to give the estimated figure. This also means that only 35 to 45 percent of all bicycles are registered.

The survey projected that there were a total of 14,100 bicycle accidents in Washington, D. C. in 1974. Twenty-one percent or 3000 of these required medical treatment. Of this total number of accidents, 5300 (38%) involved collisions with motor vehicles.

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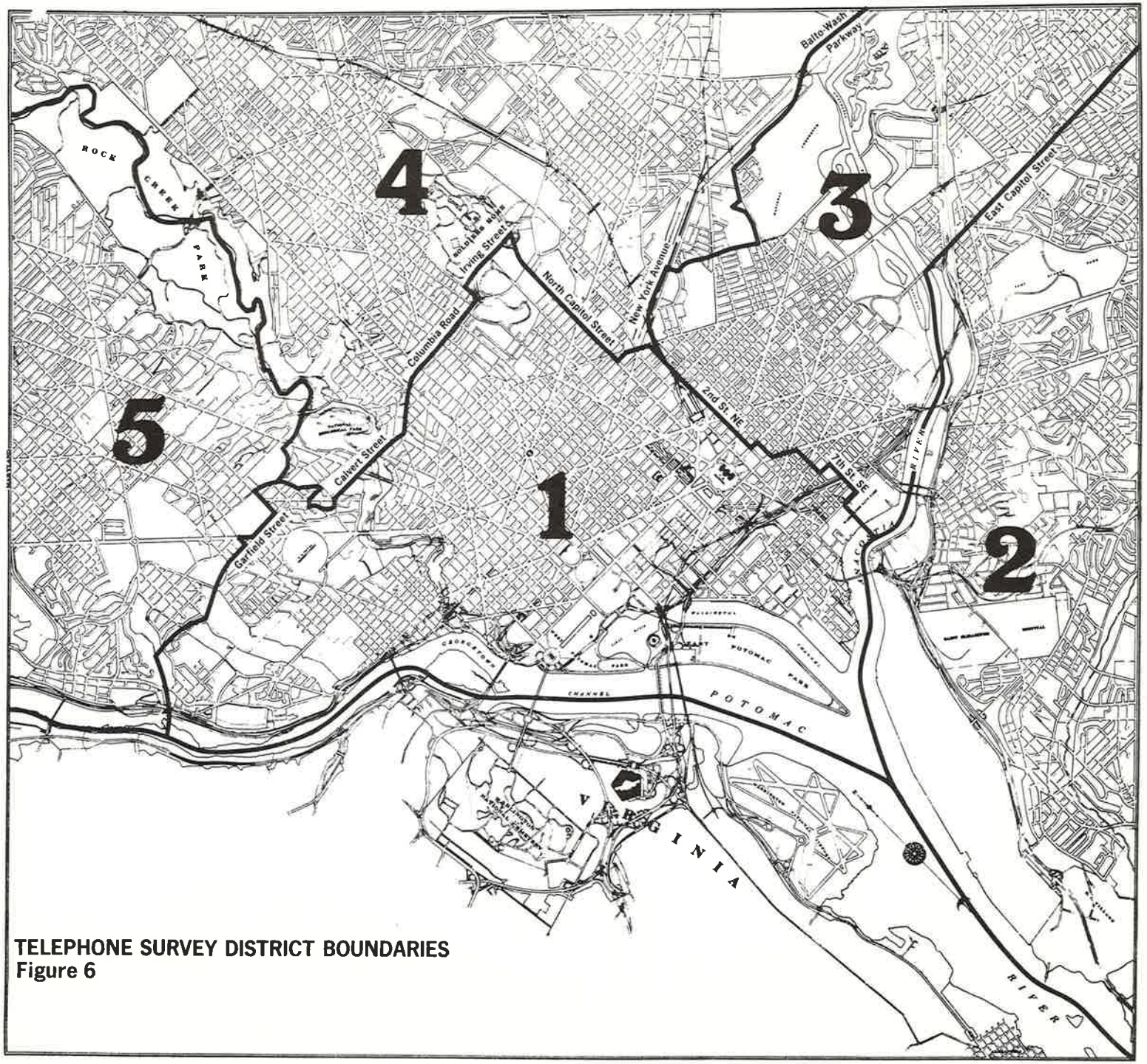
* See Memorandum 1

TABLE 6
WASHINGTON, D. C. BICYCLISTS BY SURVEY DISTRICT LOCATION

Survey District	% of Households Bicycling During Past Year	Estimated 1970 Population No.	%	% of Pop. within Area who Bicycled During Past Yr.	No. of Estimated Bicyclists Based on 1970 Pop.	% of Total Bicyclists in Washington, D. C.
1	32%	181,443	25.5%	27%	50,200	27.0%
2	33%	164,833	23.1%	21%	35,400	19.0%
3	28%	127,371	17.9%	20%	25,300	13.6%
4	38%	181,400	25.4%	29%	53,100	28.6%
5	42%	57,767	8.1%	38%	22,000	11.8%
TOTAL	34%	712,814	100.0%	26%	186,000	100.0%



TELEPHONE SURVEY DISTRICT BOUNDARIES
Figure 6

Accident Victim Analysis

Table 7 indicates the age distribution of cyclists involved in accidents for the year preceeding the survey. The age groups 6-11 and 20-23 has a disproprotionately high number of accidents in 1974. Twenty-seven percent of all accidents were of the 20-23 age group. This same pecularity was observed in the police accident reports. There were two fatalities in 1974 (ages 13 and 15).

TABLE 7
BICYCLE ACCIDENTS BY AGE OF BICYCLISTS DURING PAST YEAR

Age	Percentage of All Accidents Number	Percent	Percentage of All Bicyclists During Past Year
Under 6	-	-	3%
6 - 11	33	22%	15%
12 - 15	13	8%	12%
16 - 19	12	8%	11%
20 - 23	40	27%	14%
24 - 29	25	17%	19%
30 - 44	15	10%	16%
45 - 59	13	8%	6%
60+	-	-	2%
Don't Know	-	-	1%
TOTAL	150	100%	99%

Location of Bicycle Accidents

Table 8 indicates the location of bicycle accidents in the District of Columbia. Two-thirds of all accidents occur in the streets whereas only one-fourth of all bicycle riding is done in the streets. This further amplifies the danger of cycling in mixed traffic.

TABLE 8
1974 BICYCLE ACCIDENTS IN WASHINGTON, D. C. BY LOCATION AND USE

Type of Facility	Accidents Number	Percent	Use Percent
Special Bikeways	900	6%	18%
Sidewalks	2,600	18%	55%
Streets	9,500	67%	27%
Other	1,100	8%	-
TOTAL	14,100	100%	100%

Part Two - Summary, Conclusions, Recommendations

1. One-third of all households in the District had at least one member who bicycled in the past year.

2. There are approximately 186,000 cyclists in the District of Columbia.

3. A cyclist riding on Washington, D. C. streets is seven times more likely to be involved in an accident than on a sidewalk or special bikeway.

4. Cyclists in the age group 20-23 have the highest percentage of accidents and the highest percetange of accidents with motor vehicles.

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 3

Physical Opportunities and Constraints for Bikeway Development in the District of Columbia

January 15, 1975

The contents of this memorandum deal with the physical opportunities and barriers for the location of bikeways in the District. Data were collected from field observations and from consultation with staff members of the D.C. Department of Highways and Traffic, D.C. Redevelopment Land Agency, Metropolitan Washington Council of Governments, and the Pennsylvania Avenue Commission.

INTRODUCTION

This memorandum investigates geographically-related factors which may have a positive or negative effect on the establishment of bikeways in various parts of the District. One group of such factors has been termed "opportunities." This includes lands or roadways which are underutilized at present and could possibly be utilized for bikeways. A second category is "major generators," specific facilities (such as schools and shopping areas) likely to attract bicyclists. "Barriers" constitute a third category, being composed of elements such as rivers and highways which inhibit bicycle movements. Information on these three basic factors, along with various related elements, was assembled on a series of maps in order to identify those areas or corridors in the District amenable to the establishment of reserved bicycle lanes or rights-of-way. By the same token, certain areas which should be avoided by bikeways were also identified.

It should be noted that while some of these elements (such as major generators) are related to overall travel demand, the factors mentioned here were studied independently of actual bicycle demand. The objective was to gauge geographical problems and potentials, rather than satisfy particular travel demands with specific route proposals.

OPPORTUNITIES

A wide variety of opportunities for bikeways was identified (see Figure 1). One primary element is the many parks and public lands in the District. In particular, Rock Creek Park, the Potomac Parks, the Mall, Glover-Archibold Park, the Anacostia River parkways, Oxen Run, and the Fort Circle Park System provided continuous corridors. While certain of these areas already have bikeway facilities, the majority are not utilized at present. The Glover-Archibold, Anacostia River, and the Mall Parkways seem to have the greatest potential for bikeway location. In addition, there are large tracts of institutionally owned non-public and semi-public land, especially in northeast Washington, which form corridors which might be appropriate for bikeways.

A second opportunity element consists of active railroad rights-of-way. Those examined included the Baltimore and Ohio (B & O) Washington Branch, the Penn Central (PC) Chesapeake Division Main Line, the Main Line to Virginia, and various freight lines (the East Washington Railway in Anacostia, B & O Potomac spur to Georgetown, B & O spur to Bolling Air Force base, and the PC/B & O Freight Bypass along the Anacostia River). Also examined were programmed METRO rapid transit surface rights-of-way, including the B & O Washington Branch, the Gallatin Parkway open-cut, and the bridges over the Anacostia and Potomac Rivers. Of all these facilities, only those with rights-of-way wide enough to accommodate bikeways were considered appropriate; the most promising of these are the METRO Gallatin Parkway route, the Penn Central Main Line, and the PC/B & O Freight Bypass. The two railroad tunnels in the Capitol Hill area are in active use, and are thus not considered appropriate for bikeway development.

Abandoned railroad rights-of-way are even more desirable for bikeways. The only such facilities in the District are the remains of former D.C. Transit streetcar routes. The Glen Echo/Cabin John route offers some excellent prospects, including unused bridges, parallel to Canal Road in northwest Washington. There are also three abandoned streetcar tunnels: at Dupont Circle, the Bureau of Printing and Engraving, and Capitol Hill. Of these, the first seems to have the most potential for allowing bicyclists to bypass heavy traffic, although all may offer possibilities for bicycle parking.

Other rights-of-way which might be of value as bikeways were investigated. Utilitiy easement corridors are rare in the District. There are, however, several rights-of-way reserved for roads which were never built. There are also medians in certain streets which might be adaptable to carrying bicycle lanes. The right-of-way for the unbuilt Glover-Archibold Parkway and the medians in the center of Pennsylvania Avenue,

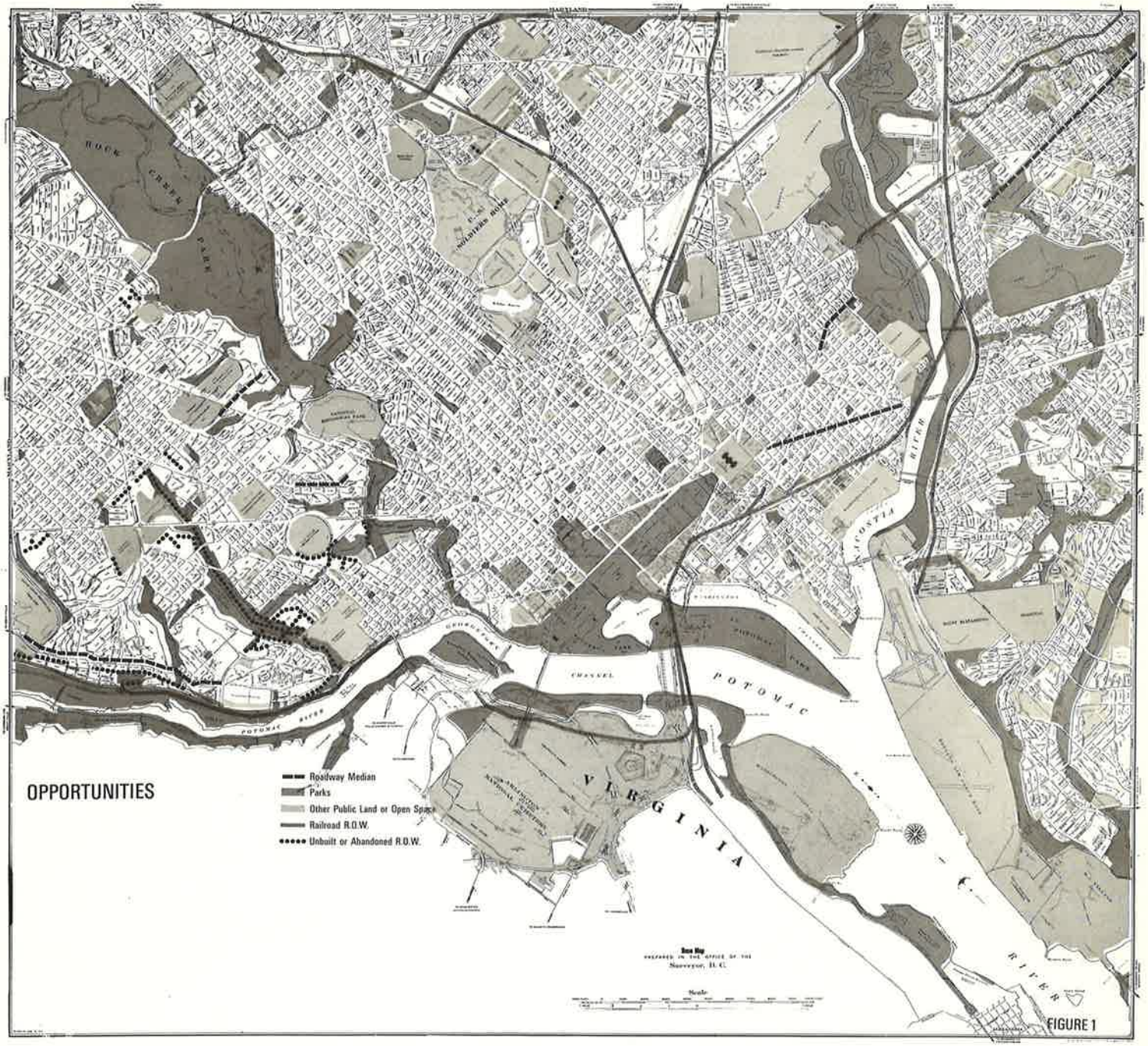

OPPORTUNITIES
Roadway Median
Parks
Other Public Land or Open Space
Railroad R.O.W.
Unbuilt or Abandoned R.O.W.
ROCK CREEK PARK
POTOMAC RIVER
ANACOSTIA RIVER
POTOMAC PARK
CHANNEL
POTOMAC
VIRGINIA
RIVER
Base Map
PREPARED IN THE OFFICE OF THE
Surveyor, D. C.
Scale

FIGURE 1

S.E., Tilden Street and MacArthur Boulevard, N.W., East Capitol Street, and C Street, N.E. are good possibilities for bikeway locations. There is also an unused right-of-way parallel to part of Maine Avenue which might be available.

MAJOR GENERATORS

Major generators consist of facilities which could potentially attract a relatively large number of bicycle trips. These facilities include schools, shopping areas, METRO stations, and various other attractions. Maps were prepared showing the location of these major generators in order to indicate the areas of the city where bikeways could be warranted (see Figure 2).

The primary generators of school trips are expected to be secondary schools, technical schools, and colleges and universities. The locations of all forty-one District public junior high and high schools were pinpointed, as well as the fourteen parochial secondary schools of the Archdiocese of Washington; the larger schools (those with enrollments over 1,000) were identified.

The large colleges and technical schools in the District have excellent potential for attracting significant numbers of bicyclists. These schools no doubt generate a great deal of bicycle traffic already, even without the benefit of bikeways.

Other major generators include hospitals, shopping areas, museums, national monuments, and transportation terminals. Some of these facilities, especially the hospitals, are potential generators of work trips by cyclists, while others could generate a variety of other trip purposes (such as recreational and shopping trips).

One final set of generators consists of all programmed METRO rapid transit stations in the District. Stations where cycle racks are planned were distinguished. As explained in more detail in another technical memorandum, METRO is expected to attract a good deal of bicycle traffic.[1]

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[1] Technical Memorandum 8 - Transit Related Bicycle Storage and Facilities.

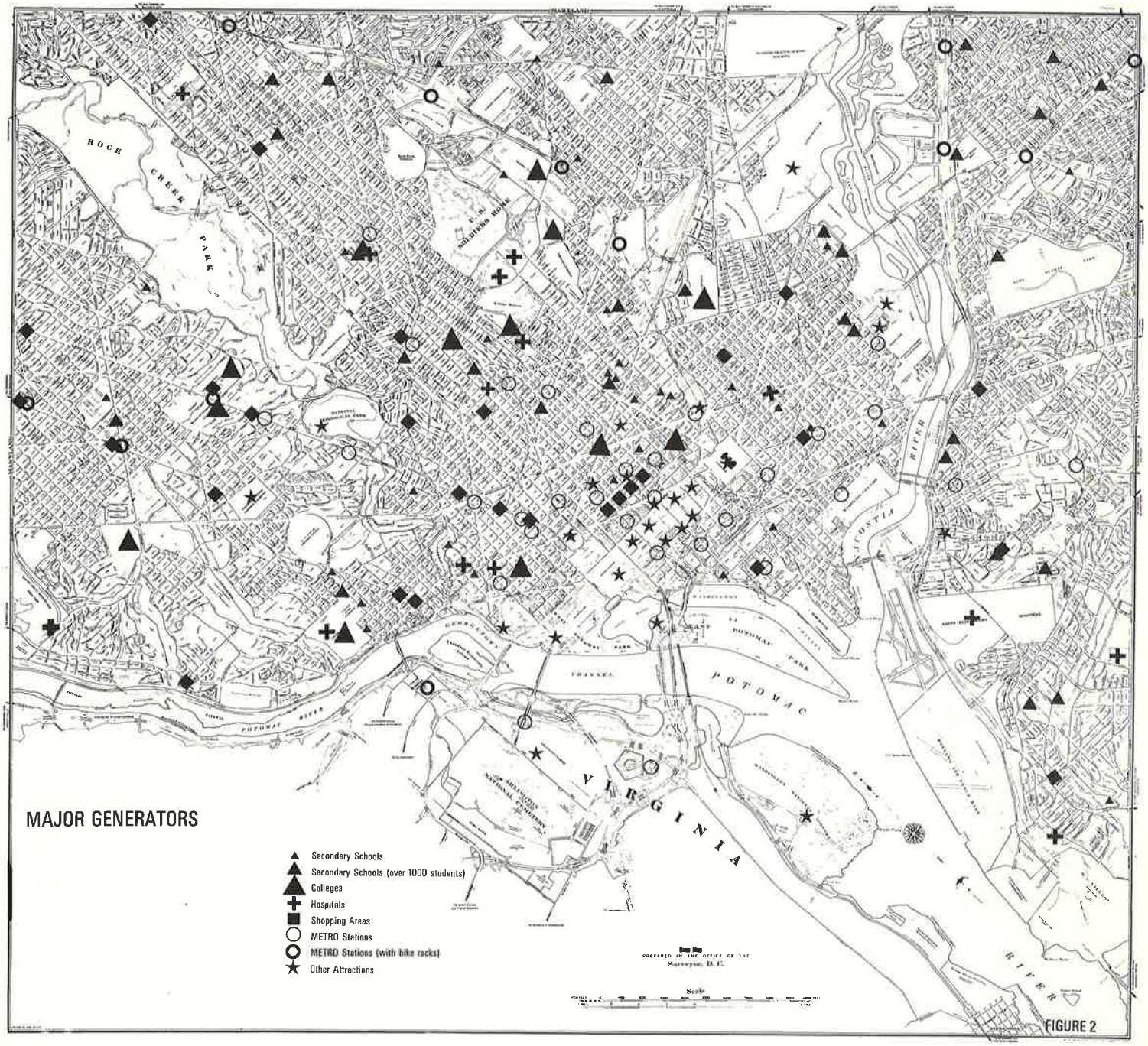
ROCK CREEK PARK
POTOMAC RIVER
POTOMAC PARK
ANACOSTIA RIVER
VIRGINIA
MAJOR GENERATORS
Secondary Schools
Secondary Schools (over 1000 students)
Colleges
Hospitals
Shopping Areas
METRO Stations
METRO Stations (with bike racks)
Other Attractions
Scale

FIGURE 2

EMPLOYMENT AREAS

As a complement to the information on major generators, the areas of high employment in the District were mapped, as these would be likely destinations for cyclists (see Figure 3). The data were based upon a 1968 study conducted by the Council of Governments.[2] Areas with moderate and large concentrations of employees were delineated (reflecting COG traffic analysis zones with more than 1,000 and more than 5,000 employees, respectively). As might be expected, the areas of greatest employment centered around the Downtown and the K Street-Connecticut Avenue corridors, with secondary employment centers in other parts of the District. The magnitude of employment in the new Southwest area was probably not reflected by these data.

ACCIDENTS

Information on bicycle-related accidents has been presented in a separate technical memorandum.[3] The results of these efforts were mapped (see Figure 4) in order to determine critical corridors or sections of roadways in which bikeways would be warranted for safety purposes. While the accident locations are fairly scattered, there appears to be a general concentration of them in the K Street-Connecticut Avenue office area, and along 4th Street, N.W., 14th Street, N.W., 8th Street, N.E., Wisconsin Avenue, N.W., and Pennsylvania Avenue, S.E.

BARRIERS

A number of physical barriers exist which presently and will in the future cause problems for bicycle use in particular areas of the City. The most obvious of these are the Potomac and Anacostia Rivers. In general, most bridges crossing these rivers are not presently suitable for bicycle traffic. It would appear, however, that the Chain, Key, Memorial, Douglas, and Allen/Benning Bridges would be most adaptable to bikeway development. The Mason/Rochambeau, Anacostia, Sousa and proposed METRO bridges might also be considered. The other bridges carry rail or high-speed auto traffic and have configurations which make it difficult for them to be adapted for bikeways.

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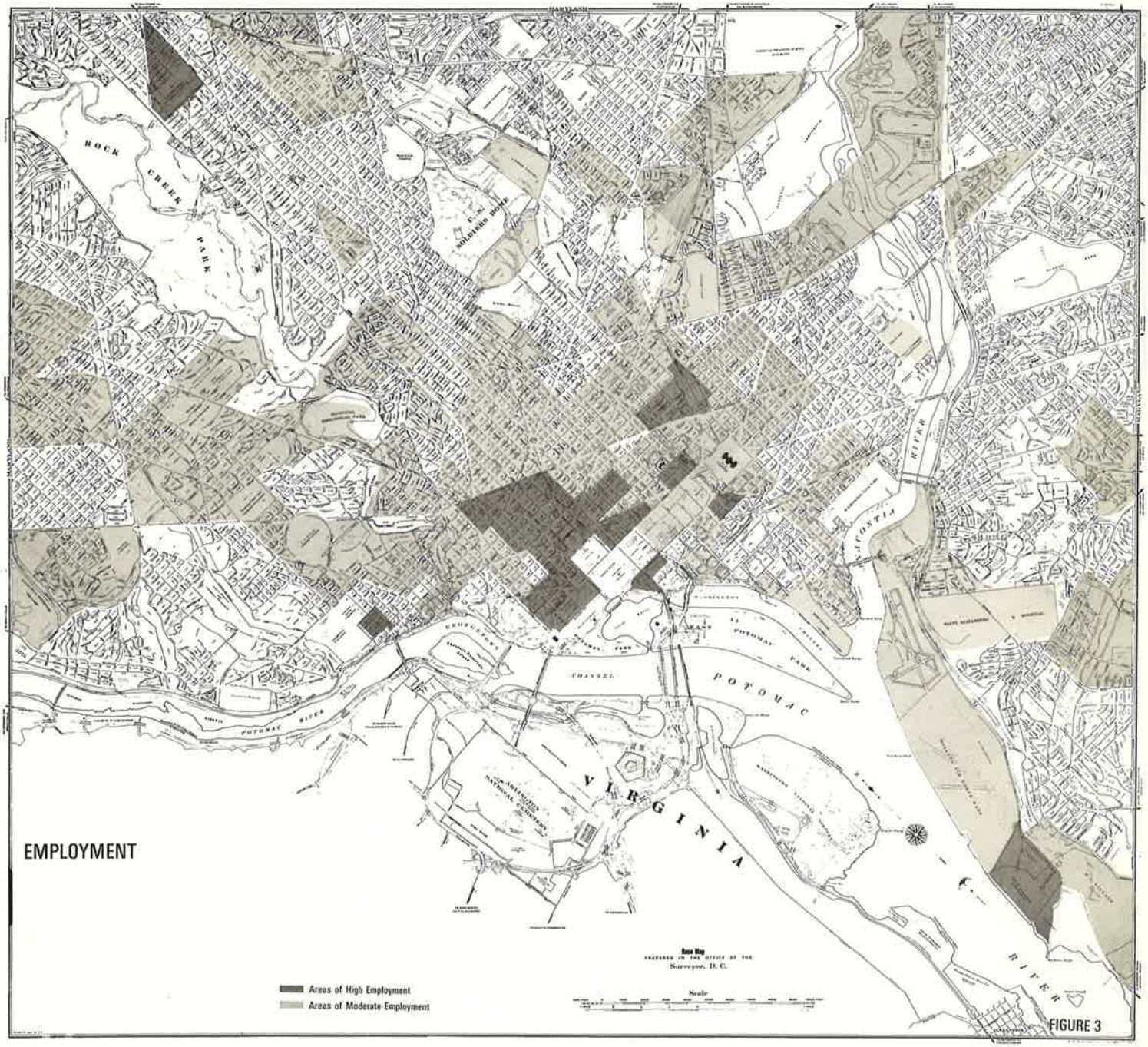
2 "Zonal Land Use Allocations for Regional Transportation Forecasts," COG Department of Transportation Planning, September, 1973.

3 Technical Memorandum 2 - Summary of the Bicyle Accident Experience in the District of Columbia.



EMPLOYMENT

FIGURE 3

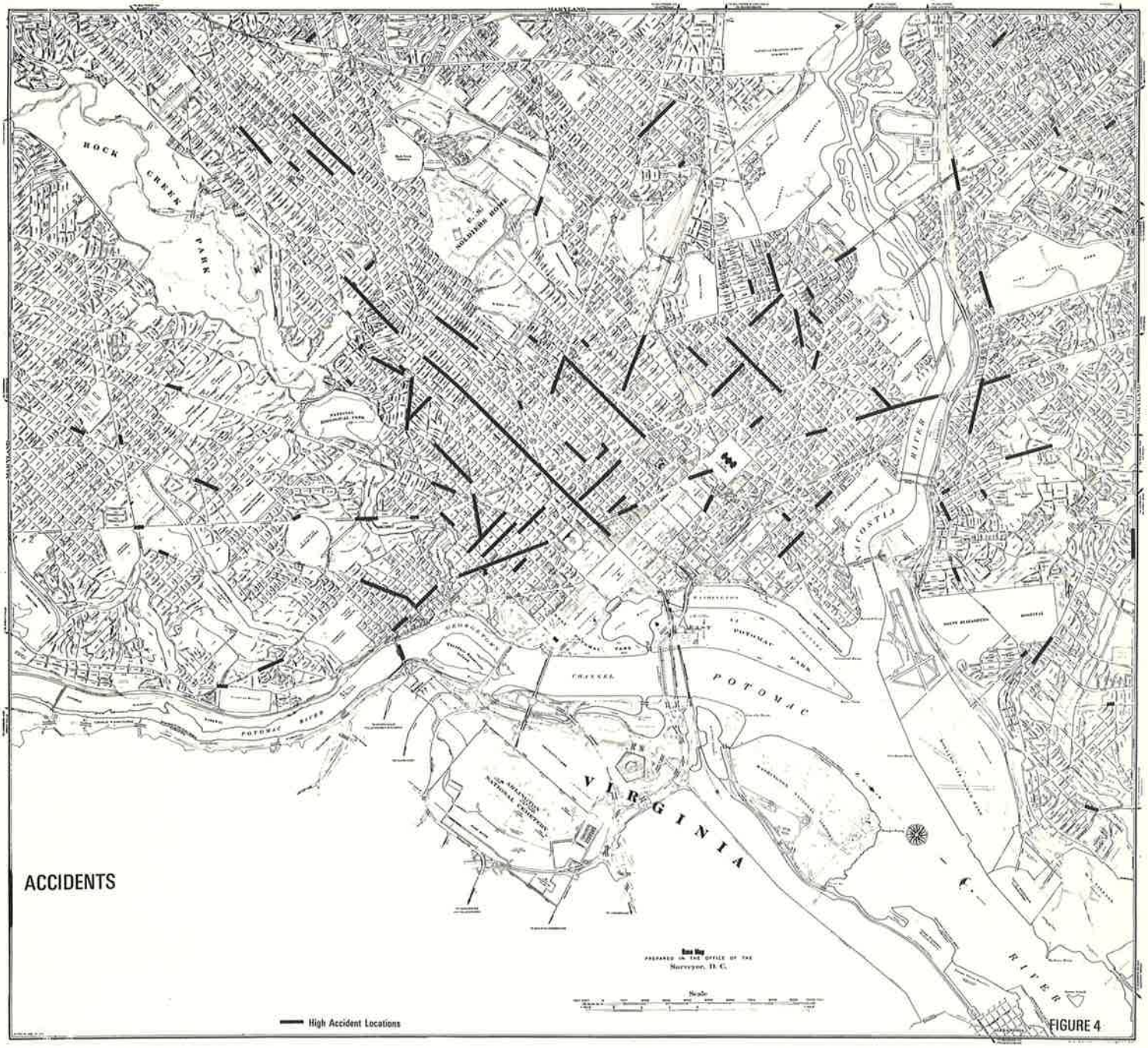

ROCK CREEK PARK
POTOMAC RIVER
POTOMAC PARK
POTOMAC
ANACOSTIA RIVER
VIRGINIA
ARLINGTON NATIONAL CEMETERY
SOLDIERS HOME
CHANNEL
Base Map
PREPARED IN THE OFFICE OF THE
Surveyor, D. C.
Scale
ACCIDENTS
High Accident Locations

FIGURE 4

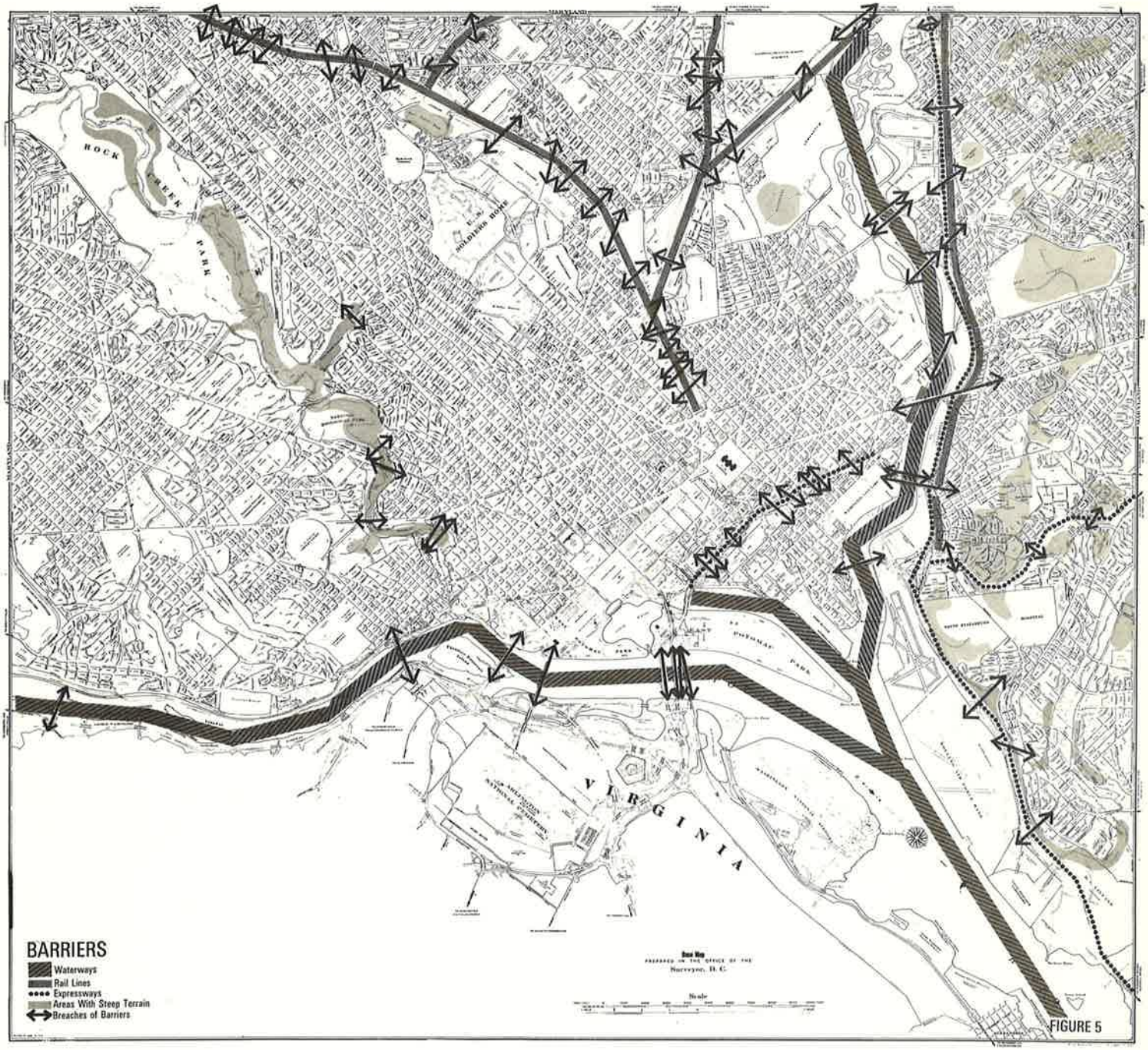

ROCK CREEK PARK
SOLDIERS HOME
POTOMAC PARK
VIRGINIA
BARRIERS
Waterways
Rail Lines
Expressways
Areas With Steep Terrain
Breaches of Barriers

FIGURE 5

Other barriers to the cross movement of bicycles include railroad lines and expressways. In general, however, many of these facilities are breached at frequent intervals by city street crossings and present a less serious problem for bikeways than the rivers. Possible exceptions might be Suitland Parkway, which is crossed by only three roadways in the District, and the section of I-95 in Southwest Washington.

Areas with steep changes in grade form another sort of barrier to bicycle movements. The most notable are the gorges created by Rock Creek (especially in the Georgetown, Kalorama Heights, Spring Road, and Military Road areas), and the hilly sections of Anacostia south of Pennsylvania Avenue. The former is crossed by numerous bridges, but the Anacostia area may present significant grade problems to cyclists. Pennsylvania Avenue is one of the few relatively flat major roadways in the area.

CONCLUSIONS

The graphic information dealing with opportunities, major generators, employment areas, and accidents was combined to form a composite map (see Figure 6). This map indicates (by varying gradations of color and density of symbols) the areas of the District in which the opportunity and the need for bikeway facilities appear strongest. It can thus serve as an input in the planning process, along with such other factors as the demand data from the telephone survey and route and network design criteria. The information on barriers to bikeways complements the composite map by illustrating the areas in which bikeway development must be channelled or constrained.

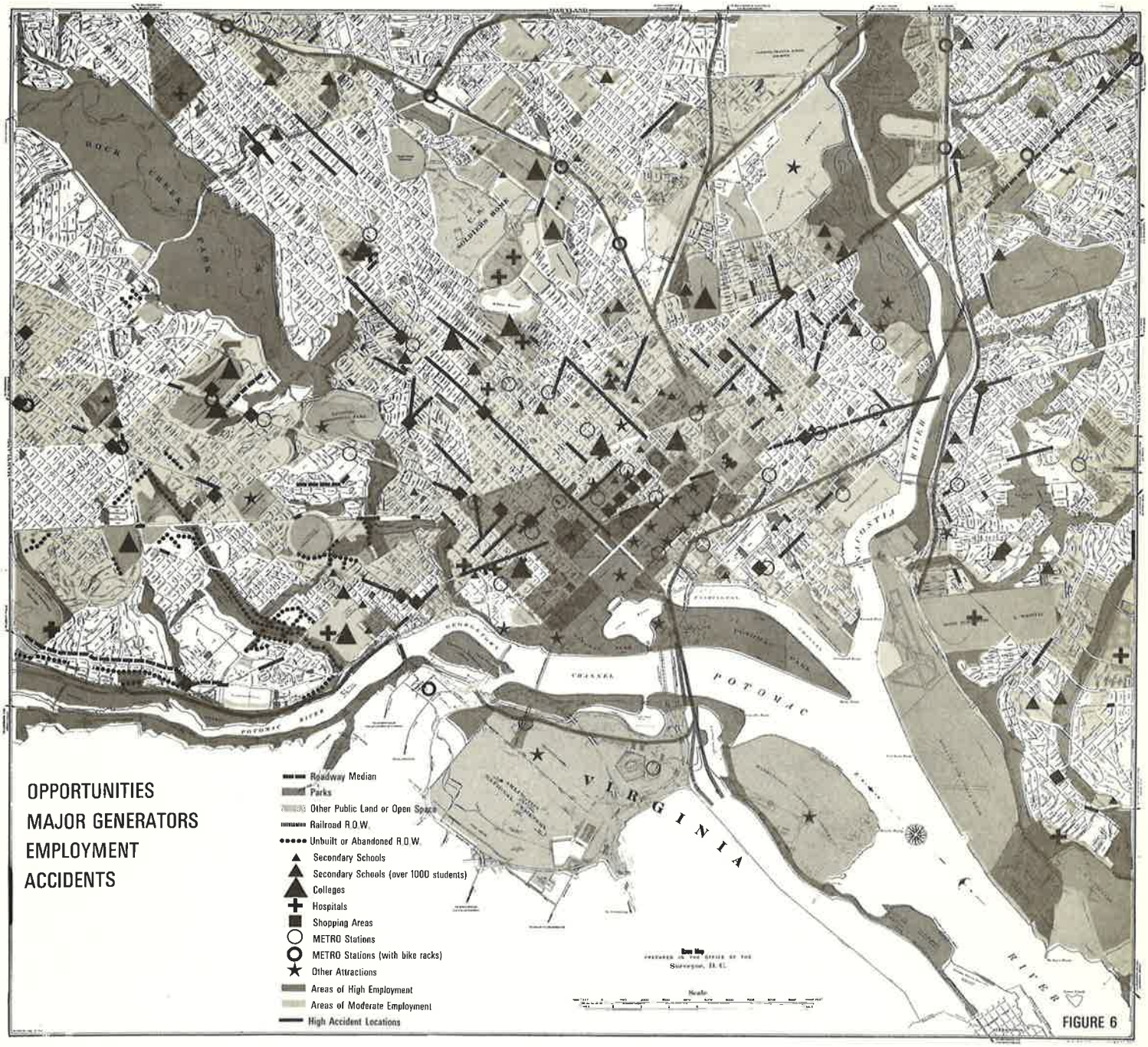

OPPORTUNITIES
MAJOR GENERATORS
EMPLOYMENT
ACCIDENTS
Roadway Median
Parks
Other Public Land or Open Space
Railroad R.O.W.
Unbuilt or Abandoned R.O.W.
Secondary Schools
Secondary Schools (over 1000 students)
Colleges
Hospitals
Shopping Areas
METRO Stations
METRO Stations (with bike racks)
Other Attractions
Areas of High Employment
Areas of Moderate Employment
High Accident Locations
ROCK CREEK PARK
POTOMAC RIVER
POTOMAC
ANACOSTIA RIVER
VIRGINIA

FIGURE 6

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 4

Proposed Framework for Monitoring Bicycle Facilities and Programs

March 26, 1975

The purpose of this memorandum is to define a framework for a bicycle facility monitoring program. The overall program goal would be to develop an empirical base by which to evaluate the effectiveness of facilities currently being planned, designed, and used.

Introduction

The District of Columbia has embarked on an ambitious program to develop an extensive system of facilities for the utility bicyclist. Over the next several years, approximately seventy miles of bikeways of various types are recommended to be constructed; hundreds of bicycle parking devices will be provided which will offer varying degrees of security against theft; and other amenities may be available such as shower and locker facilities and bicycle repair service.[1] "Software" such as educational and safety programs will increase as more "hardware" facilities encourage more to bicycle.

The provision of the basic support facilities, bikeways and parking devices, is in its infancy in the U.S. Extensive European experience exists and is the basis for many design standards and criteria used currently. However, the attitudes and habits of U.S. bicyclists, and of U.S. motorists toward bicyclists, differ markedly from those of Europeans. Only by monitoring the new experience in this country will we be able to adjust facilities to American cycling needs.

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1 Today, during the summer months, a special branch of the U.S. Park Police patrols the park bikeways on bicycles and provides minor repair services when the need arises.

Purposes of Monitoring

Many purposes will be served by a monitoring program. As discussed above, one of these purposes would be to improve current design standards. By making bicycle traffic counts, interviewing bicyclists, reviewing accident statistics and making special accident investigations, and by direct observation, the effectiveness of the design of different types of facilities can be analyzed.

Another purpose of monitoring would be to improve the criteria by which the proposed bikeway routes were located. This could be on the basis of bicycle traffic counts, interviews with bicyclists and with non-users such as residents and businessmen in the neighborhood of new bikeways.

Monitoring will be the best means to determine the parking needs of bicyclists. Parking hardware installations can be monitored to determine if too many or too few are provided at a particular installation.

The feasibility of new programs can be determined in an experimental situation by monitoring. For example, the potential for fee parking for bicycles has not been tested in the District of Columbia. Before a large investment in high security parking devices is made, an experiment should be conducted to demonstrate if a market exists.

In general, monitoring should be used to make broad, program level and fine, design level adjustments to the provision of facilities for bicycling. The information so collected can also be used to determine if expenditures on facilities are justified.

Subjects of Monitoring Surveys

The bicycling public will be the primary focus of the monitoring program. The bicyclists who use the facilities can provide information on the effectiveness of the design, and to what extent the cyclist travelled to use the facility.

Information should be sought from cyclists who do not use the facilities, as well. The reason for their aversion to the bikeway can provide insight for design improvements and/or location criteria.

Non-cyclists' opinions should also be sought as an important input to the overall monitoring program. Several different groups of non-cyclists who are affected by the bicycle transportation system should be surveyd. These are:

1. Motorists - the reactions of motor vehicle drivers to different bikeway treatments can help adjust design criteria.

2. Pedestrians - where bikeway and sidewalk come together, a potential conflict exists. The pedestrian can provide useful information to help resolve this conflict.

3. Residents and Businessmen - the reaction to bikeways of the people who live or work in the neighborhoods where they are located may help to establish location criteria for future bikeway planning.

Conclusions

A well designed monitoring program can provide valuable information for future bikeway planning. Because before-and-after studies would be valuable, it is important to begin planning this program now. Because the information gained will be valuable nation-wide, the funding of the program may be solicited from non-local sources such as the U.S. Department of Transportation or the Bicyle Manufacturers Association.

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 5

An Analysis of Legal Questions Regarding the Implementation of Bicycle Facilities in the District of Columbia

March 20, 1975

As part of the overall Comprehensive Bikeway Planning Study, a special legal analysis was performed to answer specific questions pertinent to the development and implementation of a bicycle facilities plan in the District of Columbia. An extensive list of questions was developed during the first few weeks of the study. From that list, seven questions were selected as being high priority and were submitted for analysis to an attorney subcontracted to the study. A brief summary of the findings of that analysis is attached. An extensive, detailed documentation of the analysis is bound separately and will be kept on file with other study documents.

The complete documentation of this legal analysis was submitted to both the Technical and Citizens Committee of the Study for review. Extensive comments were returned as a result of these reviews and these comments represent additional legal opinion on the questions since some of the committee members are attorneys. As such, these comments will be kept on file as part of the full legal documentation.

It should be noted that the U.S. Environmental Protection Agency Transportation Control Plan[1] for the District of Columbia includes regulations which are pertinent to some of the legal questions which were analyzed.

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1 Federal Register, Thursday, December 6, 1973, Washington, D.C., Vol. 38, No. 234, Part II.

February 28, 1975

MEMORANDUM

TO: BARTON-ASCHMAN ASSOCIATES, INC.

FROM: ALLEN T. EATON, P.C.

RE: ANALYSIS OF LEGAL ISSUES IN CONNECTION WITH BIKEWAYS STUDY

I. SUMMARY

The following will summarize our findings on the legal issues presented in connection with the bikeways study.

1. What is the legal definition of a bikeway in the District of Columbia? If bikeways are included in the definition of "roadway", do set-back and other requirements apply even if the bikeway is physically separate from a roadway? Can present ordinances be amended to include a definition and specifications for bikeways, or is a separate bikeway code necessary?

The term bikeway is not defined in the District of Columbia regulations. However, as discussed in the main portion of the study, the term "roadway" does include bikeways. Although the regulations do not set forth requirements for bikeways, certain recommendations are included herein.

For the reasons discussed in question 1C of this report, it is recommended that present ordinances be amended to include a definition and specifications for bikeways.

2. Where bicycle and pedestrian paths merge or intersect (i.e., crosswalks, narrow bridges, etc.) who has the right-of-way? When an auto crosses a bicycle lane or path (i.e., right turn, driveway entrance, etc.), who has the right-of-way? When bicycle lanes are established in a roadway, can taxicabs, buses, or right-turning autos use the lane? Who has the right-of-way in this case? Is it possible to designate certain bikeways (or bike lanes) where bicycles have first priority right-of-way in all cases? If so, by what means?

Bicycles are classified as motor vehicles under District of Columbia regulations. Thus, operators of bicycles are accorded the same rights and subjected to most of the duties as those applicable to operators of motor vehicles, including regulations relative to rights-of-way.

There appears to be authority to exclude buses, taxicabs and right-turning vehicles from bicycle lanes. However, such a regulation would present enormous traffic problems under the laws now in existence. It is possible, to establish bicycle lanes where bicyclists would have first priority right-of-way in all cases. A great deal of traffic planning would be necessary to accomplish this goal.

3. Is there legal procedence for restricting cyclists from the street if a bicycle lane or path parallels the street?

Although there is legal precedence for restricting cyclists from the street when bicycle lanes or paths are available, this is not recommended.

4. Should property damage or personal injury result from proper use of city-owned or maintained bicycle facilities (i.e., bikeways, bike parking facilities, etc.) who assumes liability?

Generally, municipal corporations are liable for torts committed in the performance of proprietary functions. Maintaining streets and operating parking facilities are proprietary functions for which the District of Columbia would be held liable for property damage or personal injury occasioned by its negligence.

5. Can the owner/operator of an existing auto parking facility be required to convert a percentage of auto parking spaces to bicycle parking at comparable rates? Can proposed new facilities be required to do this? If so, how might this best be implemented for existing and for future facilities?

Providing for adequate facilities for bicycle parking would encourage the use of bicycles over motor vehicles and assist in reducing noxious gases detrimental to the health and welfare of the citizenry of the community. Thus, under its police powers, the appropriate agency of the District of Columbia can promulgate regulations to require existing and proposed parking facilities to convert a percentage of auto parking spaces to bicycle parking at comparable rates.

6. Can the owner/manager of an existing office or residential building be required to allow bicycles in elevators or provide space for bicycle storage at street or basement level? Can these requirements be imposed on owners of a proposed new building? How might this be achieved?

The District of Columbia may also require owners or managers of existing and proposed residential and office buildings to provide space for bicycle parking. This may also be accomplished under police powers.

7. If projections that bicycle parking demands will be greater than that currently planned for METRO stations are realized, can additional land or building space be purchased or rented by WMATA for bicycle storage?

The WMATA Compact authorizes that agency to acquire, by lease or purchase, land or space necessary for the operation of transit service. Such acquisitions may be by eminent domain as well as through regular purchase or lease agreements.

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 6

Bicycle Operator Certification

January 30, 1975

This memorandum discusses the advantages and disadvantages of a bicycle operator certification program in the District of Columbia. A bicycle operator certification program has been investigated because it is one method of setting a minimum standard of operating proficiency and, therefore, could have the potential for reducing accident rates. However, no similar programs have been in use in any community in the country for a long enough period to determine their effectiveness in reducing accidents.

If it is decided that a bicycle operator certification program should be encouraged, specific suggestions will be needed regarding the contents of the program, and the legislation and administrative requirements necessary to implement the program.

Bicycle Accidents in the District

Bicycle accidents in the District of Columbia have been discussed in detail in another memorandum. However, since the primary purpose of bicycle operator certification would be the reduction of accidents, it is important to review some of the relevant accident data before evaluating the program's potentials. On the average, one in every thirteen bicyclists in the District had a bicycle accident last year. Of the total 14,100 bicycle accidents reported in the recent telephone survey, 3,000 accidents resulted in injuries requiring professional medical treatment and 5,300 accidents involved motor vehicles (see Table 1). Beyond understanding the overall magnitude of bicycle accidents, both the locations of accidents and the ages of the victims are important in evaluating bicycle operator certification.

Accident Locations. It has generally been assumed that bicycle riding on streets is more dangerous than off-street riding; and accident data from the recent telephone survey support this theory.

TABLE 1
BICYCLE ACCIDENTS IN WASHINGTON, D.C. DURING PAST YEARS

Type of Accident	Number Reported In Sample (Weighted)	District of Columbia Projection	
		Number	Percent
Total Accidents	157	14,000	100%
Accidents requiring medical treatment	33	3,000	21%
Accidents occurring on —			
-- Special bikeways	9	900	6%
-- Sidewalks	28	2,600	18%
-- Streets	101	9,500	67%
Accidents on streets involving motor vehicles	56	5,300	38%

55 percent of bicycle riding in the District occurs on streets, but 67 percent of bicycle accidents were on-street. Furthermore, over half (55 percent) of on-street bicycle accidents involved motor vehicles. On-street riding, because of increased danger, requires greater operating proficiency than off-street riding. In addition, knowledge of the rules of the road and the ability to co-exist with motor vehicles are necessary for safe on-street riding. Nearly 90 percent of the bicycle/motor vehicle accidents reported to the District Police Department in 1974 (which were probably the most serious bicycle accidents) occurred along a major thoroughfare handling 10,000 or more vehicles per day.* Nearly two-thirds of these accidents occurred at intersections, where operating proficiency is particularly important and where safety hazards will continue to exist even if separate bicycle lanes are provided. These data suggest that proficiency is very important to safe bicycle operation on streets. It follows, therefore, that bicycle operator certification might be helpful in reducing accidents by requiring a certain level of proficiency for bicycling on public roadways and a knowledge of traffic regulations.

Age of Accident Victims. The telephone survey sample sizes of accidents by age group are very small and, therefore, only tentative conclusions are drawn. According to these survey results, the individuals most heavily involved in bicycle/motor vehicle accidents were young adults ages 20-23, while those most heavily involved in on-street accidents not involving motor vehicles were children ages 6-11 (see Table 2).* Conclusions which might be drawn are (1) young children tend to be less proficient and/or more prone to acrobatics; and (2) young adults tend to ride on more dangerous and more heavily traveled streets (other data indicates that this age group is more likely to bicycle for utilitarian purposes). Finally, regardless of age, it has been estimated by the National Safety Council and the Bicycle Institute of America that the cyclist is at fault in 70 percent of all bicycle/motor vehicle accidents. While it can be argued that the bicyclist over 16 probably knows the rules of the road, the same cannot be said with confidence for children of pre-driving age. Furthermore, a knowledge of motor vehicle operation and applicable laws does not necessarily determine bicycle riding proficiency nor prove a knowledge of the applicability of traffic laws to the bicycle. The need for expanded safety education for both bicyclists and motorists is quite widely accepted and will be discussed in detail in a separate technical memorandum. Beyond providing safety education, a very direct

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* It is apparent that a large number of bicycle/motor vehicle accidents are not being officially reported at the present time. Therefore, the available data may not reflect the whole spectrum of bicycle accidents. See Memorandum #2: Summary of Bicycle Accident Experience in the District of Columbia.

TABLE 2
BICYCLE USE AND BICYCLE ACCIDENTS BY AGE GROUPS

Age	Percent of Total Bicyclists	Percent of Total Bicycling Calendar Days	Percent of Total On-Street Riding (1)	Percent of Total Bicycle Accidents (2)	Percent of Total On-Street Accidents (2)	Percent of Total Bicycle/Motor Vehicle Accidents (2)
0 - 6	3%	5%	2%	--	--	--
6 - 11	15%	23%	15%	22%	29%	11%
12 - 15	12%	17%	20%	8%	5%	--
16 - 19	11%	11%	13%	8%	8%	9%
20 - 23	14%	12%	15%	27%	26%	41%
24 - 29	19%	14%	16%	17%	17%	25%
30 - 44	16%	12%	12%	10%	10%	11%
45 - 59	6%	5%	5%	8%	7%	5%
60+	2%	1%	1%	--	--	--
TOTAL (3)	98%	100%	99%	100%	102%	102%

(1) Based on calendar bicycling days.
(2) Sample sizes very small; data should be considered as indicative only.
(3) Totals vary due to rounding.

means of controlling bicycle rider proficiency and an understanding of traffic regulations could be bicycle operator certification similar to that which is in practice for motorists.

Can Bicycle Operator Certification Reduce Accidents?

Quite simply, this question cannot be answered with any authority. Not only have no such programs been in effect long enough for evaluation, but programs such as this are extremely difficult to evaluate objectively. To be correctly evaluated, these programs should be tested with control groups over the lifetimes of the participants. Obviously, this is usually not a very feasible alternative. Motor vehicle accident reports indicate that a large majority of accidents are caused by an incorrect driver action yet most drivers are licensed and have, at some time, demonstrated driving proficiency. The unanswered question is how many accidents are prevented by denial of a driver's license. Many bicycle accidents are "falls" which may or may not be a direct result of riding proficiency--while 67 percent of bicycle accidents occur on streets, only 38 percent involve motor vehicles and only 21 percent result in significant injury (see Table 1). The telephone survey results suggest (although samples are very small) that young adults are more commonly involved in bicycle accidents than are young children. These individuals should have some knowledge of the rules of the road yet their accident rates are disproportionately high. It is possible that operator licensing could increase safe operation of the bicycle by providing a tangible incentive for improving rider proficiency and by providing a tool for enforcement of the traffic laws, as well as restricting unskilled bicyclists from the roadway. In addition, a certification program (if applied to children) could aid in the early development of "safety-minded citizens" by encouraging safety consciousness at a young age.

At this stage of development in the state-of-the-art, a strong recommendation in support of bicycle operator certification cannot be made. Yet its potential should not be entirely ignored--an experimental program might lead to more positive conclusions. Accordingly, a number of suggestions regarding the scope of bicycle operator certification programs are developed in the remainder of this memorandum.

Bicycle Operator Certification Program Options

In considering a bicycle operator certification program, it should be recognized that such a program cannot fully meet its objectives unless it is both mandatory and enforced. In addition, it should be accompanied by adequate safety education for both bicyclists and motorists. Beyond these basic criteria, the nature of a bicycle operator certification program is open to debate. There are three questions which should be answered in determining the overall scope of a certification program: (1) Who should be certified? (2) Where should certification be required?

and (3) What prerequisites should be established? A brief response to each of these questions follows.

Who should be certified? If an operator certification program is to be effective in increasing safe operation of the bicycle and in restricting poor bicycle drivers from the roadway, it must apply to everyone. This does not necessarily mean, however, that a special license must be issued to every bicyclist. Exceptions might include the following:

1. A motor vehicle operator's license might be an acceptable substitute, or a validation of the motor vehicle operator's license might be required. Current opposition to use of the driver's license apparently stems from (1) a feeling that bicyclists are primarily recreation-oriented and should not be as severely restricted as motorists, and (2) a fear that using the same license for operation of two vehicles will make it very difficult to "keep" the license, thus creating a potential transportation problem for numerous individuals. However, there are fairly strong arguments in favor of this procedure. First, if a bicyclist is truly to be given the rights of the motorist, he must accept equal responsibility for his misdeeds. An accident caused by a bicycle may be as serious as one caused by a motor vehicle although the bicyclist is more likely to suffer personally than the motorist. Secondly, by simply validating (or accepting) the driver's license, administrative costs and manpower needs can be greatly reduced--70 percent of bicyclists in the District are sixteen or older. Finally, the threat of points on a driver's license may be a highly effective deterrent to improper bicycle use. The unanswered question, however, is whether use of the driver's license would be a serious deterrent to bicycle use in general.

2. A minimum age could be established for operating a bicycle on public roadways. However, in many neighborhoods there are few places for children to ride their bicycles except on nearby low volume neighborhood streets--over half (53 percent) of the recreational neighborhood riding in the District last year occurred on streets. It might be more appropriate, therefore, to establish a minimum age for bicycling on public roadways without an accompanying adult. A good rationale can be developed to support such a requirement based on safety for the very young bicyclist. The degree of safety on the roadway will be directly related to the predictability of a bicyclist's actions and his ability to respond appropriately to crisis situations.

It can be argued that a young child can fulfill neither of these criteria adequately and, therefore, should be restricted from the roadway. Children begin riding bicycles in large numbers between ages five and six. While children should be introduced to bicycle safety at a very early age, perhaps solitary operation on public roadways should be prohibited until the child is a little older (for example, age 8-10). At that time the child would become eligible to show proof of riding proficiency and receive operator certification.

3. Since the most serious accident problems (although not the most numerous) arise in the motor vehicle/bicycle intermix, it should not be necessary to certify those riders who do not use the roadway. For example, if a recreational bicyclist only rode on paths in local parks, certification should not be necessary. This exception would, of course, detract from the data collecting potential of a certification program.

Where should certification be required? As indicated above, 90 percent of bicycle/motor vehicle accidents reported to the Police Department occur on major thoroughfares carrying over 10,000 vehicles on an average day. Since the danger of accidents on low volumes streets appears to be much less than on major thoroughfares, a modified certification program might be considered. Certification might be required in one or more of the following circumstances:

1. Certification could be required only for operation on primary and secondary arterials. Since these streets tend to be the major thoroughfares in the District of Columbia, accidents might be significantly reduced by requiring evidence of proficiency before permitting bicycle operation on these facilities. However, not all heavily traveled routes in the District are primary or secondary arterials. Therefore, the impact of licensing under these circumstances would necessarily be limited.

2. Certification might be required on those streets having speed limits above, for example, 30 miles per hour. This criterion, too, would affect most of the heavily traveled thoroughfares in the District. However, it can be expected that some streets having low speed limits will carry heavy traffic. Therefore, licensing under these circumstances would also have reduced impact.

3. Streets could be specifically signed to prohibit unlicensed bicyclists. This alternative would avoid the problems of the previously discussed methodologies. Signs could be erected on any street which had high

traffic volumes, high speeds, and/or high bicycle accident rates. The single most important drawback to this procedure is a problem of public education if many streets are signed. Extensive signing would also be a fairly costly and somewhat unaesthetic process.

The major advantages to a modified certification program are (1) decreased administrative and cost demands, and (2) increased ability to enforce the certification program. The major disadvantage is, of course, reduced ability to meet the objectives of increased safety and reduced bicycle/motor vehicle accidents. A modified certification program would also limit the potential data available for future bicycle planning activities.

What prerequisites should be established? There should be two primary concerns in determining prerequisites for bicycle operator certification: (1) knowledge of the rules of the road, and (2) proficiency in operating the bicycle. The first of these requirements could be tested by a written examination similar to the one currently required for motor vehicle operator licensing. It should, of course, be written from the bicyclist's point of view. Since young children may be required to complete the examination, the test questions should be written very simply or two tests (one for adults and one for children) should be available. Eyesight examinations might also be required.

Proficiency testing, on the other hand, requires some type of "road test" or an on-the-bike demonstration of the rider's ability to control the vehicle. Techniques which should be tested include: (1) balance in starting, at slow speed, and while changing direction; (2) general control of the bicycle; (3) maneuvering quick direction changes, turning movements and obstacle avoidance (sound, objects, and other bicycles); (4) normal and emergency stopping; (5) hand signals and intersection maneuvering; (6) response to traffic control devices; (7) parking and locking procedures; and (8) bicycle riding technique and bicycle fit. Examples of proficiency testing exercises and field layouts are appendixed to this memorandum.

Administrative Considerations

Before implementing a bicycle operation certification program, it is important to understand the administrative demands of the program as well as its applicability and content. There are three questions which need to be considered in analyzing these administrative demands: (1) Who should be responsible for the program? (2) How often should licenses be renewed? and (3) What fee should be assessed?

Responsible agency. The Permit Control Division of the Department of Motor Vehicles appears to be the most appropriate agency to assume responsibility for a bicycle operator certification

program. This agency is currently responsible for the motor vehicle operator licensing program in the District and is already equipped to handle written, reaction, eye, and road tests, all of which could be partially or wholly applied to bicycle operator certification. Should the motor vehicle license be validated for bicycle use, it would be essential for the Permit Control Division to participate in the bicycle operator certification program. If an active bicycle safety education program is conducted through the local school system, certification of young cyclists could be accomplished in association with these programs, with possible assistance provided by the Office of Traffic Safety or the Permit Control Division.

Renewal period. An appropriate renewal period is directly related to other procedural questions such as fee, cost, school participation, use of the driver's license, etc. However, if four years is considered an adequate renewal period for the driver's license, a similar period ought to be suitable for bicycle operator certification, particularly if a driver's license validation is used. It might be desirable to have a more frequent renewal for riders under age 16, simply to emphasize the need for safety consciousness. If a comprehensive and continuous safety education program were incorporated into school curricula, even annual licensing might be feasible. However, if certification of children could not be accomplished in this manner, the annual certification of all bicyclists under 16 (currently about 68,000 individuals) might pose disproportionate administrative demands. Under these circumstances, biannual certification should be considered.

Fee. The fee for bicycle operator certification will be directly related to the renewal period of the license and the ability to coordinate the program with similar activities (such as motor vehicle driver's licensing and educational programs). To encourage initial public support of the program, a minimum fee or, if possible (for example, if initial funding assistance were available) no fee or a token fee, should be assessed. The current fee for a four-year driver's license is $12.00. If the value of the average automobile was assumed to be $1,200 and the average value of a bicycle was assumed to be $100, a fee of $1.00 would appear to be an equitable fee. If most certification were done in coordination with driver's licensing and educational programs, a four-year fee of $1.00 might be adequate for administrative costs. In any event, the fee should not be in excess of administrative costs.

In order to avoid initially high program costs, a gradual phased implementation of the program should be considered. Initially, only bicyclists of pre-driving age might be licensed through safety education programs, and all new and renewed driver's licenses issued might have provisions for voluntary validation. In this manner, over a period of twelve years all existing driver's licenses would be changed to licenses with validation

provisions. While phasing has obvious administrative advantages, it would postpone considerably the desired impact of controlled use of the bicycle based on demonstrated proficiency. Until the program was completely implemented, no data could be readily used nor could reliable evaluations be made on the impact of the program. Therefore, if financial aid for initial implementing costs is available, an immediate comprehensive implementation is recommended.

Program Funding

There is no solid data available to support specific cost figures for implementing a bicycle operator certification program. However, since many administrative requirements are similar to those of the driver's licensing program, a reliable comparison might be made regarding administrative costs. Costs could probably be substantially reduced by coordinating the program with other programs such as motor vehicle operator licensing and safety education. Since bicycle operator certification must still be considered an experimental program, it is possible that some funding assistance might be available for the initiation and evaluation of such a program. The Highway Safety Act, sponsored by the Federal Highway Administration, provides funding for bicycle safety programs. Since a pilot project featuring bicycle operator licensing might provide valuable information to the FHWA, funding from this source might be available. Funds from programs such as the Public Employment Act, the Neighborhood Youth Corps, or Operation Mainstream might be available for supplemental manpower needed for immediate comprehensive implementation and/or manpower expansion of bicycle patrols.

Enforcement Techniques

A bicycle operator certification program will probably have little impact in either increasing safety or heightening public awareness of bicycle and related motor vehicle operating conditions and requirements unless it is enforced. The bicycle operator's certificate could, in fact, provide an excellent means of enforcement of all traffic regulations--much the same as the motor vehicle operator's license. However, substantial enforcement programs can be very expensive, particularly in terms of required manpower. It is also possible that the "punishment" ethic may have little political support, especially as it relates to young children.

There are a number of methods which could be used to enforce bicycle operator certification including ticketing, fines, bicycle impoundment, points on driver's license, peer courts, and required bicycle safety education. In discussing these enforcement techniques, it is important to recognize that children will often need different approaches than traditional "adult" penalties. Since some of these penalties might be harsh and/or ineffective

when applied to children, a basis for the application of each is suggested below.

Fines should be appropriate for adults who commit minor traffic violations, ride on streets without a license, fail to register a bicycle, fail to park or lock a bicycle properly, etc. However, fines should usually not be used for children since a fine's impact would be on the child's parents rather than the child himself.

Points on a driver's license or bicycle operator's license might be appropriate for riding on a street without a license, major violations by adults, major violations by children, and violations resulting in accidents. Since an accumulation of points past a set limit would result in license revocation, this technique could be very effective in preventing violations.

Peer courts are an important concept in punitive measures since they offer an effective alternative way in which to enforce regulations on children. These "courts" could be made up of adults, but would probably have more impact if they were composed of the peers of those being "tried." Court members might be previous violators, individuals selected by school or neighborhood elections, etc. This technique could be appropriately used for major violations by children, multiple minor offenses, and violations resulting in accidents. Punitive measures might include bicycle operator testing, required education, "service fines" (for example, spending a weekend clearing debris from a bikeway), bicycle impoundment, theme writing, etc.

Bicycle impoundment could be used for major violations or multiple violations by either adults or children. However, since this is a very severe punishment, especially for the transportation-oriented bicyclist, it should be used sparingly.

Required bicycle safety education would also be appropriate for major violations or violations resulting in accidents. This type of enforcement could be used with both children and adults and is important because it is educative as well as punitive.

Imprisonment is an extremely severe punishment and should not be used for operational violations by bicyclists.

Legal Constraints

Section 11.204 of Regulation 71-26 of the District of Columbia specifically prohibits a bicycle certification program as follows:

(a) No operator's permit shall be required for the operation of a bicycle.

(b) No person shall be subject to the loss or suspension of his motor vehicle operator's permit for violation

> of any regulation under this chapter, nor shall any points accrue to the loss of or suspension of such permit by reason of a violation committed while operating a bicycle or sidewalk bicycle.

This ordinance would, therefore, have to be amended to permit a certification program. It is conceivable that Section 11.201(b) of this same regulation could be used as a legal basis for a certification program:

> (b) Every person riding a bicycle on a highway shall be subject to all duties applicable to the drivers of vehicles under this Title, except as otherwise expressly provided in this chapter, and except for those duties imposed by this Title which, by their nature, can have no reasonable application to a bicycle operator.

However, this legal rationale would be debatable and, therefore, any bicycle operation certification program should be authorized by a specific regulation. This regulation should not only authorize the program, but should establish program procedures including: (1) responsible agency, (2) renewal period, (3) required fee, (4) minimum age, (5) penalties, (6) special enforcement techniques for legal minors, and (7) any special exceptions or requirements. This regulation should ideally require rather than permit compliance with the ordinance.

Summary

There is little evidence to defend or oppose a bicycle operator certification program at the present time since few programs have been implemented. However, the suspected causes of most bicycle accidents and experience with motor vehicle operator licensing suggest that bicycle operator certification might decrease bicycle accidents. Since it is not known if this will actually be the case, bicycle operator certification should be considered an experimental program if implemented. Accordingly, careful monitoring of both accidents and licensing should be conducted to determine the program's impact. It will be important to understand bicycle accidents in relationship to riding frequency rather than simply total accidents since bicycle use is expected to increase in the near future. It will also be important to determine the rate of cooperation with the program to fully understand the effectiveness of the program.

Beyond this evaluation, a careful analysis should be made of the costs of the program and the revenues generated from the fees assessed. Problems of administration, community relations and program enforcement should also be carefully studied. Finally, all of these criteria must be weighed against each other to determine the value of continuing the program. This evaluation would probably be most valuable if conducted over a period of years to determine impact following the initial period of "shock"

which sometimes occurs upon initiation of a controversial program. Any funding requests should include funding of this evaluation on the basis that the program would be an experiemental effort.

APPENDIX A

SAMPLE PROFICIENCY TEST

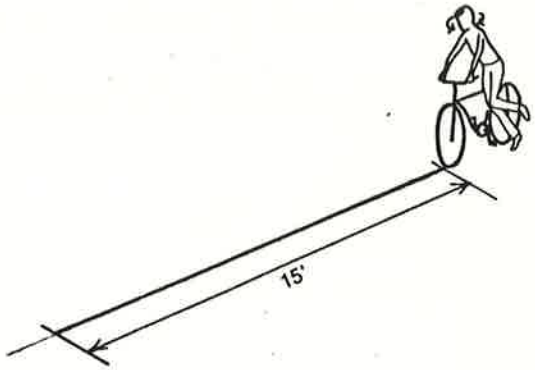
Source: American Automobile Association
"Bicycle Skills Test"
Washington, D.C.

I. MOUNTING-BALANCE

Purpose To emphasize need for looking ahead when getting on bicycle.

Test Mount bicycle and coast in a straight line for 15 feet without turning pedals more than ½ revolution. Driver should give attention ahead to a 180 degree area.

Scoring The test is passed if driver mounts, steers bike without losing balance or swerving from side to side erratically, and gives his attention to a 180 degree area ahead.

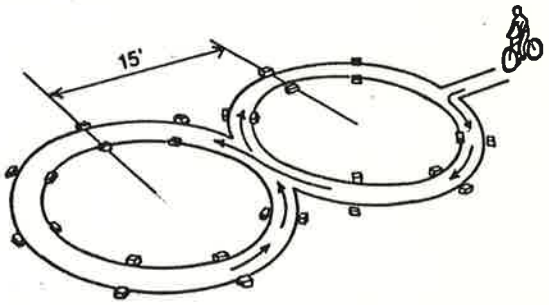


II. CIRCLING AND CHANGING IN DIRECTION

Purpose To test balance, required by changes in direction.

Test Start 5' from the circles. (12' diameter inner circle and 15' diameter outer circle) Contestant must enter first circle at the opening, drive one-half way around the circle to his left and then change direction and drive to his right around the second circle. He then enters the first circle and goes to the left, leaving the circle as he returns to the opening. Both circles should be made without touching any of the blocks or going on the wrong side of them.

Scoring The test is passed if the driver completes the circles without stopping, touching any of the blocks, or going on the wrong side of any block. The tires may touch the lines.

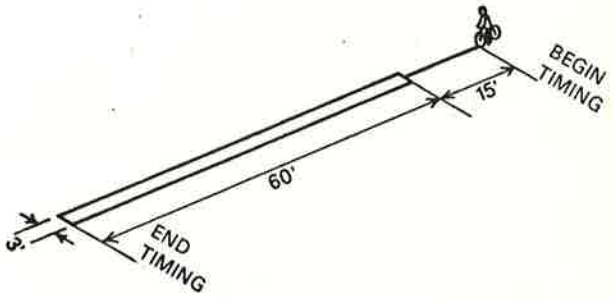


III. BALANCE AT SLOW SPEED

Purpose To test the primary sense of balance.

Test Start driver with bicycle 15 feet from a 60-foot lane and tell him to drive slowly toward the lines. The driver should go between the lines which are three feet apart as slowly as he possibly can without touching either line. Driver must take at least thirty seconds or longer to go from one end of the lane to the other, which is 60' in length.

Scoring The test is passed if driver takes at least thirty seconds to go from one end of the lane to the other and does not touch either line. In timing, watch the hub of the front wheel.

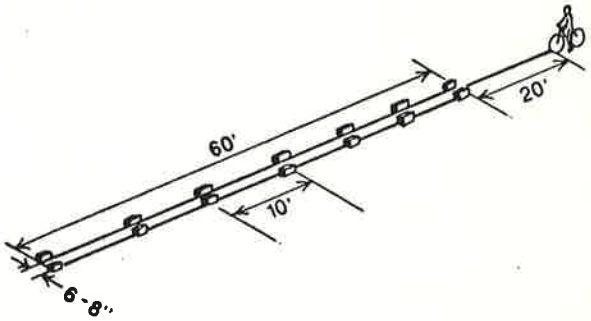


IV. STRAIGHT LINE-CONTROL

Purpose To test poise and control in driving.

Test Driver should start 20 feet from the 60-foot lane and the first pair of blocks. The driver may go at any speed but must be between each of the pairs of blocks without touching them. Blocks may be placed at 5 or 10 foot intervals on opposite sides of the lane, 6" to 8" wide.

Scoring The test is passed if the contestant steers his bicycle between all blocks without touching them with the tires, or stopping the bicycle.

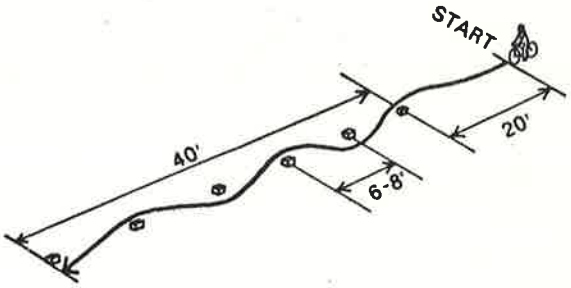


V. MANEUVERING-WEAVING

Purpose To test the ability to change direction quickly.

Test The driver should start 20 feet from the first block and begin test by going to the right of the first, left of the second, etc. Driver may go at any speed. (Blocks are spaced in a line 6' to 8' apart).

Scoring The test is passed if driver does not hit any blocks and if he goes alternately to the right and left of each block in the line.

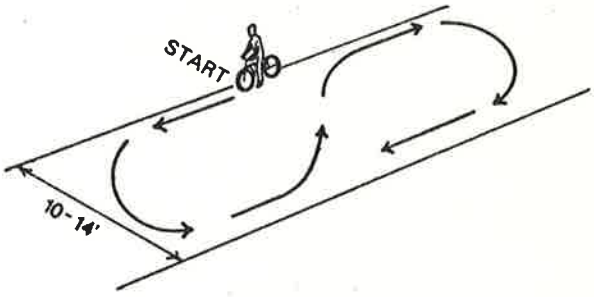


VI. TURNING AROUND IN A LIMITED SPACE

Purpose To determine the ability of the driver to turn the bicycle around smoothly and easily within a limited area.

Test The driver should go along the right side of the lane, 10' to 14' wide, and turn to the left making a U-turn. After the turn, the driver crosses back to the original side of the lane and makes a U-turn to the right.

Scoring The test is passed if driver completes the turn without stopping, losing balance, or touching either line.

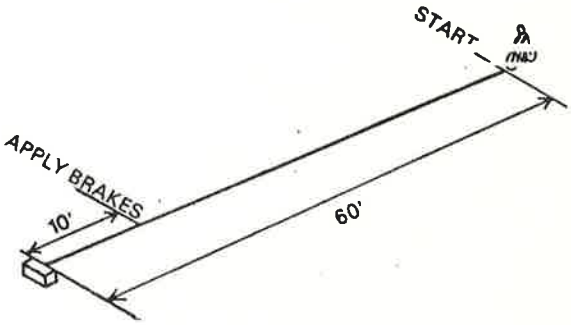


VII. STOPPING ABILITY

Purpose To establish driver's ability to stop in an emergency.

Test Driver should start at least 60 feet away and go directly toward a cardboard box at a moderate speed and stop with the front part of the wheel ten to fourteen inches from the box. Brakes should be applied by the driver as he crosses the mark or line painted on the street which should be 10' from cardboard box.

Scoring Test is passed if (1) driver successfully brings bicycle to a stop before touching ground with either foot and (2) front wheel is in area of ten to fourteen inches from the cardboard box, (3) tires do not skid.

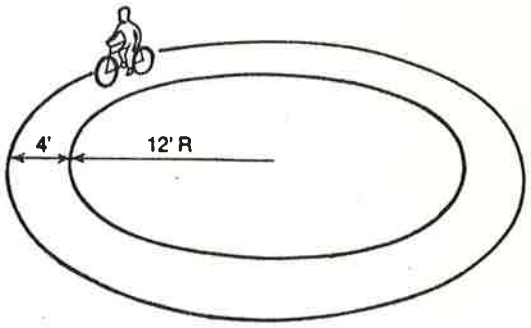


VIII. CIRCLING AND BALANCE

Purpose To test the balance and ability of the driver while circling.

Test Driver goes around a four-foot wide circular lane (inner circle having a 24' diameter) without touching either border line and using only the left hand to steer the bicycle when driving in a clockwise direction. He drives the same lane in a counter-clockwise direction using only the right hand.

Scoring The test is passed if the driver completes the circles using one hand to steer and without stopping or going on the wrong side of the line. The tires may touch the lines.

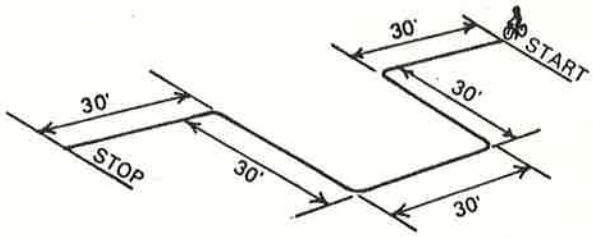


IX. SIGNALING

Purpose To test knowledge of hand signals and ability to maneuver.

Test The cyclist drives around the course, as illustrated below, giving proper hand signals at each turn and at the final stop.

Scoring The test is passed if the driver negotiates the turns without excess wobbling and executes all of the hand signals correctly.

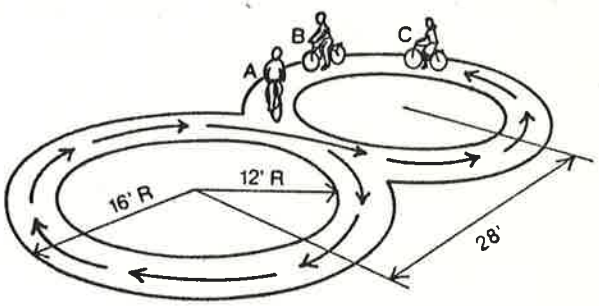


X. MULTIPLE DRIVER MANEUVERS

Purpose To test the driver's ability in a bicycle traffic situation.

Test Two to twelve contestants can compete at the same time. Each driver completes two to four cycles of the figure eight course. At a given signal, all contestants mount from standing position or one foot on ground at the respective stations shown in letters. Spacing between drivers shall not be less than ten feet or more than fifteen feet. Driver on right always has right of way.

Scoring The test is successfully passed if the driver completes the figure eight cycles without crossing or touching the outer border lines, colliding or touching other bicycles, or crossing over at intersection within less than four feet of another driver.

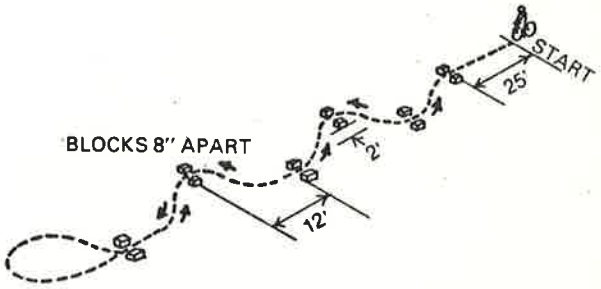


XI. MANEUVERING IN LIMITED SPACE

Purpose To test the riders' ability in gauging limited space on a zig-zag line.

Test Starting 25' from the first pair of obstacles, the cyclist drives at a slow rate of speed between the pairs of obstacles 8" apart without either tire touching any obstacles. When the cyclist has gone the entire distance, he turns and repeats the performance in the opposite direction.

Scoring The test is passed if the driver goes between all of the obstacles without touching them.

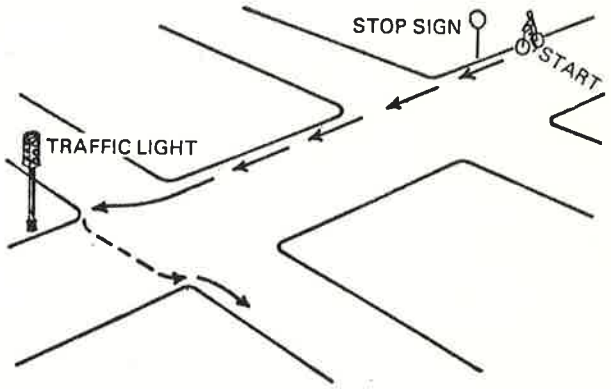


XII. TRAFFIC LIGHT AND STOP SIGN INTERSECTION

Purpose To test ability and knowledge pertaining to safety procedures practices by cyclists.

Test Approaching the stop sign intersection, the cyclist demonstrates how to signal and stop before proceeding across intersection. Driver continues to the traffic light intersection and demonstrates safe left turn in traffic.

Scoring The test is passed if the driver executes the correct procedures and signals.



Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 7

Bicycle Safety Education and Public Information Programs

January 30, 1975

The Need for Safety Education Programs

The number of bicycles using public streets and highways has increased dramatically over the past several years, and at the same time, traffic congestion has remained considerable. Accordingly, a concern for the safety of bicyclists has emerged. While there has been much discussion about the provision of special facilities for bicycling, there is evidence which suggests that bicycle facilities alone cannot reduce accidents to an acceptable level. There appears to be broad ignorance or disrespect for rules of the road among bicyclists; motorists ignore or do not understand the bicyclist's right to use public roadways; and traffic laws have not been adequately enforced as they relate to bicycle use. 24 percent of individuals surveyed in the recent User Survey[1] indicate that traffic and other related problems are deterrents to their use of the bicycle. While special facilities will be desirable in many heavily congested areas of the District, most streets will not warrant the provision of special facilities. Other efforts to improve safety should, therefore, be considered. The development of bicycle safety education programs is one way in which safe riding may be encouraged without the provision of special bikeway facilities.

Potential Impact of Bicycle Safety Education

The primary objective of a safety education program should be to increase safe operation of the bicycles. However, secondary objectives might be to: (a) decrease thievery, (b) encourage use of the bicycle as an alternative mode of transportation, and (c) serve as a preliminary education

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1 See Technical Memorandum No. 1, "Survey on Bicycling Activity in the District of Columbia," A.C. Nielsen Co., Northbrook, Illinois, 1974.

Note: Unless otherwise noted, all statistics cited in this memorandum are from the same source.

of future motorists. About 30 percent of bicyclists in the District are under 16 years of age, but these individuals account for approximately 45 percent of all bicycling days (a bicycling day equals one person riding one or more times on a given calendar day). Accident data from the recent telephone survey indicate that bicyclists of pre-driving age are involved in about 30 percent of bicycle accidents (see Table 1). However, nearly half of the bicycle accidents reported to the District Police Department in 1972 and 1973 (probably the most serious accidents) involved riders under 16 years of age. While accident data from the telephone survey can only be considered indicative (sample sizes by age are very small), conclusions might be reached that (1) individuals of all ages are in need of safety education, (2) the more frequent rider is a more proficient rider, and (3) riding off streets is safer than riding on streets (children under twelve do only about 28 percent of their riding on streets while older individuals do about 59 percent of their riding on streets).

The question still remains: Will safety education, in fact, reduce bicycle accidents? This question is impossible to answer definitively without careful monitoring of the bicycle accidents of those exposed to safety education *before* and *after* the programs have been implemented. However, some acceptable comparisons might be drawn between bicycle safety programs and other traffic safety programs such as driver's education. Furthermore, some assumptions might be made regarding education's potential impact on various types of accidents.

Comparison with Driver's Education. When driver's education was first implemented, most programs were voluntary (driver's education is still voluntary in Washington, D.C.) and insurance companies offered a reduced rate to individuals completing the program. It is not entirely clear whether this was done to encourage driver's education on the assumption that it would reduce accidents or whether accident reductions actually occurred. Reduced rates still exist, suggesting that insurance companies believe education does have a positive impact. Quantifiable evaluation is very difficult because: (a) the program's impact must be measured over a lifetime against a control group, (b) the quality of instruction varies from instructor to instructor and from place to place, and (c) many concurrent programs (such as alcoholism training and seat belt requirements) may bias the results. Consequently, studies which have attempted to quantify the impact of driver's education are still subject to question. Nevertheless, many tend to believe that driver's education is valuable in preventing accidents.

TABLE 1
BICYCLE ACCIDENTS BY AGE OF BICYCLIST DURING 1974 (1)

Age	Percent of All Accidents Reported in Sample		Percentage of All Bicyclists During Past Year
	No.	%	
Under 6	-	-	3%
6 - 11	33	22%	15%
12 - 15	13	8%	12%
16 - 19	12	8%	11%
20 - 23	40	27%	14%
24 - 29	25	17%	19%
30 - 44	15	10%	16%
45 - 59	13	8%	6%
60+	-	-	2%
Don't know	-	-	1%
TOTAL	150	100%	99%

(1) Small sample sizes -- data to be considered as indicative only

Source: Technical Memorandum No. 1, "Survey on Bicycling Activity in the District of Columbia."

Impact on Various Types of Accidents. The Bicycle Institute of America and the National Safety Council estimate that 70 percent of motor vehicle/bicycle accidents are the fault of the bicyclist. If this were actually true and all bicyclists were to receive safety education, we might conservatively estimate that about one-third of these accidents (20 percent of total bicycle/motor vehicle accidents) could be avoided. Based on these broad assumptions, over 1,000 bicycle/motor vehicle accidents might have been avoided in 1974 with bicycle safety education (see Table 2). If we further assumed that only 10 percent of all other bicycle accidents could be avoided, total bicycle accidents might be reduced from about 14,000 to about 12,000 annual accidents (see Table 2).

Bicycle safety programs in the District should recognize the fact that individuals of all ages are bicycling. In addition, it is important to remember that a large portion of bicycle riding occurs on streets (55 percent) and on sidewalks (27 percent) where the right-of-way must be shared with motorists or pedestrians. Therefore, bicycle safety education should be part of a comprehensive traffic safety program with the overall purpose of improving the actions of (a) bicyclists, (b) pedestrians, and (c) both current and eventual motorists.

Safety Education Program Options

There are a number of ways in which educational programs could be designed and implemented including: (1) Formal classroom instruction, (2) as part of physical education, (3) voluntary community or college classes, (4) road-e-os, (5) driver's education, (6) electronic media, and (7) printed media. Some of these programs (such as classroom instruction) would be more appropriate techniques for in-depth safety education, while others would be valuable in rapidly raising a community's "level of consciousness" regarding safe bicycle use. Each of these programs and its merits in meeting the goals of a bicycle safety education program is briefly discussed below.

Formal Classroom Instruction. The school system in Washington offers an excellent opportunity for instructing the younger citizens of the District in bicycle safety. At the present time, the Office of Traffic Safety* is conducting a pilot bicycle safety project in which photographs of danger spots and improper bicycle use are taken around each elementary school. These photographs are then used in a lecture presented to the study body by a representative from the Office of Traffic Safety.

* D.C. Department of Motor Vehicles

TABLE 2
POTENTIAL REDUCTION IN BICYCLE ACCIDENTS IN THE DISTRICT OF COLUMBIA THROUGH SAFETY EDUCATION

Type of Accident	Estimated 1974 Accidents[1]	Assumed Percentage Reductions[2]	Accidents That Might Have Been Avoided
Collisions with motor vehicles	5,300	20%	1,060
Other accidents	8,800	10%	880
TOTAL	14,100		1,940

1 Technical Memorandum No. 1, "Survey on Bicycling Activity in the District of Columbia.

2 Conservative estimate based on typical safety program effectiveness.

A variety of classroom materials of excellent quality is available for elementary students (a good example is All About Bikes, published by the National Safety Council of Chicago, Illinois in 1972). While there are few similar materials designed for secondary schools, there is an abundance of literature which might be used. One example is The New Complete Book of Bicycling by Eugene Sloane which covers topics from bicycle safety and repair to bicycle racing and touring. Existing curricula suggest that a minimum of six hours of classroom instruction per year would be required to adequately treat the subject of bicycle safety. Additional time would also be required for any on-bike practice or proficiency testing which accompanied the classroom instruction.

To be fully effective, bicycle safety education should include on-bike practice and proficiency testing. There were approximately 14,000 accidents projected from data collected in the telephone survey. Of these, 8,800 did not involve a motor vehicle. In both motor vehicle/bicycle and other types of accidents the skill of the bicyclist may be crucial to his ability to avoid dangerous situations. Skills which should be tested include: (1) balance in starting, at slow speed, and while changing directions; (2) general control of the bicycle; (3) maneuvering quick direction changes, turning movements and obstacle avoidance (sounds, objects, and other bicycles); (4) normal and emergency stopping; (5) hand signals and intersection maneuvering; (6) response to traffic control devices; (7) parking and locking procedures; and (8) bicycle riding technique and bicycle fit. Ideally, teachers should be properly trained and should be able to ride bicycles themselves. The support of the community would be highly advantageous and perhaps essential to the success of the program.

There are, however, a number of arguments against formal bicycle safety education. If such a program were mandatory, it could reduce the already limited time available for other academic studies. Not all children own bicycles; a mandatory bicycling education program could be considered socially undesirable since it might emphasize economic differences among children. Yet a voluntary program is not likely to reach those children most in need of safety instruction. Although in time a formal educational program could reach virtually the entire population, for the present only a third of the bicyclists and virtually none of the motorists using the roadways would benefit from formal classroom instruction in bicycle safety.

Physical Education Programs. Also a part of the formal education process, the physical education program provides an opportunity to encourage bicycling as a lifelong sport and form of transportation, as well as an opportunity to teach bicycle safety. The physical education program has a distinct advantage over other formal classroom instruction programs in that it would approach bicycling from a "riding" rather than an "academic" point of view. Such a program would probably be voluntary, but could conceivably be a mandatory portion of an overall physical education program. While the disadvantages of formal safety education would apply, bicycling as part of the physical education curriculum appears to be well suited for application in the secondary school system. The elementary grades often do not have formal physical education programs, but this type of program would be particularly advantageous in the primary grades where an increase in riding proficiency is also needed. The impact of a physical education program is likely to be as great in its ability to encourage bicycling as in its ability to decrease accidents or thefts.

Voluntary Community and College Classes. The major advantage of community classes in bicycle use is the ability to reach adult bicyclists. Many of the same disadvantages which occur in formal education would apply to programs such as this: teachers inadequately trained; only interested individuals involved (who may need assistance the least); classroom instruction has less impact than actual riding experience. However, voluntary classes for special groups (such as college students, employee groups, parents, enforcement officers, etc.) can meet a variety of community needs. In doing so, the basic goals of reducing accidents and thefts and encouraging bicycle use can be partially achieved. These programs can treat almost any related subject including vacation planning and bikeway system planning as well as safe operation of the vehicle. Like all programs with increased safe operation as an objective, on-bike practice and proficiency testing are desirable. Community programs may be especially important in the District since well over half (58 percent) of bicyclists are over 20 years of age.

Road-e-os. "Bicycle road-e-os", which test bicycling skills through various competitions, have brought bicycle safety to the public attention in many communities and have encouraged many children to treat their bicycles and the "rules of the road" with increased respect. Yet road-e-os are voluntary activities reaching only a small proportion of the bicycling population. They are usually quite brief in nature, lasting

less than a day, and therefore cannot provide in-depth safety education. It appears that road-e-os are an interesting and fairly effective means of carrying out proficiency testing but should be considered a supplemental activity to other educational efforts.

Driver's Education. Another promising means of reducing the bicycle safety problem is the use of existing driver's education. This is one method by which the motorist can be taught to share a portion of the responsibility for creating a safe bicycling environment. Without dual understanding of responsibilities and rights, the bicycle safety problem will only be partially solved. Driver's education in the District currently reaches most students but is still a voluntary program. However, driving instruction could be used to teach new drivers to recognize the bicycle as an acceptable but vulnerable part of the traffic mix. The bicycle should be incorporated throughout the program as an integral part of the traffic mix with use of the bicycle presented from the motorist's point of view.

Electronic Media. Today might be called the age of the electronic media since there is hardly a person in our society who does not watch television and/or listen to the radio. Use of the electronic media as a safety education device has several advantages: (1) Most people can be reached by these media, (2) there are several good "spots" and films available on the market at low cost, and (3) it may have very low *per capita* cost since it has a very broad impact. The primary disadvantage of a media-based educational program is that it cannot be used for in-depth safety education (except, of course, in the case of videotape and film presentations in schools, etc.). The use of a media campaign would be best, therefore, in the early stages of a comprehensive educational program. Used in this manner, the program could be quite effective in reducing mass ignorance or disrespect for rules of the road by both motorists and bicyclists. Use of the electronic media can be an expensive investment due to the generally high cost of advertising time. However, stations will sometimes offer a discount if a quantity of time is purchased (for instance, a spot(s) over a period of several weeks); radio broadcasting time is usually less expensive than television time. It is also important to note that the Federal Communications Commission requires that all radio and television stations provide a "reasonable" amount of public service broadcasting, which might include bicycle safety material. This time is usually free but is often granted at other than "prime" time periods.

The cost of producing a series of television and/or radio spot announcements would, of course, vary considerably depending upon the complexity of the subject matter, availability of required equipment, etc. If an electronic campaign is to be successful, it must be intensive and comprehensive. It should be directed toward both motorists and bicyclists, toward both children and adults. Past experience in other similar attempts (notably the "prevent forest fires" campaign) has proven that the electronic media can be an effective tool, but its cost must be weighed against its impact.

Written Media. The written media (newspapers, magazines, etc.) is perhaps the least effective means of reaching large numbers of people with significant widespread impact. While it is fairly inexpensive and written materials can be widely distributed, its impact is entirely dependent on the willingness of people to read the material. Its major advantage lies in the publicity which news coverage can provide. If new regulations are established, for instance, a printed brochure could be a good way to provide uniform information simultaneously to a large number of people. Printed literature may also be appropriately used in association with more formal methods of safety education.

Administration and Funding of Safety Education Programs

Administration. Most responsibility for bicycle safety education programs will rest with the School Board or the Office of Traffic Safety. At -he present time, the School Board is responsible for those programs, such as driver's education, which are provided for elementary and secondary school students. The Office of Traffic Safety is responsible for all programs which are community-oriented including: (a) driver's education for individuals not attending high school, (b) pre-school traffic safety, (c) guest speakers, and (d) safety instructional material. In addition, the Office of Traffic Safety is currently conducting a bicycle safety pilot project (discussed earlier) in cooperation with the School Board. The existing division of responsibility and cooperative activity appears to be an appropriate approach to the problem and should be continued.

Funding. At the present time there are limited sources of funding available specifically for safety education programs. However, there are some funds available through the Highway Safety Act (Federal Highway Administration) and some funds may be available through the Federal Office of Education. Otherwise, funding will have to come from local funds, probably as part of departmental budgets.

A legitimate question might be raised regarding the appropriate amount of money which should be spent on bicycle safety education. The National Safety Council has estimated the average 1973 "value" of a traffic death at $90,000, a traffic injury at $3,700, and property damage at $500. Deaths and injuries resulting from bicycle accidents can be assumed to have the same value as other traffic related deaths and injuries. For estimation purposes, accidents resulting in property damage and minor injury were assumed to have no dollar value. Based on these assumptions, an estimated cost of $11.5 million was incurred in 1974 as a result of bicycle accidents in the District (see Table 3). If only 10 percent of these accidents could be avoided by investments in safety education, an annual expenditure of $1 million could be justified.

Recommended Bicycle Safety Education Programs

The programs discussed earlier in this memorandum vary considerably in cost and potential impact on accident rates. Furthermore, it would not be feasible to implement all of the described programs. However, for maximum impact a comprehensive program should be considered. The programs which are recommended are identified in Table 4 and include the following:

1. A comprehensive safety program should be implemented in the school system at all grade levels.

2. The driver's education curriculum, the driver's manual and related examinations should be revised to include the bicycle as an integral but vulnerable part of the traffic mix.

3. The community programs currently administered by the Office of Traffic Safety should continue and, as necessary, should be revised to include bicycle safety. In addition, a voluntary bicycle safety program directed toward adults, particularly those ages 20-30, should be developed.

4. A concentrated mass media safety campaign should be implemented as quickly as possible in order to rapidly raise the public's level of consciousness regarding bicycle safety. This should probably be considered a fairly short-term project.

TABLE 3
COST OF 1973 BICYCLE/MOTOR VEHICLE ACCIDENTS IN THE DISTRICT OF COLUMBIA

Type of Accident	Number of Accidents[3]	Estimated Value Per Accident[1]	Estimated Cost
Fatality	4	$90,000	$ 360,000
Injury	3,000[2]	3,700	11,100,000
Remaining Accidents	11,100	-	-
TOTAL	14,100	-	$11,460,000

(1) Source: National Safety Council
(2) Injuries that required professional medical treatment
(3) Technical Memorandum No. 1, "Survey on Bicycling Activities in the District of Columbia", November 1974

TABLE 4
RECOMMENDED BICYCLE SAFETY EDUCATION PROGRAMS IN THE DISTRICT OF COLUMBIA

Program	Administering Agency	Intended Audience	Mandatory/ Voluntary	Potential Impact on Accident Rate	Potential Cost	Possible Funding Source
Classroom Instruction*	School Board	Elementary students	Mandatory	High, long-term	High	Educational budget, Highway Safety Act
Physical Education*	School Board	Secondary	Mandatory	High, long-term	Moderate	Educational budget
Driver's Education	School Board/Office of Traffic Safety	Potential motorists	Voluntary	Moderate, long-term	Low	Educational budget, Department of Motor Vehicles budget
Community Programs	Office of Traffic Safety	Adults	Voluntary	Low, long-term	Moderate	Highway Safety Act, Department of Motor Vehicles budget
Electronic Media	Office of Traffic Safety	Entire population	Voluntary	High, short-term	High (low per capita)	Highway Safety Act, Department of Motor Vehicles budget

*Includes proficiency testing

Public Information Program Options

In some instances, educational programs and public information programs will by synonymous in both purpose and content. However, a public information program has three additional objectives: (1) to generate public support of plans and programs; (2) to increase use of the bicycle; and (3) to generate contributions of money, time, land, etc. There are a number of methods through which the broad base of public support needed for succesful plan implementation can be generated. Those discussed below include: (a) press releases, (b) printed literature, and (c) action events.

Press Releases. The press release is potentially a very valuable tool which usually requires a minimum dollar investment. Although news coverage may not always be as favorable as one would like, the impact of coverage in a news broadcast, a special documentary, or a front page or feature article can be very great. The D.C. Department of Highways and Traffic already has procedures for submitting materials to the press, and these activities should be continued.

Printed Literature. There are a number of ways in which printed literature can help promote a bikeway plan and generate revenue. These include pamphlets, brochures, flyers, newsletters, posters, bumper stickers, restaurant placemats, and T-shirts. Pamphlets, brochures, and flyers would be most appropriately used as information disseminating devices. Information might include rules of the road, route maps, advertisement of coming events, tourist information, etc. A newsletter could be very helpful in keeping interested individuals (bicycle clubs, planners, public officials, etc.) informed about the state of the art of bikeway planning and plan implementation progress in the District. A subscription fee to the newsletter could cover publishing costs. Bumper stickers, T-shirts, buttons, etc. all could be sold through bicycle dealers, civic groups, etc. These could generate support among bicyclists, and could also be a source of revenue.

Action Events. Action events might include activities such as displays in banks, hotel lobbies, airports, exhibition halls, shopping centers, etc.; bicycle raffles; bike-ins or bike days; fund raising bikethons; bicycle races; and speaking engagements. Action events such as displays would be most appropriately used as information disseminating devices, while events such as bicycle raffles and bicycle races can be effective promotional activities. Bike-ins and bikethons can not only promote bikeways but also encourage

contributions; sponsored bikethons (where a "sponsor" contributes a certain amount for each mile his bicyclist rides) have been very successful fund raisers for various charities and might be equally successful in promoting bikeways.

Since most bikeway related activity has been the responsibility of the Department of Highways and Traffic, it follows that this Department should also be responsible for most promotional activities. However, as these effots relate to bicycling safety, the Office of Traffic Safety might also undertake promotional activities.

Recommendations for Public Information Programs

While bicycle-related activities appear to be fairly well publicized in the District, the following additional activities should be considered:

1. The current effort to provide releases to the news media should be continued by the Department of Highways and Traffic.

2. A series of publicity materials with a uniform logo might be produced including posters, bumper stickers, buttons, etc. This logo might be designed through a community or school contest and the materials might be sold for a fee which, at minimum, would cover the cost of production.

3. A D. C. - sponsored bikethon should be considered. This may be particularly valuable in convincing the community that bicyclists are willing to contribute to the development of a bikeway system.

4. A number of excellent bicycle safety films are available from various sources. Copies of these films should be obtained and shown or made available to appropriate groups on a regular basis. The Bicycle Manufacturers Association (located in D. C.) keeps an updated list of films and other such resources.

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 8

Transit Related Bicycle Storage and Facilities

February 12, 1975

This memorandum analyzes how the bicycle can be used to complement transit service in D.C. The memorandum records the stated and implied policies of WMATA towards the bicycle. Projections are made of levels of bicycle use to transit stations. Recommendations and conclusions are suggested that would facilitate the bicycle/transit interface.

The Bicycle as Part of the Total Transportation System

The bicycle is one element of the transportation system used for a spectrum of trip purposes. One of the basic assumptions of the bikeway study has been that those who use the bicycle at present and will use it in the future have travel needs similar to the general population. Therefore, trips made by bicycle will have purposes similar to other modes of travel. Also, like other modes of travel the bicycle will be used for the entire trip or for only one segment of the trip. Distance, traffic conditions and parking facilities near the beginning and end of the trip will all influence the use of bicycles. Trips for personal business, convenience shopping, and recreational activities will probably be made entirely by bicycle due to their shorter average distances in comparison to work trips. The typical home-to-work trip is the longest trip made of any of the daily trips. More than any other trip, it involves more than one mode of travel. The bicycle is presently being used for approximately three percent of all work trips made by residents of the District. It is assumed that these are made entirely by bicycle in the majority of cases. (The exception would be where an individual would have to walk some distance from where the bicycle is stored to the place of employment.) The average length of these work trips is approximately 2.5 miles. Given this distance restriction there appears to be an opportunity to use the bicycle in conjunction with transit to complete longer work trips. The bicycle could be used as:

(a) part of the commuting trip in combination with Metrorail; and

(b) part of the commuting trip in combination with Metrobus.

The combined use of the bicycle and transit will negate the distance factor presently limiting transportation by bicycle. The promotion of this combination of bicycle/transit travel will require that special provisions be made for the bicycle. A discussion of these provisions will be addressed in this memorandum. Appropriate recommendations will, in turn, be made. It should be noted WMATA has stated policies that address provisions for bicycles (see Appendix A).

The Bicycle as an Access Mode

Various transportation modes will be used for access to transit stations. Each mode has certain characteristics that can be grouped together as either advantages or disadvantages. The primary modes of access have been recorded in Table 1 with various characteristics noted. The bicycle can be a low cost, door-to-door mode of access, if convenient parking is provided along with safe access to the transit stations and bus stops.

Given the advantages and disadvantages of each mode, the individual transit patron will choose that mode which meets his or her "personal criteria". Cost, convenience, safety, comfort, and, of course, availability influence this choice. An in depth evaluation of how the bicycle will compete with the various modes will not be undertaken at this time; instead, an evaluation of the factors that influence bicycle use will be made to help determine the utility of the bicycle as an access mode.

1. The Service Area of the bicycle is approximately 16 times as great as that of the pedestrian. Given a trip time limit of approximately 10 minutes, an average bicyclist can complete a trip of approximately 2 miles. (See figure 1) This "service area" of the bicycle is 12.6 square miles. Given the same trip time a person walking would complete a trip of 0.5 miles. The resulting service area is 0.8 square miles or 1/16 of the bicycle's service area. Thus, the bicycle would make the transit station accessible to 16 times as many people as will walking assuming the same density of development.

2. Approximately 95 percent of all residents of the District live within one and one half miles of the planned transit stations. Given an average speed of 12 miles per hour for the bicycle, the 1½ mile maximum distance of the trip to the transit station from 95% of the homes in the District would be made in less than 10 minutes. The average time of this trip would be approximately 5 minutes.

MODE OF TRAVEL	ASSUMED OPERATING SPEED	TRIP TIME TOLERANCE	CAPTURE RADIUS	SERVICE AREA
WALKING	3 MPH	10 MIN.	0.5MI.	0.8 SQ. MI.
BICYCLING	12 MPH	10 MIN.	2 MI.	12.6 SQ. MI.

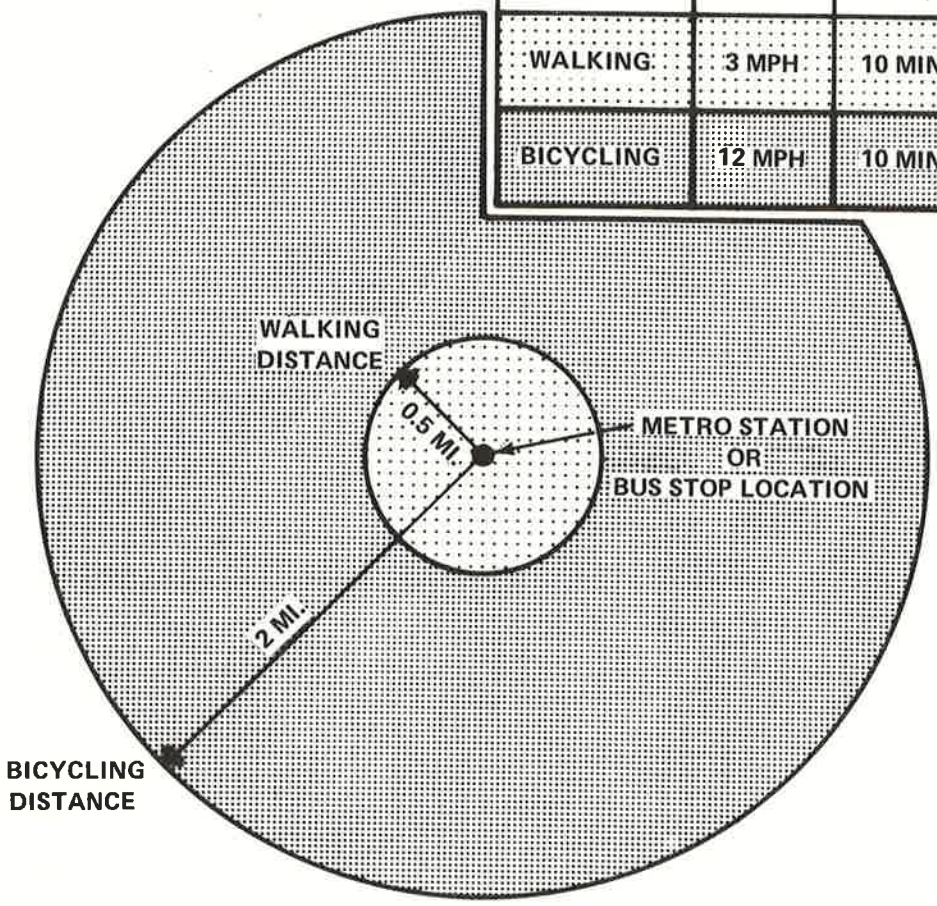


FIGURE 1

WALKING VS. BIKING ACCESS TO TRANSIT STATION AND BUS STOP

3. At present there are 186,000 bicyclists in the District. Approximately one out of every four people in the District has bicycled in the past year. 127,000 of these individuals are over the age of 16. Over 500,000 two-way purposeful bicycle trips were made in October (these included trips to work, school, and personal business such as shopping and visiting friends). The use of the bicycle would not be a totally new experience to the many people who are now or will become transit patrons. In fact, the use of the bicycle is familar to more people than the use of a transportation mode such as Metrorail.

4. The propensity of the purposeful bicycle rider to use transit is high. Data collected in the District telephone survey found that of those people presently riding to work by bicycle 44 percent would have used the bus if the bicycle was not available. It appears that many cyclists are also transit users. The possible use of both modes seems likely for at least a portion of these trips.

5. The great majority of bicycle access trips can be made in a safe and pleasant riding environment. The transit access trips will be made from residential neighborhood to "neighborhood" transit stations. The residential or local streets can be utilized for these trips. In the majority of cases these streets are carrying the lowest volume of motor vehicles at the lowest speeds. It may be assumed that these streets are much safer than collectors or arterials, have less of the air and noise pollution that accompanies high use streets. In addition, since they pass through residential neighborhoods, residential streets are more aesthetically pleasing than collectors or arterials. The bicyclist can thus choose the streets which are the safest, most convenient and the most comfortable.

These residential streets are the same streets many families utilize for recreational riding. A high level of bicycling skill or excessive physical stamina are obviously not required.

The Bicycle as an Alternative Mode of Access

These are two groups of people from which bicycle users may be generated:

1. Those who currently use buses, drive, or walk to work and who will continue to use these same modes as access to the METRO system.

2. Those who will be new patrons attracted to the Metro rail system and will need some means of access to the stations.

The number of transit patrons that will be diverted from other modes will be determined from a comparison of the advantages and disadvantages of the alternative modes available. As Table 1 illustrates cost, trip time, terminal time, and parking availability will contribute to the diversion factor. Estimates of the number that might divert to use of the bicycle for access are recorded in Tables 2 and 5 below.

There is good reason to believe that some new transit patrons will be attracted to the METRO system due to the convenience the bicycle offers as a mode of access. The assumption is that the convenience offered by the bicycle as an access mode to the transit station is such that it will induce people to use the transit system. Put in another manner this assumption states that the present forms of access are either unavailable to a segment of the population or are too inconvenient, expensive, etc., for the individual to use them.

A prime group that might be attracted to transit due to the convenience of the bicycle as an access mode are the 126,000 adult bicyclists in the District at present. Some of these individuals presently drive or use transit to work and school; however, the great majority do not bicycle for these trip purposes. Instead, they bicycle on shopping trips, to recreational activities, for social trips, and joy riding. With the short trip to the METRO system and the safe, pleasant riding environment, it is likely that many of these individuals will consider bicycling to the METRO system.

Due to a lack of factual data on the subject, a lengthy discussion is not appropriate. Few transit systems have attempted to encourage the combined use of the bicycle and transit (see Appendix B). The only new system that has provided for the bicycle is the Bay Area Rapid Transit System (BART), where up to 11.5 percent of passengers arrive by bicycle at some stations. No statistical data has been collected which determines the attraction of new patrons to transit due to provisions for bicycle access.

People utilize various modes of access because those modes meet the "personal criteria and requirements" that best suit their desires. There is no reason to believe that the bicycle does not meet these "personal criteria" in many cases. Consequently, these people will use bicycles as an access mode to transit and the combination of the two will satisfy their travel needs.

Projection of Need for Bicycle Storage Facilities at METRO Stations

There appears to be little doubt that some people will arrive at transit stations by bicycles. The discussion above notes some of

the advantages of bicycle use that will produce this result. The specific number of people is yet to be determined. In the material below, projections have been made to derive a realistic estimate of patrons that will be arriving at transit stations by bicycle. This number can then be used to determine the amount of storage that will be required at the various stations.

Based on a 1974 survey by BART, between 1.0% (Richmond) and 11.5% (Pleasant Hill) of commuters arrive by bike. This is without any special bikeways to serve BART stations. Furthermore, the BART system provides many more automobile parking spaces at intermediate stations than METRO will, so that in Washington it may be expected that constrained parking availability will induce cycling. Conversely, climate factors favor bicycle use in San Francisco over Washington, D.C. Also, feeder bus service to the BART system tends to be less effective than in D.C. The survey also points out that these figures do not reflect BART's true potential since (1) the system is not yet fully operational, (2) there are inadequate bicycle storage facilities at the stations, and (3) there has been little publicity to encourage bicycle usage.

The study "BART Trails"* states that

> At a minimum it is estimated that 10 percent of those persons now projected to walk, 20 percent of those persons projected to arrive by feeder bus, and 25 percent of those persons expected to arrive by automobile are "potential" bicycle riders. When these percentages are applied to current travel projections to BART stations throughout the system, the total future number of bicyclists would be more than 10,000. However, this figure applies to the anticipated BART patrons only.

For reasons stated above, it is felt that these diversion rates from traditional modes of access are rather higher than might be expected in the District of Columbia. It is felt that the walk-in patrons will probably live within 1/4 or 1/3 mile of the station and will continue to walk under most circumstances. At the fringes of the 1/3 mile cordon, some bicycle ridership may be expected. Probably no more than 5% of walk-in patrons would convert to the bicycle. Of the commuters previously using feeder bus, perhaps 10% of the patrons might be diverted to the bicycle in view of the fact that feeder bus service is likely

* Hart, Krivatsy and Stobee, San Francisco, 1974.

to be more extensive, more frequent, and better coordinated to the METRO train timetable than in the BART service area. It is expected that the proportion of diversions from bus to bike will be higher in the 1/3 mile to 1½ mile range than further out. Diversions from auto to bike are similarly expected to be lower than the BART study expects, since auto drivers tend to travel the farthest distances to METRO stations and will likely live outside the optimal range for bicycling. The auto rider has already rejected the wait and inconvenience of transit, so that the choice between car and bike will be largely a question of whether convenient parking facilities are available at the station for a reasonable cost. A diversion rate of 10% is suggested for auto riders.

The above diversion factors were applied to the mode-of-arrival statistics for each station. Adjustments were made for other factors. The total daily diversion to the bicycle is divided by 1.3 to allow for turnover of spaces in the mid-day period. The estimated diversion to bicycle access by mode and transit station is shown in Table 2 (the estimates of total transit patronage are recorded in Table 3).

As can be seen from Table 2, estimates were not made for all stations. The stations excluded were those serving the destination end of the trip. The stations are spaced within the downtown are so that they are within walking distance of the destination of those using the system. Therefore, little need exists to provide for distributing these people to their final destinations.

All those stations where there will be both origins and destinations of the trips, the projections of required bicycle storage was reduced. If the projection estimates had been available to illustrate the distribution of the various trips made by time of day, a more refined split may have been generated.

The base diversion factor has also been reduced in the case of seven of the stations (* donates these stations in Table 2). This 10 percent reduction has been made to allow for those stations located in a commerical area. Since commerical areas generate greater traffic on the surrounding street system, a situation is created which may discourage the less capable bicylist.

TABLE 1

ACCESS MODES TO TRANSIT STATIONS: CHARACTERISTICS

Access Mode	Relative Cost	Relative Terminal Time	Parking Requirements	Other Characteristics
Auto Park-and-Ride	High Capital Cost High Operating Cost	Low	Yes	Auto is unavailable to other family members
Auto Kiss-and-Ride	High Capital Cost High Operating Cost (two round trip each day to the transit station)	Virtually None	No	Inconvience to driver
Bus	Variable Feeder Bus change has yet to be set	Time needed to walking to Bus stop and waiting at bus stop varies depending on distance from home to bus stop and schedule of bus service	No	Weather presents problems
Walk	No cost	None	-	Distance limitation of 1/4 mile weather present problems
Bicycle	Low Capital Low operating	Minimum - given storage is conveniently located at residence and transit station	Yes	Distance limitation of 4 miles. Weather presents problems

TABLE 2

Bicycle Storage Needs at METRO Stations

Station	Walk	Bike Diversion 5%	Bus	Bike Diversion 10%	Drive	Bike Diversion 10%	Total Bike Diversion	Storage required = Total Diversion 1.3
Dupont Circle	9,800	(49)	22,609	1,130	167	17	1,246	6,958
Zoo	3,455	123	5,640	564	381	38	725	557
Cleveland Park	2,373	119	1,192	119	318	32	270	207
Van Ness	7,176	359	4,046	409	831	83	847	652
Tenley Circle*	594	30	11,216	1,122	1,002	100	1,252	867
Friendship Heights*	1,741	(66)	11,781	(833)	404	40	989	684
Union Station	13,110	(65)	6,621	(66)	69	7	138	106
Rhode Island	2,815	141	5,514	551	630	63	755	580
Brookland	2,591	(65)	7,228	(361)	682	68	494	380
Fort Totten	2,381	119	13,578	1,358	725	73	1,550	1,192
Takoma Park	3,196	160	9,452	945	1,074	107	1,212	932
Silver Spring*	2,882	144	12,442	1,244	647	65	1,453	1,006
Eastern Market	2,438	122	2,183	218	72	7	347	267
Stadium-Armory	1,469	73	3,266	326	---	---	399	306
Potomac Avenue	4,289	214	4,320	432	14	1	647	497
Minnesota Avenue	2,383	119	1,695	169	55	6	294	226
Deanwood	778	39	5,038	504	600	60	603	464
Federal City College	8,562	(214)	5,793	(290)	121	12	516	397
U St./Shaw*	3,978	199	3,652	365	---	---	564	391
Colombia Heights*	10,787	539	4,686	468	64	8	1,015	702
Georgia Avenue	1,489	74	6,771	677	26	3	754	580
Waterfront*	1,883	94	12,343	1,234	35	4	1,332	992
Navy Yard	6,896	(34)	7,790	(78)	52	5	117	90
Benning Rd.	381	19	3,245	325	58	6	350	269
Capitol Heights	552	28	2,122	212	564	56	296	228

( ) Number was decreased to account for the large number of destinations served by these stations (50 percent reduction).

* Bicycle storage requirements were reduced by 10% due to commercial uses surrounding the station areas.

TABLE 3

1990 METRO Patronage Estimates by Station and Neighborhood Characteristics

Station	Daily Volume (1990)+	Type of Neighborhood (Res., Bus, Downtown Strip Commercial, etc.)
Dupont Circle	64,000	Bus/Commercial. Older Residential Downtown
Zoo	19,000	Residential/Tourist
Cleveland Park	8,000	Residential, Upper Income
Van Ness	24,200*	Residential/Commerical
Tenley Circle	25,600*	Residential/Uptown Center
Friendship Heights	28,000*	Business/Commercial Uptown/Residential, Moderate Income
Union Station	40,000	National Visitor Center/Low Income Residential
Rhode Island	18,000*	Low Income Residential
Brookland	21,000*	Moderate Income Residential/ University
Fort Totten	34,000*	Residential, Moderate Income
Takoma Park	28,000*	Residential, Moderate Income
Silver Spring	32,000*	Bus/Commercial
Eastern Market	9,400	Older Residential
Stadium-Armory	16,600	Fringe Parking/Sports Complex/ Low Income Residential
Minnesota Avenue	15,200*	Moderate Income Residential
Deanwood	12,000*	Residential, Moderate Income
Federal City College	14,300	Older Residential, Low Income/ University
Georgia Avenue	33,400	Moderate Income, Residential
Waterfront	28,600	Commercial/Residential, Moderate Income
Navy Yard	29,400	Commercial/Low Income Residential
Benning Road	7,400*	Commercial/Residential, Moderate Income
Capitol Heights	6,500*	Residential, Moderate Income
Smithsonian	32,000	Tourist/Federal Office Buildings

+ Public Hearing data is generally based on the 1968 Net Income Analysis (W.C. Gilman Co. and Alan Voorhees). This will be updated shortly.

* Indicates Stations with WMATA-owned property.

Since the estimates made here are generally based on only one example, caution should be exercised in their use. The diversion factors were thought to be low on the conservative side. The final number of storage spaces required is based on the projection of patronage, by access mode developed by WMATA. If these projections are revised or adjusted in any way, then adjustments will be needed to the bicycle access estimates.

Rather than considering the amount of storage projected as absolute it would be better to use this number as an indication of the level of storage that will be needed. If WMATA provides storage that is secure, convenient, and inexpensive, then these bicycle storage levels will probably be utilized. But, if a minimum amount of storage is provided then few patrons will use the bicycle as an access mode.

Nevertheless, the amount of storage indicated should not be built as each station opens. The implementation should take place as the system is completed and use is generated.

A minimum amount of storage should be implemented at the time of construction of the station. No less than 50 storage "slots" should be implemented initially. At the high use stations at least 10% of the total should be implemented immediately. With the amount of "lag time" required to add more storage a slight excess of storage should be provided.

Close monitoring of the storage facilities should be carried out. As the storage facilities approach full utilization, additional amounts of storage facilities should be added. This of course requires that sufficient space be designed and allocated into the station for the projected amount of storage.

The allocation of land reveals another set of problems that must be addressed. Since the provision of storage will of course require a certain amount of space, designation of the sotrage space will have to be weighed against the other activities and facilities to be accommodated. (See recommendations for criteria on locating storage spaces at transit stations. WMATA has policies that relate to this problem also.) (See Appendix A) However, in those situations where no land will be acquired in conjunction with the station, the location of parking facilities becomes much more difficult. Seven of the stations have public, federal or private land adjacent to the station or within close proximity that might be utilized:

Dupont Circle (Department of Interior land)
Waterfront (Shopping Center land)
Navy Yard (Department of Navy land)
Stadium Armory (D. C. Hospital land)
Georgia Avenue (D. C. Highway land)
Union Station (National Visitor Center land)
Smithsonian (Department of Interior land)

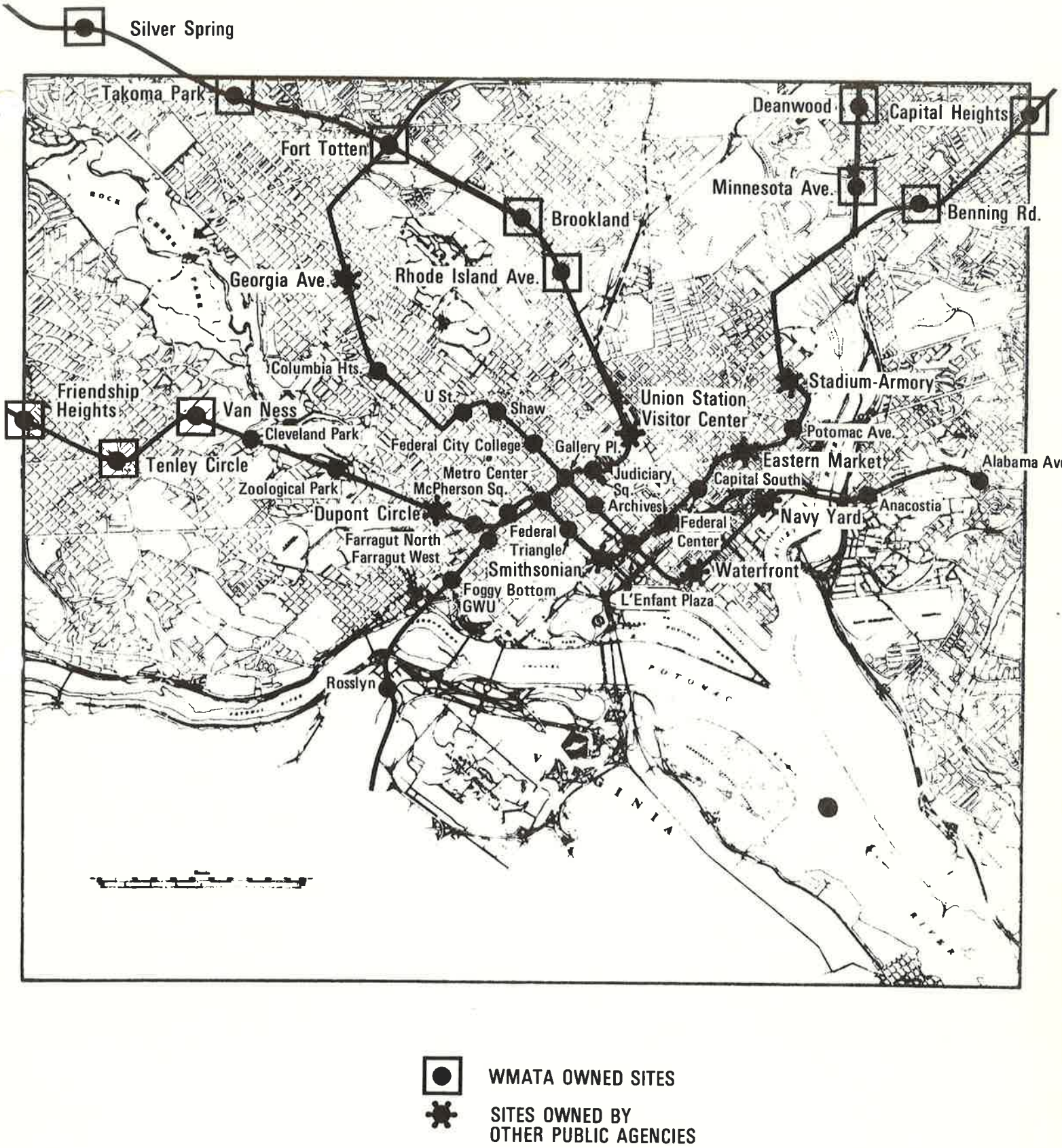
At the stations without land (see Figure 2) other alternatives will have to be developed to provide for bicycle parking facilities. The leasing or purchase of land adjacent to the site will be required in some instances. If public parking facilities are located near the station, the simplest method of providing bicycle storage may be to allow garage operators to make the necessary provisions. The type of storage, location, and fee charged would have to be negotiated, but the security and convenience of the bicyclist should not be hampered in any way.

Six other stations have unique aspects and problems that should be considered. The stations located at Chillum and Silver Springs, although outside the District boundary, may attract a substantial number of District residents. The Rosslyn, Virginia station will likely attract students from Georgetown University. Access should be considered for this trip. Neither the Anacostia, Alabama Avenue, or the Naylor Road stations have yet been designed; nor have projections been made of their expected patronage. Therefore, projections for bicycle storage at these stations could not be made. There is no reasons to believe that the diversion factors used here will not be valid for these stations also.

In the cases of Union and Smithsonian stations, consideration should be given to providing rental bicycle facilities for tourists. Given the popularity of bicycling, more tourists will be bicyclists. Provisions for rental bicycles seem appropriate at these two stations because they will attract the largest concentrations of tourists.

Access to WMATA Bus Stops

WMATA will operate a future bus system consisting primarily of circumferential routes serving METRO stations. Local radial routes will also be operated following each Rapid Transit line to facilitate find grain collection and distribution in the METRO corridor. In addition, express radial routes will be operated in corridors not served by METRO. These might serve MacArthur Boulevard, Wisconsin Avenue south of Tenley Circle, 16th Street, Rhode Island Avenue, New York Avenue, and Bolling Air Force Base.



WMATA STATIONS WITH AND WITHOUT PROPERTY
Figure 2

It is appropriate to consider bicycle routes and storage facilities in connection with bus routes, particulary in those corridors not served by METRO. It is assumed that these corridors served by radial bus routes would be attracted to the bus service for longer trips. Therefore, they may use the bicycle as an access mode if provisions were made to encourage this. Since bus service will be completely reoriented in other areas to service the METRO stations, bicycle storage facilities at these bus stops would not be appropriate.

Since the corridors in which the radial express routes have not been defined, a discussion of the location and the amount of storage is premature. Bicycle access to the bus stops on these routes would be similar to that of METRO stations. If there will be a limited number of stops, then the opportunity to concentrate storage exists. If there will be numerous stops, then the provision of bicycle storage at each stop becomes difficult due to the amount of land required for storage facilities (see the criteria for locating bicycle storage).

Recorded below are the criteria that was developed to combine bicycle storage with bus stops as proposed in Denver, Colorado.* Adjustment have been made for their use in the District.

- All storage locations are to be at least 3 to 4 miles from the central area. It is suggested that this be revised so that storage will be provided beyond a 2 1/2 mile distance. (The average bicycle work trip distance in the District.)

- All sites to be within an adequate public right-of-way, or on land donated by adjacent owners, such as parking lots for supermarkets.

- Surveillance to be good during most of the day by virtue of the type of adjacent land-use, i.e., drug stores and gas stations are good locations.

- Sites to be on high intensity bus routes serving regional activity centers. This would be revised to state that sites be on the radial routes serving the corridors without METRO service.

* Regional Bikeway System: Planning and Implementation, Denver Regional COG, (publication pending)

8. Recommendations

There appears to be enough evidence to substantiate the fact that the bicycle should be considered a potential access mode to transit stations radial bus routes. (Given the facts that the bicycle is a non-polluting vehicle, is low in cost, and requires a very limited amount of space for storage, special considerations are in order.) The recommendations listed below are made with the objective of encouraging the use of the bicycle as an access mode to transit stations or bus stops. Many of the recommendations are in concert with those WMATA policies recorded in Appendix A of this memorandum.

. Bicycle Storage: The primary step that must be taken by WMATA if bicycle use is to be encouraged is to provide secure storage facilities for bicycles at transit stations along radial bus routes. (Present park and ride sites are a logical place to begin implementing bicycle parking facilities in conjunction with bus routes.) These storage facilities should be secure. Lockers should be used at stations where storage is not within site of the station attendant or in highly conopicuous areas.

  Although monthly rentals of lockers at reduced rates is justifiable, lockers and other storage facilities should be available on a day-by-day basis. Many bicyclists may not want to commit themselves to a month of parking.

. Storage at Transit Stations: A rule of thumb that all transit stations need bicycle storage is appropriate. It is believed that the highest demand for bicycle storage will be at those "origin" or outlying stations. In most cases land is owned in association with these stations so the provision of storage should not be a major problem.

  No station should be discarded in considering storage needs simply because it has no surface space in WMATA ownership. In some instances stations in or near public grounds can be utilized for bicycle storage. At other stations there will be a demand for storage and even though land is not available, some accommodation will have to be made. This situation may require the purchase or lease of space or an arrangement with a garage owner to provide space for storage.

. Phasing of Bicycle Storage Facilities: Because of the large amount of necessary storage projected and the absence of comparable situations it is recommended that not all the storage be provided initially. A minimum

amount, 50 storage "slots" or 10% of the total storage demand projected, should be sufficient at the time of construction. However, space should be allocated for at least 50 percent of the required total.

Through a continuous monitoring program, additional storage should be provided as the existing storage approaches full utilization.

- Fee versus No Fee Storage: It is believed that a good case can be made for the concept of "no fee" bicycle storage at transit stations or bus stops. If the bicycle is thought of as having positive characteristics, (low use of natural resources and no air or noise pollution) then charging a fee limits the attractiveness of this preferred access mode.

  If in fact that the bicycle is to be treated as other modes of travel, then the bicycle storage fee should be in proportion to the cost of automobile storage. If automobile storage is to pay for itself, meaning that the fee charged for storage will pay for the value of the land, the cost of construction of the parking facility and the cost difference in what this land may generate in revenue if it was in another use, then the bicycle should be charged in a similar manner. If in fact the automobile parking is not being charged fully then the bicycle should also be given a discount on storage costs.

  Assuming that a bicycle locker costs approximately $75 to $150 to install, a fee of 25¢ per day would cover the cost of installation and maintenance if it were amortized over a five year period.

- Access within Transit Stations: Due to the concentration of trips at transit stations in the peak hours, it is felt that bicycles need access paths from the street system to the point of bicycle storage. (WMATA cannot be thought of as the agency to provide access from the surrounding neighborhoods to the transit station. This is the responsibility of the D. C. Department of Highways and Traffic.) WMATA can and should be responsible to see that the bicyclist has a safe method of reaching the bicycle storage area from the surrounding street system.

- Location of Bicycle Storage: WMATA has proposed a number of criteria in locating their bicycle storage which are excellent. These and other suggestions are listed below.

1. Bicycle storage whenever possible should be in view of the station attendant.

2. Storage areas should be adjacent to the highest activity areas or paths in the station area. This is especially critical if lockers are not used. The use of bicycle storage should not interfer with pedestrians in this area.

3. Bicycle storage should be as close to the station entrance as possible. The convenience of the bicycle is based in part on its portal to portal nature. Locating bicycle facilities at the extreme edges of WMATA property will reduce the convenience of using the bicycle.

4. Storage areas should be so located so that the number and storage "slots" can be expanded as bicycle and transit use expand.

5. Bicycle storage which does not utilize lockers should be covered or protected from the elements in some manner.

APPENDIX A - WMATA Policy Planning

WMATA (Washington Metropolitan Area Transit Authority) recognizes its responsibilities to cyclists arriving at METRO stations as well as to riders of the more accepted bus and automobile. It has stated in public hearing (Eisenhower Avenue, July 17, 1973);

> "(WMATA has) given serious consideration to (the question of) surveillance of television cameras in areas where the bicycle location is remote. We have been in communication with the Bay Area Transit System in San Francisco, where they have been experimenting with bike lockers . . . At present (WMATA is) considering offering these lockers and racks so that the user can make a choice. All of (the) drawings at this point provide a space adequate for either".

Although the WMATA Board has not formally adopted a resolution, it appears likely that many of the following actions will be taken:

- An adequate number of bicycle locking racks will be built at Metro stations where land is provided for special access facilities for the bus and/or auto which will allow the bicyclist to use his own lock to secure the two wheels and frame at no charge to the bicyclist, and also build an adequate number of bicycle lockers secured by his own lock at these same stations which will completely enclose and protect the bicycle from the weather, vandalism, and theft and allow the bicyclist to rent these lockers on a monthly or yearly basis.

- Adequate bicycle paths on the METRO station property will be built that will facilitate safe and convenient bicycle access between adjacent city streets or bicycle paths and the METRO bicycle locking facilities.

- Folding bicycles will be allowed into the stations and trains if they are so designed as not to be a hazard to other METRO passengers in the stations, at the fare gates, on the escalators, on the platforms, or on the trains.

- Regular non-folding bicycles will not be allowed to be brought into the stations or trains because of the safety hazard they present to other passengers and the impedance to pedestrian flow.

- Those persons wishing to use their bicycle for access to a METRO station both at their origin and trip destination will be allowed to rent two or more bicycle lockers to accommodate the storage of bicycles at two or more stations so that one bicycle can be used to ride to the station of trip origin and the other bicycle used to ride from the station of trip destination.

- All of its bicycle planning and design activities will be coordinated with the local jurisdictions through the existing planning and design process.

Initially, WMATA intends to place 20 bike storage racks or lockers adjacent to the entrances of all stations where they own property, with each site plan showing up to 30 additional lockers in the future, dependent upon demand. It is also intended that a number of these racks will be free for "off the street" users, the remainder will be leased on a contract basis. The exact number of each has not yet been decided.

Cyclists who rent more than one locker at the origin and destination ends of the transit trip might expect a reduced rate for the second locker due to savings in the necessary paperwork.

WMATA has also identied a number of criteria for bicycle storage at station sites. Generally, these can be applied to all bike storage facilities:

- The location of the bicycle locking facilities at each station should be subject to surveillance by patrons in their normal circulation pattern or by the kiosk operator.

- The bicycle locking facilities should permit the frame and wheels to be locked to a permanent unmovable part of the locking assembly, with the use of a bicycle lock or conventional padlock.

- If conventional type locking racks are used, they should be firmly anchored to the surface on which they rest.

- The bicycle locking facilities should be locked adjacent to but not in the main pedestrian walkway, so as not to create circulation encumbrance.

- Where practical, consideration should be given to locating the bicycle racks or stalls under cover.

In addition, WMATA has identified two criteria which will be applied to the bicycle trail as it approaches the storage area:

- Where possible, bicycle circulation through METRO sites should be via the landscaped areas and not through the auto or bus accessways.

- Due to the speed differential of pedestrians and bicyclists and for other safety considerations, separate facilities for these two modes should be provided or adequate width provided if they are to exist.

APPENDIX B - Review of Bicycle Facilities for Other Transit Systems

Several Transit Systems across the Continent were contacted to ascertain whether any ridership surveys had revealed the bicycle as a major station arrival mode. The systems contacted included Denver and Atlanta which are in the planning stage. New York and Chicago were not contacted.

The following responses were obtained:

Montreal (Metro)

No surveys have been taken. No bicycle facilities are provided. Generally, MUCTC does not own its station sites. Provision for parking, bus stops, etc. is the responsibility of the local jurisdiction.

Toronto

No surveys have been taken. Only 4 or 5 bike racks have been provided, each containing space for appproximately 20-25 bikes. These are at the ends of the lines only.

San Francisco (BART)

A survey of riders in May, 1973 was taken for 18 stations then open from Richmond to Fremont. This showed 2 stations with more than 3% of rides approaching by bike; namely Fremont and Ashby. Fremont is a high income residential community, and Ashby is close to the University of Berkley. Four (4) stations

had bike ridership between 2% and 3% of patrons, five (5) stations had between 1% and 2%. The system-wide average at the time was 1.6%. An additional factor in the higher bicyclist areas was that feeder bus service tended to be poor. An experimental project of allowing cyclists to bring their bicycles on the trains during off-peak hours is underway. This experiment should be closely followed by WMATA for possible implementation on the METRO system.

Atlanta (MARTA)

Patronage forecasts originally developed for the system did not include the bicycle as a mode of arrival. However, MARTA is now planning to incorporate bike racks at each station to accommodate 2% of the total daily patronage.

Denver (PRT)

Although described as a PRT service, the 100 mile, fixed schedule system will probably be utilized, when built, much as any conventional rapid transit system. No projections are available yet for bike ridership. However, RTD (Regional Transit District) Commission has plans to incorporate bike storage racks at 20 bus stops in suburban Denver. The criteria to be used are: No racks within 4 miles of downtown; Racks must be highly visible by day and night; Space for storage racks must be available on the sidewalk.

Philadelphia (PATCO)

Surveys taken in January, 1970, did not ask for bicycles as a mode of access. However, service at that time was limited since a system had only been open a year. Bike racks have been supplied at six suburban stations, accommodating up to 24 bikes at each station, and 48 at Lindenwold, the end of the line. However, the racks are moveable and vandal-prone and with the exception of Lindenwold, not well used.

APPENDIX C - Review of Environmental Protection Agency Standards for the METRO System

The Environmental Protection Agency has promulgated several bicycle considerations for the METRO Subway System. The considerations were issued in the Transportation Control Plan for the Washington, D. C. Metropolitan Area, Volume 38, Number 234, Part II of the Federal Register:

> "A determination of the special problems related to feeder lanes to bridges, on bridge lanes, feeder lanes to METRO and railroad stations, and feeder lanes to fringe parking areas, and the means necessary to include such lanes in the bicycle lane network....."

and

> "The METRO Subway System shall provide a sufficient number of safe and secure bicycle parking facilities at each station to meet the needs of its riders....."

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 9

Estimates of Bicycle Ownership and Use

February 10, 1975

INTRODUCTION

The purpose of estimating bicycle demand is fourfold:

1. To determine overall ridership to justify expenditures for facilities.

2. To determine diversion from motor vehicle modes for other traffic and air quality considerations.

3. To identify high use areas and corridors to guide network design and set priorities for implementation staging, and

4. To estimate the magnitude of demand for bicycle parking parking storage facilities.

Because of the limited data available on bicycle use, the estimates at best can only provide a general range of overall demand and relative levels of demand between areas and in corridors. Fortunately, this will be satisfactory for the first three purposes for which the estimates are being made.

The estimate of the need for parking facilities will provide information to guide public policy decisions regarding the allocation of funds for public bicycle storage facilities and the need to encourage the provision of those facilities by private property owners. These estimates will also provide the basis for specific plan recommendations for the provision of storage facilities including: number, location and type.

Future monitoring of the City's facilities will be required to assume that secure, convenient storage is available to encourage bicycle use. Guidelines for the monitoring are included another memorandum: "Proposed Program for Monitoring Bicycle Use".

BACKGROUND

The bicycle has only recently become to be considered a significant travel mode in the D.C. area. Because of this, data regarding bicycle tripmaking is limited. In the 1968 COG home interview survey, data were collected on all motor vehicle trips and on walking trips if they were to work or to access transit. Bicycle trips were not recorded.

In 1971, the D. C. City Council Transportation Committee conducted a census of area residents who commute to work by bicycle. Responses to a short questionnaire were solicited through various media and 407 responses were tabulated showing general origin-destination patterns, route usage, travel time, seasonal use, frequency of use, and perceived problems.

Also in 1971, the Metropolitan Washington Council of Governments, (COG) conducted a bicycle user survey. A questionnaire was distributed at an "Environomental Bike-In" at Rock Creek Park and on the Washington Monument Grounds. The questionnaire was designed to inventory present trip purposes, to identify factors presently limiting the transportation usage of bicycles, and to record user recommendations for recreational bike trails. A total of 289 responses were analyzed.

The Washington Area Bicyclists Association (WABA) asks its members to complete a detailed questionnaire as part of their application for membership. The questionaire has a focus similar to that of the two surveys described above. Thus, the organization is continuously updating their file on members' bike use characteristics. In 1973, WABA utilized this and other information to estimate bike ridership.[1]

Other bicycle travel survey data has been collected in the Washington D.C. suburbs in Maryland and Virginia. Of particular interest is the survey conducted by the Maryland National Capitol Parks and Planning Commission of employees in nine employment centers in Prince Georges County. The survey focused on the existing and potential use of the bicycle mode for the work trip.

All of these surveys provide valuable information on bike use characteristics, user preferences for facilities, and user-perceived problems. With the exception of the Prince Georges

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1 Washington Area Bicyclists Association, "Forecasts of Bicycle Usage, (Spring, 1973).

County study, none of the surveys were conducted with controlled sampling. Without this control (knowledge of what part of the area's population is represented by the sample responses) reliable inferences cannot be made on an areaside basis.

In the area of volume data two limited bicycle traffic volume counting surveys have been conducted by COG and by the D.C. Department of Highways. This data is useful to assess current patterns and magnitudes of bicycle use.

APPROACH

The demand estimates made in this study are for non-recreational bicycle travel. Purposeful bicycle travel is defined as those trips which are made with a purpose which will be satisfied at the destination. No attempt was made to estimate those recreational bike trips where riding is the primary purpose.

Currently, a significant amount of purposeful bike travel is taking place in the District of Columbia. To estimate the existing amount and type of tripmaking several questions were included in the Bikeway Phone Survey Questionnaire.[2] On the basis of responses to these questions an estimate of present levels of bike travel was made.

The use of the bicycle as a purposeful mode of travel is a growing phenomenon in most American cities. The diversion of trips to bicycle from other modes is a result of the new popularity of the bicycle, and concern about the environment, energy resources, and personal health. A methodology was defined in this study to estimate what this diversion might be in the future. The provision of safe, convenient bike routes, storage, and other support facilities will be an important factor in this diversion.

Of course, this potential won't be reached for several years. Presumably, the recent trend will continue and more area residents will use the bicycle for more purposeful trips. Data on recent trends in bicycle ownership and use were compiled to help ascertain when this potential might be reached.

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2 See Technical Memorandum No. 1, "Survey on Bicycling Activity in the District of Columbia", A. C. Nielsen Co., Northbrook, Illinois, 1974

On the basis of the estimates of existing bicycle use, an assessment of the current need for bicycle storage facilities is made in another Technical Memorandum.[3]

CURRENT OWNERSHIP AND USE

Data from the telephone survey are the basis of this estimate of the current ownership and use of bicycles in D.C. A specific question on ownership was not asked in the survey. However, an approximation is possible from the bicycle use estimates.

Estimated Ownership

It is estimated that 186,000 D.C. residents bicycled at least once in 1974. Because much of this use could involve the sharing of a single, owned bicycle by more than one family member, or the use of a rented or borrowed bicycle, this estimate is an indication of the maximum number of owned bicycles.

A minimum estimate of the number of bicycles owned by D.C. residents is based on the current number of bicycles registered. Bicycle registration became mandatory in May, 1974. By September 44,200 bicycles had been registered by the D.C. Police Department. Thus, a minimum estimate of say 50,000 seems reasonable.

The actual number of bicycles owned by D.C. residents lies in this wide range (50 to 186 thousand). A likely estimate is 100,000 to 130,000 which means that 40 to 50 percent of the total bicycles are registered and the ownership rates are 0.4 to 0.5 bicycles per household and 0.13 to 0.18 bikes per capita.

The number of D.C. households in which a member bicycles in the last year was estimated from the telephone survey to be about 89,000. The rate of ownership for these bicycling households is about 1.1 to 1.5 bicycles per household.

Estimated Use

The report on the telephone survey conducted for this study presents an estimate of bicycle use by D.C. residents and a detailed breakdown of those estimates of use by location of

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3 Technical Memorandum 11, "Bicycle Parking Needs and Implementation Guidelines".

TABLE 1 SUMMARY OF BICYCLE USE ESTIMATES

	Households	Population
District of Colombia Total	261,000	713,000
Bicycled in 1974	89,000	186,000
Bicycled in July 1974	-	147,000
Bicycled in Oct/Nov. 1974		105,000

Oct/Nov. Cyclists' Trip Purpose:	Number of Cyclists	Average Number of Days Cycled in Last 30 Days
Work	11,000	15
School	7,000	13
Personal business	34,000	8
Recreation	50,000	7
Visit a friend	40,000	7
Long distance	37,000	5
Around neighborhood	71,000	9
All purposes	105,000	

SOURCE: Figures shown are rounded estimates from the telephone survey conducted for this study.

residence, age of user, trip purpose, trip length, and other user and trip characteristics. Selected pertinent findings from that report are summarized here.

Table 1 shows general magnitude of use statistics. The "Last Year", "July", and "October/November" statistics were determined to get relative seasonal activity. In general, bicycling activity in the peak summer season is about forty percent greater than in the mid-fall season. All detailed use data from the survey is for the October/November period because most questions were phrased "... during the last month..." and the survey period was November 9 through November 28, 1975. It should be noted that during the 61 days of those two months, 43 days had reasonably cycling weather. During the two months there were 42 working or schooldays which 30 had reasonable weather.[4] October and November 1974 were exceptionally good months for outdoor activity.

This weather information puts the October/November use estimates in perspective. First, work and school trips by bicycle were made by 11,000 and 7,000 individuals, respectively. These cyclists averaged 15 and 13 days cycled to work and school "during the last 30 days." Thus, these trip-makers used the bicycle on a regular basis for these trip purposes.

Trips in other categories of uses occurred with less frequency but were participated in by more individuals. Of particular importance is "personal business" (shopping, banking, medical, etc.), and "recreation" because, as with work and school, these trip purposes require secure parking facilities at the non-residential trip end. The estimates of demand for these trips are treated in more detail in Technical Memorandum 11 cited earlier, which discusses parking needs.

DISTRIBUTION OF BICYCLING HOUSEHOLDS

The geographic distribution of bicycle trips originations was determined in a general sense in the telephone survey in that the data were grouped for five geographic areas. See Figure 1 for a D.C. map showing these areas.

Table 2 (same as Exhibit 1 from Technical Memorandum 1 shows the relative numbers of bicyclists in each of the five areas.

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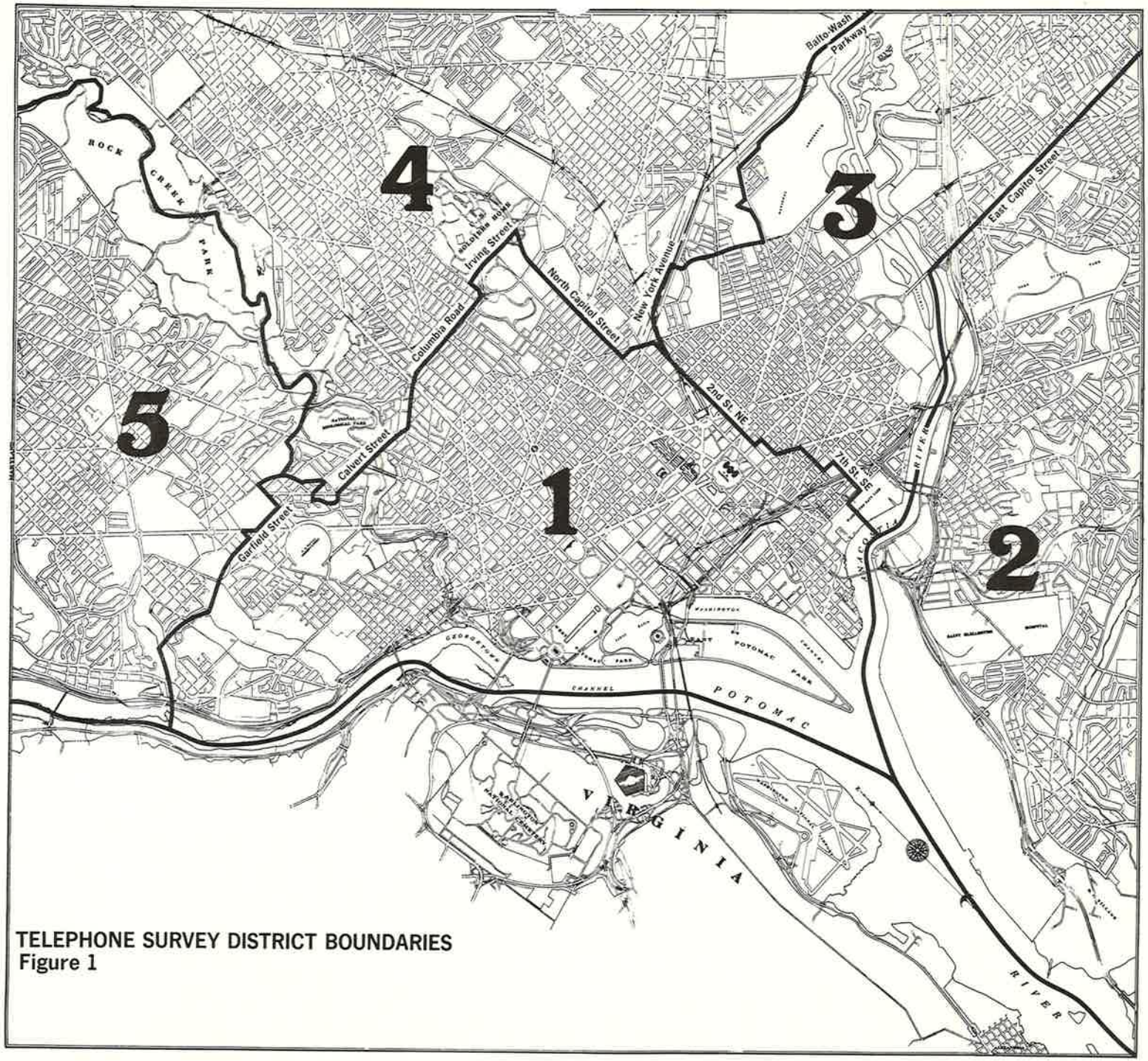
4 "Regional weather" was defined here as less than 0.1 inch precipitation, overnight low temperature greater than 35 degrees F and high less than 80 degrees F. Weather data source: "Local Climatological Data," Atmospheric Science Library, Washington National Airport Silver Spring, Md.

TABLE 2
WASHINGTON, D. C. BICYCLISTS BY SURVEY DISTRICT LOCATION

Survey District	% of Households Bicycling During Past Year	Estimated 1970 Population No.	%	% of Pop. within Area who Bicycled During Past Yr.	No. of Estimated Bicyclists Based on 1970 Pop.	% of Total Bicyclists in Washington, D. C.
1	32%	181,443	25.5%	27%	50,200	27.0%
2	33%	164,833	23.1%	21%	35,400	19.0%
3	28%	127,371	17.9%	20%	25,300	13.6%
4	38%	181,400	25.4%	29%	53,100	28.6%
5	42%	57,767	8.1%	38%	22,000	11.8%
TOTAL	34%	712,814	100.0%	26%	186,000	100.0%



TELEPHONE SURVEY DISTRICT BOUNDARIES
Figure 1

On an absolute magnitude basis, areas 1 and 4 have the most bicyclists. Generally, the distribution of total bicyclists is similar to the distribution of total population. The "participation rate" is lowest in areas 2 and 3, both of which are in part or all in Anacostia, a hilly area (grades in many places deter Anacostia bicycling) with poor access for bicycles across the Anacostia River to the remainder of D.C. [5]

Area 5 has the highest participation rate. This area has reasonable grades and good access to downtown jobs and National Park Service recreational bicycling facilities. On an overall basis, area 5 has the highest median household income and areas 2 and 3 have the lowest in the city.

Bicycle Travel Corridors

In May and June, 1974 an "internal cordon" survey was conducted by COG. All vehicles, including bicycles, were counted over a 13 hour period (6 AM to 7 PM) at about 35 percent of the streets crossing an imaginary line drawn around the central area of the city (transportation planning "rings" 0 and 1). Figure 2 shows the approximate count locations, and several "corridors" or groups of counts in the same area. Table 2 summarizes the bicycle count data. These data indicate a fairly even distribution of trips into the central area over the daytime period except for the New York Avenue - Union Station area, which had little traffic.

The heavy demand corridors are Georgetown, Capitol Hill, and Southwest D.C. and the river crossings from Virginia. Three-quarters of the rush period traffic and two-thirds of the daytime period traffic occurred in these corridors.

Origin-Destination Patterns

No specific origin-destination questions were asked in the phone survey for three reasons: 1) an effective phone interview survey has a time constraint, and origin-destination data would take too long to obtain; 2) the sample of trips would be too small to draw anything but very general conclusions; and 3) other tripmaking O-D data is available from

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5 Percent of population who bicycled.

TABLE 3

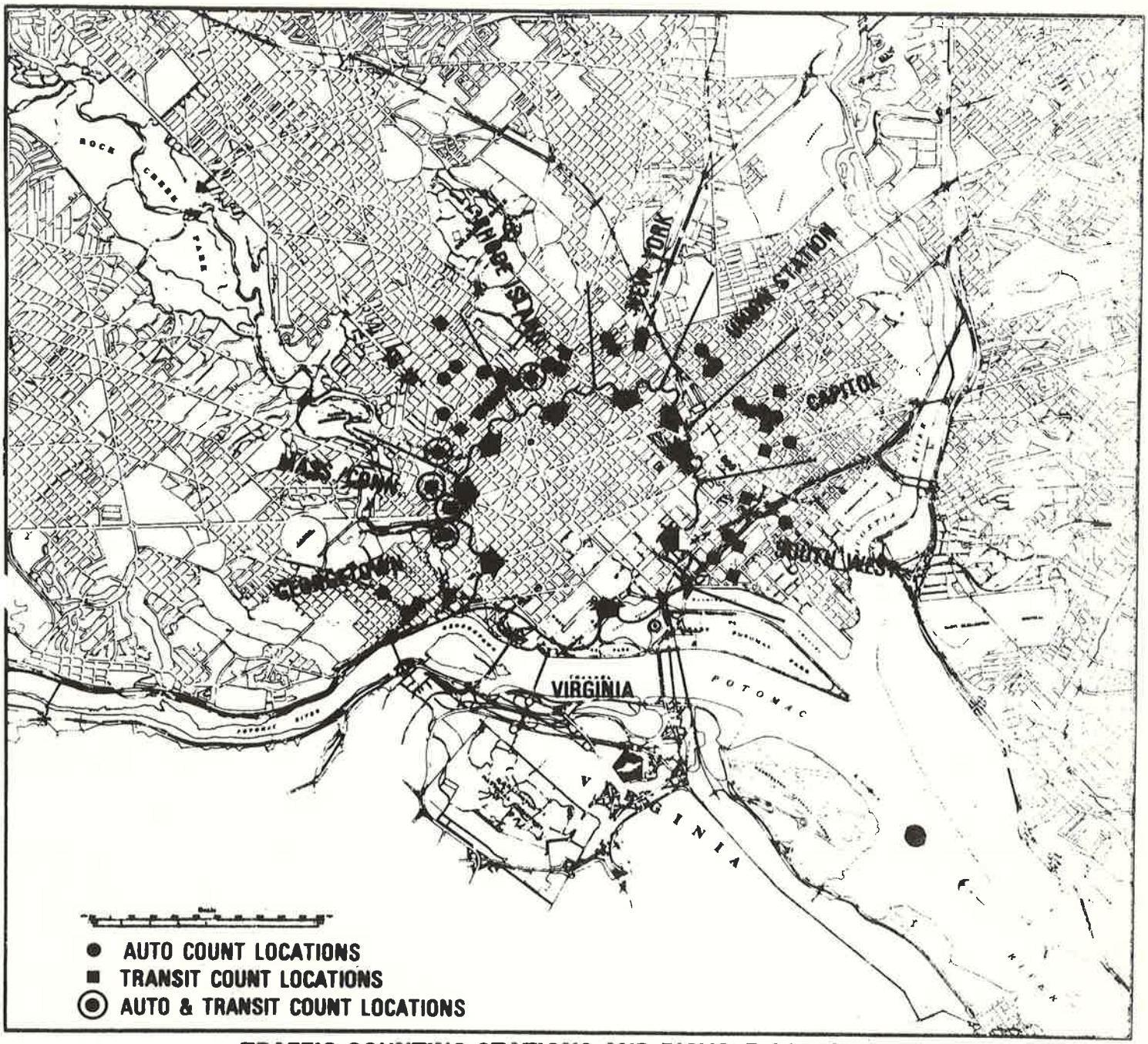
Summary of Corridor Bicycle Traffic Volumes

Spring 1974

Inbound (to downtown) Volume

Corridor	AM Peak Hour 7:30 - 8:30	AM Rush Period 6:30 - 9:00		13 Hour Total 6:00 AM-7:00 PM	
1 Georgetown	21	52	12	290	15%
2 Mass/Conn Ave.	10	37	8%	161	9%
3 16th	16	42	10%	158	8%
4 Rhode Island	6	13	3%	185	10%
5 New York	2	7	2%	36	2%
6 Union Station	7	16	4%	72	4%
7 Capitol	47	99	22%	289	15%
8 Southwest	25	71	16%	362	19%
9 Virginia	47	105	24%	328	17%
TOTAL	181	442	100%	1,881	100%

Source: Washington Metropolitan Area Council of Government
Inner Cordon Survey Conducted: May and June, 1974.



TRAFFIC COUNTING STATIONS AND BICYCLE CORRIDORS FIGURE 2

which general conclusions regarding patterns may be drawn. This other source of O-D data is the 1968 COG Home Interview Survey.

In 1968 the Council of Governments conducted a standards survey of tripmaking of area residents. For a 4 percent sample of households, interviews were conducted and data collected on all motor vehicle and some walking trips made by all members of the surveyed households. This data was then expanded to represent the study area universe and trip tables were prepared. These tables are estimates of the trip interchanges within and between small geographic areas called zones. The tables are stratified by mode, socio-economic group, time of day, and other pertinent groupings.

For this bicycle study, further stratification of the data were made to distill out only those trips which have reasonable potential for diversion to the bicycle. These stratifications were made as follows:

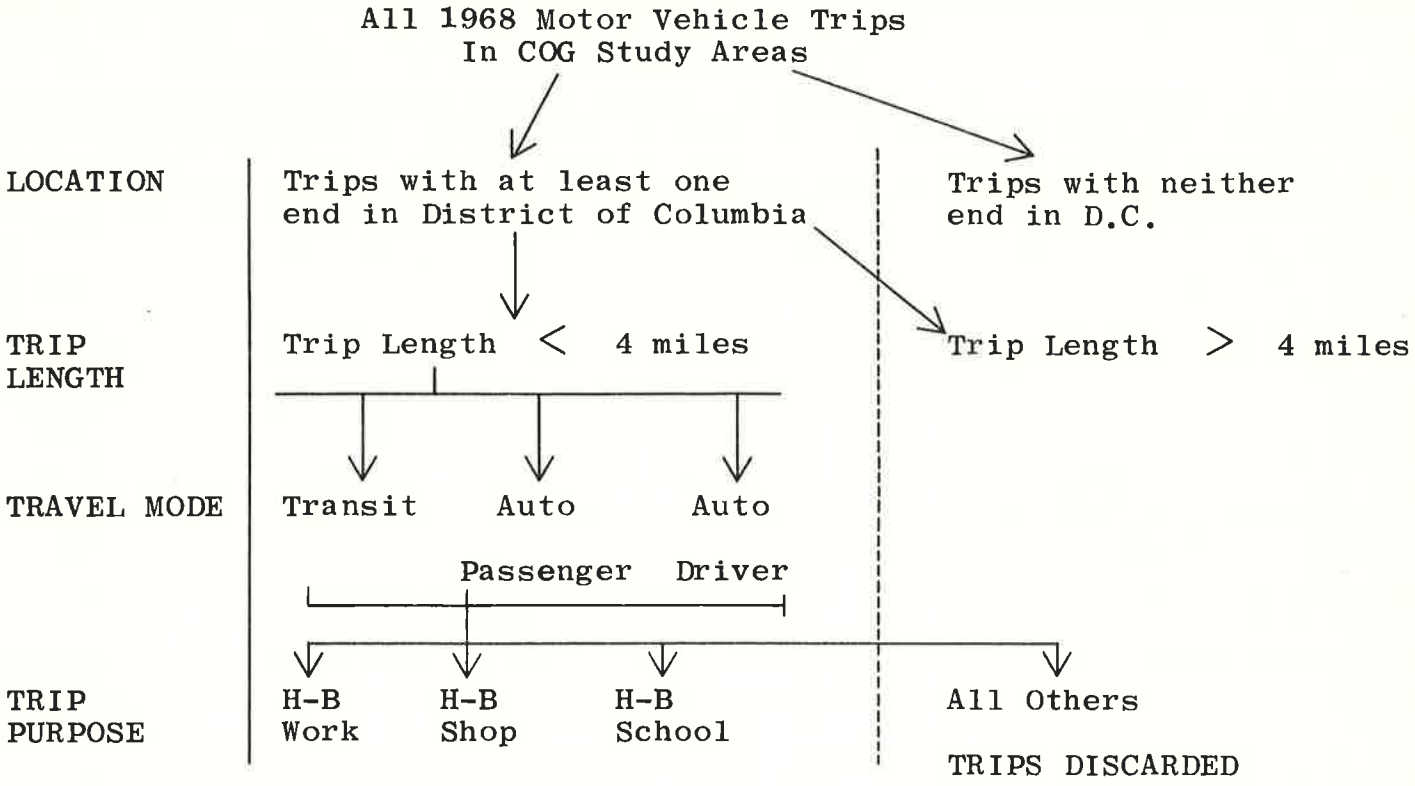
1. Trips approximately four miles or less in length were used because of the range limitations of the typical cyclists.

2. Trips with one end (either origin or destination) in the District of Columbia. While some trips of four miles or less in length with both origin and destination outside D.C. could potentially use D.C. bike facilities, these were not included. The number of trips of this type is probably relatively small.

3. Trips with one residential end. Non home-based trips were excluded in spite of the fact that they do have a potential for bike use. This potential is considered to be small compared to home-based trips.

The diagram in Figure 3 shows the overall trip-type stratification scheme.

The interchange of potential bicycle trips between transportation planning districts (groups of zones) were plotted on a series of maps to identify high potential corridors. Potential home-based work, shop, and school trips by auto driver and transit passenger modes. Auto passenger trips were not compiled because they constitute a relatively small portion of the total passenger trips and because it seemed unlikely that they would reveal any new O-D patterns other than those shown by the auto driver patterns. Only trip interchanges of relatively high magnitude were plotted so that major patterns could be identified.



Note: H-B is home-based, that is, one end of the trip is the residence of the tripmaker

FIGURE 3

Stratification of COG 1968 trips into trips with potential for diversion to the bicycle

District of Columbia
Comprehensive Bikeway Study

Barton-Aschman Associates, Inc.

January 1975

The trip interchanges between districts by purpose and mode were then summed to get a composite set of trip pattern with potential for diversion to the bicycle. The resulting desire line maps (Figures 4 and 5) show clusters of potential bicycle trips forming corridors. The predominate pattern is radial indicating the importance of the central area to these short trips. Also important are certain crosstown movements such as in Anacostia. These patterns were instrumental in the development of the recommended route network.[6]

DEMAND PROJECTIONS

Forecasting bicycle use for purposeful trips must be considered, at best, an "educated guess". The data upon which this estimate is made is from various sources and times. Many claim that the current interest in bicycling is a fad, while others feel that the bicycle will solve urban traffic congestion and pollution problems as the energy crisis promotes its use. Only limited information is available regarding the effect of bikeways and other support facilities on bicycle use.

Current "Capture Rates"

Phone survey respondents who bicycled for work, school, or personal business purposes were asked what mode they would use if the bicycle could not be used. The responses to this question were used in conjunction with the 1968 COG data to estimate current "capture rates" - the portion of potential bicycle trips by motor vehicle modes which currently divert to the bicycle when the weather and other circumstances permit. Table 3 shows the comparison of these motor vehicle and bicycle trips and the estimated capture rates.

The October/November use estimates were used as a base or "normal" bicycling day. It was assumed that the estimated number of cyclists was equavalient to the peak October/November day number of trips. The rate could only be estimated for work and school trips because of data compatibility constraints. Only the auto driver and transit passenger modes were compared for reasons cited earlier. It should be noted that the potential bike trip estimates are for 1968 because more current estimates are not available.

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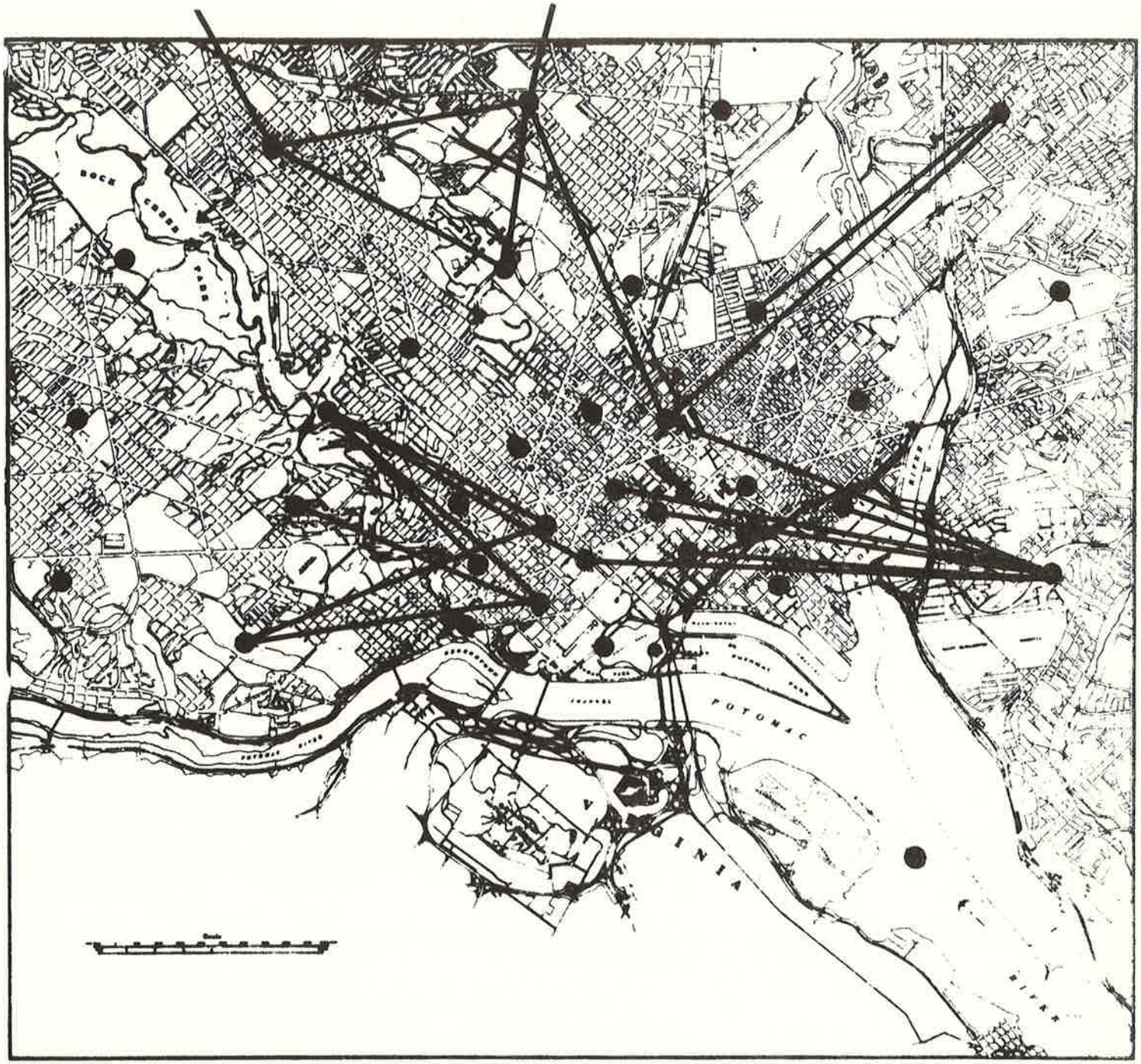
6 Technical Memorandum 10, "Proposed Trunk Route System". Barton-Aschman Associates, Inc., 1975.

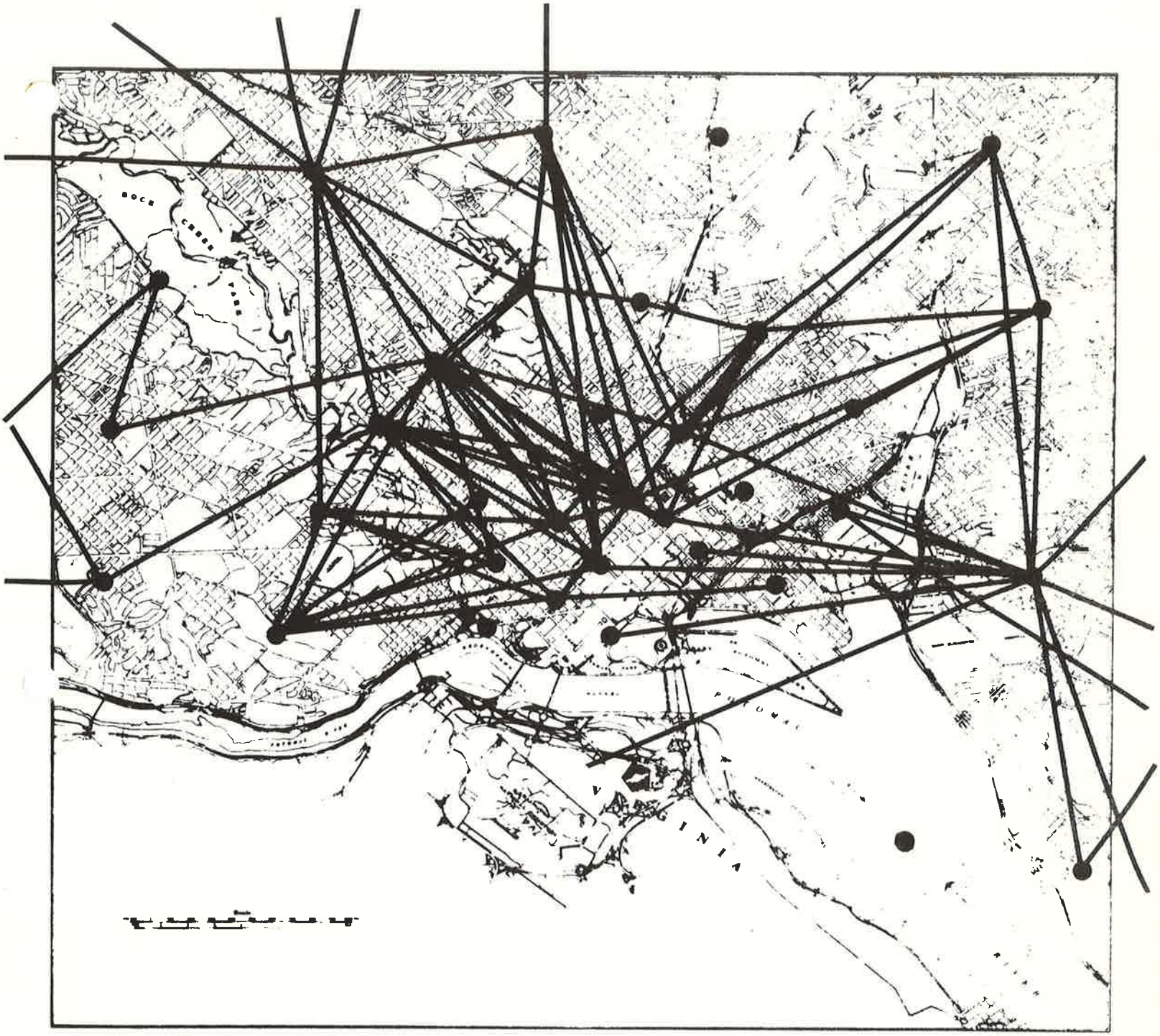


● COG DISTRICT CENTROID

REPRESENTS AT LEAST 1000 PERSON TRIPS
(BASED ON 1968 COG DATA)

Figure 4

MOTOR VEHICLE TRIP INTERCHANGES WITH POTENTIAL FOR DIVERSION TO THE BICYCLE



● COG DISTRICT CENTROID

——— REPRESENTS AT LEAST 500 PERSON TRIPS (BASED ON 1968 COG DATA)

MOTOR VEHICLE TRIP INTERCHANGES WITH A POTENTIAL FOR DIVERSION TO THE BICYCLE
Figure 5

TABLE 4

CURRENT BICYCLE CAPTURE RATES FOR D.C. TRIPS BY MODE AND PURPOSE

Mode		Home-Based Work	Home-Based School
Auto Driver	T	53,115	6,655
	B	2,640	560
	R	5.0%	8.4%
Transit Passenger	T	71,277	14,252
	B	4,840	2,030
	R	6.8%	14.2%
Walk	T	NA[1]	NA[2]
	B	2,640	3,780
		12%	4.2%

Code: T = Trips with potential for diversion to bicycle
B = Current (Oct/Nov) bicycle trips which would revert to mode.
R = Capture Rate - B ÷ T

NA Not available from COG data

1 Based on an estimate made from phone survey responses, about 22,000 D.C. residents walk to work each day.

2 In 1970, there were about 107,000 school age (primary and secondary) children residing in the D.C. Thus, the number of school walking trips was about 80,000 to 90,000 in 1968.

The current "capture rate" for work trips ranges from 5 to 12 percent of the potential, depending on mode, and 4 to 14 percent for school trips. The current capture rates for personal business, and recreational trips, and for the auto passenger mode are probably in this range (5 to 15 percent).[7]

Future Capture Rates

Current local and nation-wide trends show a strong growth in interest, ownership, and use of the bicycle for purposeful trips. What is the potential capture rate of the bicycle in Washington? Other studies have estimated capture rates for work trips as high as 38 to 41 percent in Philadelphia[1] and in Prince Georges County, Maryland.[8]

It seems reasonable that given the current trends, plus the imminent improvements to the system of facilities which will support bicycling, that the current capture rates will increase 2 to 3 times. This would result in a proportional increase in bicycle tripmaking.

Other Factors

Two other important factors must be considered in this forecast: 1) the growth in population and jobs in the District of Colombia; and 2) the effect of the METRO Rail System. All other things being equal, bicycling can be expected to increase in proportion to the City's growth in population and jobs. In 1968, COG estimated that D.C. would have 822,000 residents and 800,000 jobs in 1992, and growth of 12 percent and 48 percent respectively over the 1968 levels.[9] Thus, a minimum growth in bicycling of 12 percent would occur due to this factor alone.

METRO Rail will produce large changes in the current patterns of tripmaking. The affect of METRO Rail on the mode choice involved in the short trip less than 4 miles is difficult to forecast. Many of these trips which are now being made by bus and auto will divert to METRO Rail. It may be that it will be more difficult to divert future rail trips to the bicycle because the rail system will be faster, cheaper, and

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7 Ralph Hirsch, "Bicycle Counting into Central Philadelphia," (Philadelphia Coalition and Drexel University, June, 1973).

8 "Bikeways Survey," The Maryland National Capital Park and Planning Commission, May 1974.

9 "Zonal Land Use Allocations for Regional Travel Demand Forecasts", (Alt. #6.2, as motified, Preliminary Tabulations), Department of Transportation Planning, COG, September, 1973.
Note: The COG Projections used here are not official and do not represent official policy of COG or its member governments. The information is for study purposes only.

more convenient than either the bus or automobile. On the other hand, METRO Rail will encourage use of the bicycle as an access mode to the METRO Stations. (This demand for purposeful bicycle rise is discussed in Technical Memorandum 8).

Future Levels of Demand

The capture rate approach indicates that purposeful cycling has the potential to double or triple in the future. This potential is verified by the data shown in Table 4. Growth rates in several indicators of local bicycle use have been in the 40 to 80 percent range over the last few years. Thus, reaching an ownership "saturation level" appears to be likely within the next five to ten years. This level of ownership is where all potential cyclists will have a bicycle at their disposal.

This level of ownership, coupled with the development of a system of support facilities will result in an environment very conducive to purposeful bicycling. It is in this environment that the high potential capture rate levels will be attained.

Figure 6 presents a forecast of the likely level of bicycle ownership and use in the future. The solid lines are COG forecasts from the source cited earlier. The range of ownership is based on the current estimate of 100,000 to 130,000 bicycles and a likely doubling over the next 20 years.

The use for personal business trips is estimated to remain proportional to ownership. These trips are predominently neighborhood trips and will not be greatly increased by the implementation of bikeways.

Work trips and school trips will be served by bikeways and by the provision of good storage facilities. A factor of 2.5 was applied to current levels of tripmaking to obtain the forecast for these purposes.

TABLE 5

RECENT GROWTH IN BICYCLE
OWNERSHIP AND USE INDICATORS

	WABA[1] Membership	Reported Accidents	Reported Crimes[2]	Reported Bicycles[3]
1971	NA	259	NA	6,849
1972	250	377	2,022	6,707
increase over previous years	-	46%	-	-
1973	460	617	3,258	19,216
increase over previous years	84%	64%	61%	-
1974	870	642	3,026	50,000[4]
increase over previous years	90%	4%	-7%	-

1 Washington Area Bicyclist Association

2 Robberies, burglaries and larcenies against bicycle owners or users.

3 Registration is valid without renewal, therefore, present growth comparison is not meaningful. Data shown for general trend information only.

4 Registration became mandatory in 1974. Figure is estimated based on 44,200 registrations through September, 1974.

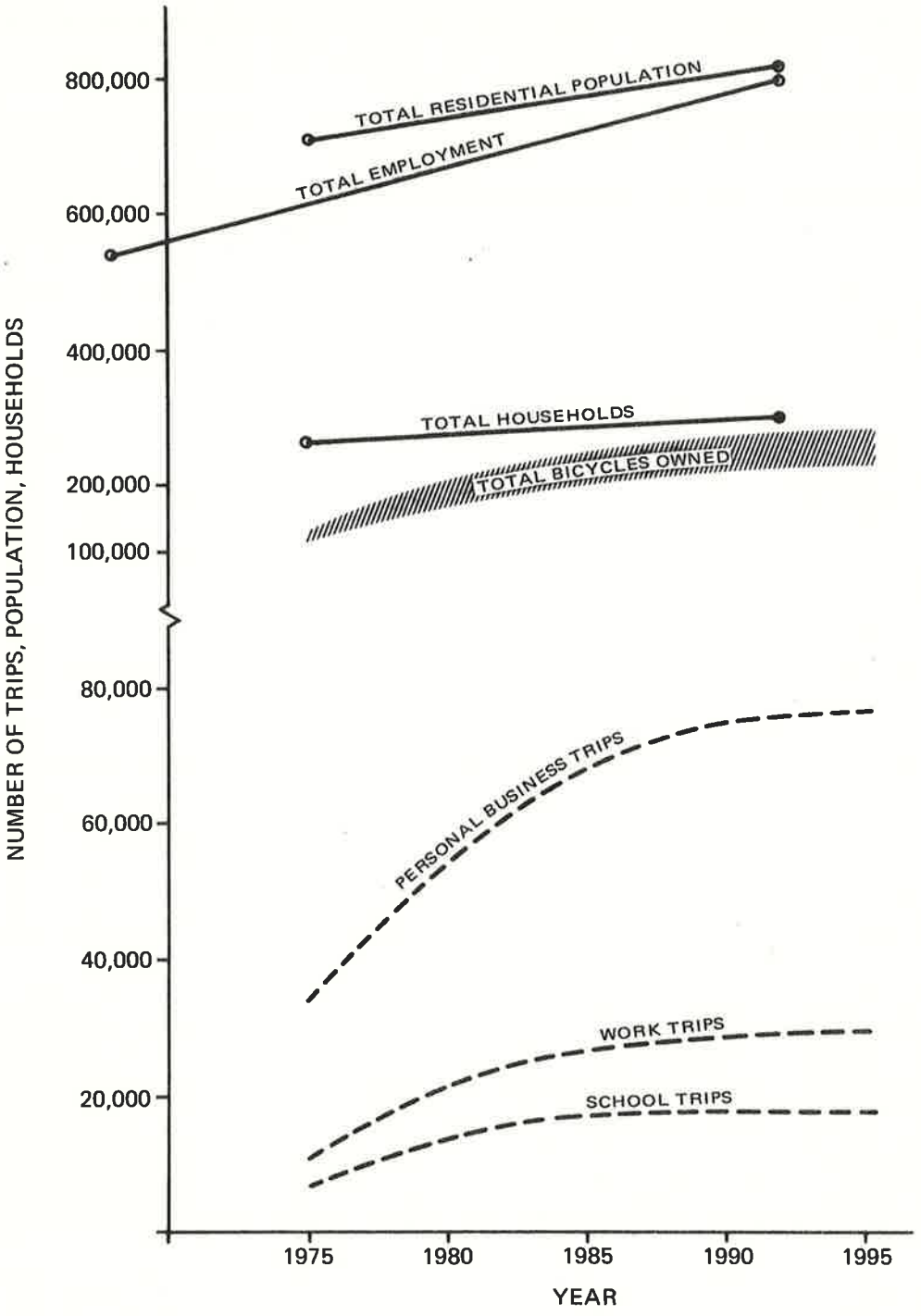

FIGURE 6 PROJECTIONS OF BICYCLE OWNERSHIP AND USE – DISTRICT OF COLUMBIA

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 10

Proposed Trunk Route System

April 2, 1975

This memorandum presents a description of the proposed trunk route system of bikeways for the District of Columbia. Included are a description of the network plan concept, the route selection process, and the recommended bikeway treatments. The final section of the memorandum presents a detailed description of the individual network elements. The intent of this information is to supplement the network route map found in the binder pocket.

NETWORK PLAN CONCEPT

From a compilation of all past proposals for bikeway routes and from the input of interested citizens, neighborhood meetings, the Technical and Citizen Advisory Committees, and the Bikeway Study Team, nearly 300 miles of route alternatives were generated and mapped. A conceptual plan was then needed to guide the development of the proposed network from this large number of alternatives. The current travel patterns of area residents and the geographic distribution of major centers of activity indicated that the nature of the bikeway arterial network would require a multiplicity of characteristics. These characteristics are expressed in the four principles described below. These principles guided the network development work and, taken together, constitute the network plan concept.

1. A grid of bikeways is needed in the high employment areas of the District. A grid in the downtown area will serve as a distributor of trips to various streets and destinations in the District. Such a network will intercept trips entering the area from the various residential neighborhoods and distribute them to the various streets on which places of employment are located.

   Due to the numerous employment locations in the downtown area, it is impossible to locate bikeways on each street. Instead, a backbone grid system will provide a method of access that will bring the bicyclist to a street adjacent to his place of employment on which he felt comfortable given his level of cycling ability, to complete his trip.

This concept has been applied to the area bounded by the Potomac and Anacostia Rivers, Rock Creek Parkway and N Street, N.E. and N.W.

2. Connectors from residential sectors of the District are needed to provide access to the high employment centers of the District. The second conceptual element of the plan is to provide connecting or arterial bikeways to serve the trip of the bicyclist from the various residential areas to the downtown or high density employment area. These bikeways will penetrate the high employment area until they reach a segment of the grid system. The remainder of the bicyclist's trip or that portion that can be conveniently provided by the grid is then made.

   It is not the intent of the connectors to penetrate every residential neighborhood. Specifically, it is not the intent to provide routes on local residential streets that are to finally connect into the downtown area. Instead these routes are envisioned as providing the major movement corridors or "bicycle thoroughfares" to which residential streets connect. Just as the grid serves as a distributor and collector in the downtown area, local or residential streets serve as distributors and collectors in the various neighborhoods. The only difference is that no special treatment will be provided on the residential streets in the outlying neighborhoods.

3. Connectors are also needed from the arterial bikeway network to major activity centers other than the downtown employment area and to serve major movement corridors not focusing on the downtown area. This element links major areas of activity such as schools, hospitals, parks and recreation areas, neighborhood shopping centers, and entertainment centers.

4. The proposed trunk route system is only the first step in the bikeway planning process. The system recommended here is to be the "arterial" system of bikeways.

   This fourth item should be emphasized. It is intended that the proposed network provide an infrastructure for future additions and neighborhood connectors to the trunk route system. Feeders and distributors within residential neighborhoods will complement the trunk route system. All streets not on the proposed network must remain available to cyclists. A desired epilogue to this study is for neighborhoods to develop internal bikeways to connect to the trunk route system with the support of the Department of Highways and Traffic.

ROUTE SELECTION

There were many factors in the choice of one alternative over another. Each of the alternatives was field checked and evaluated noting the advantages, suitability, and conformity of the route with respect to the bikeway plan concept. During the field checks, physical features such as traffic volumes, gradient, pavement conditions, intersection treatments, parking restrictions, and the number of moving lanes were all listed for each route.

Consideration of the type of bikeway treatment which is feasible on each candidate route was an essential element in the route selection process. Trade-offs between route directness and avoidance of high traffic volume arterials created conflicts since motor vehicle arterials are usually the most direct route.

The route selection process produced a recommended network of over 70 miles. The estimated existing and proposed bikeway mileage within D. C. is summarized below.

PROPOSED BIKEWAY NETWORK MILEAGE

Element	Miles
Existing Bikeways	40.8
D. C. Highways Proposals	16.4
Study Recommendations	74.6
Other Recommendations	36.1
TOTAL	167.9

Note: The "Other Recommendations" include those bikeways proposed by the National Park Service and Bolling Air Force Base.

It should be noted that the routes recommended here do not exclude any future alternatives in the same corridor. The specific routes chosen were judged by the Study Team to best meet the needs of cyclists in the particular corridor.

BIKEWAY TREATMENTS

In most cases, a specific treatment has been recommended for each specific network element. In cases where no specific treatment has been determined, a listing of possible alternatives is given or further design study is recommended. The various types of treatment that this study utilizes is defined below.

The actual design should utilize the recommended standards of the Design Manual[1] as these definitions are made only to distinguish the different types of bikeway treatments.

Class I/Bikepath - A separate trail or path which is for the exclusive use of bicycles. Where such a trail or path forms a part of a highway, it is separated from the roadways for motor vehicular traffic by an open space or barrier.[2]

Class II/Bikelane - A portion of a roadway which has been designated for preferential or exclusive use by bicycles. It is distinguished from the portion of the roadway for motor vehicular traffic by a paint stripe, curb or other similar device.[2]

Class III/Bikeroute - A roadway which is officially designated and marked for bicycle travel but which is open to motor vehicle travel and upon which no bicycle lane is designated. Where possible, the AASHTO fifteen foot outer lane is to be implemented for safe bicycling.[2]

Class III/Preferential Bike Street - This is a bikeroute where measures are taken to discourage or prohibit motor vehicle traffic except for local access. Additional provisions such as repaving, eliminating stop signs - for cyclists, and increased maintenance are made to improve bicycling.

Class III/Improved Bicycle Street - A bikeroute that is given priority for repaving, superior maintenance, eliminates stop signs for the direction of bicycle travel, and reduces automobile speed limits. Where possible, the AASHTO fifteen foot outer lane is to be implemented for safer bicycling.

Class III/Sidewalk Route - A bikepath that utilizes part of the sidewalk or sidewalk right-of-way.

It should be noted that due to the necessity of avoiding disruptions to existing systems (motor vehicle flow, pedestrians, buses), optimal bikeway treatments are not always possible. Although these considerations are external to the bikeway network, they do exert large constraints on the choice of treatment. Since this issue is a value judgement (bicycle vs. motor vehicles), it becomes a political decision. This topic is pursued in further detail in the Appendix to this memorandum which examines specific routes where this conflict is a major constraint.

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1 "District of Columbia Bikeway Plan and Design Manual", Barton-Aschman Associates, Inc., 1974

2 "Guide for Bicycle Routes", The American Association of State Highway and Transportation Officials, 1974

INDEX OF PROPOSED ROUTES

BROAD BRANCH ROAD

APPROXIMATE LENGTH: 1.5 miles, 7700 feet, 2.4 kilometers.

From Western Avenue to the Rock Creek Parkway along Broad Branch Road, N.W.

FUNCTION: Access to the existing Rock Creek Parkway Bikeway.

TREATMENT: Improved Bicycle Street. Possible future treatment - A traffic study should be conducted to determine the feasibility of a one lane, one-way peak hour operation of this section of Broad Branch Road during peak hours. If feasible, the remaining lane would operate as a two-way bikeway.

UNIQUE ASPECTS: This two-lane road is presently heavily used by bicyclists. While motor vehicle traffic volumes are low, the route is dangerous to cyclists and pedestrians because of the many curves with limited sight distances. Because the road borders a park (Rock Creek), it would be desirable to cut trees to increase sight distances. A separate bikeway is not necessary if safety can be improved. Limited signing would not detract from the natural atmosphere and would warn motorists that bicyclists and pedestrians are present, and would serve as a guide to recreational bicyclists.

PROBLEMS: Any signing should be thoughtfully designed and placed to serve the desired purpose and not to detract from the scenic atmosphere.

CONNECTICUT AVENUE ALTERNATIVE

APPROXIMATE LENGTH: 2.8 miles, 14,800 feet, 4.5 kilometers.

From Nevada Avenue to Reno Road along 36th Street, N.W., from Reno Road to 37th Street along Warren Street, N.W., from Warren Street to Porter Street along 37th Street, N.W., from 37th Street to 36th Street along Porter Street, N.W., from Porter Street to Woodley Road along 36th Street, N.W., from 36th Street to 34th Street along Woodley Road, N.W., and from Woodley Road to Massachusetts Avenue along 34th Street, N.W.

FUNCTION: Connector from the residential northwest to the employment center of the District.

TREATMENT: A Class II (unprotected) Bikeway in areas where parking demand is low and can be prohibited; a Preferential Bikeway Street where parking cannot be prohibited, but through traffic can be discouraged; and an Improved Bicycle Street where neither of the above are feasible.

UNIQUE ASPECTS OF THE ROUTE: This route is more suitable route for those who wish to avoid the traffic of Connecticut Avenue.

PROBLEMS: Basically this route has been devised to serve the Connecticut and Wisconsin Avenue corridors. Both streets provide major thoroughfares into the center of the District from the northwest residential area and from Maryland. Presently, both avenues carry high volumes of automobile and bus traffic. The traffic movement capability of both routes would be severely limited if a bikeway were located on their street surfaces. In addition, there is no opportunity to provide a sidewalk bikeway on either route because of their primarily commercial land use. At present the peak hour bus lane on Connecticut can be used by cyclists. The proficient bicyclist can and does use the bus lanes with few problems. But for the novice cyclist, this is a strenuous route. Therefore, an alternative route utilizing residential side streets has been devised to provide an alternative connection into the employment center of the District. A restudy of the feasibility of a Connecticut Avenue route may be appropriate in the future if the Express Bus Lanes are discontinued when Metro Rail is operating.

EIGHTH STREET, NORTHWEST

APPROXIMATE LENGTH: 2.6 miles, 14,000 feet, 4.3 kilomters.

From Eastern Avenue to Kansas Avenue along 8th Street, N.W.

FUNCTION: Connector from residential area leading to the 13th Street route penetrating the CBD.

TREATMENT: Improved Bicycle Street

UNIQUE ASPECTS OF THE ROUTE: As mentioned above, it is hoped that this route and the 13th Street route are implemented simultaneously to be used as a test situtation. This street should have preferential bike street treatment in sections where there are heavy through movements.

This street has no special attractions in this corridor other than to provide connections from the boundary of the District to Kansas Avenue. The characteristics of this street are similar to other streets in the area. The value of this route results from the opportunity to monitor parallel routes with different treatments. Hopefully, the magnitude of use will indicate which treatment cyclists prefer - special treatment on congested streets or little treatment on residential streets.

PROBLEMS: Basically, this is a residential street that would be improved for bicycle use. Some areas on the street have grade problems, but these hills are fairly short and should not be a major detriment to use.

FIRST STREET, NORTHWEST

APPROXIMATE LENGTH: 2.1 miles, 10,900 feet, 3.2 kilometers

From Constitution Avenue to Rhode Island Avenue, N.W.

FUNCTION: Connection from residential area and Rhode Island bikeway to grid system of "I" and "H" Streets and the Mall.

TREATMENT: North of Massachusetts Avenue - Improved Bicycle Street; south of Massachusetts - Class II Bikelanes.

UNIQUE ASPECTS OF THE ROUTE: This route will provide direct access from the northeast section of the District to the high employment areas of Judiciary Square and to the Mall.

PROBLEMS: No specific problems are evident at this time.

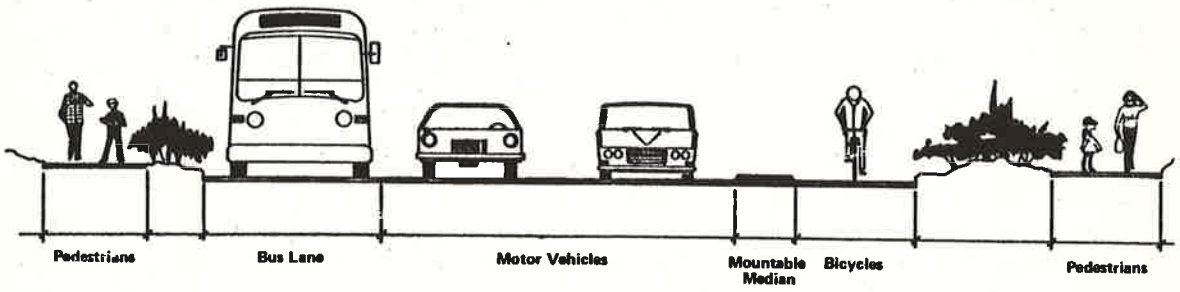
"I" AND "H" STREETS

APPROXIMATE LENGTH: 3.8 miles, 19,900 feet, 6.1 kilometers.

From New Hampshire Avenue to 6th Street, N.W. along "I" and "H" Streets, N.W.; and from 6th Street, N.W. to Maryland Avenue along "H" Street, N.E.

FUNCTION: Essential element of the grid system.

TREATMENT: Class II Bikelane - protected, see figure below.



'H' AND 'I' STREET TREATMENT

UNIQUE ASPECTS OF ROUTE: There appears to be the unique opportunity to implement these routes on the "I" and "H" Street pair. The closing of "I" due to METRO construction provides the opportunity to redesign both streets once the present METRO construction has been completed. No other possibilities exist which would allow for the implementation of exclusive lanes.

PROBLEMS: Continuation of the bikelanes across the diagonal intersections with Pennsylvania and New York Avenues requires further study.

IRVING AND KENYON STREETS, NORTHWEST

APPROXIMATE LENGTH: 0.8 miles, 4100 feet, 1.2 kilometers.

From Park Place to 14th Street along Irving and Kenyon Street, N.W.

FUNCTION: Connects Michigan Avenue into the 13th Street penetrator. To operate as a one-way pair.

TREATMENT: Improved Bicycle Street.

UNIQUE ASPECTS OF THE ROUTE: None

PROBLEMS: No specific problems are evident at this time.

KANSAS AVENUE

APPROXIMATE LENGTH: 2.5 miles, 13,300 feet, 4.1 kilometers.

From Eastern Avenue to 13th Street along Kansas Avenue, N.W.

FUNCTION: Connector from residential neighborhood to 13th Street bikeway route which in turn will penetrate CBD.

UNIQUE ASPECTS OF ROUTE: Kansas Avenue is one of the few diagonal streets with low traffic volumes.

TREATMENT: Class III - Bikeroute

The relatively low traffic volumes on Kansas are conducive to bicycle use in mixed traffic. No option is available which is as direct as Kansas Avenue with a connection to the downtown grid.

PROBLEMS: The diagonal intersections will present a problem in treatment. It is suggested that the bicyclist negotiate intersections in mixed traffic.

LOWER "K" STREET

APPROXIMATE LENGTH: 0.5 miles, 2500 feet, 0.8 kilometers.

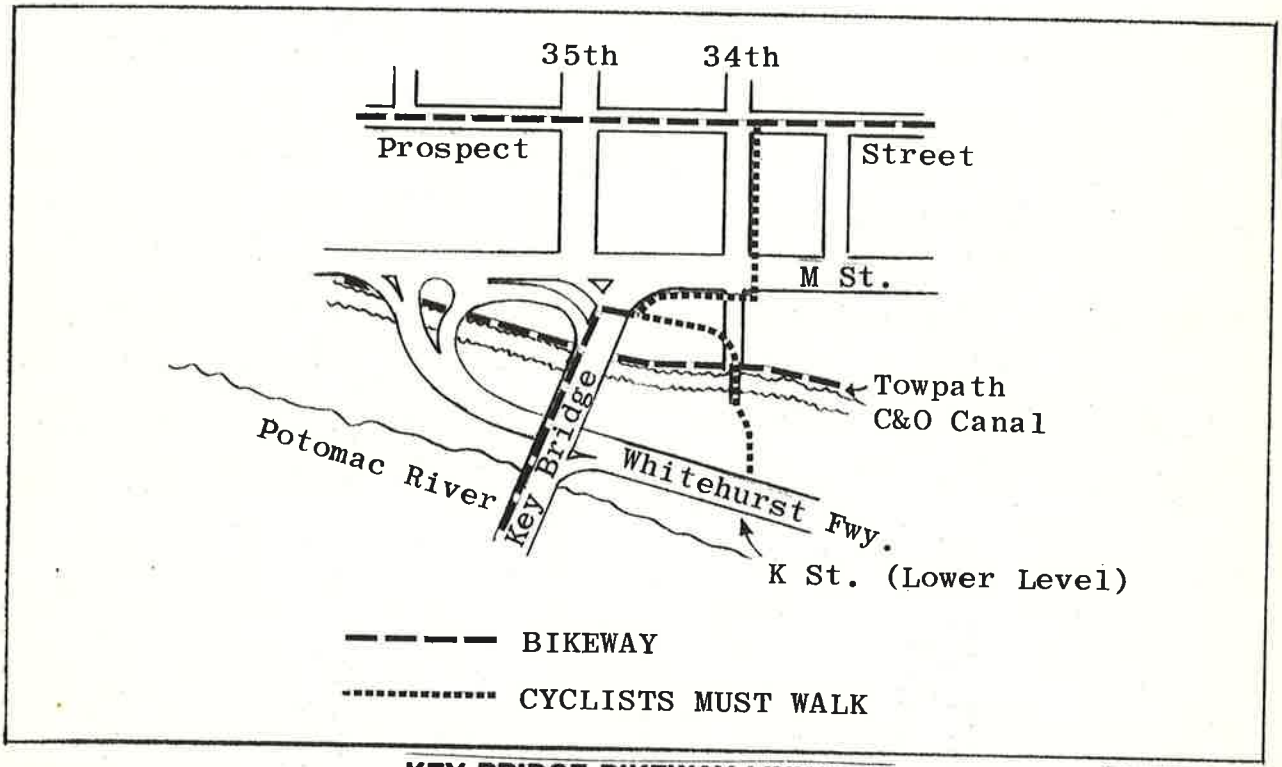
From 30th Street to 34th Street along lower "K" Street, N.W., connecting with the Rock Creek Bikeway.

FUNCTION: This route provides connections from Georgetown and Key Bridge to Downtown Washington.

TREATMENT: This bikeway is to be designed and implemented as the redevelopment of lower "K" Street is being planned.

UNIQUE ASPECTS OF THE ROUTE: This wide collector street presently serves an industrial waterfront area. The area is being rezoned and redeveloped as a retail/office/residential area and the reconstruction will provide an opportunity to establish a bikeway along "K" Street. A protected Class II Bikelane facility is recommended.

PROBLEMS: A connection from the east end of lower "K" Street to the existing Rock Creek bikeway has been provided by the Department of Highways and Traffic.



KEY BRIDGE BIKEWAY LINKAGES FIGURE

MASSACHUSETTS AVENUE

APPROXIMATE LENGTH: 3.3 miles, 17,600 feet, 5.4 kilometers

From Western Avenue to Belmont Street along Massachusetts Avenue, N.W.

FUNCTION: Connectors from Northwest Washington to the employment area of the District.

TREATMENT: Class III sidewalk bikeway built on each side of the road adjacent to the existing sidewalks within the right-of-way of the existing street.

UNIQUE ASPECTS OF THE ROUTE: This route is attractive due to the connection provided into the high employment area of the District and the wide right-of-ways that now exist which can be utilized for a bikeway. Since long stretches of the route have no cross streets in the area of American University and the U.S. Naval Observatory, the number of intersections are limited. This will increase the safety of the route considerably. Southeast of the Rock Creek Bridge along Masschusetts Avenue, D. C. Highways Department has proposed to extend the bikeway to Scott Circle.

PROBLEMS: There are several major problems that presently exist with this route. (1) The intersections of the route with the streets must be clearly marked so as to alert the bicylists and motorists. The automobile driver does not expect a bicyclist to be entering the street at a fast speed from the sidewalk. Therefore, warning signs for the bicyclist will be needed at most intersections. Yield signs can be utilized at the low volume streets. The automobile stop line must be delineated to allow a path for the cyclist to cross if cars are waiting at a signal. (2) There will be a need to separate the pedestrian and bicycle traffic in some positive manner. The conflict between the bicyclist and the pedestrian is an important aspect to be addressed. This may best be accomplished with different surface treatments. Painted signs on the surface designating the bikeway will also be needed. (3) A method is needed to allow the cyclist to negotiate traffic circles. The problem arises from the cyclist's desire to continue around the circle, bypassing one or more of the adjoining streets. Warning signs for both the cyclist and the motorist are needed in this situation along with a design study for cycling within traffic circles.

MONTROSE PARK ROUTE

APPROXIMATE LENGTH: 0.4 miles, 2000 feet, 0.6 kilometers

From "R" Street to Massachusetts Avenue along Lover's Lane.

FUNCTION: Linkage between Georgetown and Massachusetts Avenue.

TREATMENT: Class I/Bikepath

UNIQUE ASPECTS: This route is to be located on an existing dirt utility road through Rock Creek Park.

PROBLEMS: Lover's Lane is under the jurisdiction of the National Park Service. Consequently, permission to build a bikeway here will be necessary.

"N" STREET, NORTHWEST

APPROXIMATE LENGTH: 0.7 miles, 3900 feet, 1.2 kilometers

From 30th Street to potomac Street along "N" Street, N.W., and from Potomac Street to 37th Street along Prospect Street, N.W.

FUNCTION: Connector from Trolley Line Bikeway and Georgetown to the high employment area of the District.

TREATMENT: Preferential bicycle street.

UNIQUE ASPECTS OF THE ROUTE: This route was selected as an experimental bicycle street early in the study. The low traffic volumes and negligible amount of through traffic offers an opportunity to exclude motor vehicle traffic from the street except for local access only.

PROBLEMS: The major problem with this connection is the severe grade that exists between the north end of the Key Bridge and "N" Street. The cyclist will have to walk this section if he cannot negotiate the grade on his bicycle. (see preceding page) Most likely, the experienced cyclists will attempt to negotiate the traffic on "M" Street rather than cope with the hill. Consequently, the major use of this route will be from the Trolley Line Route and from those areas north of Georgetown.

Due to heavy vehicular and pedestrian traffic on "M" Street, no option was available that would not severly limit the traffic carrying capability of "M" Street.

OBSERVATORY CIRCLE

APPROXIMATE LENGTH: 0.4 miles, 2400 feet, 0.7 kilometers.

From Wisconsin Avenue to Massachusetts Avenue along the Whitehaven Parkway and Observatory Circle.

FUNCTION: This link will provide a connection between the residential areas west of Wisconsin Avenue (such as Glover Park) with the Massachusetts Avenue Bikeway.

TREATMENT: Class I Bikeway and Improved Bicycle Street.

UNIQUE ASPECTS: This route will utilize a small portion of the Whitehaven Parkway right-of-way (the Class I Section) and then connect to Observatory Circle, a short local street which connects to Massachusetts Avenue. Because of the local nature of this street, only the Improved Bicycle Street treatment will be necessary.

PROBLEMS: An investigation must be made of the feasibility of a bikeway on the Whitehaven Parkway right-of-way.

"P" AND "Q" STREETS, NORTHWEST

APPROXIMATE LENGTH: 0.8 miles, 4100 feet, 1.2 kilometers.

From 30th Street to Massachusetts Avenue along "P" and "Q" Streets, N.W.

FUNCTION: A connection across Rock Creek Parkway to the grid system.

TREATMENT: Improved bicycle street and bike lanes functioning as one-way pair.

UNIQUE ASPECTS OF THE ROUTE: This route will provide alternatives from the Georgetown area into the bike route grid system.

PROBLEMS: The two streets will act as one-way pairs providing access across Rock Creek Parkway. The major problem is that the two streets are now narrow residential streets. Consequently, no special facilities can be provided. These will connect Georgetown to the Massachusetts Avenue bikeway, and the 20th and 21st Street Bikeways.

The crossing of the Rock Creek "barrier" is the important function served by these routes. Due to the wide bridge surface and the possibility of providing bikelanes, this option is attractive.

RHODE ISLAND AVENUE

APPROXIMATE LENGTH: 4.5 miles, 23,500 feet, 7.2 kilometers.

From Eastern Avenue to 16th Street along Rhode Island Ave., N.W.

TREATMENT: This is a problem route - see Appendix.

FUNCTION: Rhode Island Avenue is a direct connection from the northeast to the grid in close proximity to the high employment area.

UNIQUE ASPECTS OF THE ROUTE: This route will serve to connect a major residential area to the employment center of the District. This route also serves the industrial employment within the Rhode Island/New York Avenue corridor. If this route is not developed, then an alternative route must be implemented.

No suitable route alternative was determined in the Rhode Island corridor. The Brentwood Parkway route will serve as a connector to the eastern extreme of the grid.

PROBLEMS: As with the other diagonal routes, the intersections will cause problems for the bicyclist. But since Rhode Island Avenue is a major through route, many of the intersection conflicts are alleviated by traffic controls. Also, because this is a major through route, traffic volumes are heavy. Provisions for separating the cyclist from the motor vehicle flow should be examined (e.g., bikelanes, shared bike-bus lanes, median bikelane, etc.).

ROCK CREEK BIKEWAY CONNECTIONS

The existing Rock Creek Bikeway is a well-used facility which will continue to be a focus of bicycling activity as more segments of it are completed. Currently, all access to the bikeway is via roads which enter the Park. To improve safety and encourage use of the existing bikeway, several access routes should be developed. These routes would be within the jurisdiction of the Park Service. As such, their specific location and treatment is a matter for Park Service consideration and therefore was not included in this study.

TENTH AND TWELFTH STREETS, NORTHWEST

APPROXIMATE LENGTH: 0.8 miles, 4300 feet, 1.3 kilometers.

From "Eye" Street to Constitution Avenue along 10th and 12th Streets, N.W.; from 10th and 12th Streets along Constitution Avenue, N.W.; and from Constitution Avenue to Jefferson Drive along 12th Street extension through the Mall.

FUNCTION: Serves as part of the downtown grid.

TREATMENT: From "I" Street to Constitution Avenue, both routes are bikeroutes operating as a one-way pair - 10th Street southbound and 12th Street northbound. On the south sidewalk of Constitution Avenue between 10th and 12th and through the Mall on 12th Street are to be sidewalk bikeroutes.

UNIQUE ASPECTS OF THE ROUTE: These routes will serve many of the high employment areas in the Federal Triangle and in downtown Washington.

PROBLEMS: Both 10th and 12th Streets are high volume streets and may need special provisions for cyclists. It may be possible to implement bikelanes due to the one-way operation of these streets. This possibility should be given further study.

THIRTEENTH STREET, NORTHWEST

APPROXIMATE LENGTH: 6 miles, 31,500 feet, 9.6 kilometers.

From Eastern Avenue to "H" Street along 13th Street, N.W.

FUNCTION: Connector from residential area to employment center.

TREATMENT: Class II bikeway, exclusive bike lane protected north to Piney Branch Road; preferential bikeway to Walter Reed Hospital; priority bike street from Walter Reed Hospital to Eastern Avenue.

UNIQUE ASPECTS OF THE ROUTE: This route will serve as a connector in a high use corridor. A number of accidents along 14th Street and others in this area denote high bicycle use and a definite safety problem.

It is suggested that comparison be made between the use of 13th Street and 8th Street which is suggested as an improved bicycle street. At present, we do not know the attracting capabilities of the various classes of bikeways. Hopefully, this test will give some indications of the ability of the various types of bikeways to generate bicycle use.

Due to the four lane, one-way directional traffic in peak periods the option of providing an exclusive lane was present without severely limiting the automobile carrying capability of the route. The options (14th St. and 11th St.) could only offer mixed traffic use since the two-way traffic could not be accommodated if a bikelane was provided.

PROBLEMS: The high traffic volumes of 13th Street create an air and noise pollution factor which is a detriment to the bicyclist's health.

There is a need to obtain right-of-way through Walter Reed General Hospital if this route is to serve the northern extremes of the District of Columbia. There are indications that Walter Reed authorities would be agreeable to this.

THIRTY-FIRST STREET, N.W.

APPROXIMATE LENGTH: 0.5 miles, 2800 feet, 0.7 kilometers

From "M" Street to "R" Street along 31st Street, N.W.

FUNCTION: North-south linkage through Georgetown

TREATMENT: Class III - Improved Bicycle Street

UNIQUE ASPECTS OF THE ROUTE: None

PROBLEMS: This is a narrow two-way street with parking on both sides. This route should be monitored for potentially dangerous conflicts between motorists and cyclists. Removal of parking from one side may be warranted.

TROLLEY LINE

APPROXIMATE LENGTH: 2.8 miles, 14,700 feet, 4.5 kilometers

From Cathedral Avenue to 37th Street along the Trolley Line right-of-way.

FUNCTION: This route will serve as a connector from the residential areas of Northwest Washington to Georgetown University.

TREATMENT: Class I Bikeway

UNIQUE ASPECTS OF THE ROUTE: At present the Canal Towpath serves this corridor as a bikeway. The National Park Service has plans to reinstate barge traffic on the canal as a tourist attraction with the use of mules. Given this use, the Towpath will no longer be suitable for bicycle use. Therefore, there is a need to substitute a bikeway for the Towpath. It appears that the trolley line provides an excellent opportunity, particularly because it is much more accessible to the Palisades residential area than the Towpath.

This bikeway can be especially attractive environmentally if "good" design features are utilized. At various places the bikeway route will provide an excellent view of the Potomac River and the Palisades. Thus, it can also serve as a linear park to be enjoyed by pedestrians as well.

PROBLEMS: The major problem appears to be acquisition of the right-of-way for this bikeway. The tressels that still exist along the length of the right-of-way appear to be in good structural condition. An examination of these tressels will be required to determine the feasibility of their use. The at-grade crossings of some streets may present a minor safety problem which can be handled by signing on both the bikeway and the street. Stop signs or signals for the bicyles and autombile traffic may be required.

The trolley car right-of-way now traverses an area adjacent to the yard area of a number of residential homes. Some fencing will be necessary in this area to alleviate any complaints of these residents.

TWENTIETH AND TWENTY-FIRST STREETS

APPROXIMATE LENGTH: 1.3 miles, 6700 feet, 2.1 kilometers.

FUNCTION: A part of the downtown grid system. These streets will operate as a one-way pair in the direction of travel.

TREATMENT: Improved bicycle streets.

UNIQUE ASPECTS OF THE ROUTE: These routes will provide direct connections from the Massachusetts Avenue route to the entire grid system including Virginia Avenue. It will also allow a connection from the P-Q pair to the grid.

PROBLEMS: These are heavily congested streets during the peak hour. While no problem is foreseen with the traffic, consideration should be given to implementing bikelanes.

UTAH AVENUE

APPROXIMATE LENGTH: 1.5 miles, 8100 feet, 2.5 kilometers.

From Western Avenue to 27th Street along Utah Avenue, N.W., from Utah Avenue to Swart Road along 27th Street, N.W., and from 27th Street to Broad Branch Road along Swart Road, N.W.

NEVADA AVENUE

APPROXIMATE LENGTH: 1.0 miles 5000 feet, 1.5 kilometers.

From Western Avenue to Broad Branch Road along Nevada Avenue, Northwest.

These two routes are described together because of their similar characteristics.

FUNCTION: Both Utah and Nevada routes serve the Chevy Chase D.C. area as arterial routes oriented toward the Rock Creek Bikeway, and Van Ness Metro Station area, and downtown Washington.

TREATMENT: Improved Bicycle Street.

UNIQUE ASPECTS: Both Nevada and Utah are wide, two lane streets with parking on both sides. Both function as collector streets through residential areas and carry moderate peak hour traffic volumes. With the exception of a few intersections, all cross-streets are under stop sign control giving cyclists on the proposed routes the right-of-way.

PROBLEMS: None

VIRGINIA AVENUE, NORTHWEST

APPROXIMATE LENGTH (in two sections) 0.7 miles, 3900 feet, 1.2 kilometers.

From Constitution Avenue to 22nd Street.

FUNCTION: Continuation of the existing bikeway on Virginia Avenue.

TREATMENT: Class III - Sidewalk Route

UNIQUE ASPECTS OF ROUTE: The existing wide sidewalk is only moderately used by pedestrians.

PROBLEMS: The continuity of the street is disrupted due to changing directional flows and diagonal intersections. Further design study may be necessary on this route.

BENNING ROAD

APPROXIMATE LENGTH: 0.8 miles, 4200 feet, 1.3 kilometers.

From Maryland Avenue to Oklahoma Avenue along Benning Road, N.E.

FUNCTION: Connects the Anacostia residential area to the employment district and breaches the barrier created by the Anacostia River.

TREATMENT: Use of the bus lane.

UNIQUE ASPECTS OF THE ROUTE: None

PROBLEMS: This route has high traffic volumes due to the crossing of the Anacostia River, the railroad corridor, and the Anacostia Freeway. Opportunities to provide an exclusive bikeway are limited in this corridor. However, the use of the bus lanes provides some separation from the main flow of motor vehicle traffic.

BRENTWOOD PARKWAY

APPROXIMATE LENGTH: 1.5 miles, 7700 feet, 2.4 kilometers.

From Rhode Island Avenue to Penn Street along Brentwood Parkway, N.E. and from Penn Street to "M" Street, N.E. along 6th Street, N.E.

FUNCTION: Provides a connection from residential areas to the CBD grid.

TREATMENT: Class I bikeway or a Class III sidewalk route similar to that of Massachusetts Avenue Northwest.

UNIQUE ASPECTS OF THE ROUTE: There appears to be an unused sidewalk right-of-way along the entire parkway which may be utilized for the implementation of a bikeway. Brief field checks indicate that there is low pedestrian use along this route, but some monitoring should be done to determine the volume of this activity. This route is adjacent to Gallaudet College and will provide a connection between the college and the downtown employment center of the District. Any alternative to this route would be much less direct and involve bicycling in mixed traffic. This route can also serve as a partial alternative to the Rhode Island Avenue route.

PROBLEMS: This bikeway will pass through a heavily industrialized area. In the field investigation of this route it was found that many automobiles are now parking on the sidewalk right-of-way. There is no reason to believe that this practice would cease once the bikeway has been constructed unless suitable protection is also installed. In addition, enforcement of parking regulations may also be necessary if the bikeway is to function as designed.

DELAWARE AVENUE, N.E.

APPROXIMATE LENGTH: 0.3 miles, 1500 feet, 0.5 kilometers

From Capitol Hill to Union Station along Delaware Avenue, N.E.

FUNCTION: Provides a connection between Capitol Hill and Union Station.

TREATMENT: Improved bicycle street. Future treatment - Preferential bicycle street.

UNIQUE ASPECTS OF THE ROUTE: It has been proposed that this street be closed to motor vehicle traffic. This presents an opportunity for an exclusive bikeway along with other non-motorized facilities.

PROBLEMS: No problems are evident at this time.

EAST WASHINGTON RAILROAD (NORTHEAST)

APPROXIMATE LENGTH: 1.9 miles, 9800 feet, 3.0 kilometers.

From Eastern Avenue to Deane Avenue along the East Washington Railway right-of-way and from Deane Avenue to Minnesota Avenue along Hunt Place, N.E.

FUNCTION: Connects residential area to Fort Circle Bikeway. and Benning Road Bikeway.

TREATMENT: Class I bikeway.

UNIQUE ASPECTS OF THE ROUTE: The possibility of acquiring the East Washington Railway right-of-way offers an opportunity to implement in Anacostia a Class I bikeway similar to that proposed for the Trolley Line Route. While this route is somewhat isolated, it passes through a dense residential area in Northeast Anacostia.

An alternate route through the same area is along the Watts Branch Parkway corridor. This is probably a more scenic route that would also avoid many of the cross streets incurred along the railroad right-of-way.

PROBLEMS: At the present time, this railroad is used very little. It has been mentioned as a possibility for abandonment in the near future. Of course, unless it is abandoned, it could not be pursued as a bikeway.

The alternatives to this route would utilize either the Watts Branch Parkway or local residential streets. As a general rule, anytime a separate right-of-way can be obtained which is as direct a connection as any of the alternatives, the separate right-of-way should be utilized.

ELEVENTH STREET

APPROXIMATE LENGTH (in two segments): 1.2 miles, 6400 feet, 2.0 kilometers.

From Lincoln Park to "H" Street, N.E., along 11th Street, N.E.; and from "M" Street S.E. to Ridge Place, S.E. along the northbound 11th Street Bridge.

FUNCTION: Provides a connection from residential areas to existing bikeways and also forms a segment of the grid system.

TREATMENT: Class III - sidewalk bikeway operating as a one way pair across the 11th Street bridges to Anacostia. Class II - Bikelane from "H" Street N.E. to East Capitol Street.

UNIQUE ASPECTS OF THE ROUTE: Provides a crossing of the Anacostia River.

PROBLEMS: Access onto the 11th Street bridge pair and connections may present some problems of a design nature. It is suggested that sidewalk bikeways be implemented on the bridges. These should be one-way bikeways, each in the direction of automobile flows. The two bikelanes would rejoin 11th Street at "M" Street, along which the northbound bikeway intersects the southbound bikeway.

North of East Capitol Street, 12th Street will be utilized because 11th Street is one-way southbound from that point.

This specific alternative was chosen since the problems of implementation have been solved for most of the route. The same type of treatment should be utilized if a route were located on any of the adjacent streets. Therefore, no benefit in changing the location of this bikeway is evident.

FOURTH AND SIXTH STREETS, NORTHEAST

APPROXIMATE LENGTH: 2 miles, 10,600 feet, 3.2 kilometers.

From "M" Street, S.E. to "M" Street, N.E., along 4th and 6th Streets, S.E. and N.E.

FUNCTION: Element of the grid system.

TREATMENT: Improved bicycle street. These two streets will act as a one-way pair of bikeways. Sixth Street will operate northbound and Fourth Street will be southbound.

UNIQUE ASPECTS OF THE ROUTE: The paired routes will connect bikeways entering the employment districts from the northeast and southeast.

PROBLEMS: No specific problems are evident at this time.

TWELFTH STREET, NORTHEAST

APPROXIMATE LENGTH: 0.7 miles, 3500 feet, 1.1 kilometers.

From Lincoln Park to "H" Street N.E. along 12th Street N.E.

FUNCTION: Part of a one-way pair with 11th Street north of East Capitol, a residential penetrator.

TREATMENT: Class II Bikelane - protected.

UNIQUE ASPECTS OF THE ROUTE: None

PROBLEMS: No specific problems are evident at this time.

OTHER NORTHEAST ROUTE EXTENSIONS

BOLLING AIR FORCE BASE ROUTE

APPROXIMATE LENGTH: 3.1 miles, 16,500 feet, 5.0 kilometers.

From South Capitol Street to Laboratory Road along the B & O railroad right-of-way.

FUNCTION: Connects residential areas to the employment center of District and connects new redevelopment of the Air Force Base to the District.

TREATMENT: Class I bikeway. This route would utilize the Baltimore and Ohio Railroad right-of-way through Bolling Air Force Base for the majority of the route. Connections are needed on South Capitol Street to connect the area east of I-95 to the route and on Portland for the same purposes. It should be noted that the specific design at this time cannot be determined due to the state of flux of Bolling Air Force Base. It is suggested that Bolling Air Force Base be contacted for the use of the abandoned railroad line. This would be ideal for a high quality bikeway.

UNIQUE ASPECTS OF THE ROUTE: The complete redevelopment of this area and the possible abandonment of the railroad provides the unique opportunity to develop a Class I bikeway. Therefore, the possibilities for such a bikeway suggest that the Air Force be convinced that such a use is compatible with their redevelopment plans. A route in this corridor is needed due to the distance of the residential area east of I-295 from any proposed transit station. This route can provide access to either the METRO stations or into the District.

PROBLEMS: The District government has no control over the redevelopment of Bolling Air Force Base. A letter to the Commander of Bolling Air Force Base suggesting that a bikeway is needed in this area would be desirable. The planning of such a route must begin now.

There are also problems concerning the connections to the bikeway that crosses the Anacostia River. Problems will also exist with connection to South Capitol due to the high traffic volumes now carried on this route. The same will be true of Portland Street. However, a joint connection of this route and the Suitland Parkway Bikepath to the South Capitol Street Bridge may be feasible.

The National Capital Park Service has proposed a bikeway along the east bank of the Anacostia River. If this is built instead of the B & O route, convenient connections must be provided so that a crossing of the Anacostia is possible and access from the residential neighborhoods east of I-295 can be made.

"M" STREET, SOUTHEAST

APPROXIMATE LENGTH: 0.4 miles, 2200 feet, 0.7 kilometers.

From 6th Street S.E. to 11th Street, S.E. along "M" Street, S.E.

FUNCTION: Extension of an existing bikeway creating a continuous route from the 11th Street Bridge to the Mall.

TREATMENT: Improved bicycle street or a Class III sidewalk route.

UNIQUE ASPECTS OF THE ROUTE: None

PROBLEMS: No problems are evident at this time.

NEW JERSEY AVENUE

APPROXIMATE LENGTH: 0.8 miles, 4000 feet, 1.3 kilometers.

From "M" Street, S.E. to the Capitol along New Jersey Avenue.

FUNCTION: An alternative to the South Capitol Street route.

TREATMENT: An improved bicycle street or a Class II bikelane.

UNIQUE ASPECTS OF THE ROUTE: An alternative or substitute for South Capitol Street.

PROBLEMS: No specific problems are evident at this time. Although this route is less direct than South Capitol, it carries much less traffic and does not have the problems of high speed ramps which are on South Capitol.

PENNSYLVANIA AVENUE, SOUTHEAST

APPROXIMATE LENGTH (2 Sections): I. 1.7 miles, 8,800 feet, 2.7 kilometers. From Southern Avenue to the Anacostia Freeway along Pennsylvania Avenue, S.E.; II. 0.9 miles, 4,600 feet, 1.4 kilometers. From 11th Street S.E. to 2nd Street, S.E. along Pennsylvania Avenue S.E., and from Pennsylvania Avenue, S.E. to East Capitol Street along 2nd Street, S.E.

FUNCTION: Provides a connector between residential areas and the downtown employment district.

TREATMENT: Class I bikeway on the median. East of the Anacostia River, this route is a problem area - See Appendix.

UNIQUE ASPECTS OF THE ROUTE: Pennsylvania Avenue is one of the few direct connections from downtown Washington to Anacostia.

PROBLEMS: The basic problem with this route and its suggested treatment is that of intersections. Because of the recommendation to implement the bikeway in the median, conflicts for the motorist arise at intersections. The motorist does not expect a cyclist to be crossing an intersection on the median. The ultimate method of eliminating this conflict is to restrict all left turns. If all left turns cannot be eliminated, then these intersections must be designed to maximize the safety of the cyclist. One possible alternative is to set up a separate signal phase for left turns. Another problem is that the median is under the jurisdiction of the National Park Service. This in itself may create a problem in implementation.

SUITLAND PARKWAY

APPROXIMATE LENGTH: 2.3 miles, 12,300 feet, 3.8 kilometers.

From Southern Avenue to the Anacostia Freeway along Suitland Parkway, S.E.

FUNCTION: Connects residential area to bikeway which will cross Anacostia River and provide access to employment center of the District.

TREATMENT: Class I bikeway. This will utilize the shoulders of the road and in sections will be separate from the motor vehicle travel surface.
UNIQUE ASPECTS OF THE ROUTE: One of the few Class I opportunities in the District.

PROBLEMS: Major problems of this route will be the junctions of the bikeway with the on and off-ramps of the Parkway. Special design features should be built into the bikeway to minimize this conflict.

It is suggested that the bikeway be angled so that the bicyclist is perpendicular and in full view of the automobile traffic approaching the on and off-ramps. Also, it is suggested that the bicyclist be required to stop before crossing these ramps. This is especially important for the off-ramps.

If there is room to store automobiles on the "on" ramps, a stop sign or yield for auto traffic may be instituted. Traffic counts would have to be taken to determine the number of cars queuing at each ramp.

At points there may be a problem with the width of the right-of-way. This is especially true of the southern side of the parkway.

It should be noted that where the bikeway has to be placed on the shoulders, some adequate type of barrier must be utilized to separate the bicycle from the automobile. This cannot be a concrete curb due to the safety problems for high speed automobile traffic, but could be permanent plastic pylons or a guard rail.

There will be a need to provide access for the bicyclist from residential streets. This can be done mostly conveniently and safely by providing bikeways to penetrate the parkway at points other than the major auto access points.

No options were offered to this route. The possibility of constructing a Class I bikeway which provides a direct connection from a large residential area to the grid system in the downtown area is unique. Any option that would utilizes less than a Class I design would most likely be rejected.

OTHER SOUTHEAST ROUTE EXTENSIONS

"I" STREET, SOUTHWEST

APPROXIMATE LENGTH: 1.0 miles, 5200 feet, 1.6 kilometers.

From New Jersey Avenue to Maine Avenue along "I" Street, S.W.

FUNCTION: Residential penetrator and an alternative detour route for South Capitol Street.

TREATMENT: Improved bicycle street.

UNIQUE ASPECTS OF THE ROUTE: None

PROBLEMS: No problems are evident at this time.

TENTH STREET/BANNEKER CIRCLE

APPROXIMATE LENGTH: 0.6 miles, 3100 feet, 0.9 kilometers

From Independence Avenue to Banneker Circle along 10th St., S.W.

FUNCTION: Provides a connection from the residential Southwest to the Mall and the grid system.

TREATMENT: Preferential bicycle street.

UNIQUE ASPECTS OF THE ROUTE: This route uses the L'Enfant Plaza which provides an excellent cycling environment.

PROBLEMS: This route crosses Smithsonian Institution property. Consequently, the appropriate consent to construct this bikeway facility should be obtained. Connections to Memorial Bridge and Potomac Park are presently hindered by a wall which surrounds Banneker Circle. The Department of Highways and Traffic is now investigating a connection from Banneker Circle to Hains Point for cyclists.

U.S. CAPITOL GROUNDS

APPROXIMATE LENGTH: 1.0 miles, 5300 feet, 1.6 kilometers

FUNCTION: To connect the existing East Capitol Street Bikeway and the proposed Mall Bikeways across the U.S. Capitol Building Grounds.

TREATMENT: Various treatments - See Appendix

UNIQUE ASPECTS OF THE ROUTE: None

PROBLEMS: Currently, bicyclists operate in mixed traffic through the Capitol Grounds. Problems occur in the parking area east of the Capitol Building where there is no defined route for bicycles, and at the First Street (NW & SW) intersections with the ring road.

While this proposal defines a treatment in these two problem areas, some conflicts will remain due to the clockwise motor vehicle traffic flow around the Capitol Building. It is recommended that the U.S. Capitol Architect consider alternatives to the current operation which would provide a safer and more convenient route for bicycles. Reversing the direction of flow would accomplish this.

EAST CAPITOL STREET

APPROXIMATE LENGTH: 2.3 miles, 11,900 feet, 3.6 kilometers.

From Southern Avenue to Minnesota Avenue along East Capitol Street.

FUNCTION: An extension of an existing bikeway connecting Anacostia with the downtown grid system.

TREATMENT: This is a problem area - See Appendix.

UNIQUE ASPECTS OF THE ROUTE: East Capitol Street provides a direct connection from Anacostia into the District. This route also connects with the Fort Circle biketrail.

PROBLEMS: East Capitol Street presently carries a large amount of automobile traffic during peak hours. Decreasing the number of lanes or narrowing those lanes will decrease the capacity of an already saturated street. Therefore, the phasing of this segment of the plan should be postponed until other elements of the system have created sufficient demand in this corridor. This should insure maximum use of this route.

SOUTH CAPITOL STREET (Anacostia)

APPROXIMATE LENGTH: 1.4 miles, 7600 feet, 2.3 kilometers.

From Overlook Avenue to Southern Avenue along South Capitol Street.

FUNCTION: Residential penetrator connecting to the downtown grid network.

TREATMENT: Improved bicycle street.

UNIQUE ASPECTS: This is a relatively flat route through the southern part of Anacostia.

PROBLEMS: South Capitol is a high volume street necessitating added protection for cyclists. However, since the proposed routes in Bolling Air Force Base roughly parallel the South Capitol route, this is a low priority consideration.

SOUTH CAPITOL STREET (north from the Frederick Douglass Bridge)

APPROXIMATE LENGTH: 0.7 miles, 3700 feet, 1.2 kilometers

From "M" Street S.E. to the Capitol along South Capitol Street.

FUNCTION: Serves as a segement of the grid. Provides a connection from bikeways in the south to the Federal employment center.

TREATMENT: Varies - (1) from the Frederick Douglass Bridge to "M" Street, the cyclists will share the proposed bus lanes. (2) From "M" Street north it is suggested that cyclists detour to either New Jersey or Main Avenues via either "I" or "M" Streets. (See separate treatment on each of these routes.) (3) North of "I" Street this is a Class III bikerout.

UNIQUE ASPECTS OF THE ROUTE: This route would serve as a connection between those routes coming in from the south with the Mall and the Federal buildings in this area.

PROBLEMS: This street carries a high volume of traffic. The entrance and exit ramps of I-95 at 'I' Street present hazards for those who wish to continue on South Capitol Street. The suggested detours provide safe alternatives.

APPENDIX

Several of the routes suggested present problems that have no easy solution. These are located primarily in the corridors of high automobile volumes and few alternative routes. The following is a summary of the various alternatives considered for Rhode Island Avenue, East Capitol Street, Pennsylvania Avenue, and the Capitol grounds.

The Problem

Each of the streets mentioned above carries extremely high volumes of traffic. The possibilities for implementing an exclusive facility for bicycles conflicts with the traffic capacity and subsequently, the volume of traffic carried by these streets. It is apparent that the solution to this problem is strictly a policy decision. The optimum provision for cyclists is to extract a lane from motor vehicle use providing the cyclist with his own exclusive right-of-way. An examination of each individual situation brought to the attention of the study group resulted in the conclusion that there are not many reasonable alternatives. The alternatives investigated included: use of the street medians, sidewalk bikeways similar to the Massachusetts Avenue recommendation, contra-flow bikelanes, and street widenings. Each of these divulged problems of costly implementation and hazards to both cyclists and motorists due to unorthodox traffic movements. The recommendation that existing lanes be narrowed to allow a wider curb lane for increased maneuverability by both the cyclist and the motorist was taken as the best alternative at this time.

Alternative Treatments for Problem Area Routes

This section summarizes several of the alternatives considered for the aforementioned problem routes. Other solutions were posed, but were given only cursory evaluation because they were deemed highly impractical or infeasible due to costs, safety conflicts, private property encroachment, and traffic disruption.

Alternative 1: Construct a sidewalk bikepath. On some streets (e.g. Massachusetts Avenue, N.W.) there is an extremely wide right-of-way. This provides the opportunity to construct a path for cyclist adjacent to the existing sidewalk for pedestrians. This path may be visually distinguished by using a material different from that of the sidewalk or special bicycle markings. This alternative is particularly applicable to routes carrying high pedestrian traffic and where there is sufficient right-of-way.

Alternative 2: Decrease existing lane widths. Most of the arterial streets in the District have eleven foot traffic lanes. These lanes can be decreased to ten feet to allow extra space in the outside lane for extra maneuverability by both the motorist and the cyclist. Decreasing the interior lane widths may also create sufficient space for a marked bikelane. Nevertheless, this alternative is only effective on streets where the resulting curb lane can reasonably accommodate both the cyclist and the motorist. Current AASHTO (American Association of State Highway and Transportation Officials) recommend a fifteen foot curb lane for mixed bicycle/motor behicle use. This alternative has the negative impact of a slight reduction in the traffic capacity of the street due to the reduction in width of the other lanes.

Alternative 3: Utilize the existing median for bicycle facilities. Many of the arterial streets in the District have 4-14 foot medians. These medians can be converted to bikeways. However, the most hazardous aspect of these median bikeways is the conflict with left-turning vehicles. Motorists are not accustomed to having cyclist on their left and would not be looking for a cyclist when making a left turn. Therefore, appropriate measures must be taken to assure the safety of the cyclist and warn the motorist of the cyclists' presence. This could be done by prohibiting left turns at certain intersections, installing separate signal phases for left turning vehicles, or providing special signal phases for cyclists.

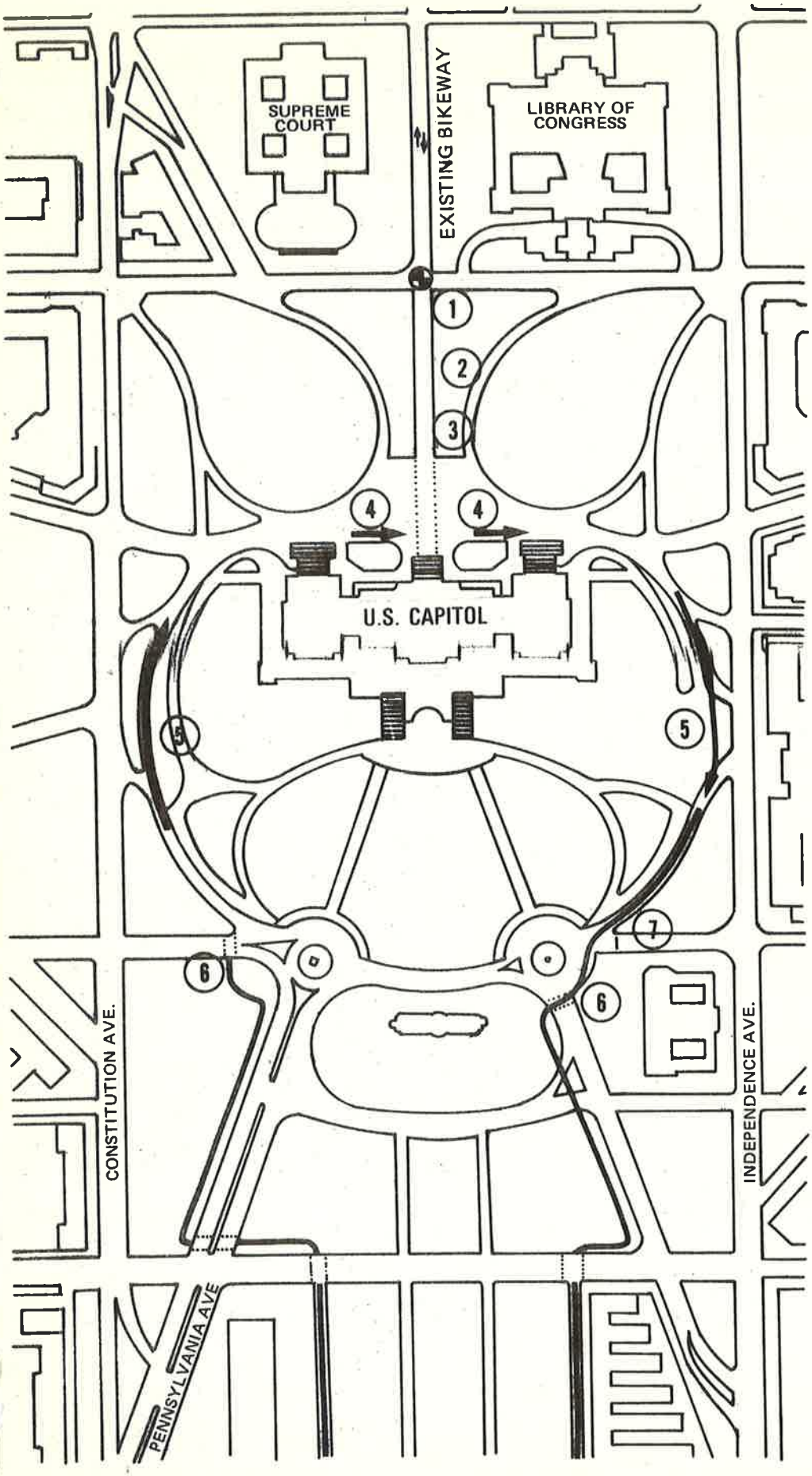
Alternative 4: Establish contra-flow bikelanes. On streets that have a high directional traffic flow factor during the peak period, a lane may be converted to bicycle use in the low volume direction. This alternative has several design and movement conflicts which must be corrected before it can be implemented. The more prominent of the problems with this alternative are: conflicts with left-turning vehicles (as mentioned in Alternative 3), head-on conflicts with vehicles using the curb lane while making a right turn, and conflicts with buses and delivery vehicles entering the curb lane. The measures that can be taken to remove these conflicts often negate the advantages this alternative has over others. While this alternative is a possible solution on many routes, it should be given further study and design before implementation.

Alternative 5: Convert a movement lane from vehicular use to a bikelane. This is the second best facility that can be provided for the cyclist; and in the District of Columbia, it is the best facility due to the lack of right-of-way for Class I exclusive facilities. However, on most arterial streets it has the drawback that it greatly reduces automobile capacity. At this time there are not sufficient volumes of cyclists to justify this alternative on many streets, but this is not to say that such a facility would not ultimately

generate cyclists. As previously mentioned, this is a policy decision. One or two test facilities should be implemented in key corridors and monitored for their use (see Memorandum 4, "Proposed Program for Monitoring Bicycle Facility Use".

Recommended Treatments for Problem Routes

Rhode Island Avenue - Alternative 2
East Capitol Street - Alternative 2
Pennsylvania Avenue, S.E. - Alternative 3 where median exists.
Capitol Grounds - See diagram on the following page.



NOTES

(1) Signal at East Capitol and First will need minor modifications

(2) Bicycles in mixed traffic

(3) Widen existing pedestrian walk (remove 4 parking spaces)

(4) Bicycles in mixed traffic

(5) Cross section

(6) Bicyclist actuated signal at crossing

(7) Motor vehicles yield

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 11

Bicycle Parking Needs and Policy Guidelines

February 18, 1975

INTRODUCTION

It is a generally accepted premise that the fear of bicycle theft is a deterrent to bicycle use. Because secure bicycle parking is, by definition, a deterrent to theft, the provision of such facilities may be a very significant factor in encouraging purposeful bicycle trip-making in the District of Columbia. This memorandum shows the need for such facilities and presents various options to implement a city-wide program to provide them.

NEED FOR BICYCLE PARKING FACILITIES -

Current Bicycle Theft Problems

A telephone survey conducted for this study asked District of Columbia residents several questions regarding their experience(s) with bicycle thefts.[1] Based on the sample data, about 13,300 bicycles were stolen from D. C. residents in 1974. This is 10 to 14 percent of the total owned bicycles.

About 3600 stolen bicycles were recovered. If the average value of those lost (9700) was $40, this represents a $400,000 loss to D. C. residents. In addition to lost value, residents pay other costs due to the theft problem. In 1974, 3026 thefts were reported to the police department. Valuable manpower is spent processing and investigating these reports. The cost to the public of prosecuting an apprehended bicycle thief is very high relative to the cost of the stolen property or the cost of providing high-security parking facilities.

Bicycle thefts occur both at the residence of the owner and at trip destinations away from home. About 2/3 of the 1974 thefts occurred either at the owners' residence or at the house of a friend during a visit. Much of this problem is attributable to the owner's carelessness. However, it is

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1. Technical Memorandum 1 "Survey on Bicycling Activity in the District of Columbia", A. C. Nielsen Co., November 1974

inconvenient to carry a bicycle into many apartments (in many buildings it is prohibited) and storage is often not highly secure. Thus, the provision of better storage at apartments would reduce thefts at residences to some degree.

The remaining one-third of the total thefts occurred in public places: work, school, park, shopping center or store. Over one half of the 4500 public-place thefts occurred while the owner was at a store or shopping center.

Demand for Parking Facilities

Assuming the bicycle can be used for any and all utilitarian trips, then logically bicycle storage is required at all destinations. Such provisions are absolutely necessary if the bicycle is to be utilized as a mode of transportation. It is unthinkable that the automobile could exist without convenient and safe parking. It is just as unreasonable to think that the bicycle will ever become an important mode of travel unless the problem of theft, and therefore, storage is solved.

Priority Areas Requiring Storage - Given the large number of potential bicycling destinations there is a need to set priorities for storage (parking) facilities. It is unlikely from an economic standpoint, that storage facilities can be provided at all trip attractors in the near future. Table 1 suggests some factors that need to be considered in determining where storage facilities are most needed. These are (a) duration time of storage, (b) amount of self-policing activity in area, and (c) amount of potential use of such facilities.

The question regarding the amount of potential use for parking facilities must be addressed to establish guidelines for the provision of storage facilities. Because of limited data and because the use of the bicycle is increasing dramatically, only tentative estimates of the amount needed can be made. It is suggested that facilities be installed on an experimental basis and that careful monitoring of their use be used to refine the need estimates. Fortunately, parking facilities are relatively low capital cost items and their installation need not be permanent. If too many are installed in any one place they can be removed and relocated to a higher demand area.

TABLE 1
STORAGE CRITERIA

Activity Area	Length of Storage Time	Degree of Security Required*	Standard Framework for Determining No. of Parking Spaces
Grade School	5 to 8 hours	High	- Percent of student body
Universities	1 to 15 hours	Moderate	- Percent of student body or number per classroom
Regional Shopping Centers	2 hours	Moderate	- Percent of auto parking spaces
Convenience Shopping Centers	0.5 hours	Moderate to low	- Percent of auto parking spaces
Commercial or Employment Districts	1 to 9 hours	High	- Percent of auto parking spaces
Single-Large Employer	8 hours	High	- Percent of employees or percent of auto parking spaces
METRO Stations, Fringe Parking Lots	1 to 8 hours	High	- Percent of transit patrons
Public Buildings			
- Libraries	5 min. to 2 hr.	Moderate	- Percent of facility users
- Post Offices	5 to 15 min.	Low	
- Government Offices	15 min. to 2 hr.	Low to Moderate	
- Hospitals	30 to 90 min.	Moderate	
Regional Parks	1 to 8 hours	Variable**	- Percent of facility users
Neighborhood Parks	1 to 3 hours	Variable**	- Percent of facility users
Single Recreational Activity (such as swimming pools)	1 to 5 hours	Variable**	- Percent of facility users on given day

* A function of the length of time bicycle is to be stored and the activity surrounding the storage area.
** Degree of security will depend on factors specific to each particular application.

Table 2 presents a suggested set of tentative standards which relate the amount of space required for most basic land uses. These standards are based on current levels of demands as determined in the telephone survey. An explanation for each standard follows:

1. Residential Land Uses. The current bicycle ownership rate in D. C. is about one-half bicycle per household. This is probably higher in single family homes than in households in multi-dwelling structures. The incidence of bicycling by age group indicates that college-age people are among the most frequent users of the bicycle.

2. Schools. Currently, about one in twenty students bicycles to school. Education, publicity, and the provision of bikeways and parking facilities has the effect of increasing this rate. Therefore, a school department policy in this regard should be considered.

3. Employment. About 2.5 percent of the employed members of surveyed households regard the bicycle as their primary mode of travel to work. Another 2.5 percent will bicycle to work occasionally when the weather is conducive. Thus, one space in twenty will serve existing demand and meet the needs of visitors at most employment areas.

4. Shopping. This will vary considerably with the type of store. Certain stores cater to clientele who would not use the bicycle. Many stores sell goods which could not be carried on a bicycle (furniture stores for example). Shopping centers tend to attract young people who congregate for social reasons and might represent a high demand potential. Thus, retail commercial land use needs must be established experimentally.

IMPLEMENTATION

A very rough estimate indicates that the provision of about 86,000 parking units would be required to meet the standards suggested in Table 2.* This represents a significant capital expenditure. Also, this is a conservative estimate as the demand is expected to grow markedly as a result of providing better facilities.

Several options are available to assure that the space and facilities are provided as suggested in Table 2. Several factors will determine the most appropriate option.

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* 1/20 x 600,000 jobs = 30,000
1/20 x 52,000 apts. = 26,000
1/20 x 150,000 students = 7,500
recreation related = 7,500
stores = 15,000
86,000

TABLE 2
SUGGESTED REQUIRED BICYCLE PARKING SPACES BY LAND USE

Land Uses	Amount of Bicycle Parking Space Required
Residential Uses	
One-family or two-family dwelling or flat	None
Apartment house, tenement house, or multiple dwelling	One for each two dwelling units
Rooming house	One for each five guest bedrooms
Motel and hotel	One for each twenty employees
Dormitory, sorority, or fraternity house not a part of a campus development	One for each two beds
Schools	
Nursery through Junior High School	One for every twenty students plus one for each twenty teachers and other employees
High school and accessory uses	One for every twenty students plus one for each twenty teachers and other employees
College or other institution of higher learning; business, trade, or other school and accessory uses located on campus	For each building, one for every twenty seats plus one for every twenty teachers or other employees
Institution Uses	
Hospitals, sanitariums, etc.	One for each twenty employees
Places of Public Assemblage Except Hotels	
Churches	One for every ten seats
Arena, armory, assembly hall, auditorium, concert hall, convention hall, dance hall, funeral parlor, public hall, stadium, community centers, skating rinks, theatres	One for each ten seats of first 10,000 seats; plus one for each 20 seats above the first 10,000

Land Uses	Amount of Bicycle Parking Space Required
Commercial Buildings	One for each twenty employees
Retail	One for each twenty employees plus varied customer provisions
Manufacturing and Industrial Establishments	One for each twenty employees

1. City Buildings and Land Uses. The District of Columbia must take the lead in providing these facilities. For example, in office buildings, bicyclists should be permitted to bring their bicycle into the building either to their office (if office space permits) or to indoor locking devices. Elevator conflicts can be eliminated by designating a bicycle elevator during peak periods.

   Where automobile parking is provided at City buildings or other facilities, auto spaces should be converted to bicycle spaces (one auto space = 15 bicycle spaces).

2. Other Government, Institutional, and Quasi-Public Facilities. A City Council resolution should be drafted to encourage these agencies to follow the City's lead as described above.

3. Privately Owned Buildings and Facilities. The private sector must be encouraged or required to follow suit. Encouragements could take the form of property tax rebates, and/or positive acknowledgement in the media of those property owners who are contributing to this cause. The legality of requiring the private sector to provide such facilities in existing buildings has been examined in another study Technical Memorandum.[2]

4. Commercial Off-Street Automobile Parking. The conversion of one in seventy-five off-street automobile parking spaces has been required by the U.S. Environmental Protection Agency. The means to accomplish this would be similar to those described above.

   The central area of the city has about 71,000 total off-street spaces suitable for this conversion. A conversion of one in 75, at 15 bicycles per auto would result in about 14,000 spaces or about one space for every twenty-five employees in the central area. The need for this amount of supply will depend on at least two other factors: (1) the degree to which the other sources of supply (listed above) will be able to serve demand, and (2) the user response to fee parking. Because of these two uncertain factors, this program should be initiated on an experimental basis. The City may have to guarantee subsidization of lost revenues during the experiment and to provide the locking hardware.

5. METRO-Related Parking. Another Technical Memorandum[3] treats this subject in depth.

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2. Technical Memorandum 5, "An Analysis of Legal Questions in connection with Bicycle Study.
3. Technical Memorandum 8, "Transit Related Bicycle Storage and Facilities".

6. General Parking. Similar to curb parking for automobiles, bicycle parking provisions on sidewalks or in downtown parks can serve general needs in congested areas. These would be city owned and maintained and would be either fee or free, depending on the hardware and the nature of its use. This would also be appropriate in outlying areas of neighborhood-oriented, strip commercial uses.

7. Schools. The ownership and operation of school parking facilities should be totally the responsibility of the School Department. The Department of Highways and Traffic can provide assistance in selecting appropriate hardware and locating it on school sites.

8. Future Land Uses. Zoning, subdivision, and planned unit development regulations should be revised to require that space and hardware be provided to serve bicycle parking needs. A "push and pull" situation may be developed in this manner: revised zoning regulations may require a certain number of bicycle parking places for each building and use type. On the other hand, there may be reasons to substitute bicycle storage for a certain percentage of a number of automobile storage spaces. For example, if a building is required to provide 200 automobile spaces the landlord or developer may be be allowed to provide for 20% of this in bicycle parking.

PROPOSED BICYCLE PARKING PROGRAM

1. The Government of the District of Columbia should take the lead by immediately instituting a program to provide secure bicycle parking in all appropriate D. C. Government facilities.

2. The D. C. Public Schools has not encouraged bicycling to schools because of safety and theft problems. A reassessment of this position should be giving consideration to (1) the impact of bikeways on traffic safety, (2) the added security provided by new bicycle parking devices, and (3) the increased use of the bicycle as a purposeful mode of travel. The Mayor or City Council should request the School Board to make this reassessment.

3. By resolution of the City Council, or by other appropriate action, the Federal Government should be encouraged to follow the D. C. Government lead by instituting a similar program. New General Services Administration Regulations have recently been adopted - an investigation should be made to determine the means to modify and/or amend those regulations to incorporate provisions for this program.

4. The D. C. Government should take action to encourage or require appropriate commercial off-street automobile parking facility operators to provide fee bicycle parking either by converting auto parking spaces or utilizing unused space.

5. The D. C. Government should take action to encourage or require owners/managers of buildings in which space is leased to allow tenants and their guests or visitors to enter the building with bicycles and use the elevators, if necessary, to store their bicycles in their leased space. Alternatively, the owner/manager can provide safe, secure and convenient bicycle parking and storage facilities and encourage the tenant and guest to use them.

6. The need for bicycle parking facilities at retail centers varies considerably with type of center. In general, auto parking at centers is curb parking only, or curb parking plus off-street parking. Where off-street auto parking is provided, the conversion of a few spaces to bicycle parking would, in most cases, provide an adequate supply. Where off-street auto parking is not provided, and where commercial off-street parking is not convenient, bicycle parking facilities should be provided on the sidewalk or in other public space by the City.

7. Technical Memorandum 8 "Transit Related Bicycle Storage and Facilities" discusses recommended modifications to the WMATA program for bicycle parking on Metro properties.

8. The District of Columbia zoning regulations and other pertinent ordinances should be amended or modified to assure that future land development projects include adequate bicycle parking.

9. A comprehensive definition of "adequate" bicycle parking storage facilities should be written and should cover the following points:

   a. Appropriateness - certain types of residential, employment, retail, and off-street automobile parking facilities do not require bicycle parking. Examples are wholesale warehouses and attendant parking garages that lack street land space. Thus, a definition of appropriate locations and/or facilities for bicycle parking is necessary to establish exclusions from any regulations.

   b. Convenience - inconveniently located parking will not be used by bicyclists. Maximum walking distances and stair climbing must be defined.

c. Safety - the bicyclist's safety must be considered in locating facilities. Conflicts with motor vehicles (in automobile parking facilities) and the possibility of assault or robbery against cyclists due to poor siting of facilities must be avoided.

d. Security - good security criteria can be set by using the bicycle locker as a standard. This provides a high level of security against theft and vandalism and also keeps bicycles out of the weather. While the locker is not appropriate for all types of parking needs, other means of securing bicycles should be measured against the level of security it provides.

e. Supply - tentative standards have been set in this memorandum for the number of parking spaces required. Fortunately, bicycle parking hardware can be moved if demand in a particular location doesn't warrant it. Supply requirements should be written into regulations and ordinances in a flexible way because standards are tentative and demand is increasing. Monitoring should be used to determine if supply requirements fit demand.

APPENDIX

This appendix includes discussions of several topics related to the provision of bicycle parking facilities. These are:

1. Hardware Options
2. Fee versus No-Fee Storage
3. Guidelines for Locating Storage
4. Showers and Clothes Lockers
5. Facility Costs
6. Zoning Ordinance Considerations

1. Parking Facility Hardware Options

There are various types of storage facilities or locking mechanisms that can be purchased and installed to prevent thefts. Since there are numerous manufacturers of these devices, the designs are not standard. To simplify the discussion in this memorandum a description of 8 types of storage devices now available are given below:

(1) Personal chain or cable with lock
(2) Bicycle rack
(3) Bicycle rack with chain or cable
(4) Bicycle rack with frame or wheel clamp
(5) Bicycle rack with frame or wheel clamp and locking device
(6) Bicycle locker
(7) Bicycle enclosure
(8) Supervised or attended storage

Personal Chain or Cable with Lock - At present the method used by most bicyclists is to carry their own locking devices with them. This provides them with flexibility since if racks or other storage facilities are not provided the bicycle can be locked to such available fixed objects as a tree, fence, or lamp post. (See Table A1 for an evaluation of the degree of security, convenience and potential for a user fee for each of the eight types of storage devices.) The great majority of chains, cables and locks are only effective in discouraging the casual theft. This is the person who is not equipped to cut a chain or lock and would only steal a bicycle if it is not secured.

The person bent on stealing a bicycle and has the needed equipment can cut or snap the vast majority of chains, cables or locks in a matter of seconds.

Bicycle Rack - Bike racks are available in a wide variety of designs that can be adapted to a wide variety of architectural features. The main purpose bicycle racks is to provide a frame to which the bicycle can be locked. The racks also hold bicycles in a variety of upright positions allowing a great number of bicycles to be concentrated in a small area, in an orderly fashion. The racks alone do not provide any additional security. Since the chains, cables and locks that would be provided by the bicyclist offer a low degree of security the rack offers a minimum of protection.

Bicycle Rack with Chain and Cable Provided - The only difference between this type of storage facility and the bike rack is that a chain and cable is permanently attached to the rack. Since the bicyclist does not have to carry the chain with him, this type of facility has the added advantage of greater convenience.

TABLE A1
BICYCLE STORAGE DEVICE EVALUATION

Storage Option	Degree of Security (chance of stealing parts or all of bicycle)	Convenience of Bicyclist	Potential to Charge User Fee
Personal chain or cable with lock	Low-minimum level	Requires carrying chain or cable plus lock	No
Bicycle rack	Low-minimum level	Requires carrying chain or cable plus lock	No
Bicycle rack with chain or cable provided	Low-moderate level	Requires carrying lock	No
Bicycle rack with frame or wheel clamp provided	Moderate	Requires carrying lock May be difficult to position bicycle in rack	Yes
Bicycle rack with frame or wheel clamp and lock provided	Moderate	Requires key or exact change to use lock May be difficult to position	Yes
Bicycle locker	High	Requires key or exact change to use lock May require lifting bicycle into elevated locker	Yes
Bicycle enclosure	Low-high	Requires key to enclose	Yes
Attendant Storage	High	---	Yes

In additon, the strength of the chain or cable can be much greater, since weight is not a constraint as it is if the bicyclist has to transport the chain himself. Thus, the degree of security offered by this type of rack can be substantially higher, depending on the type of lock the bicyclist provides and the chain that is attached to the rack.

Bicycle Rack with Frame or Wheel Clamp - This storage device is substantially different from the rack, since its design is based on an effort to rigidly secure as much of the bicycle as possible. Most facilities of this type attempt to encase the two wheels and/or the frame of the bicycle and allow it to be secured by the use of a personal lock. Thus, when a lock is applied, either the storage device itself has to be cut or the lock has to be snapped. Depending on the actual design of storage devices and the lock the bicyclist provides, these facilties also offer a high degree of security. Theft of unsecured accessories or parts, or other forms of vandalism to the bicycle can still occur with this type of rack.

Bicycle Rack with Frame and Wheel Clamp and Lock Device - The major difference between this device and the rack described above is that a built-in lock is provided as part of the rack. These racks are usually coin operated devices which provide a key much the same as a luggage locker at a bus or air terminal. The security offered by this model is high since these devices are typically made of heavy guage metal and the locking device itself is usually difficult to gain access to. Theft of unsecured accessories or parts, or other forms of vandalism to the bicycle can still occur with this type of rack.

Bicycle Locker - The bike locker is in fact a large size luggage locker. For a fee (usually coin operated), the bicyclist rents the locker and puts his bicycle in a completely enclosed compartment. All parts of the bicycle are secure. Hence these facilities offer a high degree of protection.

Bicycle Enclosure - Provision of special rooms or enclosures for bicycle storage, either (a) with or without special securing facilities or (b) with or without attendant supervision may be particularly appropriate. If such enclosures are provided for a small group of people (such as employees of a small office), security may be very high without the use of special securing facilities or attendants.

Supervised or Attended Storage - In this situation the storage area is supervised by an on-site attendant, most logically in conjunction with motor vehicle parking facilities. Bike racks are required to hold the bicycles and to maximize the use of available space. The attendant needs to be close to the facility and a ticketing or metering system might be utilized similar to those in use in motor vehicle parking facilities.

2. Fee -vs- No Fee Storage

The discussion of charging a fee for bicycle storage will depend in large part on who will provide such storage. Given the many advantages to the District of Columbia if bicycle use were greatly expanded (which include reduced air and noise pollution), the provision of free storage is logical. The same theory would hold for Metro which may increase its ridership if the bicyclist can be attracted to the system. The private sector may see the provision of bicycle storage as an added cost and problem, and will therefore demand a fee for storage.

Given the general benefits to the District that would result from a large increase in bicycle use, there may be reason to advocate a general policy by both the public and private sector to provide free storage. Given that automobile use has created an undesirable amount of congestion on District streets, any and all methods of reducing such use should be encouraged. A low cost method of achieving such a reduction may be to encourage bicycle use. Free storage would be one method of such encouragement.

If such a policy is pursued it would have to be developed through legislation and inclusion within the zoning ordinance of the District. Given that such improvements would be contributing to the general health and welfare of all residents of the District, passage of such legislation would be within the powers of the District Government.

A more flexible method of providing for storage may be to require storage at various destinations and allow the owners or those who control the activity at these areas to charge for such storage. In no way should the fee for such storage discourage use. Given the fact that approximately 16 bicycles can be stored in the space of one automobile, the space cost should be quite low. Assuming a $4.00 per day charge for an automobile space, the charge for a bicycle would be $.25 if bicycle demand was constant. This may have to be doubled to $.50 to account for lost revenue due to bad weather and other factors which make bicycle parking demand inconsistent. Added to this would be the cost of special facilities such as lockers or other devices to secure the bicycle. Given a high estimate of $100 per securing device, with an active life of at least five years, the additional cost would be approximately $.10 per day. Resulting in a total cost of $.60 per day. This is not unreasonable given the bicycle would be insured from loss or damage while stored.

3. Guidelines for Locating Bicycle Storage on Sites

Attention to detail in placement of facilities at the site is important to insure both the security of the bicycle and

the convenience of the bicyclist. Basically, the following placement criteria should be considered:

1. Place storage facilities as close to the entrance of buildings as possible. This reduces trip time and encourages use;

2. Place facilities in or near the highest activity areas of the building site which will not interfer with pedestrian movement. This will help to increase the security of the storage facilities;

3. Locate storage facilities so as to permit expansion to accommodate heavier demand as bicycle use increases;

4. Locate storage facilities in a manner that will permit easy and fast riding access to and from the site. (The bicyclist should not be required to walk his bicycle long distances.)

5. Bicycle storage should not be located so as to create areas of conflict between automobile and bicycle storage access.

4. Showers and Clothes Lockers for Bicyclists

Although bicycle storage in itself will encourage bicycle use within the District there is reason to believe that showers and clothes lockers would also help to increase the convenience of bicycle use. Bicycling can be a strenuous physical exercise. This taken in conjunction with the characteristics of the work trip where an individual has to be presentable for the day of work and the warm, humid weather, the need for a shower or facilities to change clothes is appropriate.

A dramatic comparison (if not statistically valid) exists in the District between two Federal office buildings. Both buildings provide secure office building bicycle parking. Building A has shower facilities whereas Building B does not. On one day 55 bicycles were counted at the 'A' garage facilities, while only 3 bicycles were counted at the 'B' building. This, of course, should not be taken as conclusive evidence that showers will greatly encourage bicycle use. There may be other reasons besides the shower facilities that would be evident through further study, yet some responsibility for the greater use has to be placed on the provision of showers.

There appears to be justification in at least testing or demonstrating this hypothesis. A demonstration might be established by installing shower facilities in one of the existing D. C. government buildings. Bicycle use would be moni-

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4. Building A is the Nassif Building at 400-7th St., S.W. Building B is located at 800 Independence Ave., S.W.

tored before and after installation to determine if bicycle use increased. Such a demonstration would only take a very limited amount of money. A facility could be built within a few weeks with available space.

There are some cautions that should be observed where designing or planning for shower facilities. In some situations, wash rooms on each floor of a building are locked and only those occupants of the building have keys due to the crime problem. This type of precaution would have to be taken with shower facilities also. It would be assumed that a building totally occupied by one department or division of the D. C. or Federal Government would be more likely to lend itself to a shower facility than a commercial building with a number of tenants. There may be need to have shower facilities on every floor given the security problem if there are a number of tenants in a building.

The other side of the security problem is a privacy question. A maximum degree of privacy should be insured. This would demand separate shower rooms and changing facilities. Architectural advice would be needed.

5. Facility Costs

The provision of storage facilities may represent a very significant step that can be taken for a relatively small investment. There are a wide variety of bicycle storage facilities on the market with equally wide ranging costs. Table A2 presents storage facility cost estimates based on the average storage capacity of various facilities and their subsequent costs per unit stored.

TABLE A2
STORAGE FACILITIES

TYPE	GENERAL CAPACITY PER UNIT	UNIT COST PER SPACE
Standard Rack	12	$10
Rack w/-w/out chain	12	$10-50
Clamp type or coin operated	1	$35
Lockers	1-2	$75

Source: Atlanta/Wolfe

Table A3 presents the cost estimates for installing showers in new or existing buildings.

TABLE A3
SHOWER COSTS

TYPE	NEW BUILDING (INSTALLED AT TIME OF CONSTRUCTION)	EXISTING BUILDING (INSTALLED AFTER CONSTRUCTION)
Single Unit Shower	$ 200	$ 260
Six Unit Shower	$1,560	$1,980
Sauna Unit attached to six unit showers (steam)	$ 510	$ 510

6. There are several revisions to the existing zoning ordinances which should be considered in requiring the private provision of bicycle parking facilities. First of all, an appropriate definition of bicycle parking space should be included in the ordinance. For example, a bicycle parking space might be defined as an off-street area accessible and with an adequate security device provided for exclusive use as a storage space for a bicycle. Where appropriate, changes should be made in ordinance clauses which require parking facilities to indicate that bicycle parking spaces are also required. For example, clause 3101.42(b) might be revised to read, "Ample automobile parking space and bicycle parking space... is provided to accommodate the students, teachers, and visitors likely to come to the site by automobile or by bicycle." New sections should be added regarding (1) the spaces required by land use, (2) the appropriate design of bicycle parking facilities, (3) the location, access, and maximum grade approach of the bicycle parking spaces, and (4) a timetable for compliance. Each of these items is discussed briefly below.

   1. Number of spaces required. Since the use of the bicyle, particularly for transportation purposes, is increasing dramatically at the present time, any standards should be considered tentative and revised as more accurate data on bicycle use at specific locations becomes available. The General Services Administration's guideline of a six month evaluation might be appropriate for other facilities in the District.

   2. Design of parking facilities. There are a number of bicycle parking designs available on the market which vary considerably in price and degree of security. The ordinance might specify acceptable types, refer to the Design Manual,[5] or establish general requirements such as (1) the

5. "District of Columbia Bikeway Planning and Design Manual," Barton-Aschman Associates, Inc., 1975.

bicycle parking facility shall be bolted firmly to a permanent structure, and (2) a device shall be provided which permits the frame and both wheels to be secured.

3. Location, access, and maximum grade approach. Bicycle parking facilities should be located as near as possible to the structure served in order to enhance the portal-to-portal service potential of the bicycle. Furthermore, these facilities should be easily accessible with a maximum grade approach of ten percent and aisles which have a clear width of at least eight feet. If bicycle parking is to be provided at other than ground level, elevators large enough to hold bicycles should also be provided. If bicycle parking facilities are located in attended garages, they should be placed within viewing distance of the attendant's normal location. Where necessary for safe operation, separate bicycle entrances to parking lots or garages should be provided.

4. Timetable for compliance. The ordinance should specify that all new buildings are required to install bicycle parking at the time of construction. Existing structures should also be required to install bicycle parking facilities, but should be given an adequate period of time to comply with the regulations. A period of six months to one year from the effective date of the ordinance amendments appears appropriate. Existing methods for requesting exemptions or delays should apply to bicycle parking requirements as well as other zoning ordinance requirements.

Incentives for Construction of Bikeways in Subdivisions - As mentioned earlier, there is limited space for new subdivisions within the District of Columbia. However, it might be advantageous to revise Article 5, Section 7501 - Planned Unit Developments, to encourage the provision of bikeways. For instance, higher residential densities and lower automobile parking requirements might be permitted if a bikeway system were provided which encouraged use of the bicycle instead of the automobile. In any case, bikeways, pedestrianways, etc. should be required as part of the plan submitted for review (as the locations of public streets, alleys, private rights-of-way, land easements are required). In particular, the provision of off-street facilities should be encouraged.

Design Standards for Bikeways - Actual design standards should probably not be included in the zoning and subdivision ordinances. Rather, reference should be made to the Design Manual. However, definitions of the various types of bikeways should be incorporated into the definitions section of the ordinance.

Barton-Aschman Associates, Inc. 1730 K Street, Northwest, Washington, D.C. 20006, Telephone 202-466-8230

TECHNICAL MEMORANDUM 12

Priorities and Costs for the Proposed Trunk Route System

March 25, 1975

INTRODUCTION

The purpose of setting project priorities and estimating costs for the recommended system of bicycle facilities is to guide budget planning. For this reason the cost estimates presented in this memorandum are level of magnitude approximations based on very basic parameters: route length and bikeway treatment. A more refined estimate is not warranted for budget planning purposes. Only in the actual design phase can all the detailed construction needs be determined to develop accurate estimates. It should be noted that only easily assessible costs are included in the estimates. A listing of major cost items which were not part of the estimate appears under "EXCLUDED COSTS." These are costs which cannot accurately be estimated.

PRIORITIES

The study developed a "trunk" system that should be considered as only the most basic network of arterial routes to which other arterials and neighborhood routes will be added. Thus, all of the routes are of high priority. However, for the reasons cited below, a three level priority ranking was made.

First Priority Routes are one or more of the following:

1. are easy to implement from engineering and traffic points of view,
2. have only positive impact on adjoining areas,
3. are part of the downtown area grid,
4. will make existing facilities more effective, and
5. are in a known high use corridor.

Second Priority Routes are desirable facilities which are not needed immediately because bicycling in the areas they serve is relatively safe.

Third Priority Routes are not actually low priority but the costs associated with them will not be incurred until sometime after the higher priority projects are implemented. Three categories of routes were identified in this group: 1) projects requiring right-of-way acquisition; 2) Problem Routes identified in the Appendix of Technical Memorandum 10, "Proposed Trunk Route System"; and 3) projects which must be coordinated with other roadway construction.

A fourth category of routes includes those specific recommended routes which are to be located on land which is not in the District of Columbia jurisdiction. These routes are shown in the cost estimate tabulation (priority 4) but are not included in the summary totals below. They are:

Route	Jurisdiction	Cost
Montrose Park	Nat. Park Service	$ 15,500
Bolling AFB	U.S. Air Force	$120,000
13th St. (Walter Reed Hospital Portion)	Hospital	$ 11,600

COST ESTIMATE

The total estimated cost for the trunk route network is $833,000. The costs by priority are shown below.

TABLE 1
ESTIMATED CONSTRUCTION COSTS FOR RECOMMENDED TRUNK ROUTE NETWORK

Priority	Route Miles	Total Construction Cost
1	43.2	543,000
2	11.3	46,000
3	14.0	278,000
Total	69.5	867,000

The cost estimates for each section of the network are shown in Table 3 at the end of this memorandum. These costs were developed using a gross, per mile estimate for each of eight types of bikeway treatments. These per unit costs and the construction elements included in each are shown in Table 2.

TABLE 2
PER MILE COST ESTIMATES[1] BY TYPE OF ROUTE

	Pavement[2] 5'=$30,400 8'=$37,000	New Signing $1,800	Relocate Existing Signs-$1,200	Linear Striping $1,000/line	Intersection Striping $2,400	Delineators $1,500	Curb Cuts (2/intersection) $4,800	Total per mile cost
Class I - Exclusive Bikepath	X	X						$38,800
Class I - Sidewalk Bikepath								
5' (one-way)	X	X	X		X		X	$40,600
8' (two-way)	X	X	X		X		X	$47,200
Class II - Protected Bikelane		X		X	X	X		$ 6,700
Class II - Unprotected Bikelane		X		X	X			$ 5,200
Class III - Bikeroute		X						$ 1,800
Class III - Preferential Bike Street		X	X					$ 3,000
Class III - Improved Bicycle Street		X						$ 1,800
Class III - Sidewalk Route		X	X		X		X	$10,200

1 Do not include engineering design and contingencies, and no inflation factors have been applied.
2 Asphalt pavement assumed - Concrete costs are 5' = $50,000/mile; 8' = $80,000/mile

EXCLUDED COSTS

It is important to point out what is not included in the costs estimated. The following paragraphs describe what elements of the system were not costed and why they were excluded.

1. River Bridge Improvements. Most of the river crossings are important linkages in the bikeway network. Several of the existing bridges have sidewalks which are too narrow for use as bikeways. The design options include increasing the sidewalk width by reducing the motor vehicle lane width, or by increasing the width of the bridge deck.

   Also, a guard rail should be located to separate the bicycle and pedestrians from the motor vehicle traffic. Because an engineering study of the feasibility of these proposals could not be made for this study, and because an estimate of costs is not possible without such a study, no attempt was made to estimate the costs of these proposals. The bridges in question were all inspected by civil engineers and the proposals do appear to be structurally feasible. It is recommended that these bridges be given first priority attention by the District of Columbia. A preliminary engineering study should be conducted to evaluate the cited alternatives (as well as others).

2. Trolley Line Bridges. Several steel tressel or truss and tressel structures exist along the trolley right-of-way. Two of these were examined by civil engineers and appear to be structurally sound and would require only minor refurbishing. All of these structures should be given first priority attention to determine if they can be used as recommended.

3. Bicycle Parking Devices. Technical Memorandum 11, "Bicycle Parking Needs and Policy Guidelines," has recommended the installation of secure bicycle parking devices at a variety of locations. Each situation will warrant a particular type of device depending on the type of parking, the level of security required, and whether the parking is provided for a fee or for free. A large portion of the parking requirements should be provided for on private property - in off-street automobile parking lots and garages, and in office buildings. At this time it has not bee determined how this private parking program will be implemented (because of certain legal uncertainties) nor, who will provide the hardware. For all of these reasons, no attempt was made to cost a parking program.

The previously cited parking memo did recommend that as a first step, the District of Columbia should provide parking in or near all of its offices for employees and visitors. A first priority study should be made to inventory where that parking should be located and what type of locking devices are appropriate. The District of Colubmia currently employees 45,000 persons. Assuming one device for each twenty employees, and an average cost of $55.00 results in a total hardware cost of $125,000 for this first step.

4. Pavement Surfacing and Storm Sewer Inlet Grates Adjustments. The cost estimates include no roadway pavement resurfacing which may be necessary on some of the projects. Because pavement surface condition is an important factor in bicycle safety and convenience, all bike routes should receive priority consideration in scheduling roadway maintenance work in the City.

   Also not included in the cost estimates is the cost of replacing those storm sewer grates which pose a danger for cyclists. A program should be established to replace all grates of this type on all routes where bicycling occurs. Of course, this program should begin on the existing system of designated bike routes.

5. Rock Creek Park Access. The previously cited memorandum which describes the recommended trunk route system explains the need for better access to the existing Rock Creek Park Bikeway. Because almost all of that access would be on parkland which is not part of the District of Columbia's jurisdiction, no attempt was made here to cost these facilities.

6. Right-of-way. Several miles of recommended routes are on privately owned linear rights-of-way. The acquisition of the right to develop bikeways on this land may involve costs for either purchase or lease. These costs were not estimated.

TABLE 3
PROPOSED BICYCLE TRUNK ROUTE NETWORK
SUMMARY OF PROPOSED TREATMENT, ESTIMATED COSTS, AND PRIORITIES

Route Name	Section	Length	Treatment	Construction Costs-$1000's	Priority	Comments
Abandoned Trolley	1	2.8 Miles	I-Exclusive	108.6	3	Right of way or easement acquisition on
	2	0.5 Miles	III-Preferential	1.5	1	Section 1 will delay implementation.
"N" Street, N. W.	1	0.7 Miles	III-Preferential	2.1	1	
Lower "K" Street	1	0.5 Miles	II-Protected	3.4	3	Design must be coordinated with new construction in this area.
Montrose Park	1	0.4 Miles	I-Exclusive	15.5	4	Right-of-way is Park Service jurisdictio
31st Street	1	0.9 Miles	III-Improved	1.7	1	
Observatory Circle	1	0.1 Miles	I-Exclusive	3.9	3	Right-of-way or easement acquisition wil delay implementation.
	2	0.3 Miles	III-Improved	0.5	3	
Mass. Avenue	1	3.3 Miles	I-Sidewalk	158.2	1	
"P" and "Q" Streets, N. W.	1	0.9 Miles	III-Improved	1.6	1	Part of Grid.
					1	Part of Grid.
Conn. Avenue Alt.	1	2.7 Miles	II-Unprotected	14.0	2	
	2	0.2 Miles	III-Preferential	0.6	2	
	3	1.6 Miles	III-Improved	2.9	2	
	4	0.3 Miles	I-Exclusive	11.6	2	
Broad Branch Road	1	1.5 Miles	III-Improved	2.7	2	
Utah Avenue	1	1.5 Miles	III-Improved	2.7	2	
Nevada Avenue	1	1.0 Miles	III-Improved	1.8	2	
10th and 12th Sts., N.W.	1	0.6 Miles	III-Bikeroute	1.1	1	
	2	0.3 Miles	II-Sidewalk	0.6	1	Use existing sidewalk pavement; add sign

TABLE 3
PROPOSED BICYCLE TRUNK ROUTE NETWORK
SUMMARY OF PROPOSED TREATMENT, ESTIMATED COSTS, AND PRIORITIES

Route Name	Section	Length	Treatment	Construction Costs-$1000's	Priority	Comments
6th Street, N. E.	1	2.0 Miles	III-Improved	3.6	1	One-way pair - grid.
11th Street, N. E.	1	0.3 Miles	II-Unprotected	1.7	1	11th Street Bridge connection to existing 11th Street bikeway.
	2	0.7 Miles	II-Unprotected	3.6	1	One-way pair - grid.
12th Street, N. E.	1	0.7 Miles	II-Unprotected	3.6	1	One-way pair - grid.
South Capitol Street	1	0.7 Miles	Varies-See Comment	3.6	1 1	Tech. Memo 10 details this treatment.
New Jersey, S. E.	1	0.8 Miles	III-Improved	1.4	1	Grid.
Virginia Avenue	1	1.9 Miles	II-Unprotected	9.9	1	Link existing facilities.
"I" Street, S. W.	1	1.0 Miles	III-Improved	1.8	1	Grid.
"M" Street, S. E.	1	0.4 Miles	III-Sidewalk	4.1	1	Grid.
"H" Street, N. W. & N. E.	1	1.9 Miles	II-Protected	57.3	1	Grid ($25,000/mile additional cost assum for median separator
	2	1.1 Miles	II-Unprotected	5.8	1	Connects Burning Road Route with grid.
Eye Street, N. W.	1	1.9 Miles	II-Protected	57.3	1	Grid ($25,000/mile additional cost assum for median separator.
10th Street, S. W.	1	0.6 Miles	III-Preferential	1.8	1	Grid.
20th Street, N. W.	1	1.1 Miles	II-Unprotected	5.5	1	Grid
21st Street, N. W.	1	1.3 Miles	II-Unprotected	6.8	1	Grid.

NOTE 1 - "Problem Area" treatment uncertain, to be determined in design phase. Assumed $5,500 per mile construction cost.

TABLE 3
PROPOSED BICYCLE TRUNK ROUTE NETWORK
SUMMARY OF PROPOSED TREATMENT, ESTIMATED COSTS, AND PRIORITIES

Route Name	Section	Length	Treatment	Construction Costs-$1000's	Priority	Comments
13th Street, N. W.	1	4.3 Miles	II-Protected	30.3	1	
	2	0.4 Miles	III-Preferential	1.3	1	
	3	0.3 Miles	I-Exclusive	11.6	4	Negotiations required with Walter Reed H
	4	0.8 Miles	III-Preferential	2.4	1	
8th Street, N. W.	1	2.6 Miles	III-Preferential	7.8	1	To be coordinated with 13th Street, N. W implementation.
Kansas Avenue	1	2.5 Miles	III-Bikeroute	10.0	2	$2,400 per mile additional costs assumed for special treatment at diagonal intersections.
Rhode Island	1	4.5 Miles	(See Note 1)	25.0	3	
Irving Street	1	0.8 Miles	III-Improved	1.4	1	One-way pair link Michigan Avenue route 13th Street.
Kenyon Street	1	0.8 Miles	III-Improved	1.4	1	One-way pair link Michigan Avenue route 13th Street.
Delaware Ave., N.E.	1					
1st Street, N.W.	1	1.9 Miles	III-Improved	3.4	1	Grid.
Brentwood Parkway	1	1.5 Miles	I-Sidewalk	60.9	1	
East Washington R.R. ROW	1	1.9 Miles	I-Exclusive	73.7	3	Need to negotiate for ROW use.
Benning Road	1	0.8 Miles	II-Unprotected	4.2	1	
	2					
East Capitol	1	2.3 Miles	(See Note 1)	12.5	3	
Pennsylvania Avenue	1	0.9 Miles	I-Exclusive	41.0	3	$7,000 per mile added for intersection treatments.
	2	0.7 Miles	(See Note 1)	9.0	3	
Suitland Parkway	1	2.3 Miles	I-Exclusive	89.2	1	
Bolling Air Force Base	1	3.1 Miles	I-Exclusive	120.0	4	Negotiations required with Air Force Bas management.
South Capitol (Anac.)	1	1.4 Miles	III-Improved	2.5	1	
4th Street, N. E.	1	2.0 Miles	III-Improved	3.6	1	One-way pair - grid.