WASHINGTON REGIONAL BIKEWAYS STUDY

FINAL REPORT
APRIL 1977

for

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS

TRANSPORTATION PLANNING BOARD

in cooperation with

Washington Metropolitan Area Transit Authority and Local Governments

prepared by

Deleuw, Cather & Company
Engineers & Planners

WASHINGTON REGIONAL BIKEWAYS STUDY

Prepared for the

Metropolitan Washington Council of Governments

This study has been conducted with the assistance of the Regional Bikeways Technical Subcommittee including representatives of local jurisdictions and the Washington Metropolitan Area Transit Authority.

De Leuw, Cather & Company

April, 1977

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EXECUTIVE SUMMARY

INTRODUCTION

This report summarizes key findings and recommendations of the Regional Bikeways Study for the Washington Metropolitan area, conducted by the Metropolitan Washington Council of Governments (COG) with the assistance of the consultant, DeLeuw Cather and Company. The Study was coordinated by the Regional Bikeways Technical Subcommittee of the Transportation Planning Board Technical Committee including staff representatives of local governments and the Washington Metropolitan Area Transit Authority (WMATA).

The study provides an overview of current bicycling characteristics and of the potential market for future bicycle commuting. This information provides a basis for coordinated bicycle system planning in the Washington Metropolitan Area. The study gives special attention to assessing the potential for bicycle storage and access to Metrorail transit stations.

Three types of surveys were initiated in the Fall of 1975 to meet specific information requirements for the study -- (a) telephone interviews with selected households in residential neighborhoods; (b) employee interviews at major employment centers; and (c) bicycle commuter interviews at high use locations.

MAJOR RECOMMENDATIONS

The major recommendations of the report are:

- Protected bikeways and safe bicycle storage facilities should be provided to generate increased cycling and increased safety.
- Maximum attention should be given to encouraging new bikeway construction in the Washington area. Estimates of close to 890,000 cycling trips that would be made in 1985 (approximately 50 percent over 1976 levels) were predicted on construction of 280 miles of protected bikeways.

- To establish and demonstrate the maximum potential for Metrorail-related cycling, it is recommended that initially at least three stations of Phase II of the Metrorail system be programmed for development of 'first-class' storage and bikeway facilities designed to encourage maximum bicycle ridership. Metrorail Phase II is scheduled by WMATA to begin service in July 1977.
- It is recommended that WMATA take steps towards programming and installation of bicycle lockers at Metrorail stations throughout the region as indicated in this report. WMATA and local governments should work with each other to implement bikeways and bicycle lockers in conjunction with the opening of Metrorail stations so that maximum levels of bicycle use to METRO may be reached. COG should continue to coordinate bikeway planning. Experience at the Bay Area Rapid Transit (BART) in San Francisco and other major rail transit systems in North America demonstrates that a significant number of rail transit riders will cycle to and from stations when adequate bike storage and access facilities are provided.

MAJOR FINDINGS AND ANALYSIS RESULTS

These recommendations are supported by a number of technical findings from the study's survey and analysis.

Among the major findings were:

- Approximately five percent of all employed persons have commuted to work by bicycle on at least an occasional basis, with the remainder biking only occasionally during favorable weather conditions. Approximately one-third of existing cyclists bike more than five miles to and from work.
- Three-quarters of current commute cyclists indicated that provisions of protected bikeways was the most important type of improvement that would encourage more frequent bicycle use. Only about one-third of current work commute cyclists use their auto when not cycling or are former auto commuters.

- Survey responses regarding interest in cycling to and from work suggest that commute cycling might be increased up to three times as great as current levels if cycling conditions were improved. Approximately three quarters of potential commute cyclists currently drive to and from work.
- About 590,000 bicycle trips are estimated for a typical 1976 fall weekday in the Washington Metropolitan area. About 61,000 trips of this total are for work purposes, representing just under three percent of total work trips by all modes made in the study area. The number of bicycle trips made in the area is estimated to increase by approximately 50 percent to nearly 890,000 trips by 1985. Work commute cycling will increase to an estimated 105,000 trips on a typical fall weekday, equivalent to just under four percent of total 1985 work trips.
- Metrorail-related weekday bikeway trips are estimated to increase to approximately 31,000 trips for a typical fall weekday in 1985. This assumes completion of the full Metrorail Adopted Regional System (ARS) by 1985 with adequate bicycle storage facilities to accomodate estimated demand levels.
- Bicycle storage facility needs including recommended bicycle lockers have been projected for 1985 for each Metrorail station. Projected individual station needs range from 30 bicycle spaces at some stations to over 500 spaces at three stations.

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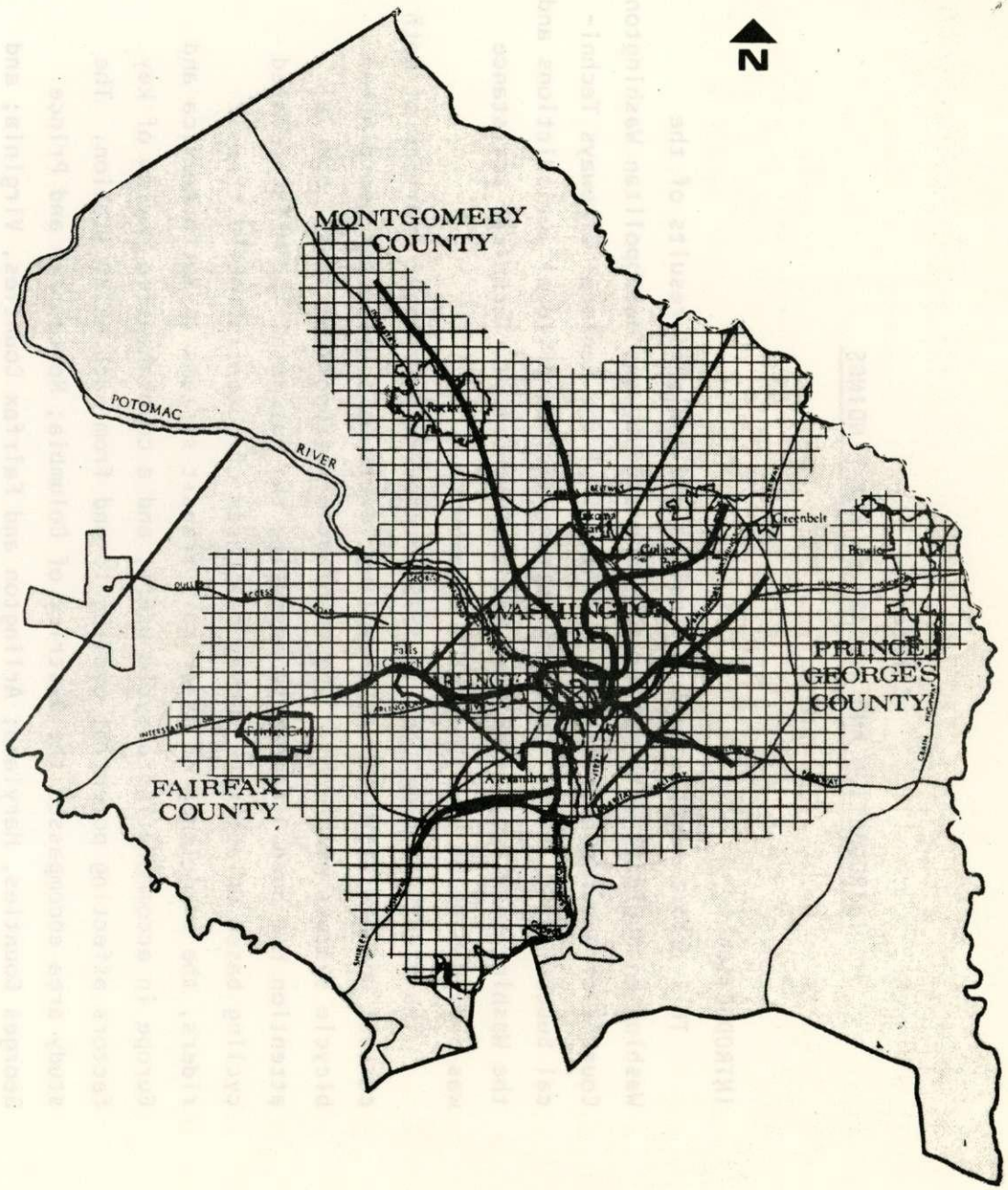
INTRODUCTION AND SUMMARY OF KEY FINDINGS

INTRODUCTION

This report summarizes key findings and analysis results of the Washington Regional Bikeways Study, conducted by the Metropolitan Washington Council of Governments with the assistance of the Regional Bikeways Technical Subcommittee (RBTS) including representatives of local jurisdictions and the Washington Metropolitan Area Transit Authority. Technical assistance was provided by De Leuw, Cather & Company.

The study was commenced in 1975 to provide a regional overview of both current and near-term future bicycling levels as a basis for coordinated bicycle systems planning in the Washington metropolitan area. Special attention has been directed to assessing the potential for METRO-related cycling based on attitude survey responses of potential METRO transit riders, the experience of other rail transit systems in North America and Europe in accommodating bicycle users, and a comprehensive review of key factors affecting potential cycling to and from each METRO station. The study area encompasses the District of Columbia; Montgomery and Prince Georges Counties, Maryland; Arlington and Fairfax Counties, Virginia; and the cities of Falls Church and Alexandria (see Figure 1-1).

Three types of surveys were employed to meet specific information requirements for this study--(a) telephone interviews with selected households in two residential neighborhoods; (b) employee interviews at four major employment centers; and (c) bicycle commuter interviews at high-use locations. The bicycle survey program was designed as a set of user and non-user surveys directed at target areas and groups. Each survey was intended to provide specific data required for subsequent analysis and forecasting tasks. The use of three complementary surveys was considered to be more cost effective than the alternative approach of a larger-sample



1-1
STUDY AREA

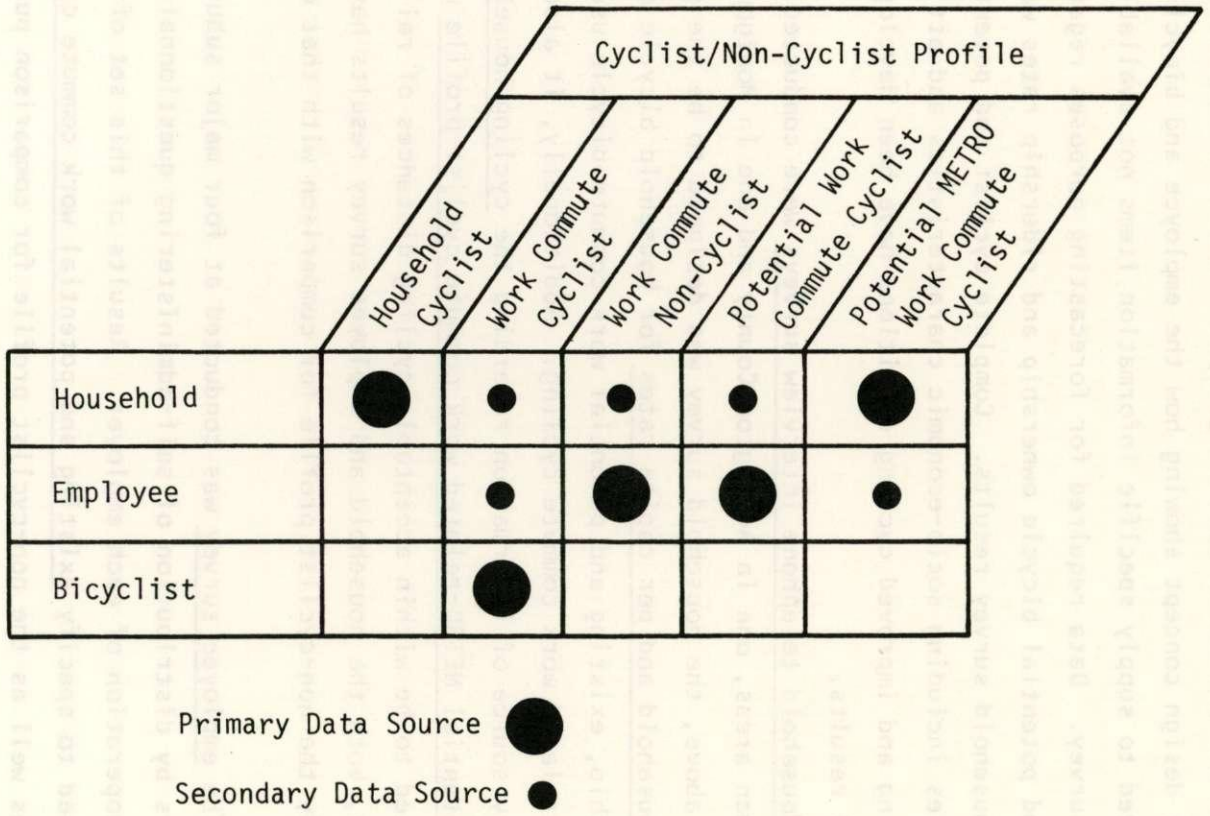
household interview program since it permitted focusing directly on cyclist and potential cyclist groups. Table 1-1 summarizes the overall survey design concept showing how the employee and bicyclist surveys were utilized to supply specific information items not available from the household survey. Data required for forecasting purposes regarding both existing and potential bicycle ownership and ridership rates was obtained from the household survey results. Complete cyclist and potential cyclist profiles including socio-economic characteristics and attitudes towards existing and improved cycling conditions have been developed using all survey results.

Household telephone interview surveys were conducted in two inner suburban areas, one in Arlington County and one in Montgomery County. As noted above, the household survey was designed to be the primary source of per household and per capita rates for household bicycle ownership and ridership, existing and potential work commute bicycle use, and potential METRO-related work commute cycling. Additionally, it also provided the primary source of information regarding the cycling household profile and the potential METRO-related work commute cyclist profile with survey sites selected to be within acceptable cycling distances of rail transit stations. Lastly, both the household and employee survey results have been used to specify the non-cyclist profile for comparison with that of the bicycle user.

The employee survey was conducted at four major suburban employment centers by distribution of self-administering questionnaire forms through the cooperation of each employer. Results of this set of surveys were designed to specify existing and potential work commute cyclist characteristics as well as the non-cyclist profile for comparison purposes. Additionally, one employment center was selected adjacent to a METRO rail transit station, and employee responses at that site provided additional data regarding potential METRO-related work commute bicycling.

TABLE 1-1

SURVEY DESIGN TO OBTAIN CYCLIST/NON-CYCLIST PROFILE DATA



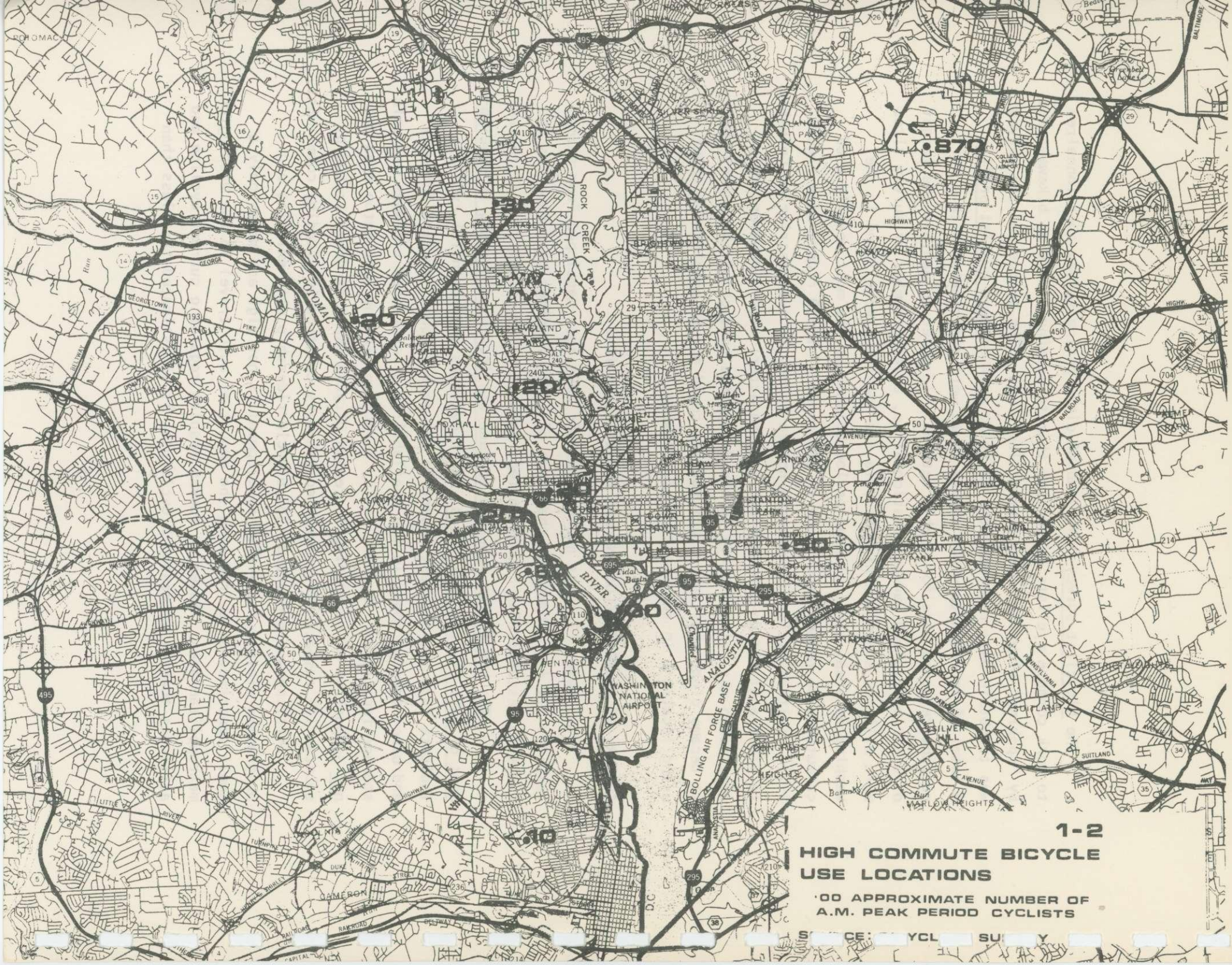
The bicyclist survey consisted of distributing survey questionnaires to work commute cyclists by handing them to passing riders on bikeways and by "spoking" bicycles at employment locations. The purpose of the survey was to obtain data regarding the existing work commute cyclist profile. A total of approximately 600 survey forms were distributed with a fifty-percent response rate for usable returns. In order to achieve the target of distributing 600 survey questionnaires, a large number of survey sites were utilized since few high bicycle use locations were found in the Washington area. Typical peak period volumes on the most heavily used commuter bike routes tend to be in the range of 25-30 riders (see Figure 1-2). Initially, it was intended not to survey in the Distrist of Columbia to limit analysis to suburban cyclist characteristics. However, this limitation was relaxed early in the design and conduct of the survey when it became clear that sufficient surveys could not be completed without using locations in the District of Columbia.

SUMMARY OF MAJOR CONCLUSIONS AND POLICY DIRECTIONS

Five major findings and conclusions have been developed from study results. It is recommended that each of these findings be pursued as the basis for establishing a coordinated regional bikeways policy and program.

1. The key factor required to generate increased cycling is development of safe bicycle facilities. Both cyclists and potential cyclists indicate that the greatest incentive for more frequent cycling for work and other trip purposes is the availability of protected bikeways and safe storage facilities. Current policy directions in the Washington area are not supportive of generating increased bicycle usage as demonstrated by substantial cutbacks in programmed bikeways construction funding commitment.

Existing and projected 1985 bicycle ridership with existing and programmed bicycle facilities development is not high and makes only a small contribution to reducing the amount of auto travel in the Washington metropolitan area. Based on survey results regarding current cycling and attitudes towards increased bicycle use, it is estimated that less than


•30
•20
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•20
•50
•870
•10
ROCK CREEK
POTOMAC
RIVER
ANACOSTIA
WASHINGTON NATIONAL AIRPORT
BOLLING AIR FORCE BASE
PENTAGON
CAMERON RUN
1-2
HIGH COMMUTE BICYCLE USE LOCATIONS
·00 APPROXIMATE NUMBER OF A.M. PEAK PERIOD CYCLISTS

four percent of all study area trips are made by bicycle and that this share of total trips may be expected to remain approximately constant through 1985 assuming development of programmed facilities.[1] Furthermore, it is estimated that the increased amount of cycling projected for the next ten years due to new facilities development will serve to reduce regional auto miles of travel by less than one percent.

2. Experience at Bay Area Rapid Transit (BART) and other major rail transit systems in North America demonstrates that a significant portion of rail transit riders will cycle to and from stations when adequate facilities are provided. At BART suburban stations, up to five percent of arriving passengers may be bicycle riders depending on local topography, bikeway availability, and related factors. Similar levels of bicycle use may be obtained for METRO system access if adequate facilities are provided, both at stations and along routes to and from stations. Recent research findings regarding localized air quality impacts at transit station areas due to auto access trip emissions as well as expressed community concerns regarding traffic congestion and parking at stations, serve to indicate that maximum bicycle use for station access offers significant potential benefits.

3. Adequate bicycle storage facilities including lockers designed as an attractive and integral part of each METRO station are required if maximum bicycle use levels are to be obtained. WMATA and local jurisdictions should take steps towards installation of bicycle lockers at METRO stations as programmed in this report (Tables 3-3, 3-4, and 3-5). At the present time, the Washington Metropolitan Area Transit Authority has adopted a tentative policy of providing only limited bicycle rack accommodations at selected station sites. This policy should be fully reviewed in the light of findings and analysis results of this study for greater commitment to expanded station bicycle facilities development.

4. To firmly establish the maximum potential for METRO-related cycling, it is recommended that at least three stations of the METRO Phase II system be programmed for development of 'first-class' storage and bikeways

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[1] The FY 1977-81 Transportation Improvement Program includes significantly reduced new bikeway system mileage in comparison with earlier development programs used as input for this study.

facilities designed to encourage maximum bicycle ridership. WMATA and the local governments should work closely together to implement bikeways and bicycle lockers in conjunction with opening of METRO system stations. This development project should be included as part of the FY 1978-short-range transportation improvement program. It will require full cooperation between WMATA and local government, and steps should be taken immediately to resolve specific funding sources in order to commence the project in conjunction with Phase II opening.

5. Maximum attention should be given to encouraging new bikeways construction in the Washington area. Special emphasis should be given to bikeways to METRO stations, to bikeways in the vicinity of major employment centers[1], and to coordinating bikeways development between area jurisdictions to ensure system connectivity and safety.[2] The efforts of the Metropolitan Washington Council of Governments and its Regional Bikeways Technical Subcommittee to make available information on existing bikeways and to coordinate planning among local government jurisdictions need to be continued as a key means toward meeting this objective.

SUMMARY OF TECHNICAL FINDINGS AND ANALYSIS RESULTS

Study Methodology

- The methodology included comprehensive surveys for assessing bicycle usage and attitudes in the metropolitan Washington area of bicyclist, household, and employee survey sample groups.
- A total of over 1900 valid survey responses were obtained, providing valid data for nearly all desired tabulations including both potential work commute and METRO work commute cyclist characteristics.

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[1] Observed bicycle use at the National Institute of Health (NIH) and provides an excellent Washington-area example of the potential for biking at major employment centers.

[2] The benefits from improved coordination between area jurisdiction is illustrated by the need for improved bicycle facilities at the Theodore Roosevelt bridge.

- Key problems encountered in conducting the survey related to identification of high bicycle use locations for questionnaire distribution, and use of a comprehensive survey questionnaire which discouraged cooperation by some individuals.
- Survey responses regarding potential METRO-related cycling were utilized as input for predicting bicycle usage and storage requirements at METRO stations. The methodology involved analysis of survey results, experience of other rail transit systems in North America, and an assessment of the potential for bicycle use at each station based on the bicycling environment in the vicinity of the station.
- For bicycle use potential assessment, selected data was mapped on METRO corridor maps to describe the bicycling environment in the vicinity of each station. Data included land use, traffic volumes, protected bike trail development (both existing and programmed), topographical features, and major barriers to cycling (such as freeway alignments and water crossings).

Household Cycling Profile

- Approximtely 30 percent of the total population in Washington suburban areas have cycled at least once in the past month. This represents about 0.8-0.9 cyclists per household on the average and is twice the number of cyclists per capita estimated for the District of Columbia.

Work Commute Cyclist Profile

- Approximately five percent of all employed persons have commuted to work by bicycle on at least an occasional basis. About one-half of these cyclists bike on a regular basis with the remainder biking only occasionally during favorable weather conditions.

- Work commute cyclists are younger, predominantly male, and tend to be management and professional employees more often than other employee types.
- While cyclists live closer to work than non-cycling employees, approximately one-third bike more than five miles to and from work. This is a substantially higher proportion of longer trip lengths than reported for work commute cycling in other urban areas.
- Approximately 78 percent of commuting cyclists utilize major street traffic lanes for at least a portion of their trip to work. Furthermore, over 50 percent of total commute biking miles are done in traffic lanes on major, minor, and residential streets with cyclists exposed to traffic-related hazards.
- Nearly two-thirds of work commute cyclists cited danger from auto traffic as the most important cycling problem.
- Approximately three-quarters of commute cyclists indicated that provision of protected bikeways was the most important type of improvement that would encourage more frequent bicycle use.
- Only about one-third of work commute cyclists use their auto when not cycling or are former auto commuters. The remainder are diverted from auto passenger, bus, and walking travel modes to bicycling. Diversion from auto to cycling may be higher for other trip purposes in outer suburban areas although no data was available to confirm this from survey results.

Potential Work Commute Cyclist Profile

- Survey responses regarding interest in cycling to and from work suggest that commute cycling might be increased up to three times as great as current levels if cycling conditions were improved.

- Approximately seventy percent of potential commute cyclists currently own bicycles and one-half have cycled in the past month for other purposes.
- Potential commute cyclists have work trip lengths similar to those of existing cyclists, probably indicating over-commitment bias in survey results due to the 'hard core' nature of existing cyclists.
- Potential work commute cyclists tend to have socio-economic characteristics similar to those of existing cyclists but considerably less pronounced than for existing cyclists.
- Auto traffic danger was cited by potential cyclists as the most important reason for not cycling to work at the present time. The second most important reason was that potential cyclists felt they would not look neat at work.
- Approximately three-quarters of potential work commute cyclists indicated that development of protected bikeways was the most important type of improvement required to induce their cycling to work.
- Approximately 75 percent of potential commute cyclists currently drive to and from work.

Potential METRO Work Commute Cyclist Profile

- Approximately 14 percent of employed persons from the Maryland household survey and 23 percent of employed persons from Virginia household survey who are definite or probable METRO users intend to cycle between home and METRO. Selected survey households were within three miles of future station locations.
- Approximately 40 percent of definite and probable METRO users indicated interest in bicycling if protected bikeways and safe storage facilities were provided.

- Most potential METRO users have work trip lengths longer than five miles and are probably not candidates for making their work trips entirely by bike.

Bicycle Ridership and Ownership

- A ridership estimation methodology based on existing bicycle use rates, attitudinal responses regarding potential use, and the extent of protected bikeway network development was developed for ridership estimation by jurisdiction for both existing and 1985 conditions.
- Approximately 590,000 bicycle trips are estimated for a typical 1976 fall weekday including nearly 92,000 in the District of Columbia. About 61,000 trips of this total are for work purposes, representing less than three percent of total work trips by all modes made in the study area.
- The number of bicycle trips made in the study area including the District of Columbia is estimated to increase by approximately 50 percent to nearly 890,000 trips by 1985. This estimate includes about 150,000 trips made in the District of Columbia. This estimate includes METRO-related trips and assumes bikeway network development as specified in the FY 1976 Short Range Transportation Improvement Program for Washington Metropolitan Area.
- The projected increases in bicycle ridership vary considerably for area jurisdictions depending on population changes and programmed bikeway network development for each jurisdiction. Arlington County ridership is projected to increase by 90 percent, the largest change for study area jurisdictions.
- Work commute cycling will increase to an estimated 105,000 trips on a typical fall weekday, equivalent to less than four percent of total 1985 work trips.

- The increased bicycle ridership by 1985 will result in less than one percent reduction in auto miles of travel in the study area including the District of Columbia. Furthermore, purposeful bicycle ridership is considered to be significantly lower during bad air quality conditions indicating that bicycle transportation is not particularly effective as a means to alleviate air pollution episode conditions. However, increased bicycle usage could result in air quality improvement on a localized level in the vicinity of major activity centers such as METRO stations, shopping centers, and large office complexes due to cold start and related effects associated with short trips.
- 1976 bicycle ownership in suburban Washington is approximately 0.3 bicycles per capita. This is about two times as great as estimated for the District of Columbia.
- Bicycle ownership per capita is estimated to increase by approximately 27 percent by 1985 in the Washington study area. Increased ridership is expected to result from greater cycling activity by existing bike owners to a large degree.

METRO-Related Cycling and Facilities

- METRO-related weekday bikeway trips will increase to an estimated 31,000 trips for a typical fall weekday in 1985. This assumes completion of the full Adopted Regional System (ARS) by 1985 with adequate bicycle storage facilities to accommodate estimated demand levels.
- While METRO-related cycling is only a small proportion of projected total bicycle trips, METRO-related work trips make up approximately 20 percent of total bicycle work trips in the study area.

- Bicycle storage facility requirements have been projected for 1985 for each METRO station. Maryland METRO stations require a total of approximately 3900 bicycle spaces; Virginia stations require 2900 bicycle spaces; and 6200 spaces are required at District of Columbia stations. Individual station requirements vary from 30 spaces to over 500 spaces at three District of Columbia stations.
- A specific breakdown has been made regarding the number of lockers or racks at each station. At least one-half of the bicycle spaces required at each station should be of the locker type. This is consistent with the BART program which is proceeding with extensive bike lockers with its present expansion. In addition, BART planners indicated they would have recommended more lockers initially based on current experience results.

Chapter 2

BICYCLE RIDERSHIP IN THE WASHINGTON AREA

Study survey results and available data summaries regarding bicycle ridership in other urban areas have been utilized to develop estimates of both existing and projected 1985 bicycle use in the Washington area. METRO-related ridership has been estimated independently and, while found to make up only a small fraction of total area bicycle tripmaking, does account for nearly one-fifth of projected 1985 work trips by bicycle. This chapter summarizes ridership estimates by jurisdiction in the study area for both 1976 and 1985, and reviews the methodology employed for estimation purposes.

BICYCLE RIDERSHIP ESTIMATION METHODOLOGY[1,2]

Employee and household surveys were conducted as part of this study to obtain information regarding attitudes to increased bicycle usage for work commuting via METRO and directly from the residence location to place of employment. These attitudinal responses and the household survey results regarding the magnitude of existing cycling have provided the basis for an approximate ridership estimation methodology that is sensitive to the degree of bicycle facilities availability. METRO-related cycling has been estimated separately using mapping techniques to account for factors and selected data for other rail transit systems in North America[3] in addition to attitude survey results.

Bicycle ridership (not including METRO trips) was estimated based on three factors:

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[1] Not including METRO-related bicycle trips.

[2] Further discussion of the methodology development is provided in De Leuw, Cather & Company, Technical Memorandum--Survey Results, Analysis, and Forecasting, September 1976.

[3] Since METRO trips are typically made for distances longer than four miles, use of independent procedures was considered to be acceptable and would not result in 'double counting'.

Existing bicycle ridership characteristics;
Attidues towards increased cycling; and
Bicycle network availability.

A brief discussion of how each factor was incorporated into the estimation methodology follows.

Existing Bicycle Ridership Characteristics. Table 2-1 summarizes selected survey results regarding the proportion of area residents who have made a bicycle trip within the preceding month and year. It should be noted that the District of Columbia has a significantly lower proportion of bicyclists than either of the household survey areas in Maryland and Virginia. For the household interview survey areas in Arlington and Montgomery Counties, 27-31 persons per 100 population indicate making at least one bicycle trip in the preceding one-month period.

Since the trip generation characteristics of the District of Columbia and suburban communities are known to be significantly different[1], the breakdown of bicycle trips by purpose derived from recently-completed District bicycle survey results[2] was not considered to be directly appropriate for suburban jurisdictions in the Washington area. Typically, a suburban household makes a significantly greater number of trips than one located in the central urban area. Furthermore, a large share of these additional trips are for non-work purposes.[3] Thus, it is reasonable to assume that the increased level of bicycle ridership determined for suburban areas from household survey results may also be made for non-work trip purposes. Based on this assumption, the trip purpose distribution shown in Table 2-2 was derived for bicycle ridership estimation in Washington suburban areas, reflecting a substantially higher degree of cycling for non-work trip purposes than found for the District of Columbia.

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[1] National Capital Region Transportation Planning Board. "Trip Generation and Land Use", Information Report No. 50. June, 1972.

[2] Barton Aschman and Associates, Inc. District of Columbia Bicycle Transportation Plan and Program, 1975.

[3] Oi and Shuldiner. An Analysis of Urban Travel Demands. 1968

Table 2-1

BICYCLE RIDERS PER CAPITA

	Bicycle Riders per 100 Population	
	Past Month[a]	Past Year
Washington Area		
Household Survey[b]		
Virginia	27	n/a
Maryland	31	n/a
District of Columbia[c]	15	27
Other[d]		
Santa Clara County, California	n/a	49
Santa Barbara, California	n/a	47
Eugene, Oregon	n/a	39
Ann Arbor, Michigan	n/a	29
Arizona	n/a	41

NOTES: (a) Adjusted for typical Fall ridership levels.

(b) De Leuw, Cather & Company

(c) Barton Aschman Associates, Inc. District of Columbia Bicycle Transportation Plan and Program. 1975.

(d) De Leuw, Cather & Company. Safety and Location Criteria for Bikeway Facilities. Draft Final Report for the Federal Highway Administration, October 1975.

Table 2-2

ESTIMATED TRIP PURPOSE DISTRIBUTION FOR

DISTRICT OF COLUMBIA AND SUBURBAN AREAS

Trip Purpose	Percent of Weekday Trips	
	District of Columbia	Suburban
Work	18	9
School	10	11
Personal Business (including shopping)	22	24
Recreation	16	17
Social	13	15
Around Neighborhood	22	24
	100	100

SOURCE: De Leuw, Cather & Company

Attitudes Towards Increased Cycling. Table 2-3 summarizes the number of survey respondents expressing willingness to commute to work by bicycle, at least on an occasional basis, from the household and employee surveys conducted in this study. From these results, it is clear that the development of bikeways and related facilities is the key determinant of increased cycling. The 1974 Prince Georges County employment center survey found similar results with 41 percent of employees residing within approximately five miles of work expressing interest in cycling if bikeways were built.

With regard to the magnitude of potential new work commute cycling, household interview survey results indicate that a 3-4 times increase over existing levels is the absolute maximum that should be expected. Employee survey responses suggest a substantially higher degree of potential expansion but these results appear significantly biased towards persons interested in cycling. In considering the projected increase based on household survey results, it should be fully understood that the responses contain a non-commitment bias and thus, overstate expected actual use. Furthermore, achieving even a portion of the expressed potential usage is directly dependent on highly improved bicycle facilities availability. Limited recent research regarding the magnitude of non-commitment bias for attitude surveys related to transit use suggest that a minimum 100 percent bias factor should be expected.[1] Thus, it was assumed that bicycle commuting to work as well as for other trip purposes will no more than double existing levels.

Bikeway Network Availability. The Washington study area is currently served by approximately 175 miles of Class I and Class II bikeways.[2] The FY 1976 Short Range Transportation Improvement Program for the Washington Metropolitan Area (SRTIP) compiled by the Metropolitan Washington Council of Governments from inputs by local jurisdictions

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[1] Hartgen, D.T., Forecasting Demand for Improved Quality Transit Service with Small-Sample Surveys. New York State Department of Transportation, Planning and Research Bureau, Preliminary Research Report No. 51, 1973.

[2] Estimated May 1975 mileage for Montgomery, Prince Georges, Arlington and Fairfax Counties; Alexandria and Falls Church; and the District of Columbia, from draft 'Map Reference Guide, Short Range Bikeway Improvement Program' prepared by the Metropolitan Washington Council of Governments, May 1975.

Table 2-3

POTENTIAL WORK COMMUTE CYCLISTS

	Household Survey		Employee Survey			
	Maryland	Virginia	AAA	Melpar	NIH	Vitro
Existing Cyclists (percent)	5	4	5	7	14	2
Potential Cyclists (percent)	9	13	28	18	20	29
Most Important Incentive for New Cyclists						
Build bikeways	57	50			76	
Safe bicycle storage	14	18	composite for all employee survey potential cyclists		9	
Provide showers and lockers	14	0			6	
Reduce street traffic	-	14			1	
Other	14	18			8	

NOTE: (a) Employee Survey responses were higher from cyclists resulting in a probable bias in the commute cycling rates for employment sites.

includes a commitment to constructing an additional 280 miles of Class I and Class II bikeways in the region over the next five years (see Table 2-4).[1] This would result in total protected bikeway system mileage of about 455 miles. Discussions with selected area jurisdictions indicate that the full five-year program will not be implemented as scheduled due to increasing funding constraints; thus, the five-year network has been assumed to represent 1985 conditions in the Washington area for forecasting purposes.

To evaluate and compare the extent of the existing and committed bikeway system networks, protected bikeway mileage has been compared with total street and highway system mileage for each area jurisdiction. Comparative results are shown in Table 2-5. In 1981, Arlington County has programmed the greatest density of bikeway routes, amounting to approximately ten percent of total street mileage. Montgomery County and the District of Columbia are also expanding bikeway system mileage significantly to approximately 8.4 and 7.1 miles per 100 miles of street mileage respectively in the five-year program. In Alexandria, no new bikeway system mileage has been indicated in the five-year program, although it has the highest density of mileage at the present time including the Potomac River trail maintained by the National Park Service. Both Fairfax and Prince Georges Counties have programmed new bikeway development that will bring their networks to approximately the same size as currently exists in other regional jurisdictions.[2]

The bikeway system density calculations presented in Table 2-5 provide a convenient means of comparing relative bikeway availability in each area jurisdiction. The measure does not address important system connectivity, terrain, or related locational aspects which will influence potential ridership response to available facilities. However, it has been used to define network availability as the key determinant of bicycle

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[1] Note that street and highway mileage estimates are for 1968 as compiled by the Metropolitan Washiongton Council of Governments. They have not been updated to account for either 1976 or future conditions nor have they been factored to reflect only street and highway mileage in urbanized portions of each jurisdiction.

[2] SRTIP may not reflect all construction to be undertaken in the next five years.

Table 2-4

WASHINGTON AREA BIKEWAYS DEVELOPMENT, 1975-81

Jurisdiction	Existing Bikeway Miles, 1975[a] Class I	Class II	Class III	Total	New Bikeway Miles, 1976-81[a] Class I	Class II	Class III	Total	1981 Total Bikeway Miles[a]
Maryland									
Montgomery County	18.4	6.1	0	24.5	122.4	0.4	3.1	125.9	150.4
Prince Georges County	5.1	12.6	0	17.7	33.5	6.5	0	40.0	57.7
Sub-Total	23.5	18.7	0	42.2	155.9	6.9	3.1	165.9	208.1
Virginia									
Arlington County	8.6	3.1	3.9	15.6	18.6	12.7	15.0	46.3	61.9
Fairfax County[b]	37.0[c]	0	0	37.0	11.6	15.6	2.1	29.3	66.3
Alexandria	0	6.4	0	6.4	0	0	0	0	6.4
Falls Church	1.6	0	0	1.6	0	0	0	0	1.6
Sub-Total	47.2	9.5	3.9	60.6	30.2	28.3	17.1	75.6	136.2
District of Columbia	0.8	2.5	2.1	5.4	17.6	22.6	35.1	75.3	80.7
National Park Service									
Montgomery County	37.5	0	0	37.5	0	0	0	0	37.5
Fairfax County	5.0	0	1.5	6.5	0	0	0	0	6.5
Alexandria	1.5	0	1.5	3.0	0	0	0	0	3.0
District of Columbia	16.0	11.0	2.0	29.0	6.6	0	0	6.0	35.6
Arlington	3.5	0	0	3.5	0	0	0	0	3.5
Sub-Total	63.5	11.0	5.0	79.5	6.6	0	0	6.6	86.1
TOTAL	135.0	41.7	11.0	187.7	210.3	57.8	55.3	323.4	511.1

NOTES: (a) Miles by facility type have been estimated in some cases.
(b) Includes Fairfax City.
(c) Includes 30 miles in Reston.

SOURCE: Metropolitan Washington Council of Governments. "Map Reference Guide, Short Range Bikeway Improvement Program," 1975.

Barton Aschman Associates, Inc. District of Columbia Bicycle Transportation Plan and Program. 1975.

Table 2-5

PROTECTED BIKEWAYS DENSITY, 1975-81

Jurisdiction	1975 Bikeway Miles[a]		1981 Bikeway Miles[a]	
	Class I/II	Per 100 Miles Street[b]	Class I/II	Per 100 Miles Street[b]
Montgomery County	62.0	2.9	176.1	8.4
Prince Georges County	17.7	0.8	44.3	2.1
Fairfax County[c]	12.0[d]	0.8	39.2[d]	2.3
Arlington County	11.7	2.7	43.0	10.0
Alexandria	11.4	6.4	11.4	6.4
District of Columbia	30.3	2.8	77.1	7.1

NOTES: (a) Includes National Park Service bikeway mileage.

(b) Estimated 1968 street and highway mileage reported in Existing Transportation Systems in the Washington Metropolitan Area--A Findings Report, 1972.

(c) Includes Falls Church and Fairfax City.

(d) Does not include bikeway mileage in Reston.

ridership. It seems reasonable to propose as a measure of the adequacy of bicycle network coverage that bikeway systems mileage be equivalent to some portion of total street mileage or arterial/major collector street mileage.

The key assumption underlying the ridership estimation methodology involves determination of the extent of an adequate protected bikeway network[1] that would provide the degree of accessibility required to attract the maximum number of potential new riders indicated by attitude survey response. After an inconclusive review of previous forecasting studies and European reference data, it was assumed that development of the bikeway network to a density equal to one-half of the arterial street network density would generate the maximum doubling of cycling activity for trips as indicated by attitude survey responses.[2] This assumption provided the data point required to define the bicycle use estimation relationship shown in Figure 2-1--the lower pair of points plotted corresponding to existing bicycle trip-making rates based on household survey results; the upper point assuming a doubling of cycling trips with the bikeway network expanded to one-half of the arterial street network density. This relationship was then applied for estimating both existing and 1985 bicycle ridership by jurisdiction for work as well as other trip purposes.[3]

This forecasting tool that has been developed in this report represents the current state-of-the art of bicycle ridership forecasting. The real relationship between bicycle ridership and bikeway network availability is not known and thus the assumptions stated above were utilized in developing the data points in the straight line for estimating purposes. As continued research is conducted in bicycle forecasting techniques, the relationship will be further defined.

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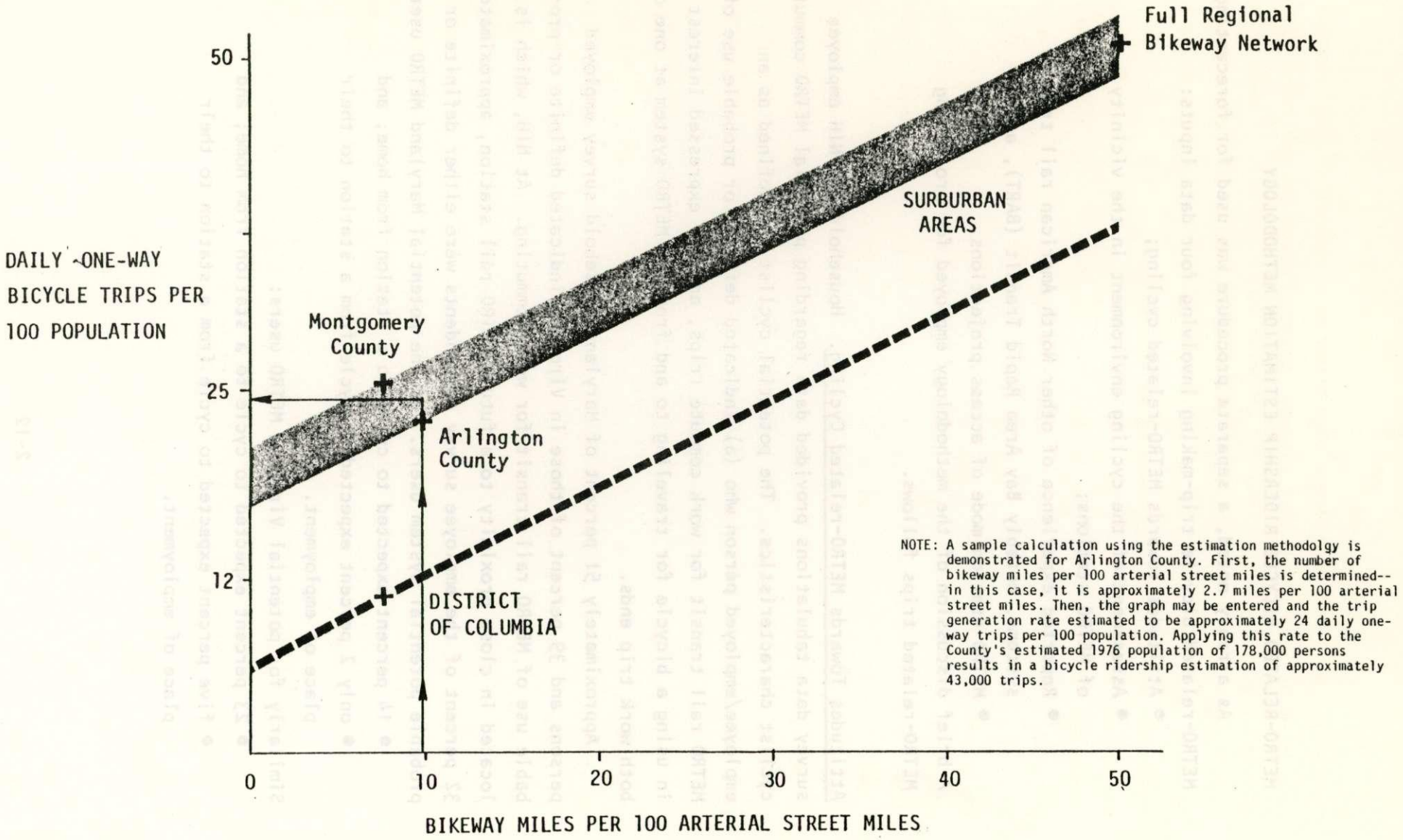
[1] On-street bicycle lanes are considered protected bikeways providing they are properly designed, built, and maintained.

[2] This assumption was made for ridership estimation purposes in this study and should not be considered a standard for bikeways development. Bikeways network palnning must consider many factors including system connectivity with major activity center locations and related items not considered in this estimation methodology.

[3] Not including METRO-related trips.

2-1
ESTIMATED BICYCLE TRIP GENERATION RELATIONSHIP



NOTE: A sample calculation using the estimation methodolgy is demonstrated for Arlington County. First, the number of bikeway miles per 100 arterial street miles is determined--in this case, it is approximately 2.7 miles per 100 arterial street miles. Then, the graph may be entered and the trip generation rate estimated to be approximately 24 daily one-way trips per 100 population. Applying this rate to the County's estimated 1976 population of 178,000 persons results in a bicycle ridership estimation of approximately 43,000 trips.

METRO-RELATED BICYCLE RIDERSHIP ESTIMATION METHODOLOGY

As already noted, a separate procedure was used for forecasting METRO-related bicycle trip-making involving four data inputs:

- Attitudes towards METRO-related cycling;
- Assessment of the cycling environment in the vicinity of METRO stations;
- Reported experience of other North American rail transit systems, notably Bay Area Rapid Transit (BART), and
- METRO station mode of access projections.

A brief discussion of the methodology employed for projecting METRO-related trips follows.

Attitudes Towards METRO-related Cycling. Household and NIH employee survey data tabulations provided data regarding potential METRO commute cyclist characteristics. The potential cyclist was defined as an employee/employed person who (a) indicated definite or probable use of METRO rail transit for work commute trips, and (b) expressed interest in using a bicycle for traveling to and from the METRO system at one or both work trip ends.

Approximately 51 percent of Maryland household survey employed persons and 39 percent of those in Virginia indicated definite or probable use of METRO rail transit for work commuting. At NIH, which is located in close proximity to a future METRO rail station, approximately 32 percent of the employee survey respondents were either definite or probable potential system users. Of the potential Maryland METRO users:

- 14 percent expected to cycle to a station from home; and
- only 2 percent expected to cycle from a station to their place of employment.

Similarly for potential Virginia METRO users:

- 23 percent expected to cycle to a station from home; and
- five percent expected to cycle from a station to their place of employment.

And lastly, for employees at NIH indicating that they would definitely or probably use METRO for work commuting:

- only five percent expected to cycle to a station from home; and
- only three percent expected to cycle from the Medical Center station to NIH.

These attitude survey responses are tabulated in Table 2-6 including the number of respondents in each classification.

These survey results provided an initial basis to determine the number of bicycle trips and required storage facilities at each METRO station. Of the definite and probable METRO users, between 14 and 23 percent indicated bicycle use for station access. Assuming a non-commitment bias of 100 percent in survey responses and factoring for frequency of use, a preliminary range of between 3-4 percent and six percent of METRO users may be expected to bicycle to and from METRO stations.

In a related question, definite and probable METRO commuters were asked regarding interest in cycling to METRO if improvements were made in perceived bicycling conditions. A high percentage of respondents from 38 percent for the Virginia household survey to 51 percent for the NIH employee survey indicated interest in riding to and from stations. These survey respondents were presented with the same list of improvement measures as existing and potential work commute cyclists and, while they also identified the need for protected bikeways as being most important, the desire for safe bike storage facilities ranked higher than for other groups and was frequently mentioned as a first or second most important improvement type (see Table 2-7).

Assessment of Station Area Cycling Environment. To establish the cycling environment in the vicinity of each METRO station, a set of key factors were identified and mapped for each station area. The factors

Table 2-6

NUMBER OF POTENTIAL METRO COMMUTE CYCLISTS

	Maryland[b]		Virginia[b]		NIH[c]	
	Number	Percent	Number	Percent	Number	Percent
Number of METRO Users						
Definite	38	19	22	14	48	12
Probable	65	32	41	26	78	20
	103	51	63	39	126	32
Use Bicycle for Station Access	14	14[a]	15	23[a]	5	5[a]
Use Bicycle for Station Egress	2	2[a]	3	5[a]	3	3[a]
Interested in METRO-related Cycling	45	44[a]	24	38[a]	64	51[a]

NOTE: (a) Percentage of definite and probable METRO users.

(b) Household survey.

(c) Employee survey.

Table 2-7

IMPROVEMENTS TO ENCOURAGE METRO-RELATED CYCLING

Improvement	Percent of Definite and Probable METRO Users					
	Most Important			Second Important		
	Maryland(a)	Virginia(a)	NIH(b)	Maryland(a)	Virginia(a)	NIH(b)
Enforce Traffic Laws	7	8	0	11	0	6
Build Bike Lanes on Streets	14	28	28	9	14	30
Reduce Street Traffic	7	17	6	5	6	2
Build Separate Bike Lanes	30	8	24	14	14	14
Provide Safe Bike Storage	7	8	20	27	6	24
Provide Showers and Lockers	2	0	1	2	0	4
Conduct Safety Education Classes	2	0	16	11	0	4
Other	32	31	6	5	6	2
TOTAL	100	100	100	84	44	84
	(N=45)	(N=24)	(N=64)	(N=38)	(N=11)	(N=54)

NOTE: Totals may not add due to rounding

(a) Household survey.

(b) Employee survey.

considered to be important for bicycle ridership estimation were as follows:

- Protected bikeway development--including both existing and 1981 programmed bikeways.
- Land Use--existing land use characteristics, particularly high density residential and other major activity areas.
- Barriers--including railroad lines, controlled access highways, and rivers and streams.
- Grades--severe grades greater than five percent over a distance greater than 1000 feet.
- Auto traffic volumes--1974 and 1975 Average Daily Traffic (ADT) volumes on major roadways.
- Potential METRO users distance from station--passenger access summaries by station and distance.
- Access modes--by station.
- Space availability at METRO stations for bicycle parking.

Information regarding the first five factors were obtained from the Metropolitan Washington Council of Governments, local planning agencies and departments, and USGS topographic maps for mapping on METRO rail corridor maps (see Appendix). Potential METRO users distance from stations and access mode were based on information provided by WMATA.[1] This information was adjusted from 1990 to 1985 based on METRO ridership projections provided by Metropolitan Washington Council of Governments. Space availability at METRO stations was ascertained through discussions with WMATA staff, and represented only a preliminary assessment of specific space availability subject to further detailed design consideration.

[1] Summary of Mode of Arrival at METRO Stations--Estimated 1990 Fare System No. 2 Trips. Prepared by A. M. Voorhees and Associates, November 1975.

Factors were compiled for each station as the basis for a composite assessment of the potential for cycling at each station--low, medium, or high potential. For example, attitude survey results indicated that special emphasis should be placed on the extent of protected bikeway development in the vicinity of METRO stations. In a similar manner, station areas with heavy auto traffic volumes and intense commercial or central business district land uses were considered to have a lower potential rating. Also, based on survey results that existing bicyclists typically walk or use transit when not cycling, a higher potential rating was assigned when these access modes were forecast heavily at a station. Thus, a composite rating for each station was derived and used to forecast bicycle ridership levels. Each factor rating and the composite measure of cycling potential are summarized for each METRO station in Maryland and Virginia in Tables 2-8. The composite ratings for the District of Columbia are presented in Table 2-8 as received from the District of Columbia Department of Transportation.

Experience from Other Transit Systems. Survey results as well as data from other transit systems was reviewed and used to specify bicycling trip diversion rates to be applied to METRO station mode of access projections. Only BART data regarding bicycle use at stations was found to be applicable for estimation purposes. May 1975 data indicates bicycle use varied considerably by station with a maximum of over four percent at the Pleasant Hill station. However, BART planners noted that bicycle use at many stations is constrained by inadequate storage facilities with available racks and lockers filled in early morning, and by limited bikeway network development in the station area. Thus, cycling diversion factors for high, medium, and low potential stations were assumed as follows:

High Potential Stations	- 7 percent
Medium Potential Stations	- 4 percent
Low Potential Stations	- 1 percent

TABLE 2-8
METRO STATION
BICYCLE USE POTENTIAL (MARYLAND)

Station	Bike Trail Development	Traffic/Land Use	Barriers/Grades	Mode Access	Distance	Space Requirements	Composite Rating
Rating →	●	○	●	○	○	○	•
Shady Grove	•	○	○	•	•	●	•
Rockville	•	•	●	○	○	●	•
Twinbrook	○	•	○	○	○	●	○
Nicholson Lane	●	•	○	○	○	●	○
Grosvenor	●	○	•	•	●	●	○
Medical Center	●	○	●	●	●	●	●
Bethesda	●	•	○	●	●	●	○
Friendship Heights	○	○	○	●	○	○	○
Glenmont	●	○	○	○	●	●	○
Wheaton	○	•	●	●	●	●	○
Forest Glen	○	○	○	○	●	●	○
Silver Spring	•	•	•	○	○	●	•
Greenbelt	•	●	○	○	○	●	○
College Park	●	●	○	•	○	●	●
Prince George's Plaza	•	○	○	●	●	○	○
Chillum-West Hyattsville	•	○	●	●	●	●	○
New Carrollton	•	•	•	•	•	●	•
Landover	•	○	•	•	○	●	•
Cheverly	•	●	○	●	○	●	○
Addison Road	•	●	○	○	○	●	○
Capital Heights	•	●	○	○	○	●	○
Branch Avenue	•	•	•	•	•	●	•
Suitland	•	•	●	○	●	●	○
Naylor Road	•	○	•	○	●	●	•

BICYCLE USE POTENTIAL

● = HIGH

○ = MEDIUM

• = LOW

TABLE 2-8 (CONTINUED)

METRO STATION
BICYCLE USE POTENTIAL (VIRGINIA)

Station / Factors	Bike Trail Development	Traffic/Land Use	Barriers/Grades	Mode Access	Distance	Space Requirements	Composite Rating
Rating	●	○	●	○	○	•	
Pentagon	●	•	•	○	•	○	•
Pentagon City	●	○	•	●	●	●	○
Crystal City	○	•	○	●	○	●	○
National Airport	○	•	●	●	○	●	○
Braddock Road	○	●	○	●	○	●	○
King Street	•	○	•	●	●	●	○
Eisenhower Avenue	•	○	•	•	•	●	•
Huntington	•	○	•	•	○	●	•
Van Dorn	•	○	•	•	○	●	•
Springfield	•	○	•	•	•	●	•
Franconia	•	○	•	•	•	●	•
Arlington Cemetary	●	●	○	•	○	●	○
Rosslyn	○	•	●	●	○	•	•
Court House	○	○	●	○	•	○	○
Clarendon	•	○	●	●	•	○	○
Ballston	○	○	●	○	●	○	○
Glebe Road	•	•	●	●	●	○	○
E. Falls Church	○	○	●	○	●	●	○
W. Falls Church	•	○	●	●	○	●	○
Dunn Loring	•	○	○	•	○	●	○
Vienna	•	•	○	•	•	●	•

BICYCLE USE POTENTIAL

● = HIGH

○ = MEDIUM

• = LOW

TABLE 2-8 (CONTINUED)

METRO STATION BICYCLE USE POTENTIAL (DISTRICT OF COLUMBIA)

Station	Composite Rating
Tenley Circle	●
Van Ness	●
Cleveland Park	●
Zoological Park	●
Dupont Circle	●
Union Station	●
Rhode Island	○
Brakland	○
Ft. Totten	○
Takoma	○
Foggy Bottom	●
Capitol South	○
Eastern Market	•
Potomac Ave.	•
Stadium Armory	○
Minn. Ave.	•
Deanwood	•
Benning Road	○
Alabama Ave.	○
Anacostia	•
Navy Yard	•
Waterfront	○
Federal City College	○
Shaw	○
U Street	○
Columbia Hts.	○
Georgia Ave.	○

BICYCLE USE POTENTIAL

● = HIGH

○ = MEDIUM

• = LOW

NOTE: Composite ratings for D.C. METRO Stations provided by D.C. Department of Transportation, September 1976.

These factors assume adequate bikeways availability and station storage facilities to accommodate projected demand levels. Furthermore, they reflect average peak ridership levels during favorable weather conditions. Adverse weather, darkness, and poor air quality conditions, would reduce the number of cycling trips to and from stations.

These diversion rates were found to correspond with the range suggested by attitude survey responses. Also, attitude survey results were tabulated to see if potential METRO-related cycling levels varied according to anticipated mode of station arrival without cycling-related improvements. It was hypothesized that cyclists might be more heavily attracted from bus or walking access modes. Unfortunately, sample sizes were too small to provide a reliable test of this hypothesis for estimation purposes. Survey data, however, did indicate that existing cyclists typically walk or use transit when not cycling and therefore, mode of access was retained as a factor in developing the composite rating.

METRO Station Mode of Access Projections. In determining total storage facilities required at each station, the total number of access trips to each station was estimated for 1985. Mode of arrival and total access trips were received from WMATA[1] for 1990. System ridership estimates by year were provided by the Metropolitan Washington Council of Governments to factor the access trips from 1990 to 1985.

At two stations, Pentagon and Fort Totten, high bus access trips resulted in a distorted picture of the potential for bicycle usage. Therefore, the bus access trips were adjusted to those trips within three miles of the Pentagon and Fort Totten stations to present a realistic case for the bike use potential.

PROJECTED 1985 METRO-RELATED BICYCLE TRIPS

Using the assumed diversion factors for high, medium and low potential stations and projected trips to and from METRO stations, 1985 METRO-related bicycle trips were estimated. Table 2-9 summarizes

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[1] Summary of Mode of Arrival at METRO stations--Estimated 1990 Fare System No. 2 Trips. Prepared by A. M. Voorhees and Associates, November 1975.

the number of bicycle trips projected to and from each METRO station in Maryland, Virginia, and the District of Columbia, respectively. In Maryland, nine stations resulted in greater than 500 one-way bicycle trips with the Chillum-West Hyattsville Station estimated at 905 trips. In Virginia, seven stations were found to have more than 500 bicycle trips with 900 trips estimated for Glebe Road Station. In the District of Columbia, thirteen stations were estimated to have more than 500 bicycle access trips in 1985.

ESTIMATED 1976 BICYCLE USE BY JURISDICTION AND TRIP PURPOSE

Application of the ridership estimation methodology for existing bicycle network characteristics results in an estimate that nearly 590,000 bicycle trips[1] are made in the Washington study area (including the District of Columbia on a typical fall weekday. In Table 2-10, a breakdown of bicycle trips by purpose and jurisdiction is presented.

Approximately one-tenth of total 1976 weekday bicycle trips or an estimated 61,000 trips will be made to and from work. This amounts to approximately three percent of all work trips made within the study area on a typical weekday. As a check of the estimation methodology, household interview survey results showed that 4 to 5 percent of employed persons commute by bicycle at least on an occasional basis. Applying frequency of cycling data from the bicyclist survey, which indicated that about one-half of commuting bicyclists are occasional riders, it may be determined 2-3 percent of total work trips on a typical weekday are made by bicycle. This corresponds with the upper limit of the estimate derived using the estimation procedure, and served to provide a general validation of the methodology.

PROJECTED 1985 BICYCLE USE BY JURISDICTION AND TRIP PURPOSE

Applying the methodology described in the preceding sections for 1985 population and bikeway network levels by jurisdiction,[2] it is

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[1] One-way trips.

[2] Assuming bikeway network development as currently programmed for 1981 in 'Map Reference Guide, Short Range Bikeway Improvement Program' prepared by the Metropolitan Washington Council of Governments, May 1975.

TABLE 2-9

PROJECTED 1985 METRO-RELATED BICYCLE TRIPS

MARYLAND

Station	Bicycle Access Potential Rating (b)	Estimated 1985 Daily Access/ Egress Trips	Estimated 1985 Daily Bicycle Trips
Shady Grove	Low	n/a	100 (a)
Rockville	Low	11631	100 (a)
Twinbrook	Med	6679	270
Nicholson Lane	Med	16382	660
Grosvenor	Med	5827	230
Medical Center	High	8235	580
Bethesda	Med	17633	710
Friendship Heights	Med	11294	450
Glenmont	Med	13087	520
Wheaton	Med	11073	440
Forest Glen	Med	15627	620
Silver Spring	Low	26041	260
Greenbelt	Med	12713	510
College Park	High	9759	680
Prince George's Plaza	Med	5785	230
Chillum-West Hyattsville	Med	23573	940
New Carrollton	Low	9277	90
Landover	Low	11734	120
Cheverly	Med	3175	130
Addison Road	Med	11049	440
Capital Heights	Med	9971	400
Branch Avenue	Low	11990	120
Suitland	Med	15125	600
Naylor Road	Low	11577	120
TOTAL			9320

NOTE: (a) Assumed by De Leuw, Cather & Company

(b) Bicycle trip diversion rates were assumed as low--1 percent; medium--4 percent; and high--7 percent.

TABLE 2-9 (CONTINUED)

PROJECTED 1985 METRO-RELATED BICYCLE TRIPS

VIRGINIA

Station	Bicycle Access Potential Rating	Estimated 1985 Daily Access/ Egress Trips	Estimated 1985 Daily Bicycle Trips
Pentagon	Low	53174	190
Pentagon City	Med	14864	590
Crystal City	Med	10730	430
National Airport	Med	2000	80
Braddock Road	Med	13495	540
King Street	Med	7988	320
Eisenhower Avenue	Low	20391	200
Huntington	Low	10655	110
Van Dorn	Low	7290	70
Springfield	Low	11137	110
Franconia	Low	7259	70
Arlington Cemetary	Med	6539	260
Rosslyn	Low	25624	260
Court House	Med	5967	240
Clarendon	Med	12693	510
Ballston	Med	2744	110
Glebe Road	Med	22779	910
E. Falls Church	Med	16324	650
W. Falls Church	Med	15154	610
Dunn Loring	Med	13034	520
Vienna	Low	12147	120
		TOTAL	6900

(a) Bicycle trip diversion rates were assumed as low--1 percent; medium--4 percent; and high--7 percent.

TABLE 2-9 (CONTINUED)

PROJECTED 1985 METRO-RELATED BICYCLE TRIPS

DISTRICT OF COLUMBIA

Station[a]	Bicycle Access Potential Rating[b]	Estimated 1985 Daily Access/ Egress Trips	Estimated 1985 Daily Bicycle Trips
Tenley Circle	High	18678	1310
Van Ness	High	10613	740
Cleveland Park	High	7005	490
Zoological Park	High	8206	570
Dupont Circle	High	12701	890
Union Station	High	12040	840
Rhode Island Avenue	Med	19769	790
Brookland	Med	14369	580
Fort Totten	Med	36393	1350
Takoma	Med	18933	760
Foggy Bottom	High	12449	870
Capital South	Med	2624	100
Eastern Market	Low	9236	90
Potomac Avenue	Low	8829	90
Stadium Armory	Med	9973	400
Minnesota Avenue	Low	18113	180
Deanwood	Low	4380	40
Benning Road	Med	13183	50
Alabama Avenue	Med	33703	1350
Anacostia	Low	22302	220
Navy Yard	Low	3367	35
Waterfront	Med	9776	390
Federal City College	Med	4576	180
Shaw	Med	5235	210
U Street	Med	8715	350
Columbia Heights	Med	18255	730
Georgia Avenue	Med	26893	1080
		TOTAL	14685

NOTES: (a) The following stations were not included because of their location in the Central Business District (CBD)--Farragut North, Farragut West, McPherson Square, Metro Center, Federal Triangle, Smithsonian, L'Enfant Plaza, Federal Center, Archieves, Gallery Place, Judiciary Square.

(b) Ratings of potential bicycle use for the District of Columbia were assigned by the D. C. Department of Transportation, September, 1976.

(c) Bicycle trip diversion rates were assumed as low--1 percent; medium--4 percent; and high--7 percent.

Table 2-10
ESTIMATED WEEKDAY BICYCLE TRIPS[d]
FALL 1976

Jurisdiction	Trip Purpose: Work	School	Personal Business[a]	Recreation	Social	Neighborhood	Total Trips
Montgomery County	13,000	15,900	34,700	24,700	21,700	34,700	144,800
Prince Georges County	13,500	16,500	36,000	25,500	22,500	36,000	149,800
Arlington County	3,800	4,700	10,200	7,300	6,400	10,200	42,700
Fairfax County[b]	10,900	13,300	28,900	20,500	18,100	28,900	120,600
Alexandria	3,500	4,300	9,500	6,700	5.900	9,500	39,400
District of Columbia	16,500	9,200	20,200	13,900	11,900	20,200	91,800
TOTAL	61,200	63,900	139,500	98,600	86,500	139,500	589,200

NOTES: (a) Includes shopping trips.

(b) Includes Falls Church and Fairfax City.

(c) Totals may not add due to rounding.

(d) One-way trips.

estimated that bicycle ridership including METRO-related trips will increase to nearly 900,000 one-way trips on a typical fall weekday (see Table 2-11). This represents a 50 percent increase over estimated existing ridership. Of this total, approximately 31,000 trips are to and from METRO rail transit stations. Table 2-12 shows the bicycle ridership increases projected for each jurisdiction. The number of work commute trips will increase to over 106,000 by 1985 including nearly 19,000 METRO-related trips. This represents less than four percent of all 1985 work trips in the study area or a slightly greater proportion than currently utilizing bicycle transportation for work trips.

Arlington and Montgomery Counties and the District of Columbia are projected to experience the largest gains in cycling, since these jurisdictions have programmed the most extensive bikeway network improvements. The number of bicycle trips in Arlington County will nearly double, while Montgomery County and the District will have approximately one-half and nearly one-thirds more bicycle trips respectively in 1985.

The METRO-related cycling is presented in summary form by jurisdiction and trip purpose in Table 2-13. While the total number of METRO-related trips represents a small portion of all urban travel, METRO-related cycling trip volumes are significant for work trips, especially in the District of Columbia.

Table 2-11
ESTIMATED WEEKDAY BICYCLE TRIPS[e][f]
1985

Jurisdiction	Work[d]	School	Personal Business[a]	Recreation	Social	Neighborhood	Total Trips[c]
Montgomery County	22,800	24,100	53,400	37,500	33,400	52,500	223,700
Prince Georges County	20,900	22,500	49,300	34,500	30,600	48,500	206,400
Arlington County	8,800	8,900	19,200	13,400	11,900	18,700	80,800
Fairfax County[b]	17,000	19,800	43,300	30,300	26,900	42,700	180,000
Alexandria	5,500	5,200	11,100	7,600	7,000	10,700	47,000
District of Columbia	31,500	13,800	40,000	20,800	17,600	27,500	151,000
	106,500	94,300	216,300	144,000	127,400	200,600	889,000

NOTES: (a) Includes shopping trips.
(b) Includes Falls Church and Fairfax City.
(c) Totals may not add due to rounding.
(d) Bicycle use to and from METRO rail stations included.
(e) One-way trips.
(f) Bicycle trips are for a typical fall weekday with favorable weather conditions.

Table 2-12

COMPARISON OF 1976 AND 1985 BICYCLE TRIPS BY JURISDICTION

	Number of Bicycle Trips[b]		
	1976	1985	Percent Increase
Montgomery County	144,800	223,700	55
Prince Georges County	149,800	206,400	38
Arlington County	42,700	80,800	89
Fairfax County[a]	120,600	180,000	49
Alexandria	39,400	47,000	19
District of Columbia	91,800	151,000	64
TOTAL	589,000	889,000	51

NOTE: (a) Includes Falls Church and Fairfax City.

(b) Bicycle use to and from METRO rail stations included.

TABLE 2-13

PROJECTED 1985 METRO-RELATED WEEKDAY BICYCLE TRIPS[c]

Jurisdiction	Trip Purpose		
	Work[e]	Non-Work	Total[b]
Montgomery County	2050	1950	5000
Prince Georges County	2680	1720	4400
Arlington County	1830	1170	3000
Fairfax County[a]	1000	600	1600
Alexandria	1530	970	2500
District of Columbia	8970	5730	14700
TOTAL	19000	12000	31000

NOTES: (a) Includes Falls Church and Fairfax City

(b) Totals do not add due to rounding

(c) One-way trips

(d) Bicycle trips are for a typical fall weekday with fair to good weather conditions.

(e) Work/non-work split provided in WMATA Net Income Analysis Study, Summary of Modal Choice Results for 1992, prepared in 1975.

Chapter 3

METRO STATION BICYCLE FACILITIES

INTRODUCTION

The provision of access facilities at METRO stations is vital to the success of the rail rapid transit system. WMATA is concerned with providing for bicycle access and has made tentative policy decisions with regard to bicycle storage facilities at stations. Incorporated into the design of the stations are provisions for fifty bicycle racks where WMATA-owned land is available. WMATA recognizes that the number of spaces planned for bicycle storage is minimal, primarily due to the absence of bicyclist forecast data, and has welcomed information about experience at other transit systems and storage equipment availability.

Some of the key points addressed in response to the need for providing effective bicycle facilities at METRO stations include the following:

- Both bicycle storage lockers and racks and access trails in the station vicinity are required.
- Experience at BART and other major rail transit systems indicated that rail transit riders will cycle to and from stations when adequate facilities are provided.
- Bicycle storage facilities can be designed as an attractive and integral part of each METRO station.
- Both lockers and racks are basic in meeting the needs of short-term and long-term parkers and are required if maximum bicycle use levels are to be obtained.
- To firmly establish the maximum potential for METRO-related cycling, an immediate action program to encourage maximum bicycle ridership needs to be developed.

- In order to implement a realistic program, cooperation and coordination are necessary among WMATA, the local jurisdictions, and the Council of Governments.

This chapter considers each of these items, drawing upon a survey of North American and European transit systems regarding bicycle use experience and through an inventory of available bicycle storage equipment.

RAPID TRANSIT SYSTEM EXPERIENCE AND POLICIES

In August 1976, De Leuw, Cather & Company in conjunction with the Metropolitan Washington Council of Governments, conducted a survey of 16 rail rapid transit systems in the United States, Canada, and Europe. Fourteen transit systems from North America and Europe responded, identifying their system policy towards bicycle, extent of bicycle storage facilities, and use of existing bicycle facilities. The responses are summarized in Table 3-1.

In general, most rail transit systems (including heavy rail, light rail, and commuter rail) have policies that prohibit bicycles on transit vehicles. Only BART in San Francisco and the PATH system in New York-New Jersey allow bicycles on trains, with BART only permitting bicycle use in off-peak periods. Both systems require pre-registration permits for bicycle on trains. Contrary to original expectations, there have been no operational problems with bicycle on either the BART or PATH transit systems.

Most of the newer transit systems are providing some form of bicycle storage facilities at stations. Older systems have not provided even limited facilities, although in some instances, bicycle racks have been provided by local communities.

Class II racks (see Bicycle Storage Facility Types) have been preferred by the newer systems, since they compromise cost with security. However, experience at the BART system indicates a high demand for Class I locker type facilities. BART is the only major

TABLE 3-1
RAPID TRANSIT SYSTEM BICYCLE EXPERIENCE

System	City, State	Type of Transit System	Are bicycles allowed on transit vehicles?	Are bicycle racks provided at stations?	Are bicycle lockers provided at stations?	Type of locker or rack preferred?	Is ther a charge for bicycle racks?	Is ther a charge for bicycle lockers?	Theft problem?	Vandalism?	Guard or attendant on duty?	Have there been any operationsl problems as a result of bikes on transit vehicles?	Has there been any effort to provide bicycle access trails to transit stations?	Usage of existing bike storage facilities	Comments
Port Authority Transit Corporation (PATCO)	Philadelphia (PA-NJ)	Regional Rail Rapid Tranist	No	Yes	No	Rally Rack RR-300 RR-600	No	N/A	Yes	Yes	Yes	N/A N/A	None None	Good Good	Bike rack expansion program underway
Urban Community Transit Commission (UCTC)	Montreal, Quebec, Canada	Rail Rapid Transit	No	No	No	N/A	N/A	N/A	N/A	N/A	N/A	NR	NR	N/A	----
Illinois Central Gulf Railroad (ICG)	Chicago, Illinois	Commuter Rail	No	Yes	No	Recreation Equipment Corp. Model No. 53105	No	N/A	NR	NR	No	N/A	None	Not Available	Bicycle rider's responsibility to secure bicycle to rack
Bay Area Rapid Transit District (BART)	San Francisco, California	Rail Rapid Transit	Yes w/permit	Yes	Yes	Rack: BART inhouse design; Locker: Bike Lokr Model M02	No	Yes	Yes	Yes	Yes	No	Yes	Good 0-5%	1968 bicycle permits have been issued; expansion program, 324 new bicycle lockers (648 bicycle spaces)
Massachusetts Bay Transportation Authority (MBTA)	Boston, Massachusetts	Rail Rapid Transit Light Rail Transit Commuter Rail	No	No	No	N/A	N/A	N/A	N/A	N/A	N/A	Yes	None	N/A	Bike Sundays on one commuter rail line with 250 bicyclists (average). Bike rack program in planning stage
Port Authority of New York & New Jersey (PATH)	New York, New York	Commuter Rail	Yes w/permit	Only 1 station (Jersey City Intermodal Terminal)	No	Rally Rack RR-100	No	N/A	No	No	Yes	No	None	Not Available	1000 bicycle permits have been issued
New York City Transit Authority (NYCTA)	New York, New York	Rail Rapid Transit	No	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NR	N/A	Special arrangements for groups of bicyclists on weekends.
Southeast Pennsylvania Transportation Authority (SEPTA)	Philadelphia, Pennsylvania	Rail Rapid Transit Light Rail Transit Commuter Rail	No	Yes at 46 commuter rail stations	No	Galvanized Metal Racks	No	N/A	No	No	at some stations	N/A	None	Fair-Poor	125 bicycles per day at 46 stations during April-October period (less than 1% of total trips)
Chicago Transit Authority (CTA)	Chicago, Illinois	Rail Rapid Transit	No	Yes, at 5 stations (by community)	No	Galvanized or tubular steel racks	No	N/A	No	No	No	N/A	None	Fair	82 bicycles per day at 5 stations
Sistema de Transporte Colectivo (Mexico City)	Mexico City, Mexico	Rail Rapid Transit	No	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NR	N/A	"no facilities exist....even when we recognize the....potential usefulness to our users"
Regional Transit Authority (RTA)	Cleveland, Ohio	Rail Rapid Transit Light Rail Transit	No	Yes at 3 stations (lt. rail)	No	NR	No	N/A	No	No	NR	N/A	None	Very light usage	"The only bicycles at the racks are old ones not likely to be stolen."
Toronto Transit Commission (TTC)	Toronto, Canada	Rail Rapid Transit Light Rail Transit	No except folding bicycles	Yes	No	NR	No	N/A	NR	NR	NR	N/A	Yes	Not Available	"The Commission has encouraged the use of public transit facilities by attempting to provide convenient access to all modes of transportation....including bicycle."
Paris Transit Administration (RATP)	Paris, France	Rail Rapid Transit Suburban Rail	Yes on certain segments only	Yes	Yes	Enclosed Protected Area and Outside Sheltered areas	No	Yes	No	No	Yes	N/A Bikes Stored in Baggage Compartment	NR	Heavy	Bikes are not permitted on the downtown or urban lines. Bikes are permitted in baggage departments of the Regional Rail Network trains with baggage service.
London Transport	London, England	Rail Rapid Transit Suburban Rail	Yes, however restricted	Yes	No	Concrete Blocks and Metal Racks	No	N/A	Yes	No	No	No	Yes	Good	Bicycles restricted to trains on certain lines and between 10.00 and 16.00 hours and after 19.00 hours Monday - Friday and all day Saturdays, Sundays, and Holidays.

transit system with lockers at stations and also charges for locker use. In all cases, bicycle racks are provided free of charge. The high demand for lockers at BART stations prompted an ambitious expansion program of 648 new locker spaces this year. In addition, it is believed that the inadequate supply of both racks and lockers has been a deterrent to many potential bicycle users. BART planners further indicate that initially more lockers would have been recommended based on current experience results. In light of the BART experience, it is recommended that fifty percent of the storage equipment be of the locker type (Class I) and fifty percent of the rack type (Class II).

Some systems have experienced safety problems including theft and vandalism, although this has not been reported as a major problem. Storage facility location and quality were cited as being important factors for both usage and safety.

In most areas, there has been little effort to provide bicycle access trails directly to transit stations. Only BART and Toronto Transit Commission indicated an effort by the local communities to provide trails.

Bicycle usage varies from system to system. Lack of bicycle storage facilities, poor climatic conditions, limited access trails, and no marketing are apparent reasons for no or little bicycle usage to and from some systems. However, the BART and PATCO transit systems report from one to five percent bicycle usage at stations. This has encouraged both systems to undertake major bicycle storage facility expansion programs.

BICYCLE STORAGE FACILITY TYPES AND DESIGN

Bicycle storage needs have been classified for serving commuter or long-term parking and convenience or short-term parking. Examples of commuter parking facilities are bike lockers, attended storage areas, and unattended weather protection areas with some sort of

controlled access. Convenience parking requires, as a minimum, means of securing the two wheels and frame with a lock carried by the user.

While parking needs may be identified by trip purpose of the user--commuter or convenience, parking devices may be classified by the amount and type of protection offered. Available devices can be separated into three types or classes--Class I offering the most protection from theft, weather, and damage; and Class III offering the least. Protection from theft is the most critical element to consider when selecting bicycle parking devices and locations.

Class I offers total protection against weather and excellent protection from theft or damage to frame, both wheels, and all accessories. This is accomplished by either a locker type device, similar to a large baggage locker found at airports, or by making available a controlled access space where bicycle may be stored. This type of space must be either attended or locked, with the key kept by a responsible official. Prices for parking devices of this class range between $100 and $170 per bike.

Class II secures the frame and the two wheels from theft while requiring the cyclist to carry no more than a lock. Other parts of the bicycle, such as the seat, air pump, tool kit, etc., are not protected by this class of device. A special structure or existing building overhand is needed to provide weather protection. As expected, the price range is lower than the Class I locker. Prices start at about $25 per bike to a high of about $80 per bike.

Class III offers the least protection from theft, falls into the lowest price range, and should be considered only for short-term convenience parking. A Class III device consists of any fixed object to which a bicycle may be chained and locked. It may also support the bicycle. The cyclist must provide a lock and chain or cable (weighing as much as ten pounds). The cost ranges from none for use of existing parking meters, railing, and poles, to approximately $18 per bike for some devices. No weather protection is offered.

Table 3-2 presents available bicycle storage facility devices with use as reported in August 1976 by some rapid transit systems. No attempt will be made to rank or rate the different devices. Security, visual appearance, and space required for installation are a function of localized needs, requirements, and site specific conditions. Visual appearance in particular is a very subjective criterion; however, bicycle storage facilities can be attractively painted and landscaped to blend in with the local setting as desired. In addition, location of facilities is most important for convenience, theft protection, and pedestrian safety and movement.

The design and location of bicycle storage facilities at METRO stations should consider the following recommendations:

- At least two types of lockers and racks should be tested at selected METRO stations to evaluate strength, security, weather protection, and cyclist preference factors.
- Storage facilities should be located close to and in sight of the METRO station attendant.
- Storage facilities should be located so that bicycles are protected from inclement weather, and more importantly, from theft and vandalism.
- Landscaping and attractive design schemes can be successful in enhancing the appearance of the facilities to blend with the local station setting.
- Facilities should be located to minimize potential pedestrian, auto, bus and bicycle movement conflicts in the station area.
- Storage areas should be located so that the number of storage spaces can be easily expanded as bicycle and transit ridership expand.

Bicycle storage fees for usage are a policy decision that needs to be addressed in the context of user fees and fares for all access

TABLE 3-2
AVAILABLE BICYCLE STORAGE FACILITY TYPES

Name of Device	Manufacturer City, State	Class	Model	Price	Notes
1. Rack III	Rack III San Francisco, California	II	Padlock Coin-Op	$37.95 each $95.50 each	
2. Rally Rack	Rally Enterprises, Inc. Mill Valley, California	III	RR-100	$17.90 each	Used by PATH system (NY-NJ) at Journal Square Transp. Center
		II	RR-200	$19.90 each	Used by WMATA (DC) at present and future stations
		II	RR-300	$44.90 each	PATCO (PA-JN) installing 171 Rally Racks RR-300
		II	RR-400	$135.00 each	
		II	RR-500	$100.00 each	
3. Cycle-Safe	BMR Fabricators, Inc. Tocca, Georgia	I	D-H Padlock Coin-Op	 $126.00 each $168.00 each	
4. Bike Lokr	Bike Lockers, Inc. North Highlands, California	I	Padlock Coin-Op	? $297.00 each	2 bikes per locker BART installing 324 Bike Lokrs
5. Bike Stable	Bike Stable Co., Inc. South Bend, Indiana	I	--	?	
6. Cycle-Sentry	Sentec Industries, Inc. San Francisco, California	II	Galvanized Painted	$36.00 each $39.00 each	
7. Bike-Safe	Patterson-Williams Santa Clara, California	II	--	?	
8. Bala-Byk-Lok-Rak	Bala-Byk-Lok-Rak Pacifica, California	II	Padlock Coin-Op	$31.50 each $65.00 each	
9. Bike Lock-Up	Howard Enterprises Stockton, California	II	Standard Deluxe	$31.00 each $35.00 each	
10. Park-a-bike Systems	Park-a-bike Systems Denver, Colorado	II	--	$25.00 each	
11. Spider Web	Fred Wolfe Denver, Colorado	II	--	?	
12. Bike Bank	Echelon Corporation Edina, Minnesota	II	--	?	
13. Game Time	Sidney Shore Associates New York, New York	III	--	?	
14. Allen Racks	Allen T. Duffey Willits, California	III	--	?	
15. --	Recreation Equipment Corp.	III	Model 53105	$110.00 each	10 bike capacity - Illinois Central Gulf Commuter Rail Stations

modes to METRO stations. In general, experience elsewhere indicates free usage for the Class II and III type racks and minimal fees for the Class I locker type equipment. The administrative cost of a locker program can be minimized by either free locker usage or rental on a monthly or multi-monthly basis with pre-registration required.

IMPLEMENTATION PROGRAM

Based on the forecast demand for cycling to and from METRO stations, it is recommended that a comprehensive METRO station bicycle facilities program be implemented in the Washington area by WMATA and the local jurisdictions. The recommended program consists of two phases--a long-range comprehensive program that encompasses requirements for stations being opened or completed to 1985, and a short-range immediate-action program to be completed within the next 12 months in concert with the Phase II METRO opening. WMATA and the local jurisdictions should work toward the installation of the recommended number of spaces through identification and resolution of specific station area constraints.

Elements of the comprehensive program include providing for long-range station bicycle storage requirements in conjunction with continuing planning, coordination, and marketing. The immediate-action program includes specification of bicycle lockers and racks and other requirements for a few selected stations included in the Phase II METRO system. The purpose of the immediate-action program is to demonstrate that adequate facilities will encourage cyclist use as well as to provide design guidance for further implementation of bicycle storage facilities as METRO stations are opened. The immediate-action program is within the funding capabilities of WMATA and the local jurisdictions, and presents a realistic approach towards an expanded METRO bicycle facilities policy.

Immediate-Action Program

The immediate-action program has been developed to coincide with the Phase II METRO system opening, currently scheduled for late Summer or Fall, 1977. The programs consists of the following elements:

- Bicycle storage requirements for three METRO stations;
- Access trails;
- Marketing; and
- Monitoring and evaluation.

Three stations are suggested for the immediate-action program:

- Union Station
- Rosslyn
- Silver Spring

The selection of only three stations represents a minimum in terms of commitment to the program. Additional stations, if not all Phase II stations, could be included if WMATA and the local jurisdictions desire to make such a commitment

Bicycle Storage Requirements. The following is recommended for initiating the program:

Station	Storage[1]	Approximate Initial Cost
Union Station	75 racks 75 lockers	$21,000
Rosslyn	55 racks 55 lockers	$15,400
Silver Spring	55 racks 55 lockers	$15,400

As mentioned previously, two different types of lockers and racks should be tested and evaluated. Experience from BART and other systems should be used as input into the selection process. Furthermore, the responsibility for the installation of racks and lockers should be jointly shared by WMATA and the appropriate local jurisdiction.

Access Trails. As an essential part of the immediate-action program, the construction of new bicycle access trails to the stations should act as a stimulus for increased bicycle usage. At least one major bikeway, to be selected by the local jurisdiction, should be implemented for each station. The bikeway should probably be of the

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[1] Rosslyn and Silver Spring stations' 1985 forecasted requirements were utilized since they are both interim terminal stations for a number of years.

Class II type, located on major streets and roadways using striping, signs, and other necessary traffic engineering improvements. The implementation of new bikeways to provide a safer biking environment is considered to be a key element of the immediate-action program and required for overall program success.

Marketing. As a means of increasing bicycle usage to METRO stations, a marketing program should be implemented. Information regarding bicycle storage equipment, bikeways, etc., should be included in the METRO Owner's Guide and other pamphlets explaining how to use the new rail system. Furthermore, METRO advertising should encourage bike access as well as bus, kiss-n-ride, and park-n-ride modes. Bicycle access information should also be distributed to bicycle interest groups, clubs, and coalitions in the Washington area.

Monitoring and Evaluation. It is suggested that a monitoring and evaluation effort be conducted for a twelve-month period following the opening of the Phase II METRO stations. The monitoring should include routine counts on a weekly or bi-weekly basis. A survey of cyclists should be undertaken to determine:

- adequacy of the access trails and routes
- acceptability of storage fees
- acceptability of different types of racks and lockers

Overall program evaluation should address the following items:

- total cost of the program including both operating costs and revenues
- utilization of the bicycle storage facilities by time of day
- impacts of adverse weather on bicycle usage
- cyclist access mode when not cycling
- previous travel mode of cyclist prior to METRO Phase II opening
- bike trip distance of cyclists
- potential for expanded METRO bicycle program including bicycles on trains
- bicycle security in the storage areas

The monitoring and evaluation effort should be a joint effort of the Metropolitan Washington Council of Governments, the WMATA Office of Planning, and each of the participating local jurisdictions.

Comprehensive Program

The long-range comprehensive program is based on the current METRO construction schedule and on the bicycle usage forecasts for 1985. The following program description includes:

- Bicycle storage requirements for each METRO station;
- Development of trails in the METRO corridors; particularly within 500 feet of the METRO stations;
- Financial requirements; and
- Continuing planning, local coordination, and marketing.

Bicycle Storage Requirements. Based on the forecasts of bicycle use to METRO stations presented in Chapter 2, storage facilities requirements have been developed. A 1.2 daily space turnover rate has been assumed to estimate the required number of bicycle storage spaces. Estimated storage requirements for each METRO station in Maryland, Virginia, and the District of Columbia are presented in Table 3-3. In Table 3-4, bicycle storage requirements are summarized by METRO phase and jurisdiction.

It is recommended that based on experience at BART in San Francisco that about one-half of the bicycle storage spaces be of the Class I locker type with the remainder of the Class II rack type. Long-term bicycle commuters indicate strong preference for the use of lockers, particularly due to their higher security.

Development of Trails in the METRO Corridors. Protected bicycle trails, either existing or programmed to 1981, are presented in the Appendix on ten METRO corridor maps. Many stations have very few access trails which are existing or programmed. Exceptions include the METRO stations at Glenmont, College Park, and Braddock Road, and those situated in the Arlington and Bethesda METRO corridors. Recent

Table 3-3

METRO STATION BICYCLE STORAGE REQUIREMENTS

MARYLAND

Station (Construction Phase)	Bicycle Access Potential	Bicycle Storage Facilities Required (a),(b)
Shady Grove (VIA)	Low	40
Rockville (VIA)	Low	40
Twinbrook (VIA)	Med	110
Nicholson Lane (VIA)	Med	275
Grosvenor (VI)	Med	100
Medical Center (VI)	High	240
Bethesda (VI)	Med	295
Friendship Heights (VI)	Med	190
Glenmont (VII)	Med	220
Wheaton (VII)	Med	185
Forest Glen (VII)	Med	260
Silver Spring (IIA)	Low	110
Greenbelt (VIII)	Med	210
College Park (VIII)	High	285
Prince George's Plaza (VIII)	Med	100
Chillum-West Hyattsville (VIII)	Med	390
New Carrollton (III)	Low	40
Landover (III)	Low	50
Cheverly (III)	Med	50
Addison Road (IVA)	Med	185
Capital Heights (IVA)	Med	170
Branch Avenue (VIII)	Low	50
Suitland (VIII)	Med	250
Naylor Road (VIII)	Low	50
TOTAL		3,895

NOTE: (a) Storage requirements were developed assuming a diversion factor to bicycles from all access trips of 7 percent-high potential stations; 4 percent-medium potential stations; and 1 percent-low potential stations. In addition, a 1.2 turnover rate was assumed for storage requirements.

(b) The number of recommended locker spaces reflect anticipated demand. In some cases there may not initially be sufficient space at the station to accomodate the forecasted storage space requirements.

Table 3-3 (Continued)

METRO STATION BICYCLE STORAGE REQUIREMENTS

VIRGINIA

Station (Construction Phase)	Bicycle Access Potential	Bicycle Storage Facilities Required (a), (b)
Pentagon (II)	Low	80
Pentagon City (II)	Med	250
Crystal City (II)	Med	180
National Airport (II)	Med	35
Braddock Road (V)	Med	225
King Street (V)	Med	130
Eisenhower Avenue (V)	Low	85
Huntington (V)	Low	45
Van Dorn (VIA)	Low	30
Springfield (VIA)	Low	50
Franconia (VIA)	Low	30
Arlington Cemetary (II)	Med	110
Rosslyn (II)	Low	110
Court House (IV)	Med	100
Clarendon (IV)	Med	210
Ballston (IV)	Med	45
Glebe Road (IV)	Med	380
E. Falls Church (VIA)	Med	270
W. Falls Church (VIA)	Med	255
Dunn Loring (VIA)	Med	220
Vienna (VIA)	Low	50
TOTAL		2,890

NOTE: (a) Storage requirements were developed assuming a diversion factor to bicycles from all access trips of 7 percent-high potential stations; 4 percent-medium potential stations; and 1 percent-low potential stations. In addition, a 1.2 turnover rate was assumed for storage requirements.

(b) The number of recommended locker spaces reflect anticipated demand. In some cases there may not initially be sufficient space at the station to accommodate the forecasted storage space requirements.

Table 3-3 (Continued)

METRO STATION BICYCLE STORAGE REQUIREMENTS

DISTRICT OF COLUMBIA

Station (Construction Phase)[a]	Bicycle Access Potential[b]	Bicycle Storage Facilities Required[c],[d]
Tenley Circle (VI)	High	545
Van Ness (V)	High	310
Cleveland Park (V)	High	205
Zoological Park (V)	High	240
Dupont Circle (IA)	High	370
Union Station (I)	High	350
Rhode Island Avenue (I)	Med	330
Brookland (IIA)	Med	240
Fort Totten (IIA)	Med	560
Takoma (IIA)	Med	320
Foggy Bottom (II)	High	365
Capital South (II)	Med	45
Eastern Market (II)	Low	40
Potomac Avenue (II)	Low	40
Stadium Armory (II)	Med	165
Minnesota Avenue (III)	Low	75
Deanwood (III)	Low	20
Benning Road (IVA)	Med	20
Alabama Avenue (VIII)	Med	560
Anacostia (VIII)	Low	90
Navy Yard (VIII)	Low	15
Waterfront (VIII)	Med	165
Federal City College (VIA)	Med	80
Shaw (VIA)	Med	90
U Street (VIA)	Med	145
Columbia Heights (VIII)	Med	300
Georgia Avenue (VIII)	Med	450
TOTAL		6,135

NOTE: (a) The following stations were not included because of their location in the Central Business District (CBD) with a high percentage of destinations: Farragut North, Farragut West, McPherson Square, Metro Center, Federal Triangle, Smithsonian, L'Enfant Plaza, Federal Center, Archives, Gallery Place, Judiciary Square.

(b) The potential ratings for the District of Columbia were assigned by the D. C. Department of Transportation, September, 1976.

(c) Storage requirements were developed assuming a diversion factor to bicycles from all access trips of 7 percent-high potential stations; 4 percent-medium potential stations; and 1 percent-low potential stations. In addition, a 1.2 turnover rate was assumed for storage requirements.

(d) The number of recommended locker spaces reflect anticipated demand. In some cases there may not initially be sufficient space at the station to accommodate the forecasted storage space requirements.

Table 3-4

NUMBER OF BICYCLE STORAGE SPACES BY JURISDICTION [b]

PHASE (DATE OF OPENING) / JURISDICTION	I (March,'76)	IA (February,'77)	II (July,'77)	IIA (November,'77)	III (July,'78)	IV (June,'79)	IVA (November,'79)	V (October,'80)	VI (July,'81)	VIA (September,'81)	VII (February,'82)	VIII (June,'83)	TOTAL
Montgomery County				110					825	465	665		2065
Prince Georges County					140		355					1335	1830
Arlington			220			735			270				1225
Fairfax County [a]									650				650
Alexandria			545					355	115				1015
District of Columbia	680	370	655	1120	95		20	755	860			1580	6135
TOTAL	680	370	1420	1230	235	735	375	1110	2720	465	665	2915	12920

Notes: (a) Includes Falls Church and Fairfax City.
(b) Storage Requirements based on estimate for 1985.

cutbacks in the bicycle trail construction program should be re-examined to consider providing additional bicycle trails in the vicinity of METRO stations.

An important aspect of station access involves bicycle routing to and from the station storage area, especially within 500 feet of the station. High bus volumes, pedestrian flows, and traffic congestion can present a dangerous situation to both the experienced and inexperienced cyclists as well as to the other station patrons. Some noted problems include bicyclists maneuvering into appropriate turning lanes to enter the station area, cycling on sidewalks with heavy pedestrian flow, and other bike-motor vehicle conflicts. Appropriate striping, signs, and adequate roadway width will help to alleviate potential conflict and injury situations.

Financial Requirements. A commitment to expanded station bicycle storage facilities must consider both capital and operating cost requirements. The initial cost for the storage facilities is presented in Table 3-5, broken by jurisdiction and METRO phase. Costs are based on unit prices of $150 per locker and $30 per rack. Installation engineering, design, and construction is estimated at $50 per locker or rack.

The total capital cost of the comprehensive program that will fulfill the projected needs for 1985 is estimated at approximately $2.0 million. This is less than one percent of the estimated capital cost of the WMATA rapid rail system. The comprehensive capital cost program is allocated by jurisdiction on a fiscal year basis in Table 3-6. The assumption is that these costs are local in nature and should be assigned based upon station location and not upon the WMATA capital cost allocated formula which is regional in nature. It is further assumed that the total facilities will be designed, built, and installed prior to the individual station opening. An alternative approach would be to design initially for the forecasted requirements for 1985 and install perhaps only 25 to 100 racks and lockers for each station opening. Additional racks and lockers could be added incrementally as

Table 3-5
METRO BICYCLE STORAGE COSTS BY JURISDICTION AND CONSTRUCTION PHASE ($0,000'S)

Phase (Date of Opening) / JURISDICTION	I (March,'76)	IA (February,'77)	II (July,'77)	IIA (November,'77)	III (July,'78)	IV (June,'79)	IVA (November,'79)	V (October,'80)	VI (July,'81)	VIA (September,'81)	VII (February,'82)	VIII (June,'83)	TOTAL(c)
Montgomery County				17					127	72	102		318
Prince Georges County					22		55					206	283
Arlington			34			113			42				189
Fairfax County (a)									100				100
Alexandria			84					55	18				157
District of Columbia	103	57	101	173	15		3	116	152			244	964
TOTAL	103	57	219	190	37	113	58	171	439	72	102	450	2,011

Notes: (a) Includes Falls Church and Fairfax City
(b) Costs assume 50 per cent lockers, 50 per cent racks; $150.00 per locker and $30.00 per rack; and $50 for each locker or rack installation, engineering,design and administration.
(c) Costs are allocated based on the station location and not the WMATA capital costs allocation formula.
(d) All costs are in thousands of mid-1976 dollars.

Table 3-6

METRO BICYCLE STORAGE COST BY JURISDICTION AND FISCAL YEAR ($000'S)

Jurisdiction \ Fiscal Year	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	Total
Montgomery County		17				301		318
Prince Georges County			22	55			206	283
Arlington		34	113			42		189
Fairfax County (a)						100		100
Alexandria		84			55	18		157
District of Columbia	160	274	15	3	116	152	244	964
Total	160	409	150	58	171	613	450	$2,011

Notes: (a) Includes Falls Church and Fairfax City.
(b) Costs are allocated based on the station location and not the WMATA capital costs allocation formula.
(c) All costs are in mid-1976 dollars.

the ridership and METRO system expands. Enough racks and lockers should be installed to equal or exceed the initial demand so that cyclists will not be deterred from cycling due to insufficient bicycle parking spaces.

Operating costs for racks and lockers, with the exception of administration costs, are minimal. Fees, reserved spaces, and registration do require personnel time. No fee is required to use the racks at BART and a small fee (25¢ per day or $5.00 per month) is charged for use of lockers. The charge for lockers and racks at Washington METRO is a policy decision that should be made in the context of subsidies for other access modes, capital costs of the lockers/racks program, and benefits to be derived from this program including financial, community and environmental.

Funding sources include state and local funds, the existing METRO capital construction program, and various Federal grant programs. The METRO capital construction program is severely strained and WMATA is under pressure from the Urban Mass Transportation Administration (UMTA) to hold down capital costs. An application for UMTA grant money could be instituted separately. In addition, local jurisdictions could program funds for lockers/racks in a fashion similar to the way access trails are funded.

Continuing Planning, Local Coordination and Marketing. This study represents the initial development, nationally, of a bicycle ridership forecasting technique based on available data. The issues raised in this study need to be addressed by building upon the results of this study through the coordinated regional bikeways planning process and the continued development of more sophisticated forecasting methodologies. While this study has focused on several key issues with regard to bikeway planning, a mechanism should be developed to continue bikeway planning. Since bikeway planning is both a regional and local concern, it is recommended that the Metropolitan Washington Council of Governments and its existing Regional Bikeways Technical Subcommittee continue their efforts to share information on planned, programmed and

and existing bikeways and to coordinate planning among local government jurisdictions. In particular, coordination of bikeways development between area jurisdictions to ensure system connectivity (e.g., Potomac River bridges), to establish regional bikeway access policy (e.g., METRO-related bicycle policies), and to explore the potential and feasibility of bicycle storage facilities at Metrobus terminals and fringe parking lots are three critical areas requiring ongoing, continued support.

It is further recommended that maximum attention should be given to encouraging new bikeways construction in the Washington area. While some bikeways are necessary from a regional viewpoint, others to be emphasized include bikeways to major activity centers and to METRO stations. These latter two are generally of local concern. Thus, local jurisdictions must also take an active role, in planning and implementing bikeways.

Finally, not to be overlooked, the bicycle clubs and support groups in the area provide a valuable resource for input into a program and feedback after a program has been developed. BART in San Francisco has continuous contact with the bicycle groups which helps to enhance the understanding of planners and cyclists of their mutual problems and concerns.

In order to promote bicycle usage to METRO stations, the Metropolitan Washington Council of Governments (MWCOG), WMATA and the local jurisdictions need an effective marketing program. Part of the program can be included in present and future METRO advertising at no additional cost. Other items might include:

- station area maps showing bike access trails and location of racks and lockers;
- distribution of maps and information to local and area bicycle interest groups including bicycle coalitions and clubs; and
- metropolitan area annually updated regional bikeways map showing METRO station access.

APPENDIX

METRO BIKEWAY ENVIRONMENT CORRIDOR MAPS

NOTE: Land use and auto traffic volume maps that complement the corridor maps are available at the Metropolitan Washington Council of Governments.

APPENDIX

METRO BIKEWAY ENVIRONMENT CORRIDOR MAPS

NOTE: Land use and auto traffic volume maps that complement the corridor maps are available at the Metropolitan Washington Council of Governments.

METRO CORRIDOR BIKEWAY ENVIRONMENT

ROCKVILLE

- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- PARK LAND
- GRADES

CORRIDOR

- BARRIER CROSSING
- BARRIER
- EXISTING BIKE TRAILS
- PROPOSED BIKE TRAILS

2000 0 2000 4000

scale feet

SHADY GROVE

ROCKVILLE

TWINBROOK

NICHOLSON

NEEDWOOD GOLF COURSE

MUNICIPAL RED GATE GOLF COURSE

CARNEGIE INSTITUTE OF WASHINGTON

MONTGOMERY COUNTY INCINERATOR

MONTGOMERY COLLEGE

WOODMONT COUNTRY CLUB

LAKEWOOD COUNTRY CLUB

PREP SCHOOL

RAILROAD

BALTIMORE AND OHIO RAILROAD

ROCKVILLE PIKE

PARKLAWN

Mill Creek

Rock Creek

Watts Branch

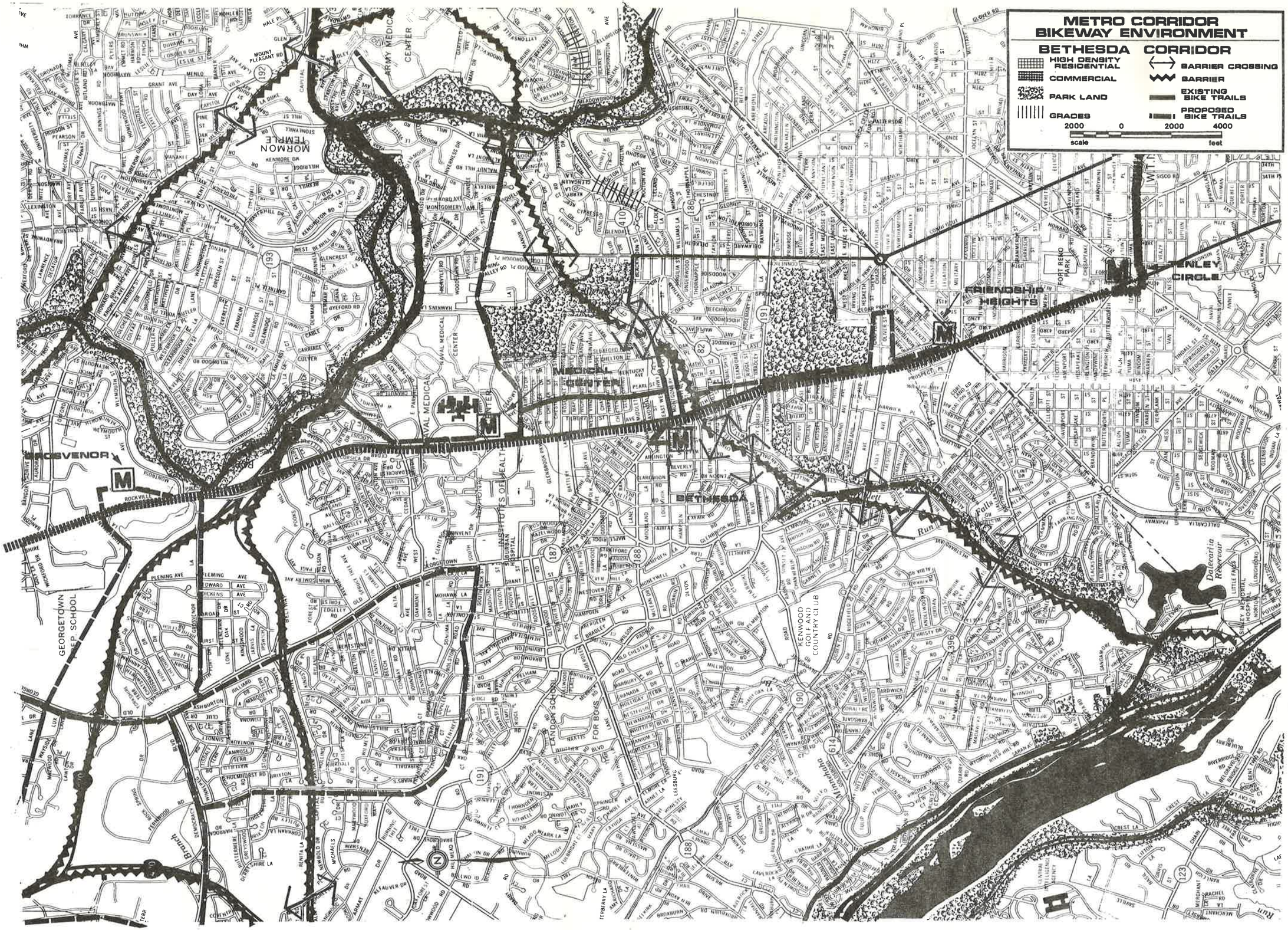
METRO CORRIDOR BIKEWAY ENVIRONMENT

BETHESDA CORRIDOR

- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- PARK LAND
- GRADES
- BARRIER CROSSING
- BARRIER
- EXISTING BIKE TRAILS
- PROPOSED BIKE TRAILS

2000 0 2000 4000

scale feet



METRO CORRIDOR BIKEWAY ENVIRONMENT

GLENMONT CORRIDOR

- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- PARK LAND
- GRADES
- BARRIER CROSSING
- BARRIER
- EXISTING BIKE TRAILS
- PROPOSED BIKE TRAILS

2000 0 2000 4000

scale feet

INDIAN SPRING COUNTRY CLUB

GLENMONT

WHEATON

FOREST GLEN

SILVER SPRING

GATE OF HEAVEN CEMETERY

MORMON TEMPLE

ARMY MEDICAL CENTER

NAVAL MEDICAL CENTER

METRO CORRIDOR BIKEWAY ENVIRONMENT

GREENBELT

- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- PARK LAND
- GRADES

CORRIDOR

- BARRIER CROSSING
- BARRIER
- EXISTING BIKE TRAILS
- PROPOSED BIKE TRAILS

2000 0 2000 4000

scale feet

GREENBELT

COLLEGE PARK

PRINCE GEORGES PLAZA

UNIVERSITY OF MARYLAND

AGRICULTURAL RESEARCH CENTER

WASHINGTON MEMORIAL PARK CEMETERY

METRO CORRIDOR BIKEWAY ENVIRONMENT

NEW CARROLLTON CORRIDOR

- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- PARK LAND
- GRADES
- BARRIER CROSSING
- BARRIER
- EXISTING BIKE TRAILS
- PROPOSED BIKE TRAILS

2000 0 2000 4000

scale feet

CHEVERLY

LANDOVER

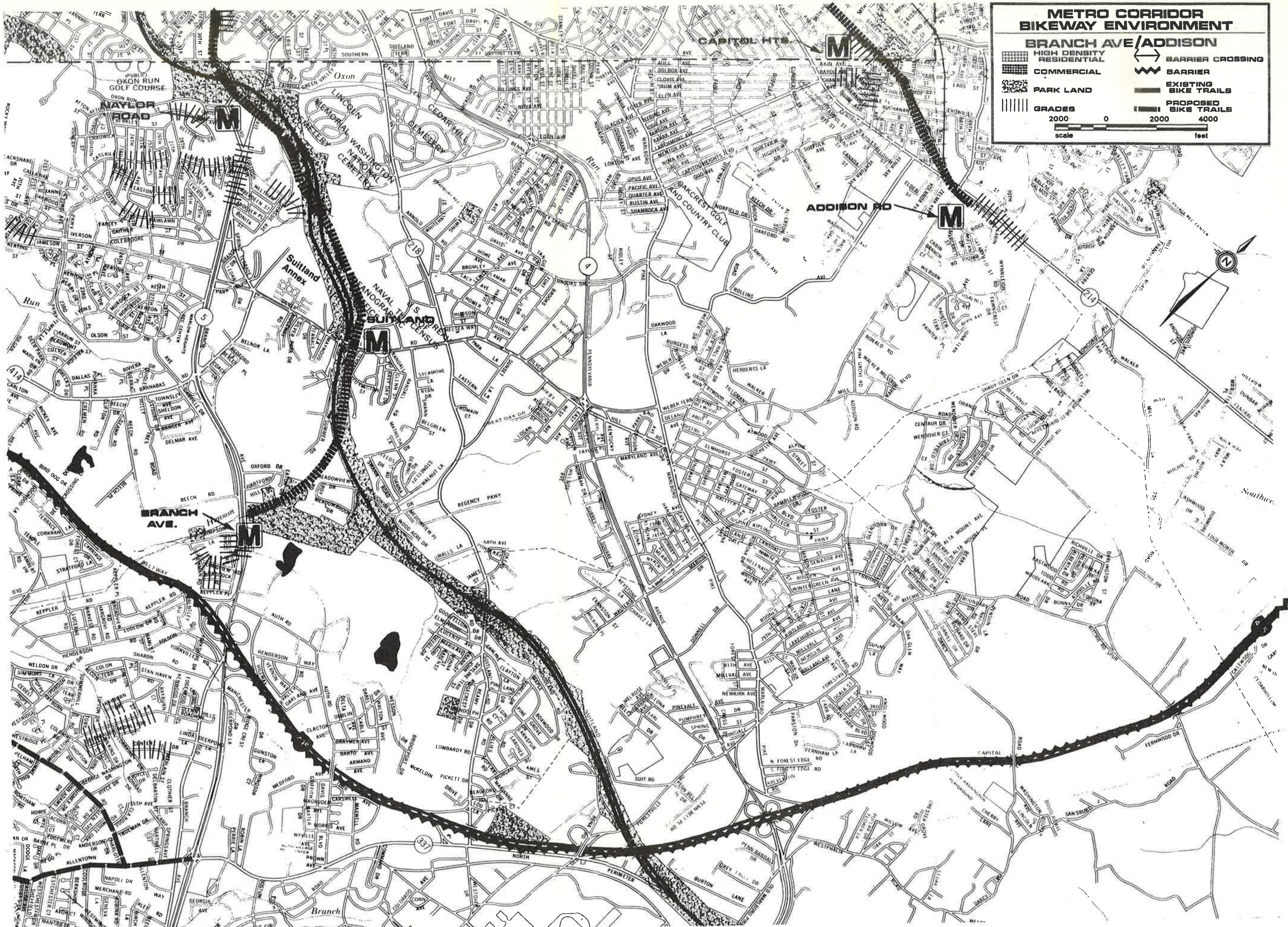
NEW CARROLLTON

COUNTRY CLUB

Branch

Branch

Branch


METRO CORRIDOR
BIKEWAY ENVIRONMENT
BRANCH AVE/ADDISON
HIGH DENSITY RESIDENTIAL
COMMERCIAL
PARK LAND
GRADES
BARRIER CROSSING
BARRIER
EXISTING BIKE TRAILS
PROPOSED BIKE TRAILS
2000 0 2000 4000
scale
feet
CAPITOL HTS.
NAYLOR ROAD
SUITLAND
ADDISON RD
BRANCH AVE.
OXON RUN GOLF COURSE
LINCOLN MEMORIAL CEMETERY
WASHINGTON NATIONAL CEMETERY
CEDAR HILL CEMETERY
Suitland Annex
OAKCREST GOLF AND COUNTRY CLUB

METRO CORRIDOR BIKEWAY ENVIRONMENT

ALEXANDRIA - CORRIDOR

- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- PARK LAND
- GRADES
- BARRIER CROSSING
- BARRIER
- EXISTING BIKE TRAILS
- PROPOSED BIKE TRAILS

2000 0 2000 4000

scale feet

BOLLING AIR FORCE BASE

POTOMAC

WASHINGTON NATIONAL AIRPORT

NATIONAL AIRPORT

CRYSTAL CITY

PENTAGON CITY

KING ST.

EISENHOWER AVE

HUNTINGTON

BLUE PLAINS

NAVAL RESEARCH LABORATORY

MEMORIAL HOSPITAL

FORT M. NAIR

ARMY NAVY COUNTRY CLUB

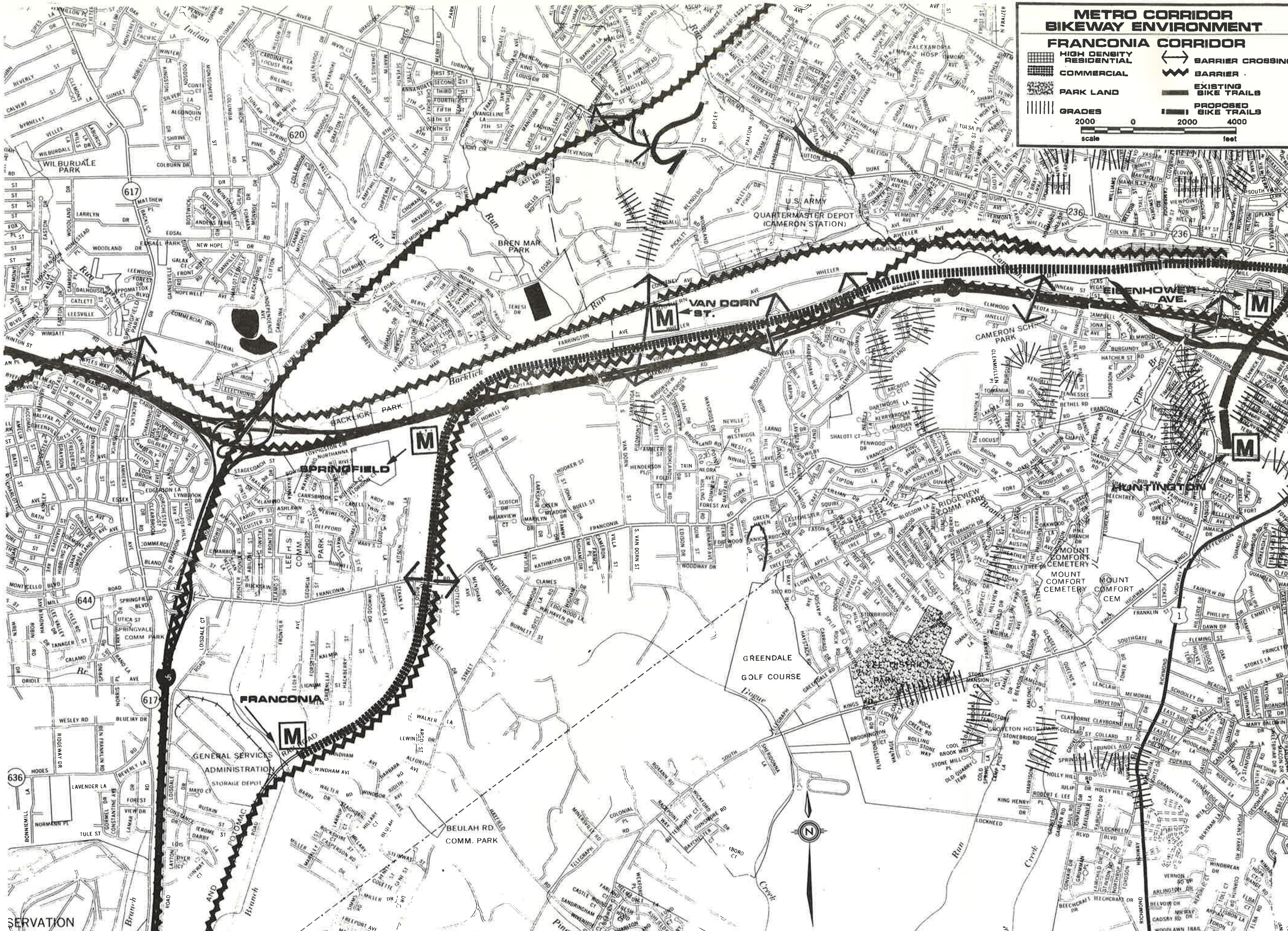
VIRGINIA THEOLOGICAL SEMINARY

MOUNT COMFORT CEMETERY

BELLE HAVEN COUNTRY CLUB

Hooff Run

Four Mile Run


METRO CORRIDOR
BIKEWAY ENVIRONMENT
FRANCONIA CORRIDOR
HIGH DENSITY RESIDENTIAL
COMMERCIAL
PARK LAND
GRADES
BARRIER CROSSING
BARRIER
EXISTING BIKE TRAILS
PROPOSED BIKE TRAILS
2000 0 2000 4000
scale feet
VAN DORN ST.
EISENHOWER AVE.
SPRINGFIELD
FRANCONIA
HUNTINGTON
U.S. ARMY QUARTERMASTER DEPOT (CAMERON STATION)
BREN MAR PARK
WILBURDALE PARK
CAMERON SCH. PARK
RIDGEVIEW COMM. PARK
MOUNT COMFORT CEMETERY
GREENDALE GOLF COURSE
LEE DISTRICT PARK
BEULAH RD. COMM. PARK
GENERAL SERVICES ADMINISTRATION
SPRINGVALE COMM PARK
LEE H.S. COMM. PARK

METRO CORRIDOR BIKEWAY ENVIRONMENT

ARLINGTON CORRIDOR

- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- PARK LAND
- GRADES
- BARRIER CROSSING
- BARRIER
- EXISTING BIKE TRAILS
- PROPOSED BIKE TRAILS

2000 0 2000 4000

scale feet

HAZARDOUS BRIDGE CROSSING

HAZARDOUS CROSSING

WASHINGTON GOLF AND COUNTRY CLUB

MARYMOUNT COLLEGE

ROSSLYN

COURTHOUSE

CLARENDON

BALLSTON

GLEBE RD

EAST FALLS CHURCH

ARLINGTON CEMETARY

FORT MYER

ARLINGTON NATIONAL CEMETERY

PENTAGON

ARMY NAVY COUNTRY CLUB

CRYSTAL CITY

NATIONAL AIRPORT

GEORGETOWN UNIVERSITY HOSPITAL

GEORGETOWN UNIVERSITY

WASHINGTON

ARLINGTON HALL

NAVY ANNEX

NORTHERN VIRGINIA DOCTOR'S HOSP.

J.E.B. STUART COMM. PK.

BAILEY'S SCH. PARK

ARCHBOLD

Four Mile Run

Donaldson Run

METRO CORRIDOR BIKEWAY ENVIRONMENT

VIENNA CORRIDOR

- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- PARK LAND
- GRADES
- BARRIER CROSSING
- BARRIER
- EXISTING BIKE TRAILS
- PROPOSED BIKE TRAILS

2000 0 2000 4000

scale feet

WEST FALLS CHURCH →

VIENNA →

WESTWOOD COUNTRY CLUB

ARMY–NAVY COUNTRY CLUB

FAIRFAX HOSPITAL

KEMPER PARK

MOSBY WOODS PARK

HIDEAWAY PARK

NOTTOWAY PARK

DISTRICT PARK

NATIONAL MEMORIAL PARK CEMETERY

Holmes Run

Accotink Creek

Daniels Run

Crook Branch

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