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MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

CIVIL ENGINEERING REPORT

JANUARY 1959

DE LEUW, CATHER & COMPANY • CONSULTING ENGINEERS • CHICAGO

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For the
National Capital Planning Commission
National Capital Regional Planning Council

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Port Development Department
The Port of New York Authority
New York, New York

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Automotive Safety Foundation
Washington, D.C.

DONALD C. HYDE
General Manager
Cleveland Transit System
Cleveland, Ohio

JOE R. ONG
Consulting Transportation Engineer
Cincinnati, Ohio

SURVEY STAFF

W. E. FINLEY, Director, National Capital Planning Commission. Mr. Finley replaced John Nolen, Jr., who resigned as director in the spring of 1958

PAUL C. WATT, Director, National Capital Regional Planning Council

KENETH M. HOOVER, Project Director, Mass Transportation Survey

RALPH R. HECKMAN, Assistant Project Director until the fall of 1957

ROBERT A. KEITH, Traffic Planning Engineer

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DE LEUW, CATHER & COMPANY
ENGINEERS
150 NORTH WACKER DRIVE
CHICAGO 6
FINANCIAL 6-0424

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January 26, 1959

National Capital Planning Commission
National Capital Regional Planning Council
7013 Interior Building
Washington 25, D.C.

Gentlemen:

We are pleased to submit herewith our report on the civil engineering phase of the Mass Transportation Survey--National Capital Region. Portions of our report and certain of our exhibits presumably will be combined with material from other consultants on this project for inclusion in your own report to the President.

We would like to acknowledge the fine cooperation we have received throughout this engagement from members of the Commission and Council, your respective staffs, your many consultants and expert advisors on this project, and the various official and semi-official bodies in the District of Columbia as well as in Maryland and Virginia. They have given unstintingly of their time and talents toward making this a worthwhile report to guide the future development of all types of transportation facilities in the National Capital Region.

Very truly yours,

DE LEUW, CATHER & COMPANY

Charles E. De Leuw

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OBJECTIVES OF THE STUDY

This report is part of the comprehensive Mass Transportation Survey of the National Capital Region made by the National Capital Planning Commission and the National Capital Regional Planning Council.

The purpose of the survey was to develop a future transportation plan for the metropolitan area. This report describes the civil engineering consultant's phase of the survey. It serves as a complement to the summary report of the Commission and Council which contains all the principal conclusions and recommendations of the survey.

The Mass Transportation Survey was authorized by congressional action (Public Law 24, 84th Congress) and reads as follows:

> "For necessary expenses to enable the National Capital Planning Commission and the National Capital Regional Planning Council to jointly conduct a survey of the present and future mass transportation needs of the National Capital Region as defined in the National Capital Planning Act of 1952 (66 Stat. 781), and to report their findings and recommendations to the President . . ."

The Joint Steering Committee of the Commission and the Council has carried out the survey through a project director, a panel of transportation experts, and a small staff.

Specifically, the primary study phases of the survey have been: land planning; traffic engineering; civil engineering; and finance and public administration.

The total transportation plan to be recommended by the Commission and the Council will be developed after the probable future living and travel patterns have been determined, the roles to be played by transit and automobile have been studied, and the fiscal and governmental ramifications have been analyzed.

This report has been accepted by the Commission and the Council, but the acceptance does not necessarily imply approval of the data or conclusions presented in the report. Responsibility for the conclusions and recommendations based on assumptions and analyses made by others rests solely with De Leuw, Cather & Company.

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CHAPTER 1

HIGHLIGHTS OF THE REPORT

The recommended transportation plan for the National Capital Region evolved slowly from the findings of numerous interlocked studies. One of the techniques used was to investigate various transportation systems without immediate concern for their practicality. The results of these studies were of immeasurable value in guiding subsequent steps toward a sound and realistic plan.

The title, Mass Transportation Survey, was always broadly interpreted as including the movement of people in automobiles on modern highways--not just public transit. Thus the plan presented herein is a balanced plan making appropriate use of each of the newest modes of transportation.

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Schemes Studied

The following is a brief description of the four basic schemes studied:

Plan I--The auto-dominant system would consist of an extensive network of freeways, parkways and arterial streets together with large scale downtown parking facilities on the assumption that a steadily increasing proportion of people will use private automobiles. Public transportation would consist of buses sharing the streets and highways with other automotive traffic as at present.

Plan II--The express bus system would consist of high-speed buses making few stops and traveling on freeways and parkways--or on their own grade-separated lanes where need be--in order to assure a high standard of transit service. Local buses would supplement the express bus service. The need for highways and downtown parking facilities would be less than under the auto-dominant system.

Plan III--The rail or other train-type transit system, also operating at high speeds and making few stops, would be on grade-separated ways located either in the center malls of radial freeways or on other exclusive rights-of-way. As with the express bus system, local bus service would be provided and the need for highways and downtown parking facilities would be less than with the auto-dominant system.

Plan IV--The information obtained from these three basic study plans was used to formulate a recommended transportation plan to facilitate the optimum movement of people and goods in the National Capital Region.

In subsequent chapters will be found descriptions of the various plans, with discussions of the advantages and disadvantages of each.

Comparative Statistics

Comparative costs and other data concerning the various plans are given in Table 1. Details of the estimates are included in the appendices while discussions on the separate items will be found in the chapters describing each plan.

Highlights and Recommendations

The following items give in brief form the principal conclusions derived from the studies and the recommendations drawn therefrom:

1. The recommended transportation system (Plan IV) to serve the National Capital Region when it reaches a population of 3,000,000 would be composed of a network of freeways, together with a rather extensive system of rail rapid transit and express bus facilities. Express buses would be used in the early years on the routes later to be served by rail rapid transit. After 1980, additional express bus routes may have to yield to rail rapid transit or the equivalent, and design of radial freeways should provide for this eventuality.

2. Despite the extensive rapid transit system contemplated, however, an elaborate network of freeways and parkways will be needed by 1980. No transit system, for example, could obviate the need for truck facilities nor could it serve people who use their automobiles for business, nor

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TABLE 1

CAPITAL COSTS AND OTHER DATA ON FOUR ALTERNATE TRANSPORTATION SYSTEMS TO SERVE ESTIMATED 1980 TRAFFIC VOLUMES IN THE NATIONAL CAPITAL REGION

	Estimated Capital Cost--(Thousands of Dollars)			
	Plan I Auto-Dominant	Plan II All-Bus	Plan III All-Rail	Plan IV Recommended
Highway Facilities				
Freeways	$1,870,450	$1,401,400	$1,401,400	$1,401,400
Parkways	299,050	220,150	220,150	220,150
Major Streets	201,650	181,450	181,450	181,450
	$2,371,150	$1,803,000	$1,803,000	$1,803,000
Parking Facilities				
Outer Transit Stations	$ -	$ 20,800	$ 20,800	$ 20,800
Intermediate Stations	-	16,800	16,800	16,800
Sector Zero (Downtown)	236,000	119,000	119,000	119,000
	$ 236,000	$ 156,600	$ 156,600	$ 156,600
Total Highway and Parking Facilities	$2,607,150	$1,959,600	$1,959,600	$1,959,600
Express Bus Facilities				
Special Bus Roadways	-	$ 57,100	-	$ -
Outer Terminals and Freeway Stations*	-	31,050	-	30,000
Shops and Garages	-	13,500	-	5,050**
Rolling Stock (Buses)	-	45,000	-	28,750**
		$ 146,650		$ 63,000
Rail Rapid Transit				
Subways	-	-	$ 501,700	$ 313,150
Open Construction	-	-	170,550	85,050
Outer Terminals	-	-	5,400	5,250
Yards and Shops	-	-	21,000	12,250
Rolling Stock (3-Car Units)	-	-	75,000	44,100
			$ 823,750	$ 459,900
Total Transit Facilities	-	$ 146,650	$ 823,750	$ 526,900
Total System Cost	$2,607,150	$2,106,250	$2,783,350	$2,486,500

	Physical Features			
	Plan I Auto-Dominant	Plan II All-Bus	Plan III All-Rail	Plan IV Recommended
Highway Facilities				
Route-Miles of Freeways and Parkways	344	326	326	326
Factor	100	95	95	95
Lane-Miles of Freeways and Parkways	2,032	1,775	1,775	1,775
Factor	100	87	87	87
Net Additional Parking Spaces Needed				
Outer Transit Stations	-	20,300	20,300	20,300
Intermediate Stations	-	11,200	11,200	11,200
Sector Zero (Downtown)	35,000	48,300	48,300	48,300
Total	35,000	80,300	80,300	80,300
Factor	100	95	95	95
Transit Facilities				
Express Bus				
Number of Routes	-	11	-	3
Route-Miles***	-	103.8	-	46.4
Buses Required	-	1,800	-	880
Rail Rapid Transit				
Number of Routes	-	-	9	4
Route-Miles***				
Subway	-	-	32.4	14.3
Open-to-the-Sky	-	-	44.8	20.1
Three-Car Units Required	-	-	400	245

*-Including parking facilities.
**-More buses would be required in 1965 than in 1980, since rail rapid transit would replace some of the express bus routes during this period. As buses purchased prior to 1965 become worn out, therefore, they would not all be replaced. The depreciation funds represented by such excess buses would presumably be invested in rail rapid transit cars. Garages and bus shops, which would have a longer life than the buses, should be so designed that they could be partially converted for use in servicing the rail cars or used by the expanding fleet of local buses.
***-Includes duplication where two or more routes operate on same street or right-of-way.

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people whose trips do not both start and end within the transit service area. A good system of rapid transit, nevertheless, would permit reductions of highways to more practical widths than otherwise.

3. Notwithstanding the large blocks of motor-vehicle-imperative trips, the proposed transit system was found to be attractive to substantial numbers of people. The greatest service would be rendered to those making trips to or from the central business and government district or to focal points in adjoining areas, such as the Pentagon.

4. By careful coordination between highway and transit systems, substantial economies over the total capital costs of separate and competing systems have been anticipated. Rail facilities would share rights-of-way with highways in some instances, and freeways would be utilized for operation of express buses where appropriate.

5. Only by construction of subways can certain physical problems, particularly in the north and northwest sectors, as discussed in the report, be satisfactorily overcome. Subways would permit quick delivery by transit to the heart of the core area. They would also reduce congestion for pedestrians and automobiles as well as for local buses and express buses distributing their passengers in the central business and government district.

6. A period of eight to ten years is sometimes required for the planning, design and construction of a rapid transit subway. It is necessary, therefore, to anticipate the need for such facilities several years ahead of actual operation. Work should start at the earliest practicable date on the preparation of preliminary engineering plans for the subway sections of the recommended rail rapid transit facilities.

7. While the rail rapid transit facilities would entail relatively high fixed charges on the initial capital investment, the operating cost per passenger served would be lower than for passengers carried on express buses. Moreover, the fixed charges on the rail facilities would decrease after the initial debt was amortized, and would become smaller per passenger served as the number of passengers increased.

8. The proposed network of freeways and parkways will have to be supplemented by a comprehensive system of expressways, major streets, park roads, and other arterial thoroughfares, principally at surface grade.

9. Need for parking facilities has been studied in connection with each plan, both for the central business district and at transit terminals and intermediate stations. The various transit schemes would effect large savings in the cost of parking facilities over the cost in connection with the auto-dominant scheme.

10. There are serious engineering questions as to the practicality of the auto-dominant plan (Plan I). While the outer portions of the system could undoubtedly be made to work, key sections of the freeway system, particularly the Inner Loop Freeway and the proposed north central freeway, would require more lanes than critical rights-of-way problems would permit, and more than would be functionally operable. Furthermore, there is no possibility that the streets in the central area could accommodate the number of vehicles which would be moving to and from the freeway ramps with the estimated volumes of traffic.

11. The difference in capital costs between the auto-dominant plan and the recommended total transportation plan would not be great. The land takings for highways and parking garages under the auto-dominant plan, however, would be so great as to cause indirect damages, particularly in and around the central core.

12. A transportation policy requiring the National Capital Region to be served almost exclusively by automobiles would be incompatible with the distribution of living, shopping and working places of the area's inhabitants as foreseen by the staff of the Commission and Council. If a regional population of 3,000,000 is to be served principally by automobiles, the central core must be relegated to a much less important role than the planning staff considers appropriate, and radical decentralization of most urban functions must be accepted as the pattern of future growth. It is a matter of administrative policy as to whether or not this should be the long range objective.

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13. The all-bus plan (Plan II) proved to be infeasible primarily because of the lack of suitable rights-of-way for express bus operation in the two corridors most in need of express service (i.e., to the north and northwest).

14. In further reference to the all-bus plan, it is not possible to estimate accurately the number of automobiles and trucks that will be moving on the streets of the central area during peak hours in 1980. The Inner Loop Freeway and other by-passes are expected to accomplish a marked reduction in through traffic on the surface streets. The number of terminating and originating vehicles, on the other hand, will probably increase. Although streets in the central area may be widened and otherwise improved, the capacity for buses will always be limited to the number that can be moved in the curb lanes through the various loading zones. The civil engineering consultant considers it likely that by 1980 the number of buses required by the all-bus plan would result in movement at walking speeds or less during rush hours. The service would be slowed, even in off-peak periods, by the many complex and closely spaced intersections, as well as by the interference of autos and pedestrians.

15. Use of express buses should be limited, therefore, to those routes included in the recommended system. In the stage development of this system, however, express buses should be used on surface streets and on freeways as the latter become available. This procedure would initiate

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fast service at an early date to the areas which would later be served by rail rapid transit. Thus, the system in effect in 1965 would be the all-bus plan, but without any separate bus roadways. It would be reasonably adequate to serve the estimated patronage of that era.

16. A system composed primarily of rail rapid transit facilities (Plan III) proved to be unreasonably expensive and provide more capacity on most routes than would be needed for many years beyond 1980.

17. Partially offsetting the large investment required for rail rapid transit facilities in Plan III would be a saving in the cost of the freeway and parkway system. Any good rapid transit system would cause a decrease in the use of automobiles, resulting in a reduction in the number of lanes required in certain sections of highway. There were only a few instances, however, where a section of proposed freeway or parkway in the auto-dominant plan would be unnecessary if a comprehensive rail rapid transit system were built.

18. Thought should be given in planning all radial freeways to the ultimate need for rail rapid transit, or an equivalent type requiring a private right-of-way. In some instances, actual need may not develop for many years. Unless space for such facilities is included in the initial stage of construction, however, the cost of providing for them later may be prohibitive.

19. Monorail, Carveyor and other new types of transit were studied, but none was found which would be as satisfactory for the conditions in Washington as conventional vehicles and facilities. The use of existing railroad rights-of-way and/or trackage was found to be infeasible for either electric or self-propelled rapid transit cars.

Flexibility for the Future

Washington is a young and vigorously-growing capital city. While it is old in terms of the history of America, it was incorporated only 156 years ago, whereas other world capitals have existed for hundreds of years. The all-rail plan as studied in 1958 is not appropriate for Washington as visualized in 1980, but such a system may be needed for the city as it will be a few decades later.

The freeways built early in the program will have a profound influence on the pattern of growth in the metropolitan region. They will encourage speedy and intense settlement in the areas directly served. There should be flexibility in the plan, therefore, and reserve capacity in future transportation arteries. The first freeways built may be overcrowded long before 1980, and express bus service may have to give way to rail rapid transit to meet transportation demands. It is recommended that in the planning of future radial freeways, therefore, a cross section be adopted providing a 64-foot center mall which can be used successively for additional landscaping, reversible roadways for general traffic, express bus operation on separate roadways and finally, for rail rapid transit or equivalent.

Many years will be required to build all of the freeways and parkways needed in the National Capital Region. Unless rights-of-way are reserved promptly for all of these highways, it may become prohibitively expensive to build many vital sections of the network. An official plan should be adopted not only for the immediate future, but for a generation hence. Rights-of-way should be preserved which will be sufficiently wide for all transportation purposes for decades to come.

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CHAPTER II

PLAN IV--RECOMMENDED HIGHWAY-TRANSIT SYSTEM

In developing the recommended transportation system, consideration was given to plans which bracketed all likely solutions. As will be described more fully in later sections of this report, an "auto-dominant" plan was prepared. This postulated a system of freeways in 1980 adequate to serve the area on the assumption that almost everyone would customarily use automobiles as drivers or passengers. There would be relatively few people who would be unable or unwilling to furnish their own individual transportation. This latter group--accounting for about one-seventh of total person-trips--would use local buses. At the time of the 1955 survey, about one-fifth of all person-trips in the area were made on buses or streetcars.

Another plan featured a comprehensive rail rapid transit system. Nine radial transit routes for the operation of high-speed trains would cover the metropolitan area under this scheme. Trains would operate on private rights-of-way both in subway and on other fully grade-separated and insulated facilities. Also studied was a second "transit-dominant" plan with eleven express bus lines on private rights-of-way or on freeways serving all major flows of passenger movement. This plan is also more fully described in a later section. The best features of each of these plans, in our opinion, were consolidated in a single scheme which is hereafter referred to as the recommended plan.

The recommended transportation system to serve the National Capital Region would be composed of a network of freeways together with a rather extensive system of rail rapid transit and express bus facilities. Express buses would be used in the early years on the routes ultimately to be served by rail rapid transit. The highways recommended for construction by 1980 are more extensive than those now programmed. The 326 route-miles of freeways and parkways would be almost as great as the 344 route-miles required under the assumptions for an auto-dominant scheme, but the lane-miles would be considerably less. (To illustrate the meaning of terms used, one route-mile of eight-lane freeway constitutes eight lane-miles.) Improvements to arterial surface streets are also contemplated in the recommended plan.

The proposed transit service would consist partially of rail rapid transit trains running on separate rights-of-way. It would also include express buses operating in the general traffic stream on freeways and parkways. A supporting system of local bus routes is assumed to be provided as an integral part of the service. The local buses would serve as feeders to the network of rail and bus rapid transit lines and as distributors of express traffic in the central business district. They would also provide public transportation in areas where express service would not be justified, both in the District and in the suburbs.

Throughout this report the terms "express" and "rapid transit" are used interchangeably to indicate service by either buses on freeways and parkways, rail vehicles on insulated rights-of-way, or combinations thereof.

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Coordination Between Highways and Transit

By careful coordination between highway and transit systems, substantial economies over the total capital costs of separate and competing systems have been anticipated. Rail facilities would share rights-of-way with highways in some instances, and freeways would be utilized for operation of express buses where appropriate. Further savings have been planned by providing public transportation so attractive that the use of transit would somewhat reduce the need for highways. This is particularly important in providing good transportation to and through areas where the costs of rights-of-way for additional freeways would be excessive.

Despite the extensive rapid transit system contemplated, however, an elaborate network of freeways and parkways will be necessary by 1980. The transit system, for example, could not serve people who need their vehicles during the day for trips in which the automobile is essential because of the nature of the journey. This group alone accounts for approximately 30 percent of all the estimated automobile trips that would occur under the assumptions of the auto-dominant system. Another large group that could not be drawn to transit in any substantial numbers are those moving between points within the survey area and points outside--classified as external-internal trips--and those making through trips entirely across the survey area from external points to external points. Finally, the vehicular trips indicated for the highway system include the movements of commercial vehicles translated into an equivalent number of automobiles. Trucks are estimated to represent 16 percent of the total vehicular trips in the area during a normal 24-hour weekday in 1980 under the auto-dominant estimates, or the equivalent of 27 percent of total 24-hour traffic.

Notwithstanding the large blocks of motor-vehicle-imperative trips, the transit system was found by the traffic engineering consultant to be attractive to substantial numbers of people. The greatest service would be rendered to those making trips to or from the central business and government district or to focal points in adjoining areas, such as the Pentagon. Of all the estimated 1980 trips on the rapid transit system, approximately 6 percent would consist of intra-line trips and 61 percent would have origins or destinations in Sector Zero, the boundaries of which are shown in Exhibit 5. The remaining 33 percent would pass through this area, but many trips would terminate just outside its borders. Of all the trips drawn to the proposed rail and bus rapid transit system, about 70 percent would represent people who would otherwise have used local bus service. Only 30 percent would be made by those who would have used automobiles as drivers or passengers.

Recommended Highway System

Throughout this report the following words or terms shall mean:

Freeway. A divided arterial highway for mixed traffic with full control of access and grade separations at all intersections.

Parkway. Same as a freeway except that commercial vehicles, other than express buses, are prohibited, and greater attention is given in design to landscaping and fitting the facility to the topography. (It is acknowledged that this term is often used by others with less restrictive meanings.)

Expressway. A divided arterial highway for mixed traffic with partial control of access and with grade separations at most important intersections.

Park Road. Same as an expressway except that commercial vehicles other than buses are prohibited, and greater attention is given in design to landscaping and fitting the facility to the topography.

Major Street. An arterial highway, primarily for through traffic, with intersections at grade and direct access to abutting property.

Under the impetus of the Federal Highway Act of 1956 and other highway programs, more than one billion dollars worth of freeways, parkways and major street improvements are currently under construction or planned in the National Capital Region. The extent of the planned freeway system, together with the location of existing highways of this character, is shown by Exhibit 1. Existing facilities total 81 miles in length, while those planned will add 178 miles to this system. The period over which actual construction is proposed to take place varies within the different jurisdictions. It is expected that most of these highways will be completed within seven years, however, although the financing of the interstate system extends to 1969, with another two or three years for completing construction anticipated.

The roads built as part of the National System of Interstate and Defense Highways under the Act of 1956 will be financed on the basis of 90 percent Federal funds and 10 percent local funds. Many other sections of the network will be built under programs qualifying for Federal assistance, usually to the extent of about one-half of the total cost.

Even an over-designed system of rapid transit routes would not drastically reduce the need for freeways, below those recommended herein, according to the findings of one of the investigations made as part of this study. It was found that, with or without improved transit, many more lane-miles of freeway will be necessary by 1980 than those now planned. Studies by De Leuw, Cather & Company indicate that 67 miles of additional freeway and parkway routes for a total of 326 miles, will be required, and many existing or proposed highways should be made wider than now planned. See Exhibit 2. On the other hand, a few sections have been planned for more lanes than estimated 1980 volumes would justify if certain additional routes newly proposed as a result of this current study are built. There may well be an economy in constructing highways initially to their ultimate width rather than widening them later under traffic, but our estimates are for the system that will be required, in our opinion, to serve the National Capital Region when it reaches a population of 3,000,000. The net cost of the freeways and parkways in addition to those already planned, including the cost of added lanes where deemed necessary on existing and proposed routes, would be approximately $635,750,000 at 1958 prices. Furthermore, surface streets and highways would have to be extended, widened, and otherwise improved at a cost beyond that now budgeted of approximately $13,650,000. See Exhibit 3.

Additional Routes

Most of the planned freeways and parkways are well known because of the years of discussion and public hearings which have preceded their adoption. They are clearly shown by appropriate symbols in Exhibit 1. This discussion will be limited, therefore, to those highways which have been added to the system by De Leuw, Cather & Company in order to provide a total highway network. See Exhibit 2. This, with the assistance of a comprehensive bus and rail rapid transit system, is thought to be adequate to meet the total transportation needs of the area with a population of 3,000,000 distributed according to a land use pattern as discussed in a separate report.

Intermediate Loop

There have been proposals for many years for a recreational drive encircling the central area of the District of Columbia at a radius of some five miles from the White House. It has become known as Fort Drive because it was planned to pass the sites of many early-day fortifications. Before World War II, decisions were made to build portions of the route to limited access standards. The need has now been demonstrated for a freeway-parkway for the entire length of this facility in the District, and continuing through Arlington County. Some of the rights-of-way heretofore acquired for the proposed Fort Drive could be incorporated into such a freeway or parkway, but in many locations the width required, as well as the quality of alignment and grade, would necessitate taking additional or alternative rights-of-way.

Such a route would interconnect all of the radial freeways and permit great volumes of crosstown traffic to avoid the central core of the region. Only by the construction of such a facility can the Inner Loop Freeway be spared excessive traffic which will otherwise jeopardize its efficient functioning before 1980. The Intermediate Loop would be interrupted at the more southerly of the two Potomac River crossings in the program recommended for completion by 1980. It is assumed that the Washington National Airport will still be in use until at least that date, and that a bridge close to the ends of the runways would not be permitted. The cost of a four-lane tunnel across the river to complete the Intermediate Loop would be approximately $53,000,000. This large expenditure cannot be justified prior to 1980 on the basis of traffic estimates, but may have to be made shortly after that date--earlier if traffic exceeds expectations. Existing restrictive conditions may change, however. A site for a bridge may

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be found which will be acceptable to all concerned, or changes in aircraft may develop--such as general application of vertical take-off techniques.

In any case, consideration should be given to building a crossing in this vicinity eventually to facilitate the movement of cross-town traffic and to relieve the downtown freeway facilities.

Chantilly Airport

The recent decision to build a new commercial airport near Chantilly, Virginia, 21 miles west of the central business district of Washington, will generate a demand for a superior highway facility between these two points.

It is estimated that the airport itself may serve about 10,000,000 air passengers a year. In addition to this, the airport and the freeway to serve it will stimulate some growth of residential neighborhoods and of industrial parks. Decisions by Government officials as to an exact route are imminent (December 1958). The freeway network shown herein, believed to represent the best long-range functional plan, includes a freeway on one possible alignment. Because of the unpredictable developments that may follow the building of a modern jet airport in this area, the freeway to serve it should be provided with all the reserve capacity possible.

Wisconsin Avenue

A freeway along or generally parallel to Wisconsin Avenue will be needed by 1965. It should extend from a point in the District on the Intermediate Loop to a point in Maryland on the Circumferential. This highway would connect with the Intermediate Loop and thence to downtown Washington, for passenger vehicles, via Glover-Archbold Parkway, the George Washington Memorial Parkway and Whitehurst Freeway. Trips could also be made via the Intermediate Loop to the northeast and east portions of the area. The Wisconsin Avenue Freeway should have provisions for transit operation, as discussed later.

North Central Freeway

A large and heavily populated suburban area lies directly north of Washington. This section is expected to continue to grow rapidly. It is connected with the central business district of Washington only by surface streets, all of which are reaching or have passed practical capacity usage in rush hours.

If this large segment of the metropolitan area is to develop as anticipated by the planning agencies, it will have to be provided with highways to downtown Washington having much greater capacity than anything now contemplated. Not even drastic widening of surface streets through the District and suburbs--with the loss of trees, lawns and other amenities of life in these attractive residential areas--would provide capacity to keep abreast of anticipated growth. The improvements to North Capitol Street currently under way will only partially relieve the pressure.

A freeway is proposed by De Leuw, Cather & Company, therefore, on an alignment to be selected carefully by engineering and city planning studies but extending generally from the north leg of the Inner Loop Freeway at the interchange with the center leg to a point on the Circumferential and a connection with Northern Parkway approximately at the north limits of Silver Spring. The outer portions of this route are proposed to be used to provide a joint right-of-way with a rail rapid transit facility under the recommended comprehensive plan.

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Southeast Route

Planning agencies anticipate extraordinary growth east of the Anacostia River and south of Suitland Parkway in the Henson Creek area. As this growth takes place, a freeway will be needed between the Circumferential and the Inner Loop, tentatively shown as terminating at an interchange on the Inner Loop Freeway system in the vicinity of 11th Street S.E. and K Street S.E.

Selection of the exact route should be based on exhaustive engineering and city planning studies. Alignments shown on the maps herewith are functional only, and final locations might be anywhere in a corridor two or three miles wide. Reserve capacity for the future should be a feature of this facility.

Alexandria Waterfront Drive

Consideration has been given by various agencies to a route through the city of Alexandria, but this freeway is not yet included in the system of planned highways. Such a route would connect improved parkways on each side of the city, providing a continuous route from the 14th Street Bridge to Mt. Vernon, as well as giving commercial vehicles access to Alexandria's water front.

Other Freeways

There are a number of other short sections of freeway, most of which have been proposed in earlier reports of official agencies, but which are not definitely planned at the current time. These include a freeway extending from the Intermediate Loop to the vicinity of the easternmost point of the District of Columbia.

Arlington Boulevard--U. S. 50

The Virginia Department of Highways proposes to improve Arlington Boulevard--U. S. Route 50 in Arlington County to high standards. Lacking definitive plans for the improvement, the civil engineering consultant has classified this arterial as an expressway in the major street program rather than with the freeway-parkway system. Final decisions on design, however, may properly put this highway in the higher category. The traffic capacity will be essentially the same in either case, and this capacity has been taken into account in estimating the additional highway capacity needed to serve Arlington County.

While U. S. 50 is at present designated as the location of Interstate Route 66, we have presumed that a more northerly location will be substituted. We have also presumed that the Key Bridge alternate connection for Route 66 will be developed as part of the Interstate System.

Recommended Rail Routes

Two basic routes would be served by rail rapid transit under the proposed plan. One would extend in a north-south direction from near Wheaton to south of Alexandria, while the other would reach from the northwest area north of Bethesda to a point beyond the Anacostia River, southeast of the central business district. See Exhibit 4. Plan and profile sheets for these rail facilities will be found in the appendix, Plates 1 to 8.

The north-south route would start at a point near the Interstate Circumferential in Montgomery County, where a bus transfer station could be provided as well as adequate parking facilities. A double track rapid transit railroad would be built, it is proposed, in the center mall of that portion of the north central freeway extending generally from the vicinity of Wheaton to a point within the District between Takoma Park and Soldiers Home, in the vicinity of New Hampshire Avenue. The exact point

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would be determined by the alignment of the proposed freeway. It would enter a subway in the roadbed of that street and continue southwesterly to 13th Street N. W. The route would then continue southerly in 13th Street N. W. for a distance of approximately 1.4 miles to a point just north of Logan Circle. Here, taking advantage of the proposed Northwest Urban Renewal Area, it would jog to 12th Street N. W. and continue in subway through the central business district, passing over the other proposed subway route in E Street N. W. See Exhibit 5.

The line would be routed through the Federal Triangle on 12th Street N. W. and continue beneath The Mall. The final profile and staging of construction should be coordinated with the proposed 12th Street Expressway. The rail facility would then pass under Washington Channel in tunnel, the alignment and design requiring close coordination with the proposed Washington Channel crossing of the Inner Loop Freeway. Emerging from a portal in East Potomac Park, the line would cross the Potomac River on a new bridge parallel to and just south of the railroad bridge, with the possible alternative of a Potomac River tunnel.

The two-track facility would swing westerly to the Pentagon after crossing the river, with trackage for short-line service and other variations in routing, and then continue southerly to a station opposite Washington National Airport. Shuttle bus service would be operated to the airport buildings, using a proposed viaduct over the railroad yards. In the vicinity of this station, shops and storage yards would be provided in the area between the Richmond, Fredricksburg and Potomac Railroad tracks and the Jefferson Davis Highway (U. S. 1). The rapid transit line would then continue alternately at grade, on fill and on elevated structure alongside the railroad tracks through Alexandria, turning south and crossing over the tracks in the vicinity of Duke Street. A terminal would be built south of Hunting Creek near Jefferson Manor. At this point a bus-to-rail transfer facility would be installed as well as a parking lot. In all cases, such outer terminals would also have adequate facilities for delivering or meeting passengers with cars which would be parked only momentarily. See Exhibit 6.

The total length of this rail line would be about 20. miles.

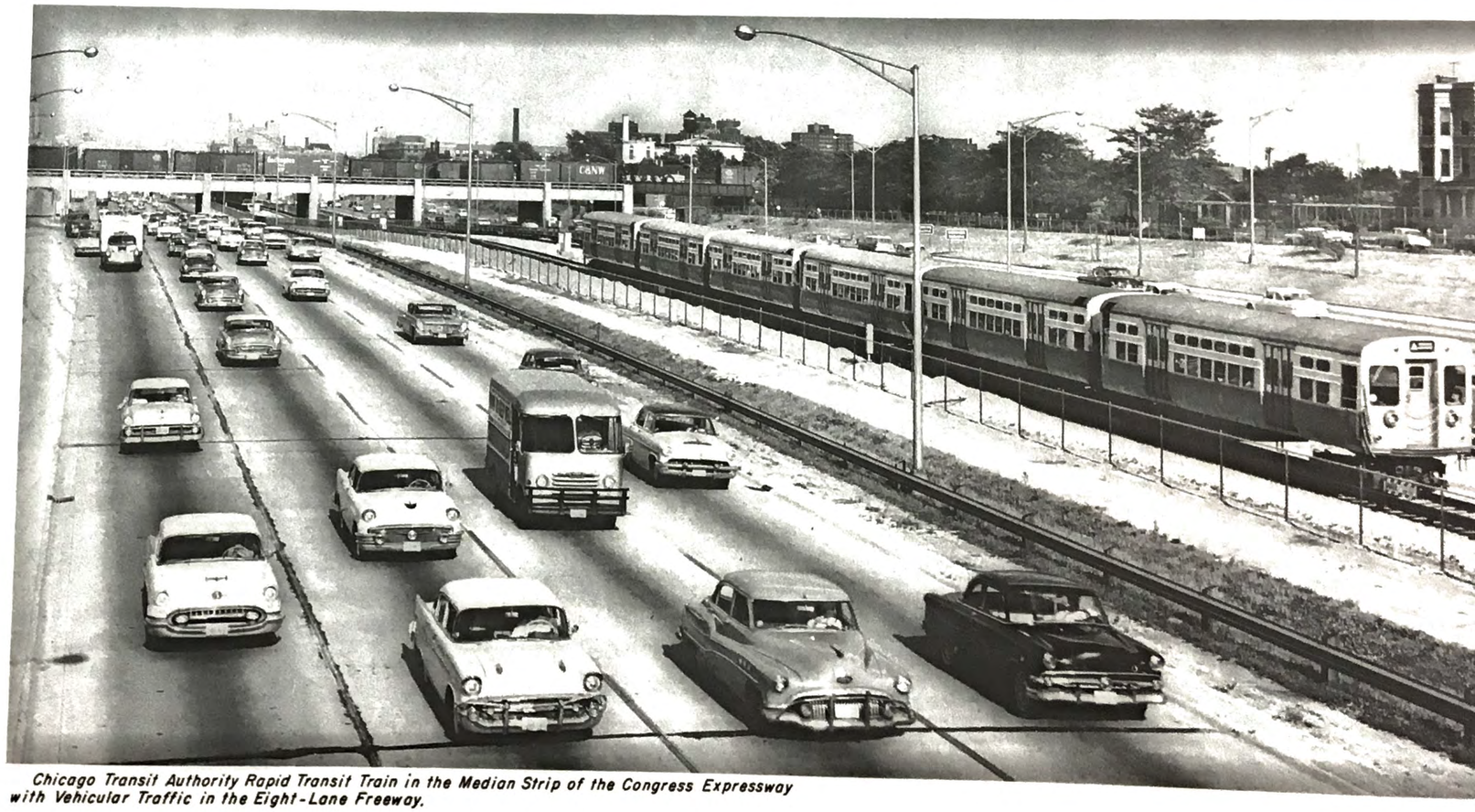
Another rail rapid transit facility would start from a terminal in the vicinity of Pooks Hill, north of Bethesda, Maryland. A freeway route in this corridor is proposed by De Leuw, Cather & Company, and the rail line would occupy the center mall of such a freeway from the outer terminal to a point between the District line and the Intermediate Loop, a distance of about 4.4 miles. As with the northerly portal on the north-south subway route, the exact point would finally be determined after consideration of the freeway location. From that point the rapid transit facility would consist of a subway in the bed of existing public rights-of-way for essentially the entire remaining distance to the southeast terminal.

The route would follow Wisconsin Avenue from near the Intermediate Loop for a distance of 1.6 miles to its intersection with Massachusetts Avenue. At this point it would turn southeasterly in the bed of Massachusetts Avenue and continue via a new bridge across Rock Creek Park and then in subway to the vicinity of DuPont Circle, turning south in 19th Street N. W. to E Street N. W. It would then turn easterly in E Street N. W. passing under the subway in 12th Street N. W. to the vicinity of the Union Station. The subway would turn south, passing under the proposed depressed vehicular roadways in Constitution and Independence Avenues, then jog easterly to 4th Street S. E. and continue southerly, passing under the Naval Gun Factory property. It would pass under the Anacostia River in a two-track tunnel to a terminal just south of the river. Yards and shops would be provided in the vicinity of this terminal as well as bus transfer facilities and parking lots.

The total length of this rail line would be 13.7 miles.

A connection between the two rail routes would be provided in Pennsylvania Avenue near their point of crossing at E and 12th Streets N. W. This connection would permit the interchange of equipment for maintenance purposes, but would not be used in passenger service.

The north-south route would have 20 stations, including the terminals, for an average spacing of about one mile. The route running from the vicinity of Bethesda to south of the Anacostia River would have 16 stations spaced approximately 0.9 miles apart on an average.



Chicago Transit Authority Rapid Transit Train in the Median Strip of the Congress Expressway with Vehicular Traffic in the Eight-Lane Freeway.

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Construction

These stations would be made attractive to the patrons by incorporating all of the architectural features characterizing the most advanced design. Walls and other surfaces which the public could touch would be faced with structural glass, tile, stainless steel, or other mar-proof and easily cleaned materials. Full use would be made of acoustical materials to keep the noise level at a minimum. Fluorescent lighting would be applied generously in all parts of the stations and in their vicinity. Escalators would be provided at many places, their use now being practical even where the device is partially exposed to the elements. In the downtown area, entrances would be opened, it is proposed, between the subway stations and the basement levels of stores and office buildings.

That portion of the rail rapid transit system in subway would be built, for the most part, by the use of cut-and-cover methods. This would keep the vertical distance between sidewalk level and platform level to a minimum, and would be the most practical design for conditions in Washington. Street traffic would be interrupted only temporarily with this method of construction, since the street would be restored for use by decking over the excavation after the initial stage had been completed.

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Passenger Equipment

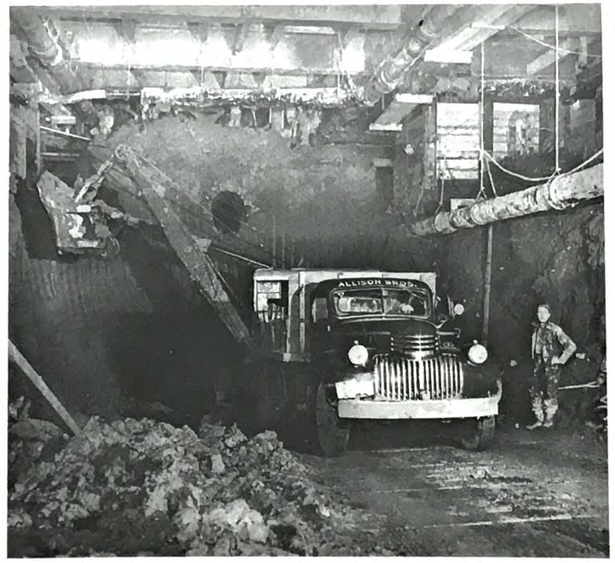
Several new types of rapid transit cars have been developed in recent years, and it is difficult to select between them for qualities of comfort, appearance, and ease of maintenance. It is likely, however, that an articulated car consisting of three units permanently coupled on four trucks would prove to be the most appropriate for the Washington operation. This design permits lightweight construction with economy in use of materials and yet sufficient flexibility to permit trains to vary in length from 150 to 450 feet. Station platforms would be 500 feet long. The interior of the cars would be finished in modern synthetic materials as well as in corrosion-resistant metals for ease of cleaning. Lighting would be kept at high intensity, and all equipment would be fully air-conditioned to assure a supply of clean, fresh air at comfortable temperatures in all seasons.

The trucks of the articulated units could have rubber-tired wheels--as in the case of the latest Paris trains which are now in successful operation after a development period of many years. On the other hand, they might have steel wheels operating on steel rails in the conventional manner, but perfected to be very quiet, similar to the equipment used in the new subway in Stockholm.

Fully automatic operation of such rail vehicles under the control of electronic devices can be foreseen, but in the interest of conservatism, the estimates of operating costs contained herein are based on the best of modern practice proved sound by actual operation. The cars purchased for the Washington system, however, should be readily convertible to fully automatic operation.

Modern Subway Station — Yonge Street Subway--Toronto

Fare Collection Turnstiles and Booth — Cleveland Rapid Transit



Subway Construction Proceeding Under Temporary Decking of Street
Yonge Street Subway -- Toronto

Paris Pneumatic-Tired Subway Car

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Recommended Express Bus Routes

In addition to two main rail rapid transit lines, comprised of four radial routes, eight distinct express bus routes are proposed, serving all remaining segments of the metropolitan area. See Exhibit 4. The bus routes, similar to the rail routes, would have their own systems of bus feeders which, in some cases, would involve a physical transfer of passengers at outer or intermediate stations. In other instances, however, the express buses might collect their loads by operating over the surface streets on the suburban portions of their routes.

On all routes, outer terminals would consist of adequate facilities for bus-to-bus transfers, as required, together with extensive parking space. In many cases the terminals would be built only when the territory beyond had been developed, temporary facilities serving in the interim. Bus stations would be provided along the freeways at approximately one-mile intervals. The spacing would depend somewhat on the existence of intersecting major streets to serve feeder buses as well as persons walking, driving or being driven to the stations. See Exhibit 7.

The largest buses practical for urban operation would be employed in the express service--probably of about 52-seat size. Feeder service to the outer terminals might be rendered in some instances with smaller buses appropriate to route characteristics.

Two or more types of service would be operated between the outer terminals and the points of leaving the freeways near the downtown area. During peak periods on all routes, and even during midday on the heavier lines, some buses would run non-stop from the suburban terminals to downtown. Other buses would stop at every station or every second station.

At appropriate points in the vicinity of the Inner Loop Freeway, the express buses would leave the radial freeways and continue their trips on the surface streets within the central area. On most express bus routes, the peak hour flow of buses would exceed the number that could be operated efficiently on a single surface street. Each express route, therefore, would have to fan out into three or four downtown distributor routes. This would broaden the distribution within the area, but some patrons would still find it necessary to transfer to other bus lines or to the proposed subways to reach their ultimate destinations.

Through routing of express buses would likely be found desirable in some combinations. It is contemplated that on many routes the express buses would loop back before reaching the far side of Sector Zero and return to the freeway system for additional express trips or go into midday storage at a convenient point. Through passengers using express buses on such routes would transfer between vehicles in the central business district.

The recommended transportation system is designed to be adequate to serve a population of 3,000,000 in the National Capital Region. The number of buses on the various routes would be such that they could be absorbed into the general traffic stream. As the population of the area approached 3,000,000, however, special ramps for the exclusive use of buses might have to be built in the vicinity of the Inner Loop Freeway. The cost of such ramps is not included in the estimates. It might also be necessary to restrict the volumes of traffic on certain sections of the freeway and parkway system as the target date was approached or as segments of the incomplete system were placed in operation. These steps would be taken not only for the benefit of bus patrons, but in order to keep all traffic moving. As population grew beyond 3,000,000, special roadways for buses might have to be built, or the rail system might have to be expanded to supplant bus routes as discussed at some length in Chapter XI.

Improvements to Arterials

The proposed network of freeways and parkways will have to be supplemented by a comprehensive system of expressways, park roads, major streets, and other arterial thoroughfares, principally at surface grade. They will consist mainly of development of existing rights-of-way by widening of pavements, extensions to connect interrupted streets, and grade separations at complex intersections. These streets will act as feeders and distributors for the network of limited access highways. They will also carry the heavy volumes of traffic making short trips or trips in corridors that would not support more elaborate facilities.

It is presumed that a system of local bus routes will operate on the improved major streets to carry passengers to and from the stations of the rapid transit system. Local routes will also provide service for people making trips independent of that system as at present. The reports of other consultants will discuss the administrative and legal processes under which existing transit company operations might be coordinated with the proposed rapid transit system.

The network of major streets and other arterials which will be necessary by about 1980 is shown in Exhibit 3. It will be noted that some of the major streets terminate at freeways, serving principally as feeders to that system. The cost of the improvements, estimated at a total of $181,450,000, is summarized by type of work, by status of highway, and by stage of construction in Table 2.

Appendix Table A-8 compares estimated traffic volumes in 1980 with estimated capacity of radial surface arterials as recommended to be improved. The data are for each of 13 corridors and for each of two screen lines as listed in Tables A-8a and A-8b.

Priorities for Construction

Close coordination between the highway and rapid transit programs is presumed in making our recommendations. In order to arrive at a stage construction program for the transit facilities, therefore, it has been necessary for us to suggest a schedule of freeway construction beyond the period for which the various highway departments have currently planned their work. Some freeways not even planned as of 1958 have been proposed for early construction because they will soon be needed for bus or rail rapid transit operation.

While it would be desirable to have the entire network of freeways and parkways completed at the earliest possible moment, practical considerations of finance, as well as objections to disrupting too many existing thoroughfares at once, dictates that the program be carried out over a period of years. Measured by estimated cost, more than one-half of the freeway facilities required by 1980 are already planned, most of them for completion by 1969. Even if this schedule can be maintained, however, there will be some areas of the metropolitan region that will be seriously handicapped in their normal development by lack of highways. That there should be such a backlog of urban highway work is not surprising in view of the general curtailment of construction between 1930 and 1945.

Stage construction of the recommended system of freeways and parkways has been scheduled, therefore, as shown in Exhibit 8. This program emphasizes the need for a disproportionate amount of the total to be completed in the first stage, indicated in the exhibit to be the period through 1965. Smaller portions of the total are indicated

for construction during the succeeding five-year periods through 1980. Table 2 indicates the total cost of construction, in each of the phases, together with distribution by type and status of highway.

The stage construction of improvements to major streets and other arterials has not been planned in detail. This program, however, will have to be coordinated with the construction of the freeways so that traffic will not be unduly disrupted.

Stage construction of rail rapid transit will have to be closely coordinated with construction of the freeways since the joint use of rights-of-way is contemplated. In some important instances, express bus operation on freeways and arterial streets is proposed as an interim step toward ultimate construction and operation of rail rapid transit. Exhibit 9 shows the proposed staging of rail rapid transit construction which would provide proper coordination with the highway program.

A period of eight to ten years is sometimes required for the planning, design and construction of a rapid transit subway. It is necessary, therefore, to anticipate the need for such facilities several years ahead of actual operation. Work should start at the earliest practicable date on preparation of preliminary engineering plans for the subway sections of the recommended rail rapid transit facilities.

The decision as to when to build a particular rapid transit facility should consider the potentials for growth of the section of the metropolitan area to be served. These potentials are determined in large part by the assurance of an adequate system of freeways.

The staging of express bus operation on freeways and parkways is obviously tied closely to the programming of the freeways on which buses will operate. Express bus operation can be extended gradually as short sections of freeway are opened to traffic, with temporary terminals installed at the completion of each phase. The terminals indicated in the comprehensive plans shown in this report might not be fully developed for a number of years.

River Crossings

A reduction in the future number of lanes of bridges across the Potomac and Anacostia Rivers otherwise required would be accomplished by construction of the proposed rail rapid transit facilities over these two waterways. A two-track rapid transit bridge would be built across the Potomac River in the 14th Street corridor. The number of passengers it would divert from automobiles to rapid transit trains in rush hours, at 1980 levels, would be equivalent to two lanes of automobile traffic in one direction or a total of four lanes of bridges. The capacity of the two-track transit bridge would be equivalent to that of about 18 bridge lanes, even at the assumed low number of standees on the trains. Thus, the transit bridge would be adequate for decades, whereas additional highway bridge lanes might have to be built soon after 1980.

Similarly, a proposed two-track rail tunnel under the Anacostia River in the vicinity of 11th Street S.E., although used to only a fraction of its capacity, would carry enough passengers in rapid transit trains in the target year of 1980 to relieve the need for building four lanes of bridges across the Anacostia in this general area.

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TABLE 2

PLAN IV--RECOMMENDED HIGHWAY SYSTEM
SUMMARY OF CONSTRUCTION COST OF FREEWAYS, PARKWAYS AND MAJOR STREETS

Status	Type	Estimated Construction Cost--(Thousands of Dollars) Through 1965	1966-1970	1971-1975	1976-1980	Total
INTERSTATE						
Planned	Freeways	$ 612,450	$ 62,650	$ 43,050	$ -	$ 718,150
	Parkways	19,650	-	-	-	19,650
	Major Streets	-	-	-	-	-
Added	Freeways	9,200	350	27,450	-	37,000
	Parkways	-2,350	-	-	-	-2,350
	Major Streets	-	-	-	-	-
OTHER						
Planned	Freeways	103,450	49,200	-	17,250	169,900
	Parkways	37,850	37,000	-	3,250	78,100
	Major Streets	167,800	-	-	-	167,800
Added	Freeways	265,200	92,550	74,950	43,650	476,350
	Parkways	41,150	35,500	42,800	5,300	124,750
	Major Streets	13,650	-	-	-	13,650
TOTAL	Freeways	$ 990,300	$204,750	$145,450	$60,900	$1,401,400
	Parkways	96,300	72,500	42,800	8,550	220,150
	Major Streets	181,450	-	-	-	181,450
GRAND TOTAL		$1,268,050	$277,250	$188,250	$69,450	$1,803,000

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CHAPTER III

ESTIMATED CAPITAL COSTS

Estimates have been made of the capital cost of each of the four basic systems studied--auto-dominant; all-bus rapid transit coordinated with freeways; all-rail rapid transit coordinated with freeways; and recommended highway-transit system. For each of these plans, the highway cost has been based on an estimate of the cost of right-of-way and construction for all freeways and parkways in the recommended system to be completed after February 1, 1958, together with the estimated cost of all widenings and extensions of major streets to be completed after the same date.

Comparative costs for the various plans will be found in Table 1, page 2. Details of the estimates are included in Appendices A and B, while a summary of the cost of each plan accompanies the description of that plan.

The highway estimates include preliminary expenses, rights-of-way, construction, engineering, contingencies, and all other items usually covered by such estimates.

Approximately one-half of the dollar amount for freeways and parkways was taken directly from estimates prepared by or for the various highway departments. These varied in degree of refinement from engineers' estimates based on final contract drawings and specifications to figures based on preliminary plans as prepared for submission to the Congress under the terms of the 1956 Highway Act as a "Detailed Estimate of Cost of Completing the Interstate System."

The costs of other highways for which estimates were not available, or of increasing the widths of those previously programmed, were computed on the basis of lane-mile costs for comparable highways through similar parts of the region with such modifications as were deemed

TABLE 3

PLAN IV--RECOMMENDED HIGHWAY SYSTEM
SUMMARY OF CONSTRUCTION COST OF FREEWAYS, PARKWAYS AND MAJOR STREETS

Jurisdiction	Type	Estimated Construction Cost--(Thousands of Dollars) Through 1965	1966-1970	1971-1975	1976-1980	Total
DISTRICT OF COLUMBIA	Freeways	$ 307,250	$157,950	$ 45,700	$ 3,600	$ 714,500
	Parkways	77,300	52,150	"	"	129,450
	Major streets	27,800	"	"	"	27,800
MARYLAND	Freeways	181,650	20,400	75,800	26,350	306,200
	Parkways	5,350	14,350	"	4,200	23,900
	Major streets	104,300	"	"	"	104,300
VIRGINIA	Freeways	299,400	26,400	23,950	30,950	380,700
	Parkways	13,650	6,000	42,800	4,350	66,800
	Major streets	49,350	"	"	"	49,350
TOTAL	Freeways	$ 900,300	$204,750	$145,450	$60,900	$1,401,400
	Parkways	96,300	72,500	42,800	8,550	220,150
	Major streets	181,450	"	"	"	181,450
GRAND TOTAL		$1,268,050	$277,250	$188,250	$69,450	$1,803,000

TABLE 4

PLAN IV--RECOMMENDED TRANSIT PLAN
SUMMARY OF ESTIMATED COST
BY ROUTE AND STAGE OF CONSTRUCTION

Route	Estimated Cost--(Thousands of Dollars) Through 1965	1966-70	1971-75	1976-80	Total
Rail					
DE	$ 15,800	$ 41,800	$ 24,800	$ -	$ 82,400
F	24,000	38,000	7,700*	17,150*	86,850
J	27,000	28,300	76,750	-	132,050
K	35,000	65,850	-	-	100,850
	$101,800	$173,950	$109,250	$17,150	$402,150
Yards and Shops	-	4,000	6,800	1,450	12,250
Rolling Stock	-	14,400	24,500	5,200	44,100
Total Rail	$101,800	$192,350	$140,550	$23,800	$458,500
Express Bus					
A	$ -	$ -	$ 2,250	-	$ 2,250
B	1,350	-	-	-	1,350
AB	450	-	-	-	450
C	3,150	-	1,800	-	4,950
D	1,800	-	-	-	1,800
E	1,800	-	-	-	1,800
DE	450	-	-	-	450
F	2,700	-	-	-	2,700
G	4,050	-	-	-	4,050
FG	450	-	-	-	450
H	3,150	-	-	-	3,150
I	450	2,250	-	-	2,700
J	1,800	-	-	-	1,800
K	2,700	-	-	-	2,700
	$ 24,300	$ 2,250	$ 4,050	-	$ 30,600
Shops and Garages	8,650**	-	-	-	8,650
Rolling Stock	28,750**	-	-	-	28,750
Total Bus	$ 61,700	$ 2,250	$ 4,050	-	$ 68,000
TOTAL--PLAN IV	$163,500	$194,600	$144,600	$23,800	$526,500

*--Extension of Rail Route F south of Airport Transfer Terminal.

**--More buses would be required in 1965 than in 1980, since rail rapid transit would replace some of the express bus routes during this period. As buses purchased prior to 1965 became worn out, therefore, they would not all be replaced. The depreciation funds represented by such excess buses would presumably be invested in rail rapid transit cars. Garages and bus shops, which would have a longer life than the buses, should be so designed that they could be partially converted for use in servicing the rail cars or used by the expanding fleet of local buses.

NOTE: See Exhibit 4 for location of transit routes.

appropriate. Special sections, such as the tunnel considered in certain plans for construction under the Potomac near Washington National Airport, were separately estimated on the basis of unit costs for the type of structure involved.

Estimates of the capital cost of the rail rapid transit and express bus systems cover all costs that would be occasioned by provision of these facilities.

The cost estimates for rail rapid transit in subways cover construction, maintenance of traffic (including temporary decking of streets), maintenance and restoration of all public utilities, engineering, and contingencies. Where rail rapid transit lines are contemplated on private rights-of-way, such as in the center malls of freeways, the estimates include the value of the rights-of-way occupied by the transit facility, shown separately, together with the cost of stations, terminals, tracks, signal and communication systems, electric distribution facilities, and other component parts of a complete transit system. See Exhibit 10. In addition, the estimates include a pro-rata share chargeable to transit of the cost of excavation, drainage, and structures to carry cross streets over or under the facility. Separate estimates have been made of the cost of yards, shops, and other facilities for the servicing and storage of rolling stock.

The estimates of capital cost involved in express bus operation include outer terminal stations, exclusive of parking facilities; intermediate stations along the freeways and parkways, including acceleration and deceleration lanes, but excluding parking facilities; and special bridge or highway lanes provided for exclusive use of buses as described more fully under the all-bus plan. Separate estimates have been made of the cost of shops, garages and other facilities for the servicing and storage of buses.

Cost of Recommended Plan

Table 3 shows the cost, as estimated on the foregoing basis, of the recommended system of freeways and parkways. The estimates are divided by type of highway, by political jurisdiction, and by stage of construction. See Appendix A for the detailed estimates.

Table 4 shows the estimated cost of the recommended rail rapid transit facilities by route and by stage of construction. This table also shows comparable information for the express bus facilities. Details of these estimates will be found in Appendix B.

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Table 5 shows the estimated capital cost of rapid transit cars and buses for express (but not local) service, together with the cost of yards, shops and garages.

The cost estimates for the recommended plan include the additional cost as a highway expense for right-of-way and construction involved in providing 64-foot medians in the following freeways to assure sufficient capacity for the future, as discussed in Chapter XI:

Northeast Freeway--From the Inner Loop Freeway to the Circumferential;

Chantilly-Pimmit Run Freeway--From George Washington Memorial Parkway to Survey Limits; and

Interstate Route 66--From Theodore Roosevelt (Constitution Avenue) Bridge to the Circumferential.

All additional costs incurred in providing wide medians in freeways for construction of rail rapid transit facilities definitely recommended in Plan IV have been included as a capital cost of the rapid transit system.

TABLE 5

TRANSIT EQUIPMENT REQUIREMENTS AND ESTIMATED CAPITAL INVESTMENT IN YARDS, SHOPS AND GARAGES FOR ALTERNATE TRANSIT PLANS WITH RECOMMENDED SYSTEM OF HIGHWAYS

Plan	Type of Equipment*	Number of Units Required Including Spares	Estimated Cost of Rolling Stock, Yards, Shops and Garages**
Plan II--All Express Bus--1980	Bus	1,800	$58,500,000
Plan III--All Rail Rapid Transit--1980	Three-Car Articulated Unit	400	$92,000,000
Plan IV--All Express Bus--1965	Bus	1,150	$37,400,000
Plan IV--Combined Bus and Rail--1980	Three-Car Articulated Unit	245	$56,350,000
	Bus	980	31,850,000
Total--Plan IV, 1980			$88,200,000

*-Loading Standard:

	Rush	Base
Bus (52 Seats)	60	45
Three-Car Articulated Unit (170 Seats)	220	150

**-Unit Cost:

Bus	$25,000	Three-Car Articulated Unit	$180,000
Shops and Garages	7,500	Yards and Shops	50,000
Total	$32,500		$230,000

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CHAPTER IV

ESTIMATED TRANSIT REVENUES

Revenues for each of the transit systems considered were estimated by routes. The fare structure basic to these estimates was prepared for the purpose of the studies by the Board of Experts.

The fare structure would consist of a basic fare of $0.20 for rides in a central zone having a radius of four miles from the White House. An additional fare of $0.05 would be charged on rides continuing through or into each of a series of concentric rings two miles wide around the central zone. For inbound trips, the initial fare would be $0.20 with an additional $0.05 for each zone line crossed.

It was assumed that feeder buses and other buses in local service would all be part of the same system, and that transfer between these vehicles and buses or trains in express service could be made under the same zone fare rate structure. Revenues were estimated for the rapid transit portion of the system alone, but in so doing, $0.05 of each fare was allotted for the provision of local service as feeders to the rapid transit system or as distributors of its passengers in Sector Zero.

The allocation of $0.05 per average ride for the service of local buses in collecting and distributing the rapid transit passengers assumes that only about one-half of the patrons would require such service. Most passengers in the outer sections would arrive at the rapid transit stations in automobiles or on foot, while in the central business district or at other destinations, most passengers would be delivered within walking distance without the need to use a local bus.

The traffic engineering consultant's assignment of transit passengers to each of the three rapid transit sys-

TABLE 6

PLAN IV--RECOMMENDED PLAN
OPERATING REVENUES AND MAINTENANCE AND OPERATING EXPENSES
EXPRESS BUS AND RAIL RAPID TRANSIT PLAN WITH RECOMMENDED SYSTEM OF HIGHWAYS

	Annual Revenues and Expenses (Thousands of Dollars)			
	1965	1970	1975	1980
Operating Revenues				
Rapid Transit Revenues	$34,500			$62,750
Less Revenues Allocated to Feeder Service	6,150			11,250
Total	$28,350	$36,650	$44,800	$51,500
Maintenance and Operating Expenses				
Express Buses	$23,150			$20,650
Rail Rapid Transit	-			17,900
Total	$23,150	$29,350	$33,900	$38,550
Net Revenues				
Before Fixed Charges on Shops, Garages and Yards	$ 5,200			$12,950
Less Fixed Charges on Shops, Garages and Yards*	550			1,250
Total	$ 4,650	$ 6,550	$ 9,800	$11,700

*-Fixed charges on 30-year, 5% bonds for $7,500 per bus for shops and garages and $50,000 per 3-car articulated unit for shops and yards.

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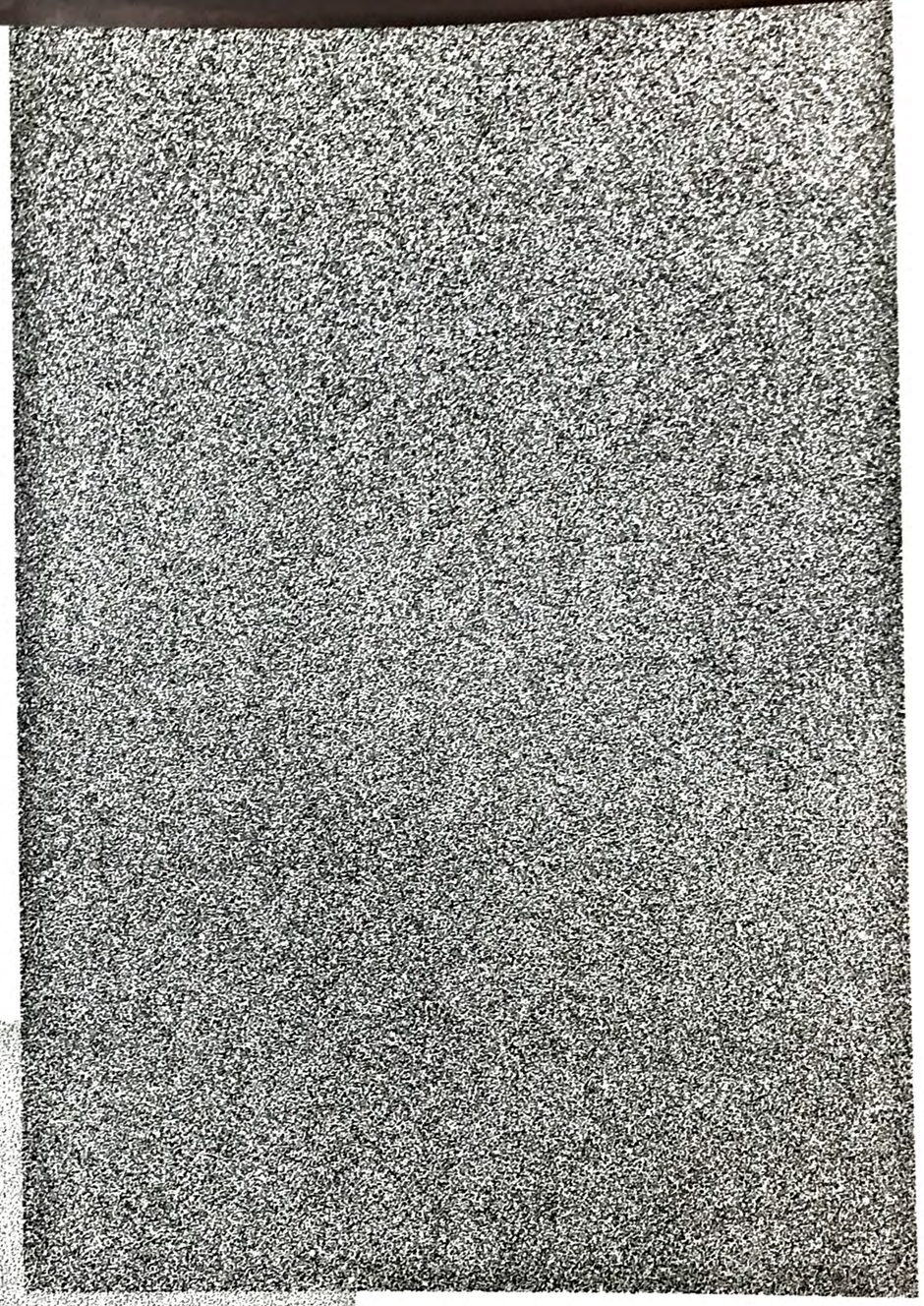
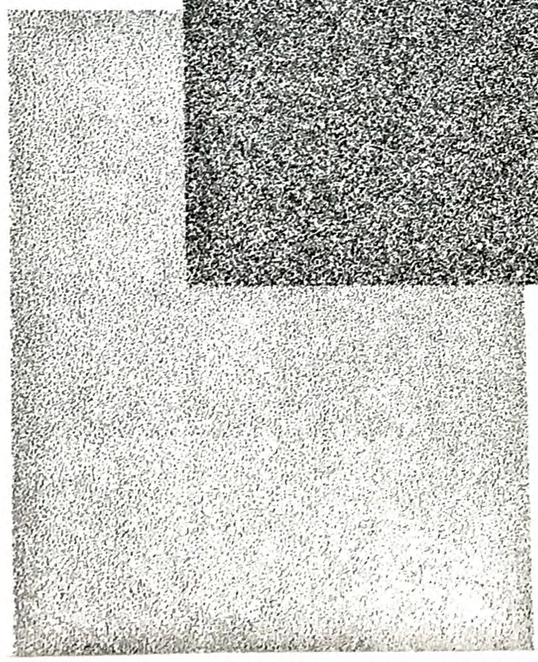
tems studied was by station of boarding and station of alighting, insofar as size of survey zones permitted. The fare between every combination of stations was computed and applied to the number of riders involved. The sum of these computations represented the system revenue. See Appendix C for the estimated number of passengers from each fare zone to every other fare zone by route for each plan for 1980, and for the recommended plan for 1965.

It was found that the average fare on the recommended system in 1980, including that portion allocated for the feeder or distributor portion of the trip, would be $0.28. The average fare would be slightly higher on the all-bus plan because of deletions of close-in stations. The average fare would be a little lower on the all-rail system, than on the recommended system, because of the short rides on the rapid transit lines generated by the added subway stations in the central fare zone.

Fare collection costs assume the greatest practicable use of mechanical devices for making change and collecting fares. The method used on different routes would be designed to balance the cost of fare collection at turnstiles and booths with the cost of collection on the vehicles themselves. Estimated revenues at five-year intervals for the recommended transit system are shown in Table 6. Appendix C shows the details of passenger and revenue estimates by route for each of the three systems for 1980 and for the recommended interim system only for 1965.





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CHAPTER V

ESTIMATED TRANSIT OPERATING AND MAINTENANCE EXPENSES

Operating and maintenance expenses were estimated for the rapid transit portions of each of the three transit systems considered--all-bus, all-rail and recommended. These estimates involved operating costs of buses, averaging the operating costs on freeways and on surface streets in the downtown area; and the operating costs of rubber-tired cars in trains of various lengths composed of three-car articulated units. These estimates are based on wage scales and other prices prevailing in 1958.

The operating expense estimates were based on service of high quality. In computing equipment requirements, service was tentatively scheduled so that express buses in rush hours would carry an average of only 15 percent standees. Due to the characteristics of the load pattern on the various routes, this would normally mean that no one would stand for more than three to five minutes even during rush hours. During off-peak periods, buses would be scheduled to provide an excess of seats over the number of passengers riding through the heaviest load point. The assumed loading of rail vehicles was on the basis of 30 percent over the number of seats in the heavier direction during the peak hour. However, the section over which this standard of loading would prevail would normally be only one or two miles long. Passengers who were required to stand would do so for only a few minutes. In off-peak hours, an excess of seats would be scheduled.

The operating speeds of buses on the freeway portions of their routes were based on the spacing of the stations with skip-stop operation in rush hours anticipated. Non-stop runs at even higher average speeds would probably be scheduled from the outer ends of the lines, but the speeds between outer terminals and the Inner Loop Free-

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Bus-to-Rail Transfer Station — University-Cedar Station — Cleveland

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way were taken at an average of about 39 miles per hour in both rush and off-peak periods. Speeds on the downtown surface streets were judged to be 8 miles per hour including stops for passengers. A trip involving four miles of operation on a freeway and one mile on downtown streets, for example, would be made at an overall average speed of 22 miles per hour.

The average scheduled speeds of trains were likewise computed on the basis of the characteristics of modern transit equipment. Manufacturers' specifications were checked against experience and combined with station spacing, grades and lengths of station stops. The resultant speed averaged about 37 miles per hour in both rush and off-peak periods, including that portion of each trip made within the limits of the downtown area. This would require equipment capable of crest speeds of over 60 miles per hour. Such equipment is now in operation on an experimental basis in at least one city.

The maintenance and operating expenses were estimated on a per-mile basis for both the express bus and rail rapid transit routes. The costs used were $1.30 per three-car articulated unit-mile traveled and $0.50 per bus-mile for express bus operation on freeways and $0.65 on downtown streets for a weighted average of $0.55 per bus-mile. These figures were determined after an analysis of expenses on similar rapid transit routes in New York, Philadelphia, Chicago, and Toronto. Expenses included in these unit costs are maintenance of way and structures; maintenance of equipment; power; conducting transportation; injuries and damages; depreciation; and general and miscellaneous expenses. Public ownership of the system is assumed, and no allowance is made for taxes other than the usual payroll taxes. It was also assumed that fixed charges on roadways, subways, stations, terminals and other fixed plant, excluding yards and shops, would be provided out of general funds and would not have to be supported by the fares of transit passengers.

While the rail rapid transit facilities would entail relatively high fixed charges to support the initial capital investment, the operating cost per passenger served would be considerably lower than for passengers carried on express buses. Moreover, the fixed charges on the rail facilities would decrease after the initial debt was amortized, and would become smaller per passenger served as the number of passengers increased. Platform wages are not a major item of expense in the operation of rail rapid transit because high-capacity trains are run with small crews. In a period of continually increasing wage rates, such as has been experienced over the past several years, on the other hand, the expense of serving the average bus passenger might increase substantially over estimates based on 1958 levels. The accounting item "Conducting Transportation"--which consists primarily of the wages of platform labor (motormen, conductors and bus drivers)--would represent about 30 percent of total maintenance and operating expenses on the rail lines proposed in the recommended system but would equal about 50 percent of such costs on the rapid transit bus portion of the system.

Operation of a totally self-contained system, physically separated from all other forms of traffic, moreover, would permit the greatest possible application of automation when and if desirable.

A summary of the operating expenses for the recommended system at five-year intervals through 1980 is presented in Table 6. Appendix C contains the estimated operating expenses under each of the various transit plans for 1980.

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CHAPTER VI

PARKING FACILITIES

Sector Zero--1980

The first section of this chapter presents an estimate of the number and cost of additional parking spaces that will be needed in Sector Zero (central business and government district) by 1980. Separate estimates are presented for the auto-dominant scheme (Plan I) and for the recommended plan (Plan IV). Parking requirements with the all-bus and all-rail systems (Plans II and III) would be approximately the same as with the recommended highway-transit scheme. The principal difference between the three transit schemes, under the assumptions used in the traffic estimates, was in the difference in the number of transit passengers assigned to local and express service; the total number of transit users was about the same in each scheme.

An inventory of all existing curb and off-street parking space in Sector Zero was made specifically for this project in 1955 by the Motor Vehicle Parking Agency of the District of Columbia. There were approximately 96,000 available parking spaces in Sector Zero at this time, with approximately 75,000 spaces for long-time parkers. Of the long-time parking spaces, about two-thirds were free. This factor is a significant influence in choice between automobile and transit for large numbers of people.

Of the total spaces, 26,500 were at the curb and 69,500 were available in off-street facilities. It has been estimated that only 67,000 of these spaces will remain in 1980. Loss in curb parking space will result from freeway construction and increased restrictions to provide better traffic movement. Loss in off-street parking space will be attributed to changing land use and new construction. Table D-1 summarizes 1955 spaces available and spaces expected to remain in 1980 in various districts of Sector Zero. These remaining spaces have been allocated to long-time and short-time usage as shown in Tables D-3 and D-4.

The traffic engineering consultant furnished estimates of the total number of auto drivers with destinations in Sector Zero for a 24-hour period in 1980 under both the auto-dominant and recommended plans. These estimates also separated worker trips from non-worker trips. In addition, the traffic engineering consultant projected the number of worker and non-worker trips destined to each district of Sector Zero. Table D-2, based on these estimates, shows the number of 24-hour, 1980 auto-driver trips destined for each district of Sector Zero in both worker and non-worker categories for the auto-dominant and recommended plans. This table shows that there would be approximately 364,000 inbound auto-driver trips to Sector Zero in a 24-hour period in 1980 under the auto-dominant plan, compared with approximately 312,000 such trips under the recommended plan. (These numbers include intra-Sector Zero trips.)

The number of parking spaces required in Sector Zero in 1980 for each transportation plan was developed from total 24-hour inbound trips. It has been estimated that the number of long-time parkers would be approximately equal to 90 percent of drivers in the worker category and that the remaining drivers would fall into the short-time classification. Although some non-workers would be long-time parkers, these would be compensated for by night workers and short-time work trips. It has been further estimated that optimum peak occupancy would be 90 percent for long-time parking spaces and 80 percent for short-time parking spaces. Turnover factors, based on existing parking habits in various cities throughout the United States, were applied to both long-time and short-time parkers in order to develop the total number of parking spaces required for each transportation plan, as shown in Tables D-3 and D-4. The number of parking spaces required in each district from 1955 to 1980 would be the difference between the total estimated requirement and the number of parking spaces available in 1955 which are anticipated to still be usable in 1980. This requirement would be 85,000 spaces for the auto-dominant plan and 48,500 spaces for the recommended plan.

Projected intensity of land use in Sector Zero in 1980 would necessitate construction of most of the new off-street parking spaces in multi-level garages. At the 1958 price index, cost of construction of parking facilities required for the auto-dominant plan would be $170,000,000, while cost of construction of those facilities required for the recommended plan would be $97,000,000.

Estimates of the cost of land required for additional parking facilities between 1955 and 1980 have been developed from estimates that approximately 30,000 parking spaces could be provided by decking existing public parking lots. The cost estimates assume that parking facilities will be combined with other types of enterprise in order to make optimum use of land. An average cost of $15.00 per square foot has been estimated to be the pro rata share chargeable to the parking deck. This unit cost includes demolition, legal fees and other expenses, and contingencies.

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On this basis, the cost of land required for parking facilities has been estimated at $66,000,000 for about 100 acres for the auto-dominant plan and $22,000,000 for about 35 acres for the recommended plan. The total cost of new parking facilities required in Sector Zero would be $236,000,000 for the auto-dominant plan and $119,000,000 for the recommended plan.

Sector Zero--1965

Estimates were made in the same manner to determine the parking requirements in Sector Zero in 1965 for the auto-dominant and recommended interim transit plans, the latter being an all-bus plan at this stage. It was assumed that the highways and transit facilities recommended for completion by 1965 in the stage construction program would be available by that date. The requirements would be the same with the all-rail plan as for the recommended plan, first stage, under the assumption that the difference in the number of patrons under the two plans represented shifts to and from local buses, rather than to and from autos.

The estimated number of existing curb and off-street parking spaces in Sector Zero which would still be available in 1965 is shown in Table D-1. This table shows that about 85,500 of the 96,000 parking spaces existing in 1955 would still be available in 1965. These spaces have also been allocated to long-time and short-time usage as shown in Tables D-6 and D-7.

The traffic engineering consultant furnished estimates of the total number of auto drivers with destinations in Sector Zero for a 24-hour period in 1965 under both the auto-dominant and recommended interim transit plans. Table D-5, based on factors also furnished by the traffic engineering consultant, shows the number of these trips in both worker and non-worker categories for each district in Sector Zero. This table shows that there would be approximately 312,000 inbound auto-driver trips to Sector Zero in a 24-hour period in 1965, compared with approximately 276,000 such trips under the recommended transit plan. (These numbers include intra-Sector Zero trips.)

The number of parking spaces required in Sector Zero in 1965 for each transportation plan was developed from total 24-hour inbound trips in the same manner as was previously described for developing the requirement for 1980. Tables D-6 and D-7 show that the estimated number of additional parking spaces required from 1955 to 1965 would be 42,400 for the auto-dominant plan and 20,000 for the recommended transit plan.

TABLE 7

SUMMARY OF PARKING REQUIREMENTS AND COSTS
UNDER THE AUTO-DOMINANT AND RECOMMENDED PLANS

		Plan I Auto-Dominant Plan		Plan IV Recommended Plan*	
Sector Zero	1955	1965	1980	1965	1980
Spaces Existing in 1955 Which Are Expected to Remain in Year Shown					
Curb	26,500	24,000	20,200	24,000	20,200
Off-Street	69,500	61,500	46,800	61,500	46,800
Total	96,000	85,500	67,000	85,500	67,000
Total Spaces Needed		127,900	152,000	105,500	115,500
Net Additional Spaces Needed		42,400	85,000	20,000	48,500
Cost of Additional Spaces		$124,000,000	$236,000,000	$52,000,000	$119,000,000
Terminal Stations					
Spaces Needed		-	-	10,400	20,800
Estimated Cost		-	-	$10,400,000	$ 20,800,000
Intermediate Stations					
Spaces Needed		-	-	7,800	11,200
Estimated Cost		-	-	$11,700,000	$ 16,800,000
Total Cost of New Parking Facilities		$124,000,000	$236,000,000	$74,100,000	$156,600,000

*-The data for the all-bus (Plan II) and all-rail (Plan III) schemes would be approximately the same as for the recommended plan.

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Based on unit costs previously developed for 1980 parking space requirements, it has been estimated that the cost of construction of parking facilities required in 1965 would be $85,000,000 for the auto-dominant plan and $40,000,000 for the recommended interim plan. The estimated cost of additional land required for parking in Sector Zero would be $39,000,000 for the auto-dominant plan and $12,000,000 for the recommended interim transit plan, giving a total estimated cost for parking of $124,000,000 for the auto-dominant plan and $52,000,000 for the recommended transit plan.

Parking at Transit Stations--1980

In addition to providing parking space for motorists in Sector Zero, it would be necessary to provide parking facilities at the stations along express transit routes. The number of parking spaces required at each transit station would be a function of the number of passengers boarding at that station and the distance from Sector Zero.

Estimates have been made of the parking space requirements for 1980 at various terminal and intermediate transit stations along routes of the recommended transit plan. It has been estimated that approximately 20,800 parking spaces would be required at terminal transit stations and 11,200 parking spaces would be required at intermediate stations. The cost of providing these parking facilities has been estimated at $20,800,000 at terminal transit stations and $16,800,000 at intermediate stations, giving a total cost of $37,600,000. There would be no cost for such facilities under the auto-dominant plan.

Parking at Transit Stations--1965

In similar manner, estimates have been made of the cost of parking facilities at intermediate and outlying transit stations in 1965 under the three transit plans considered. It has been estimated that the cost of providing these facilities would be $10,400,000 at terminal transit stations and $11,700,000 at intermediate stations, giving a total of $22,100,000. There would be no cost for such facilities under the auto-dominant plan.

The total cost of all new parking facilities in 1965 and in 1980 under each of the plans is shown in Table 7.

Income and Expenses

It has been assumed that most of the additional off-street parking facilities in Sector Zero would be privately owned, and that they would be operated on a fee basis. The principal exception would be garages in Federal buildings. It is estimated that, considering that some facilities would be free or metered at low rates, fees would average $1.05 per day for all-day parking in Sector Zero, with proportionate fees for short-time parking. It is anticipated that the fees that could be charged in the more advantageously located facilities would be sufficient to continue to attract private investment.

The parking lots or decks at the terminal and intermediate transit stations would probably be owned by the agency which builds the transit system. They might be leased to private operators or be run by the transit agency. It is estimated that fees averaging $0.35 for all-day parking would meet all operating and maintenance expenses, pay fixed charges, and leave an appropriate net return to the operator.

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CHAPTER VII

PLAN I--AUTO-DOMINANT PLAN

The term Auto-Dominant Plan has been applied to that system of freeways and parkways which would be adequate to serve a major portion of the travel needs of the metropolitan area, with transit playing a minor role. The plan assumes that public transportation would consist of local buses operating on the surface streets, giving service of the type and relative extent provided in 1955. The patrons of this system would be those whose trips were "transit-oriented"--essentially dependent on transit for their journeys about the region. Under these assumptions, the traffic consultant estimated that approximately 14 percent of all person-trips in the area in 1980 would be made by public transportation, while 86 percent would be made by private automobile. In 1955, transit accounted for 20.4 percent of all person-trips.

Forecasts of the number of trips made by the average person, to what destinations, and for what purposes were based on a gravity model method as explained in the report of the traffic consultant.

In estimating the requirements for highway capacity under the auto-dominant plan, the needs of commercial vehicles have been recognized. Each truck was taken as the equivalent of two passenger automobiles in computing the required rush hour capacity. This relatively low factor was used since many of the commercial vehicles moving during peak periods consist of light delivery trucks. The heavier vehicles move predominantly during midday or night hours and therefore do not significantly affect the design capacity of the freeway network.

Composition of Network

The routes comprising the auto-dominant system were selected in several ways. First, the freeways and parkways in existence or under construction were, quite reasonably, made a part of the system. To these were added the highways currently programmed for construction with limited access characteristics. The firm commitments of the various highway departments extend generally to 1969.

At this point the traffic engineering consultant assigned the estimated 1980 volumes of traffic to the network of freeways and parkways existing or programmed to be completed by the late 1960's. The system was then expanded, for preliminary evaluation, by adding routes for which the need has been seen by official agencies in the various jurisdictions. In some instances, De Leuw, Cather & Company upgraded the type of highway contemplated by such agencies from expressway standards to freeway standards. Other highways were added by the civil engineering consultant to meet deficiencies in the network revealed by this phase of the study.

In order to permit civil engineering estimates of the number of lanes required in each section of this more extensive road network, the traffic consultant assigned the predicted peak hour two-way weekday vehicular traffic in 1980 to the auto-dominant freeway system. All traffic assignments were first based on the assumption that every freeway in the system would have ample capacity for relatively fast, fluid movement at all times with average peak hour speeds of 30 miles per hour on the Inner Loop, 36 miles per hour between the Inner Loop and the Washington Circumferential, and 42 miles per hour on and beyond the Circumferential.

The auto-dominant plan of highways as finally developed by this method would consist of a network of 344 miles of freeways and parkways within the study area. This is only 86 miles more of this type of highway than currently existing or programmed, but the lane-miles would be 45 percent greater. The system would consist essentially of 15 radial routes dividing the circular metropolitan area into segments averaging 24 degrees in width. These radial routes would be interconnected by a series of concentric circles consisting of the Inner Loop Freeway system, the Intermediate Loop on the approximate alignment of the previously proposed Fort Drive, and a Circumferential lying at a distance from the White House varying from seven to eleven miles.

Traffic Assignments

The traffic consultant's assignments were converted by De Leuw, Cather & Company's staff to estimates of traffic flow in the heavier direction of travel for the peak one-hour period on an average weekday, this being estimated to be the appropriate design hourly volume (DHV). Directional distribution of this traffic (D-factor) was estimated on the basis of the factors shown in Appendix A.

The methods used in the assignment of traffic to the network of freeways are fully described in the report of the traffic engineering consultant. Briefly, they consisted of a series of successive approximations, modifying the initial estimates of speed and convenience as guided by the

volumes of traffic determined to be potential to various sections of the system. Significantly, it was found impractical to provide freeways for all of the traffic which might desire such facilities. To do so would require as many as 30 lanes of freeways in one corridor and almost as many in some others. It was assumed in the assignments, therefore, that surface streets would be used in rush hours to an extent not to exceed 80 percent of their estimated future practical capacity to allow for vehicles on local errands as well as movements to and from the freeway ramps.

The auto-dominant system shown herewith as Exhibit 11 presents the resultant network of freeways, indicating for each section the total number of lanes which would be required to carry the estimated 1980 volume of traffic. For this purpose the capacity of a lane was estimated to be 1,500 vehicles per lane per hour in the heavier direction during the peak 60-minute period. (In some sections of the Circumferential, the capacity was figured at 1,200 vehicles per lane per hour.) It will be noted from Exhibit 11 that the number of lanes required, on the foregoing basis, is reasonable in most instances, being usually no more than the number actually available or programmed. Where extra lanes would be needed, however, they would be difficult to provide in many areas.

The traffic engineering consultant estimated that adoption of the auto-dominant scheme would result, by 1980, in a one-third increase over 1955 in number of autos entering and stopping in Sector Zero during morning rush hours.

Critical Sections

The corridor of heaviest demand in the auto-dominant plan extends from the southwest leg of the Inner Loop Freeway along the previously proposed center leg of the Inner Loop Freeway paralleling 3rd Street S.W. and N.W. and thence northerly on an undefined alignment through the District to the Circumferential in the vicinity of Silver Spring. While the need for a highway through this corridor has been recognized, no definitive studies have been made on a freeway route northerly from the north leg of the Inner Loop Freeway. Twelve to eighteen lanes would be required to carry traffic in various sections of this route under the assumptions on which the auto-dominant plan is based.

Other demands imposed by the assumptions of the auto-dominant plan which would be difficult, if not impossible, to meet would be a corridor from the east end of Highway (14th Street) Bridge via the southwest route of the Inner

TABLE 8

PLAN I--1980 AUTO-DOMINANT SYSTEM
SUMMARY OF CONSTRUCTION COST OF FREEWAYS, PARKWAYS AND MAJOR STREETS

Jurisdiction	Type	Estimated Construction Cost--(Thousands of Dollars) Interstate Planned	Interstate Added	Other Planned	Other Added	Total
DISTRICT OF COLUMBIA	Freeways	$325,900	$173,650	$127,300	$515,700	$1,142,550
	Parkways	12,650	-	44,900	133,400	190,950
	Major Streets	-	-	18,400	26,100	44,500
MARYLAND						
Montgomery County	Freeways	56,350	-11,200	34,700	112,450	192,300
	Parkways	7,000	-2,350	7,200	-	11,850
	Major Streets	-	-	62,850	2,600	65,450
Prince Georges County	Freeways	114,100	23,200	7,900	7,250	152,450
	Parkways	-	-	3,100	13,900	17,000
	Major Streets	-	-	38,150	700	38,850
VIRGINIA						
Alexandria	Freeways	33,250	-	-	67,150	100,400
	Parkways	-	-	-	-	-
	Major Streets	-	-	7,550	350	7,900
Arlington County	Freeways	62,650	11,950	-	42,700	117,300
	Parkways	-	-	12,600	56,350	68,950
	Major Streets	-	-	13,300	2,800	16,100
Fairfax County	Freeways	125,900	14,650	-	24,900	165,450
	Parkways	-	-	10,300	-	10,300
	Major Streets	-	-	27,550	1,300	28,850
TOTAL	Freeways	$718,150	$212,250	$169,900	$ 770,150	$1,870,450
	Parkways	19,650	-2,350	78,100	203,650	299,050
	Major Streets	-	-	167,800	33,850	201,650
GRAND TOTAL		$737,800	$209,900	$415,800	$1,007,650	$2,371,150

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Loop Freeway to 11th Street S.E. In this section, as many as fourteen lanes would be required, whereas no more than eight can readily be provided or made to function. Moreover, the high proportion of traffic going to and from the central business district via this route, under the assumptions, would overload the streets serving the freeway ramps.

Estimated traffic volumes in this section would be even higher, furthermore, were it not for the assumption of a downstream four-lane bridge or tunnel across the Potomac River. This crossing would connect the Maryland and Virginia portions of the Intermediate Loop approximately at the south edge of the Washington National Airport. If this expensive connection ($53,000,000 for a tunnel) were to prove impossible to provide, the requirements along the south side of the Inner Loop Freeway would be increased by approximately two lanes under the auto-dominant system assumptions.

The remaining grossly overloaded section of the auto-dominant system is that portion of the Inner Loop Freeway comprising the north side of the Loop between approximately DuPont Circle and New York Avenue. While the studies in 1955 found it hard to develop an eight-lane freeway in this section, the estimates for the auto-dominant system showed a need in this corridor for as many as fourteen lanes. Even this excessive demand was kept down only by proposing two rather expensive sections of freeway not heretofore proposed in any official plan.

One would be an eight-lane limited access extension of the New York Avenue Freeway from its presently proposed connection with the Inner Loop Freeway at Florida Avenue, to a point much closer to the center of the business district--perhaps just west of Mount Vernon Square. This spur is mentioned only as a facility that would be functionally required under the assumptions of the auto-dominant plan. To build such a spur or to connect it with the surface street system would probably be impractical. The other new four- to eight-lane freeway required to relieve the north side of the Inner Loop would lie along or in the vicinity of Franklin Street and Columbia Road. The latter would provide a by-pass route lying entirely to the north of the Inner Loop Freeway via an extension through Rock Creek Park and across Whitehaven Parkway to the George Washington Memorial Parkway.

Estimated Cost

The auto-dominant system of highways would consist of 2,032 lane-miles of limited access freeways and parkways. The cost of substantial portions of this system at present day prices has been estimated by the highway departments of the two states and the District. The unit costs as thus developed have been applied to comparable sections of the balance of the system with a resultant estimate of cost for the freeways and parkways at 1958 prices of $2,169,500,000. To this sum would have to be added approximately $201,650,000 for street widening and other major highway construction by 1980 so that the total cost of all highways required under the auto-dominant system would be approximately $2,371,150,000.

Table 8 shows estimates of cost by type of highway, by political jurisdiction and by eligibility for Federal aid.

Parking Demand

The number of automobiles to be parked within the limits of Sector Zero at the moment of peak accumulation under the assumptions of the auto-dominant plan would be approximately 1.6 times the number parked in that area during the survey of 1955. A great deal of curb parking would have to be eliminated in order to provide street capacity in the area for moving traffic. Furthermore, an estimated 22,700 existing spaces in off-street lots will probably disappear between now and 1980 due to the construction of new buildings, many of which are programmed to be built by the Federal Government. It is estimated, therefore, that 85,000 new off-street spaces would have to be provided to serve the needs of motorists under the auto-dominant plan. The total cost is estimated at approximately $236,000,000, even assuming that the great demand for appropriate sites for garages would not inflate land values. See Chapter VI.

Conclusions

There are serious engineering questions as to the practicality of the auto-dominant plan (Plan I). While the outer portions of the system could undoubtedly be made to work, key sections of the freeway system, particularly the Inner Loop Freeway and the proposed north central freeway would require more lanes than controlling rights-of-way problems would permit, and more than would be functionally operable. Furthermore, there is little likelihood that the streets in the central area could accommodate the number of vehicles which would be moving to and from the freeway ramps with the estimated volumes of traffic.

The difference in capital costs between the auto-dominant plan and the recommended total transportation plan would not be great. The land takings for highways and parking garages under the auto-dominant plan, however, would be so great as to cause indirect damages, particularly in and around the central core.

A transportation policy requiring the National Capital Region to be served almost exclusively by automobiles would be incompatible with the distribution of living, shopping and working places of the area's inhabitants as foreseen by the staff of the Commission and Council. If a regional population of 3,000,000 is to be served principally by automobiles, the central core must be relegated to a less important role, and radical decentralization of most urban functions must be accepted as the pattern of future growth. Further growth of the region would only emphasize the difficulties of maintaining an attractive central business and government district. It is a matter for administrative policy as to whether or not this should be the long range objective.

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CHAPTER VIII

PLAN II--ALL-BUS RAPID TRANSIT PLAN WITH RECOMMENDED SYSTEM OF HIGHWAYS

The recommended transit scheme is composed of both express bus routes on freeways and rail lines on insulated rights-of-way. This combination was selected, however, only after testing, first, a rapid transit system consisting solely of express bus routes on freeways and separate bus roadways; and second, a system composed exclusively of rail facilities.

Both the all-bus and the all-rail transit plans were initially considered in connection with a highway system that would be limited to the freeways, parkways and major streets now existing or definitely planned. See Exhibit 1. This system of highways was found to be so inadequate, however, regardless of the best companion transit system that could be devised, that an enlarged highway network was developed. See Exhibits 2 and 3. This recommended highway system would be the same for either the all-bus or the all-rail transit plans. It is also identical with that proposed for the combination bus-rail transit system--the recommended plan.

The rapid transit system involving the lowest investment for special transit facilities would be comprised of express bus routes on freeways built for general traffic, with separate lanes for buses where needed. A system was tested, therefore, which would provide bus service on eleven routes. Express buses would serve essentially every radial corridor considered in the auto-dominant system of highways. See Exhibit 12.

Operation

The largest buses practical for urban operation would be employed in the express service--of about 52-seat size. Feeder service to the outer terminals would be provided with smaller buses appropriate to route characteristics of each line, or by through-routing the express buses into the tributary area on local streets.

Two or more types of service would be operated between the outer terminals and the points of leaving the freeways near the downtown area. During peak periods on all routes, and even during midday on the heavier lines, some buses would run non-stop from the suburban terminals to downtown. Other buses would stop at every station or at alternate stations. On approaching the central business district, the express buses, under the proposed plan of operation, would leave the freeways and distribute their passengers along the surface streets. It is assumed that the buses would be given preferential treatment by the traffic regulations on these surface streets in order to expedite service to their passengers.

Critical Routes

The most critical portions of the all-bus system would be the two routes serving the northwest and northerly corridors, respectively. The first is shown in Exhibit 12 to extend in the general direction of Massachusetts Avenue and Wisconsin Avenue to the vicinity of Bethesda. The other is shown extending northerly from the north leg of the Inner Loop at about 3rd Street N. W., on an undefined alignment for a north central freeway that would take the combination transportation artery in the general vicinity of the U. S. Soldiers Home and Silver Spring to the Circumferential and thence for a short distance in the planned Northern Parkway to a bus terminal in the vicinity of Wheaton.

No freeway is yet planned in either critical corridor within the District lines. It was found, however, that even with a complete transit system, freeways would be required in the vicinity of Wisconsin Avenue penetrating the District as far as the Intermediate Loop and from the Silver Spring-Wheaton area through the entire north portion of the District to a connection with the Inner Loop Freeway. An eight-lane north central freeway would be so heavily used by general traffic by about 1970 that the buses required on such a route could not be operated in the traffic stream without jeopardizing the speed and dependability of the transit service.

The all-bus system, therefore, contemplates two special highway lanes for the exclusive use of buses in certain sections of each of these routes.

Special Bus Roadways

On the northwesterly route, special bus roadways would have to extend from the Inner Loop Freeway to the Intermediate Loop near Tenley Circle. North of Tenley Circle, the number of buses required to 1980 could be absorbed in the general traffic stream, and cost for separate bus roadways in this section are not included in the estimates. Since no freeway is proposed in this corridor below Tenley Circle, it has been assumed for the purpose of cost estimates that two lanes for the exclusive use of buses could be built on a

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suitable alignment. Preferably, these would be built in a fully grade separated roadway along a valley or other natural separator between neighborhoods. Detailed engineering studies might disclose, however, that the most feasible way, physically, of providing the needed facility would be to build an elevated structure in existing streets or through Glover-Archbold Park. Such a proposal could conceivably raise insurmountable objections from the standpoint of esthetics and other considerations. One alternative would be to operate the buses indefinitely on surface streets with such privileges as could be accorded them to speed their operation. Another alternative would be to build a bus subway in this 3.2-mile section. The cost of such a subway would be approximately $60,000,000, which is hardly realistic considering the relatively low passenger-carrying capacity of a bus subway.

Consideration was given to bus operation on private roadways in a wide center mall of the north central freeway as a long-term, or even permanent, solution to the rapid transit requirements of the area which, in the recommended plan, would be met by the rail line to Wheaton. There are compelling reasons, however, why such a scheme should not be adopted. The number of buses per hour after the first few years would be greater than could be operated with every bus stopping at all intermediate stations. With buses operating in mixed traffic on a freeway, this situation is met by having only one-half or one-third of the buses stop at any one station. The balance pass that station as non-stop or skip-stop buses. There would be capacity for buses to operate in this manner to at least 1980 on the freeways proposed for rapid transit bus service in the recommended scheme--Plan IV. The required number of buses could not be absorbed very long on the north central freeway. With private bus roadways in a center mall, a rate of flow of more than about 120 buses per hour in one direction in the peak 20 minutes would require four bus lanes rather than two or else multi-platform stations that would necessitate awkward and probably infeasible bulges in the center mall, comparable with barrier-type turnpike toll plazas.

The most practical plan appears to be to do away with the close-in stations on the north and northwest routes during the all-bus phase in the stage development of the recommended plan, and to serve the inner areas with local buses. The people in these areas would later be given fast service, it is proposed, when there has been time to build the recommended rail rapid transit facilities. If such construction starts early in the program, it can be completed and the facilities placed in operation before the number of buses required in the interim becomes unmanageable.

TABLE 9

UTILIZATION OF FREEWAYS BY URBAN TRANSIT BUSES IN VARIOUS CITIES*

City	Bus Route	Length of Route: Terminal to Terminal	Length of Route: Part of Route on Freeway: Miles	Length of Route: Part of Route on Freeway: Percent	Number of Stops on Freeway	Rush Hour Intervals in Minutes	Rush Hour Service--Bus Speeds in Miles Per Hour: Express: On Freeway	Express: Terminal to Terminal	Local: Terminal to Terminal
Atlanta	6 Lines	11.5	-	-	0	3	-	17	10
Chicago	#2--Hyde Park	8.5	5.5	65	0	7	36	23	16
	#5--Jeffery	14.0	5.5	39	0	3	36	13	10
	Outer Drive Express	11.5	6.5	57	0	3	38	13	10
	LaSalle Express	7.6	4.0	53	0	2	38	11	9.2
Cleveland	#39--Memorial Shoreway	-	8.5	-	0	3	21-24	18-20	-
	#55--Bulkley Blvd.	-	5.5	-	0	1-1/2	13	13	-
Dallas	5 Lines	-	1.3-3.7	-	0	5-10	-	-	-
Detroit	#33--Dearborn	-	3.8	-	0	N.A.	32	18-20	14-15
	#41	-	6.7	-	0	N.A.	40	18-20	14-15
	#58--Plymouth	-	4.6	-	0	N.A.	19.2	18-20	-
Los Angeles	#44--Beverly	11.0	3.1	28	0	N.A.	27	12	10
	#83	10.0	3.1	31	0	N.A.	27	11-14	-
	#91	15	5.2	35	0	N.A.	27	15	12.5
	#93--Express	-	8.0	-	3	N.A.	23-30	18-20	-
	#93--Local	-	4.4	-	2	N.A.	23-28	15-17	-
	#58	-	15.0	-	0	N.A.	28	-	-
	#5	15.6	6.6	42	3	N.A.	36	17-21	11.2
	#7	-	5.6	-	0	N.A.	37	-	-
Pittsburgh	#22, #23 and #24	-	-	-	0	N.A.	-	16.5-25.4	11.6-15.9
Oakland	Key System Transbay Lines (L)	13.69(L)	-	-	0	2-6	43**	20-26	-
San Francisco	#30	-	3.6	-	0	N.A.	-	-	-
	Greyhound to:								
	San Rafael	13	-	-	0	8	-	28	-
	San Mateo	11	-	-	0	N.A.	-	-	-
	Redwood City	17	-	-	0	N.A.	-	-	-
	San Jose	49	21	-	0	N.A.	-	32	-

N.A.-Not available.

*-Compiled by De Leuw, Cather & Company from data in report "The Utilization of Freeways by Urban Transit Buses: A Nation-Wide Survey" by Wolfgang S. Homburger and Norman Kennedy--The Institute of Transportation and Traffic Engineering--University of California, Berkeley.

**-On Key System's "L" Line as observed by De Leuw, Cather & Company on April 18, 1958.

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It must constantly be kept in mind that even the target date of 1980 is a relatively short-term objective in a region that may continue to grow in population for decades or even centuries. The future welfare of the region would be jeopardized by embracing a plan which threatened to become inadequate within a few years.

Effect of Surface Operation in Sector Zero

It is not possible to estimate accurately the number of automobiles and trucks that will be moving on the streets of the central area during peak hours in 1980. The Inner Loop Freeway and other by-passes are expected to accomplish a marked reduction in through traffic on the surface streets. The number of terminating and originating vehicles, on the other hand, will probably increase. Although streets in the central area may be widened and otherwise improved, the capacity for buses will always be limited to the number that can be moved in the curb lanes through the various loading zones.

The civil engineering consultant considers it likely that by 1980 the number of buses required by the all-bus system would result in movement at walking speeds or less during rush hours. The service would be slowed even in off-peak periods, by the many complex and closely spaced intersections, as well as by the interference of autos and pedestrians.

This conclusion is verified by the experience in several cities where express buses are now operating on freeways in the manner proposed under the all-bus plan. High operating speeds on the freeway portions of the routes are tempered by low speeds in the congested downtown areas so that the average overall speed in most cases is not impressive. See Table 9

Under the recommended bus-rail plan, the average speeds on bus routes should be satisfactory. The proposed rail facilities would greatly reduce the number of buses otherwise required. Thus, the remaining buses in Sector Zero would be able to move at reasonable speeds.

Consideration was given to off-street bus terminals, to bus subways in the central area, and to distribution of bus passengers from the outer limits of the downtown area by moving belt or other type of mass transportation facility. None of these schemes proved practical, however, because of the large area of the business district. Many route-miles of expensive facilities would be required to cover the area

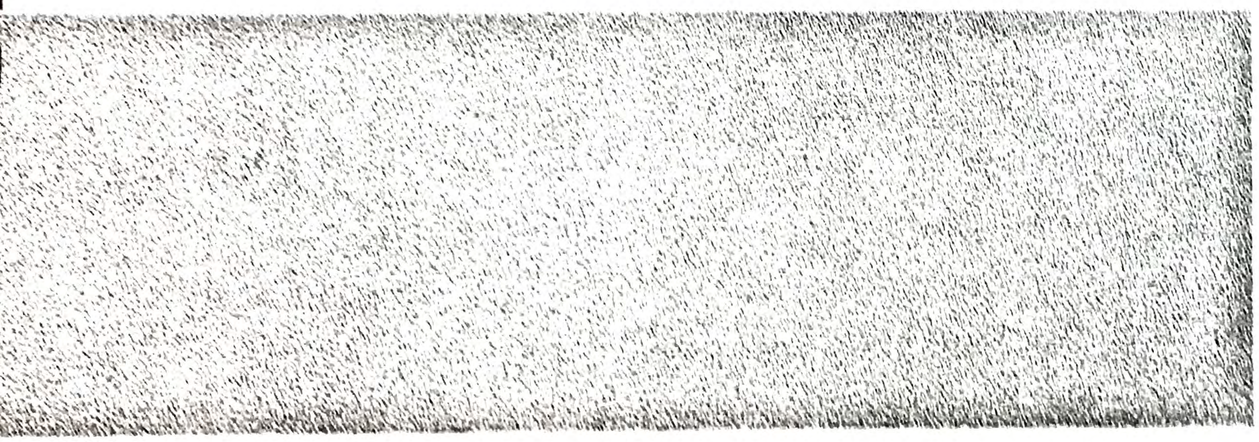

TABLE 10

PLAN II--ALL-BUS PLAN
SUMMARY OF ESTIMATED COST BY ROUTE AND TYPE OF CONSTRUCTION

Route	Stations Number	Stations Cost (Add 000)	Terminals Number	Terminals Cost (Add 000)	Special Lanes Lane-Miles	Special Lanes Cost (Add 000)	Bridge Lanes Lane-Miles	Bridge Lanes Cost (Add 000)	Total Cost (Add 000)
A	4	$ 1,800	1	$ 450	-	$ -	-	$ -	$ 2,250
B	2	900	1	450	-	-	-	-	1,350
AB	1	450	-	-	-	-	-	-	450
C	10	4,500	1	450	-	-	-	-	4,950
D	3	1,350	1	450	-	-	-	-	1,800
E	3	1,350	1	450	-	-	-	-	1,800
DE	1	450	-	-	-	-	-	-	450
F	5	2,250	1	450	-	-	1.2*	3,900	6,600
G	8	3,600	1	450	-	-	1.2*	3,900	7,950
FG	1	450	-	-	-	-	-	-	450
H	6	2,700	1	450	-	-	-	-	3,150
I	5	2,250	1	450	-	-	-	-	2,700
J	4	1,800	1	450	6.3	17,600	-	-	19,850
K	5	2,250	1	450	18.5	31,700	-	-	34,400
	58	$26,100	11	$4,950	24.8	$49,300	2.4	$7,800	$88,150
Yards and Shops									13,500
Rolling Stock (Buses)									45,000
TOTAL--PLAN II									$146,650

*-Pro-rated.

NOTE: See Exhibit 12 for location of transit routes.

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adequately with bus subways or mechanical devices. A centrally-located off-street bus terminal would have to be about as large as the Port of New York Authority bus terminal in Midtown Manhattan, and its approaches would require several thousand feet of fully grade-separated bus roadways.

Because of the great number of bus routes that would be operating in the downtown area, passengers would be able to reach their destinations with a minimum of walking. A substantial proportion, however, might be required to transfer between buses.

For a large portion of the potential patrons living within two or three miles of downtown, the length of the ride on the surface streets in the unusually large central area would be disproportionate to the distance traveled on the freeways. The trip time from origin to destination would not be greatly reduced, therefore, over that via local buses operating on the surface streets.

Estimated Cost

The capital investment required for the all-bus rapid transit system would include the cost of special turnouts and passenger stations at approximately one-mile intervals along each of the routes to within one to three miles of the Inner Loop Freeway. There would also be terminal stations at the outer ends of the lines with parking facilities tailored to the estimated needs. These stations would accommodate the transfer of passengers from feeder buses and from automobiles delivering or meeting express bus riders. There would also be a rather sizeable capital investment, estimated at $57,100,000, required for special bus lanes in the 14th Street (Potomac River) bridge corridor as well as in the northwest and north central sections of the freeway system. Finally, the express bus system would involve the purchase of vehicles as well as the building of garages and shops for their maintenance. The cost of all of these items, which total $146,650,000 is summarized in Table 10. This figure includes special bus roadways in the northwest and north central corridors under the assumption that they could be built at an average cost per lane-mile of a freeway in the same general type of territory.

More than offsetting this investment in transit facilities would be a saving in the cost of the freeway and parkway system. The transit system would cause a lesser use of automobiles, resulting in a reduction in the number of lanes required in certain sections of highway. The studies revealed only a few instances, however, of a freeway or parkway becoming unnecessary as a result of potential express bus operation. The estimated cost of the 1980 highway system required with the all-bus rapid transit system, but excluding any facilities provided primarily because of the operation of buses, would be $1,803,000,000. This would represent a saving of $568,150,000 over the estimated cost of the auto-dominant system which assumed no express bus operation on any of the freeways or parkways. There would be a further net saving of $79,400,000 in parking facilities, the need for lots at the bus terminals and stations partially offsetting the reduction in cost of garages in the central business district. These figures are recapitulated in Table 1, Chapter I.

Estimated Revenues and Expenses

The patronage of a preliminary plan for an all-bus system as estimated by the traffic engineering consultant was modified by De Leuw, Cather & Company. The traffic estimates were thereby made more consistent with the final proposals for station locations as well as with the plan for distribution of passengers in Sector Zero. See Exhibit 12.

The basic assignment was essentially the same for both the all-bus and all-rail systems. The changes made by De Leuw, Cather & Company were based on the assumption that there would be no stations on the all-bus rapid transit system to serve areas of the District which could be served almost as well by local buses. This principle led to the elimination of all stations inside the Intermediate Loop on the northwest and north central routes (bus routes J and K), and all stations on other routes within the area bounded by the Inner Loop Freeway on the north and west and the Anacostia River on the other sides (except for alighting passengers on inbound trips and boarding passengers on outbound trips).

Adjustments were also made in the number of express bus patrons to account for those which had been assigned as intra-line passengers between outlying points and the stations which were eliminated. Most of the passengers thus removed from the all-bus system in the estimates of De Leuw, Cather & Company could be expected to use local buses. There would be sufficient capacity on the surface streets to absorb the increase in number of local buses required, in 1980, as compared with other schemes, together with the automobiles of those who would choose to drive. The critical sections of the freeways and major streets in these corridors are beyond the stations that would be eliminated.

Tables C-6 to C-9 in the Appendix show the number of passengers, by routes, between fare zones for each of the plans for 1980 and for the recommended plan for 1965. These tables also show the number of passengers, by type of trip, affected by elimination or restrictions on the use of certain stations. Many of these passengers would make their trips exclusively on local buses, while some would transfer in Sector Zero to other routes of the rapid transit system.

Using the traffic estimates as modified by De Leuw, Cather & Company, and based on the fare structure set forth in the section on the recommended ultimate system, it is estimated that the annual revenues at the 1980 level less revenues allocated for feeder bus service would be $46,400,000 for the all-bus plan. It is further computed that the maintenance and operating expenses for the estimated volume of traffic would be $38,200,000, including fixed charges on shops, garages and yards, leaving a net of $8,200,000. See appendix, Table C-1.

Conclusion

For the reasons set forth above, it is urged that the use of express buses be limited to those routes included in the recommended system. In the stage development of this system, however, express buses should be used on surface streets and on freeways as the latter become available. This procedure would initiate fast service at an early date to the areas which would later be served by rail rapid transit. Thus, the system in effect in 1965 would be the all-bus plan but without any separate bus roadways. It would be reasonably adequate to serve the estimated patronage of that era. See Exhibit 13.

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CHAPTER IX

PLAN III--ALL-RAIL RAPID TRANSIT PLAN WITH RECOMMENDED SYSTEM OF HIGHWAYS

Washington's geography as well as its low-density pattern of residential, commercial and government office building developments discourage widespread use of rail rapid transit. The high initial cost of such facilities, even if built in the center mall of a freeway, requires concentrations of travel not found in Washington except in a few instances. Characteristics of the region tending to prevent heavy flows of transit traffic along a single route include the large areas devoted to public or institutional use; the vast extent of parks, waterways, ravines and otherwise uninhabited areas; and, despite noteworthy apartment buildings, the extensive areas devoted to single-family dwellings on large lots. In the central area a similar lack of concentration prevails. Proportionately more area in the central core is devoted to streets and parks than in any other large American city. The limitation on the heights of buildings together with the custom of setting public buildings in park-like surroundings result in a central core covering over six square miles. Many larger cities have downtown areas covering only about one square mile.

Although recognizing these inherent obstacles to successful rail rapid transit operation in Washington, nine rail routes were selected for evaluation. They extended generally to all sectors of the metropolitan area, reaching to or just beyond the limits of the original ten mile square. As these routes converged on the central area, they were combined until they formed a cross composed of one two-track north-south route and one four-track east-west trunk route intersecting at 12th and E Streets N.W. See Exhibit 14.

Routes Studied

The all-rail system would include the four radial routes which were combined into two trunk lines to form the rail rapid transit portion of the recommended system, discussed in Chapter II. In addition, there would be three rail lines radiating from the ends of a four-track east-west trunk route, plus three additional branch lines and/or extensions to the aforementioned recommended system.

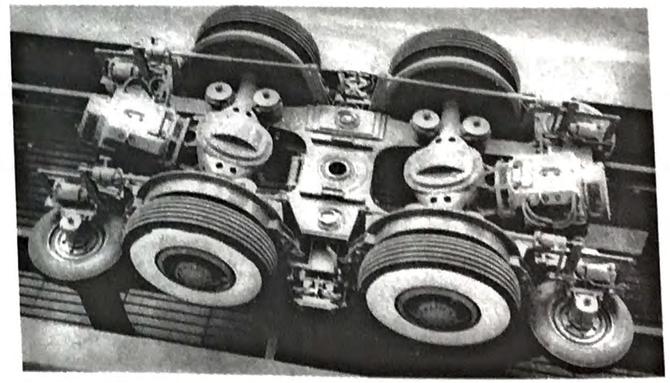
The first of the added facilities would be a line starting in the vicinity of Falls Church, Virginia. For a distance of 6.7 miles, it would occupy the center mall of a new interstate freeway route which is planned to lie to the north of the present U.S. 50. In the Clarendon-Rosslyn area, the rail facility would enter a portal and continue in subway under the Potomac River approximately on the line of E Street N.W., and through the business district on E Street.

Another route would lie along the right-of-way of the Baltimore & Ohio Railroad tracks. Starting at a point in the vicinity of College Park, Maryland, the line would run southwesterly toward Union Station, using open air construction. It might, in the final design, occupy the median strip in the east leg of the proposed Inner Loop Freeway for about one-half mile. In any case, it would enter a portal near 11th and E Streets N.E. and proceed in subway under E Street N.E. to a junction with other rail routes at Union Station and thence continue westerly through the central business district.

The third route would presumably have to be built entirely in subway for lack of a more suitable right-of-way. It would extend from a point in Maryland near Seat Pleasant via East Capitol Street and Massachusetts Avenue in the District to a junction with other rail routes in the vicinity of Union Station.

Two rail routes would serve the southeast quadrant of the metropolitan area under the all-rail rapid transit plan. One would lie in the median strip or to the side of the vehicular roadways in Suitland Parkway, generally at surface grade. The other could be incorporated as part of the median strip in any future widening or alterations of the Anacostia Freeway, or run generally parallel with that highway on its own right-of-way, with the rail route terminating in the vicinity of Oxon Hill. These two routes

Motor Bogie (Truck) of Pneumatic-Tired Subway Car Developed by Régie Autonome des Transports Parisiens (Paris Metro)



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would converge at a point just south and east of the Anacostia River, continuing in river tunnel and in subway on the alignment heretofore described in discussing the recommended system.

The final rail route would follow the general alignment of present Shirley Highway from its intersection with Seminary Road in the northwest section of Alexandria, to the Pentagon. At this point it would join the tracks previously described as part of the recommended system. This rail route could be built in connection with the proposed widening of Shirley Highway. In this case a portion might lie in open cut or in the median of the reconstructed highway, depending on the nature of that project when finally determined.

TABLE 11

PLAN III--ALL-RAIL PLAN
SUMMARY OF MILEAGE AND ESTIMATED COST
BY ROUTE AND TYPE OF CONSTRUCTION

Route	Length of Route in Miles			Total Cost (Add 000)
	Subway	Open	Total	
AB	0.8	6.1	6.9	$ 47,200
C	5.9	-	5.9	133,000
D*	3.5	5.1	8.6	105,600
E	-	3.2	3.2	17,850
F*	1.6	9.0	10.6	86,850
G	0.8	3.6	4.4	32,950
H	2.6	6.7	9.3	83,600
J*	5.5	4.4	9.9	138,850
K	3.8	6.4	10.2	100,850
	24.5	44.5	69.0	$746,750
Yards and Shops				20,000
Rolling Stock				72,000
TOTAL--PLAN III				$838,750

*-Includes portion used jointly with other routes.

NOTE: See Exhibit 14 for location of transit routes.

Estimated Cost

The total length of route in the all-rail rapid transit system would be 69 miles. The cost is estimated at $746,750,000, exclusive of yards, shops and rolling stock. These would add $92,000,000 for a total of $838,750,000, not including parking facilities which were discussed in Chapter VI. Table 11 shows the mileage by route and by type of construction, together with the estimated cost of each portion of the system. A recapitulation of the cost of Plan III will be found in Chapter I.

Partially offsetting the investment in rail rapid transit facilities would be a saving in the cost of the freeway and parkway system. The transit system would cause lesser use of automobiles, resulting in a reduction in the number of lanes required in certain sections of highway. There were only a few instances, however, where a section of proposed freeway or parkway in the auto-dominant plan would become unnecessary if a comprehensive rail rapid transit system were built.

The estimated cost of the 1980 highway system with the all-rail rapid transit plan, but excluding the cost of the rail facilities, would be $1,803,000,000. This would represent a saving of $568,150,000 over the estimated cost of the auto-dominant system. There would be a further net saving of $79,400,000 in parking facilities, the need for parking lots at the rail terminals and stations partially offsetting the reduction in cost of garages in the central business district.

Estimated Revenues and Expenses

Passenger revenues in 1980 for an all-rail rapid transit system, less revenues allocated for feeder bus service, are estimated at $51,900,000 per year. This estimate is based on the fare structure described in connection with the recommended system. The estimated maintenance and operating expenses including fixed charges on capital investment would be $32,300,000, leaving a net after fixed charges on capital investment of $19,600,000, as shown in the Appendix, Table C-1.

Conclusions

Thought should be given in planning all radial freeways to the ultimate need for rail rapid transit, or a similar type requiring a private right-of-way. In some instances, actual need may not develop for many years. Unless space for such facilities is included in the initial stage of construction, however, the cost of providing for them later may be prohibitive.

Washington is a young and vigorously-growing capital city. While it is old in terms of the history of America, it was incorporated only 156 years ago, whereas Berlin is over 700 years old, London is about 1,900, and Paris is over 2,000. The all-rail plan as studied in 1958 is not appropriate for Washington as visualized in 1980, but such a system may be needed for the city as it will be a few decades later.

Meanwhile, construction of the rail facilities included in the recommended scheme, Plan IV, should proceed in an orderly, but aggressive, manner. Only by the construction of such facilities can the physical problems heretofore discussed be satisfactorily overcome, especially in the north central and northwest sectors. The downtown subways proposed as a part of this system would permit quick delivery by transit to the heart of the core area. At the same time, they would reduce congestion on the surface streets for pedestrians and automobiles as well as for local buses and express buses distributing their passengers in the central business and government district.

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CHAPTER X

OTHER TYPES OF TRANSIT

In selecting the recommended type of rapid transit facilities, full consideration was given to several new devices which are under development or in successful operation. Each of these contrivances has specific applications for which it is unquestionably well qualified. There is no situation in Washington, however, where any of these devices would be superior for trunk routes, in our opinion, to the more conventional type of facilities.

Certain characteristics are sometimes attributed to this new equipment with the implication that these boons are not otherwise available. It is well to remember that any modern motor bus or rail vehicle of standard types can be given the attributes of quietness, good lighting, air-conditioning, fast operation, attractive appointments, and high rates of acceleration and deceleration. The estimates of cost for equipment envisage all of these elements in cars and buses to be provided for the recommended rapid transit system.

The Dwight D. Eisenhower Library

Monorail

Several types of rail rapid transit are included in the general term, monorail. These include cars or trains of cars supported from underneath by a single rail, the cars being saddle shaped so that the center of gravity falls at about the point of support (Alweg System). In another type, the car is suspended from one overhead rail, while in still another it is hung from two closely spaced overhead rails in a single housing.

There is a misconception in the public mind that these devices are somewhat ethereal. Actually, they require substantial structures which, in our opinion, would not be acceptable in the public streets of any Washington area whether built along the curb line or in the center of the street. By way of illustration, a typical device would require a supporting beam 3 feet deep and 15 inches wide with columns 2 or 3 feet square at 60-foot spacing along both curbs or in a median strip. For suspended monorail, this device would have to be some 25 feet above the street or at approximately the level of third story windows.

ALWEG Trains (Twin-Coach Unit)

All Types of Monorail Require Structures, Even in Outlying Suburban Areas.

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Monorail Cars Require Substantial Structures, Even for Low Speeds--Amusement Park Installation at Dallas.

Between bents, the track would be suspended by a structure which would replace the ties and roadbed of a standard railroad. The longitudinal girders would be supported by either tee-shaped columns or by arches spanning streets or railroad tracks at surface grade below. All stresses generated by the operation of monorail trains would be applied to the supporting structure at such distances from the foundations that the leverage would be about twice that of a conventional elevated electric railroad. All structures, therefore, would have to be somewhat larger and stronger.

The cost of construction for monorail would be greater than the cost of a standard elevated railroad to support a train of comparable specifications and operating characteristics. This increased cost for a suspended system over that for a supported system on structure has been estimated at about 12 percent. The greatest cost differential would occur, however, in sections where a conventional train could be operated on standard track at ground level. All portions of a monorail system, either supported or suspended type, would have to be composed of expensive structures, including even the yards and shops.

It does not appear to be necessary or desirable to employ any of the various types of monorail in the National Capital Region in order to provide adequate rapid transit.

Model of Goodyear-Stephens-Adamson Passenger Conveyor Belt Subway System.

Automated Buses

Another device which was considered and discarded was an elevated roadway for the operation of buses, singly or in trains. Suggestions have been made that such operation could be fully automated, dispensing with the need for employees on the vehicles. This feature is admittedly possible from the mechanical and electronic viewpoint. In Washington, however, a substantial portion of the time of each bus trip would be spent on surface streets, either at the outer end or in the central business district where, of course, men would have to operate the vehicles.

Elevated bus roadways, or their equivalent, were considered in the all-bus plan for routes where freeways were not available. These would be conventional roadways, however, except that their use would be restricted to buses. The extensive use of such roadways would entail a capital cost which could not be justified economically on the routes where bus operation is recommended. For the heavier volumes of transit traffic, rail facilities are more economical, both in first cost and in future operating and maintenance expenses.

Carveyor

A device known as Carveyor has been successfully engineered. It consists of a series of small passenger cars supported on a continuously moving system of belts and rollers. A passenger enters a station and steps onto

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Moving Sidewalks are Especially Applicable Where Steep Ramps Would Otherwise be Required

a loading platform belt moving at 1-1/2 miles per hour, which is about one-half average walking speed. Moving at the same speed on a parallel conveyor belt is the end-to-end series of small cars into one of which the passenger steps. Since cars arrive at the station in a constant stream, there is never any waiting or rushing to catch a train.

As cars leave a station, the doors automatically close. The cars then move over rollers which speed up each car in turn to 15 miles per hour. The cars become spaced at 10 times the center-to-center spacing in stations for the run between stations. They move progressively from the accelerating rollers to a belt moving at 15 miles per hour and then to decelerating rollers which slow each car in turn to 1-1/2 miles per hour as it enters the next station.

Carveyors on long routes would be impractical because of limitations on average speeds inherent in the device. Preliminary plans and cost estimates were prepared which showed that for a subway installation, the capital cost would be approximately as great as for a standard subway. The conventional subway would have the major advantages over the comparatively unproved Carveyor of higher speeds, greater reserve capacity and greater flexibility for future extensions.

There does not appear to be an appropriate application in Washington for Carveyor to serve any of the heavy corridor movements. Its use for lateral distribution from the recommended downtown subways may prove to be desirable but is not proposed at this time.

Moving Sidewalks

For distribution within the central business district, consideration was given to moving sidewalks. This device is in successful operation on a limited basis in a number of places. It has proved its value for mass movements of people over short distances, particularly where steep upgrades are involved. The device consists essentially of an endless belt of any required width moving continuously at a speed of 1-1/2 miles per hour. People may stand on the belt and be carried without effort or they may add their speed of walking to that of the belt.

The machine itself is relatively inexpensive, but substantial cost is involved in providing an underground structure to house it, particularly in areas such as downtown Washington, where major utilities would be disturbed by the construction. Furthermore, no major corridor movements were found in the downtown area that would justify special treatment, the characteristic being one of dispersion of movements rather than concentration. As previously discussed, there would be a great number of local and express bus routes operating on the surface streets under any plan. The average person could reach almost any destination in the six-square mile Sector Zero, after leaving the radial transit route on which he had made the major portion of his trip, either by a short walk or by transferring to only one other transit vehicle.

Other Devices

Several interesting ideas were submitted by public-minded citizens regarding the use of large capacity helicopters and other proposals. Each of these was carefully investigated in turn and was reluctantly discarded only after it had been proved infeasible for reasons of economics, engineering practicability or lack of service value.

Helicopters may be employed in the National Capital Region to carry passengers between various points in Washington and both the Baltimore and Chantilly Airports. This will not constitute mass transit, however, in the usual sense.

Electrification of existing railroad tracks for use by rapid transit trains was suggested. None of the present facilities, however, connect heavily populated urban or suburban areas with focal points in the central core. The light use made of presently available service indicates that few people find the routing convenient. Even if the lines were extended in subway to the heart of the core area, there would be many problems to overcome. Operation of rapid transit trains on close headways would interfere with the efficient rendering of freight service on which the railroads depend. This objection would also be made to the use of self-propelled rail-diesel cars. Electrification by installation of a third rail for transit operation would endanger switchmen, track workers, and other employees, and would interfere with the functioning of wayside signals and other facilities now suited to electrification of some of the trackage for railroad voltages and operating techniques. While these problems would not be insurmountable if the plan held great promise, we conclude that the prospect of low patronage and great construction and operating difficulties join in mitigating against such a scheme.

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CHAPTER XI

PRESERVING CAPACITY FOR THE FUTURE

The pattern of future growth of the National Capital Region will be influenced strongly by the nature and quality of its transportation system. The cornerstone of the population and employment distribution studies, however, was the assumption that the entire region would be covered with an adequate transportation network. The area could then develop under the influence of such things as topography and access to public utility services without considering the variable of transportation. This was a reasonable approach to that phase of the problem, since it is always desirable to hold one factor constant while measuring the influence of variations in others.

The freeways built early in the program, however, will have a profound influence on the pattern of growth of the metropolitan region. They will encourage rapid and intense settlement in the areas directly served, delaying the growth of areas lacking such freeways. Evolution of the residential and industrial development in this manner would simply repeat what has happened in every large city, including Washington, as new transportation arteries were built.

Facing this very realistic set of circumstances, it seems wise to strive for flexibility and reserve capacity in development of future transportation arteries. Rail rapid transit to certain sections of the area has been shown to be justified as the ultimate plan by estimated patronage. These findings are based largely on existing and anticipated development. Meanwhile, if highway facilities are built to other sectors of the metropolitan area, but not to those for which rail rapid transit is recommended, need for the recommended lines may be delayed, and need for rail facilities to other areas may develop. Final decisions on construction of rail rapid transit, therefore, should be made in conjunction with adoption of a complete freeway program. No major underground utility work or other construction should be done by public agencies, in the meantime, which would block the eventual building of subways and other rail rapid transit lines on the routes and in such manner as indicated in this report.

Even after a complete freeway program is set, administrative decisions will determine the sequence in which various highways are built. This construction schedule will have a strong modifying effect on the distribution of population and perhaps also on the location of job opportunities. The first freeways built, therefore, may be overcrowded long before 1980, and express bus service may have to give way to rail rapid transit to meet transportation demands. It should also be kept in mind that while the proposed plan is intended to serve a population of 3,000,000, the freeways would still be in use even if the population grew to 4,000,000 or 5,000,000. Rights-of-way for additional freeways will be difficult to find.

It is recommended, therefore, that in the planning of future radial freeways a cross section similar to that shown in Exhibit 15 be provided to afford maximum flexibility and reserve capacity for vehicles as well as for the mass movement of people. Under this plan there would be a three- or four-lane roadway for traffic in each direction. These roadways would be separated by a 64-foot mall with 51 feet from center-to-center of the columns supporting cross-street bridges. In the first stage, this wide mall would be landscaped and held available for future developments. Public transportation in this stage would consist of express buses operating in the general traffic lanes. They would make stops at appropriate intervals on the parallel service roads without special station facilities or at simple stations within the end span of the cross-street bridges.

As automobile and truck traffic became heavier, the center mall could be developed with a three-lane vehicular roadway to be used by one-way traffic. Direction of flow would be reversed between the morning and evening rush periods. This would be consistent with policies of the U. S. Department of Commerce, Bureau of Public Roads. See Circular Memoranda of recent date on this subject in Appendix E. Presumably, express bus traffic would be much heavier in this stage, and buses might occupy a substantial portion of one of the lanes on the initial roadways of the freeway.

In the third stage the express bus traffic would be removed from the freeway and operated on a private roadway in the center mall. The bus roadway would be reduced to two lanes at the stations in order to provide adequate platforms for passenger loading and unloading. Stairways or escalators would connect with stations on the cross-street bridges where passengers from local feeder buses would transfer.

In the fourth stage of development, the bus roadways could be displaced by a double track rail rapid transit facility which would provide capacity for any volume of transit patronage likely to develop within the next century.

This plan of stage development on radial freeways still in the planning stage would permit adequate facilities to be

provided to meet any likely eventuality without requiring prohibitive outlays of capital in the early years. This plan is particularly adaptable to the proposed interstate freeway to the northeast, which is now in the preliminary stages of planning; to the route extending westerly into Virginia on an alignment lying one to two miles north of U. S. 50; and to the Chantilly Airport route. Other routes for which this plan should be considered include Shirley Highway, when this freeway is rebuilt and widened, and the proposed new freeway to the southeast.

Many years will be required to build all of the freeways and parkways needed in the National Capital Region. Meanwhile, people are proceeding at a frantic pace to build homes, shopping centers and factories on any land that is available. Unless rights-of-way are reserved promptly for all of the highways that will be needed for the next several years, it may become prohibitively expensive to build many vital sections of the network. Great emphasis should be placed, therefore, on the adoption of an official plan for highways not only for the immediate future, but for a generation hence. Rights-of-way should be preserved which will be sufficiently wide for all transportation purposes for decades to come.

The Dwight D. Eisenhower Library

Center for Transportation

Eno
Center for Transportation

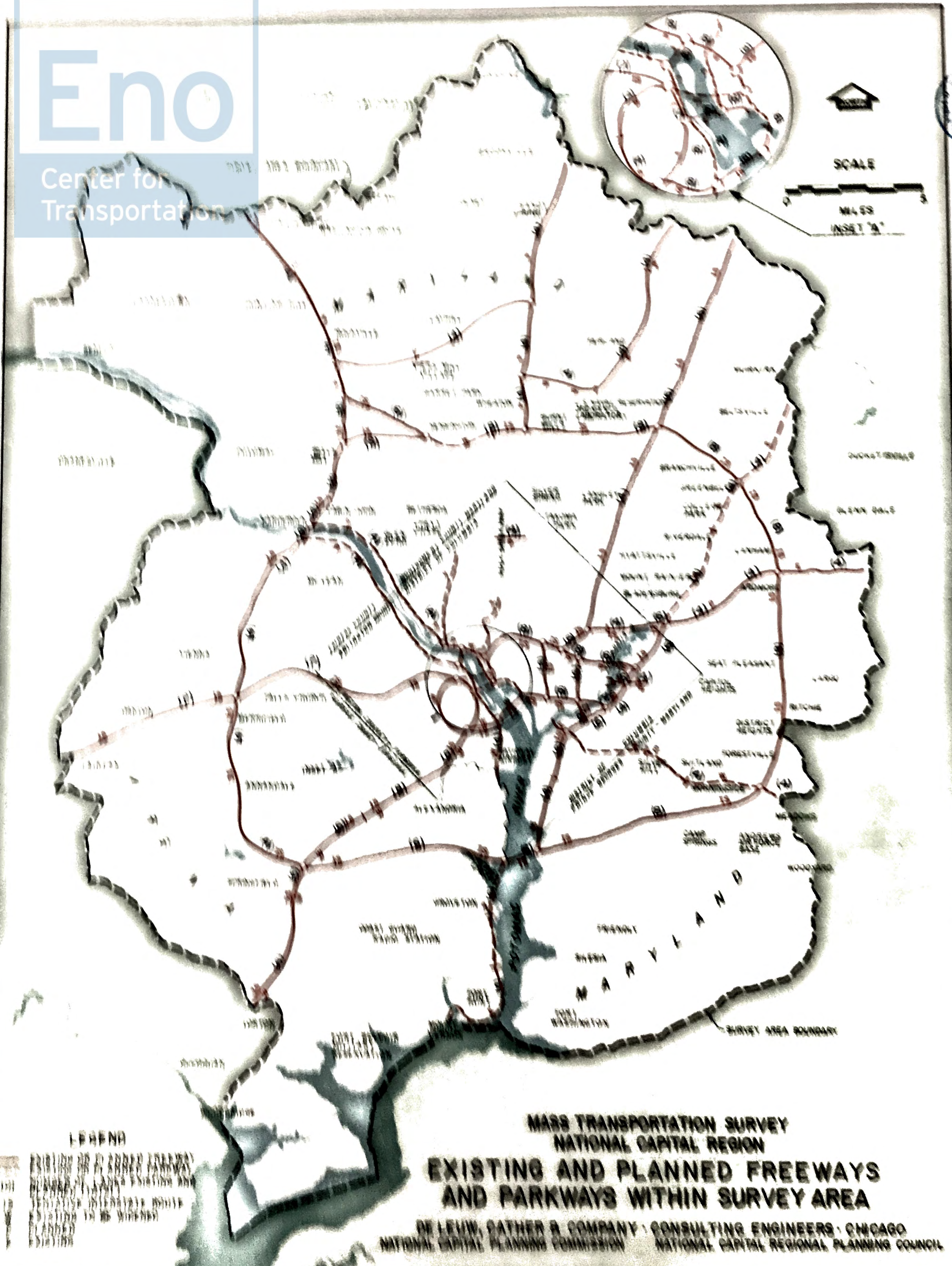
EXHIBITS

The Dwight D. Eisenhower Library

LIST OF EXHIBITS

Eno
Center for
Transportation

EXHIBIT 1



MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

EXISTING AND PLANNED FREEWAYS AND PARKWAYS WITHIN SURVEY AREA

DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO
NATIONAL CAPITAL PLANNING COMMISSION · NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

EXHIBIT 2

Eno
Center for Transportation

BRINK
GOSHEN
SURVEY AREA BOUNDARY
LAYTONSVILLE
SUNSHINE
BROOKVILLE
REDLAND
OLNEY
SANDY SPRING
GAITHERSBURG
WASHINGTON GROVE
DARNESTOWN
HUNTING HILL
ROCKVILLE
LAYHILL
SENECA
VIERS MILL VILLAGE
FAIRLAND
GARRET PARK
WHEATON
MUIRKIRK
U S NAVAL RESERVATION ORDNANCE LABORATORY
KENSINGTON
BURNT MILLS
BELTSVILLE
DRANESVILLE
POTOMAC
BELLS MILL
BRANCHVILLE
DUCKETTSVILLE
SILVER SPRING
LANGLEY PARK
GREENBELT
CABIN JOHN
BETHESDA
TAKOMA PARK
COLLEGE PARK
CARDEROCK
CHEVY CHASE
GLEN ECHO
GLENN DALE
RIVERDALE
HYATTSVILLE
LANHAM
MC LEAN
MONTGOMERY COUNTY-MARYLAND
DISTRICT OF COLUMBIA
ROCK CREEK PARK
MOUNT RAINIER
BLADENSBURG
ARDMORE
VIENNA
FAIRFAX COUNTY
ARLINGTON COUNTY
SEAT PLEASANT
ANACOSTIA
CAPITOL HEIGHTS
LARGO
OAKTON
FALLS CHURCH
MERRIFIELD
RITCHIE
DISTRICT HEIGHTS
FAIRFAX
ARLINGTON COUNTY-FAIRFAX COUNTY-VIRGINIA
NATIONAL AIRPORT
COLUMBIA COUNTY-MARYLAND
FORESTVILLE
SILVER HILL
SUITLAND
INSET "A"
ANNANDALE
ALEXANDRIA
POTOMAC RIVER
DISTRICT OF COLUMBIA-PRINCE GEORGES
MORNINGSIDE
MEADOWS
SURVEY AREA BOUNDARY
CAMP SPRINGS
ANDREWS AIR FORCE BASE
WOODYARD
SPRINGFIELD
HUNTING CREEK
GROVETON
COAST GUARD RADIO STATION
FRIENDLY
SILESIA
POTOMAC RIVER
FORT HUNT
FORT WASHINGTON
LORTON
MOUNT VERNON
FORT BELVOIR MILITARY RESERVATION
OCCOQUAN
WOODBRIDGE

NORTH

SCALE
0 5
MILES

INSET "A"

FREEWAYS ADDED
PARKWAYS ADDED
EXISTING OR PLANNED FREEWAY
EXISTING OR PLANNED PARKWAY
0 NUMBER OF LANES REQUIRED
(0) NUMBER OF LANES PLANNED AND EXISTING (TOTAL)
[0] NUMBER OF LANES EXISTING
Is TENTATIVE INTERSTATE ROUTE

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

RECOMMENDED COMPREHENSIVE SYSTEM OF FREEWAYS AND PARKWAYS

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NATIONAL CAPITAL PLANNING COMMISSION NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

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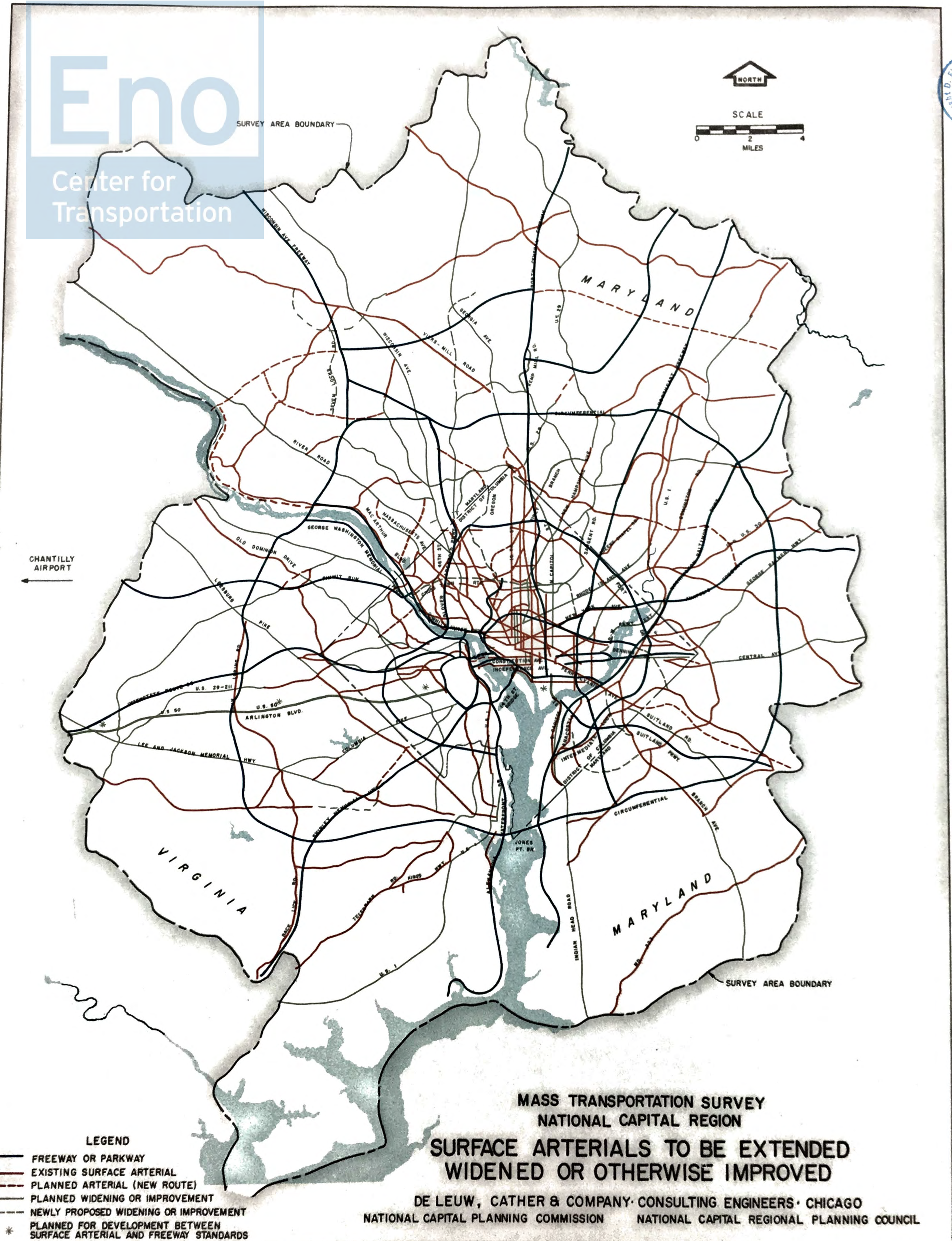
Center for Transportation



MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

SURFACE ARTERIALS TO BE EXTENDED WIDENED OR OTHERWISE IMPROVED

DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO
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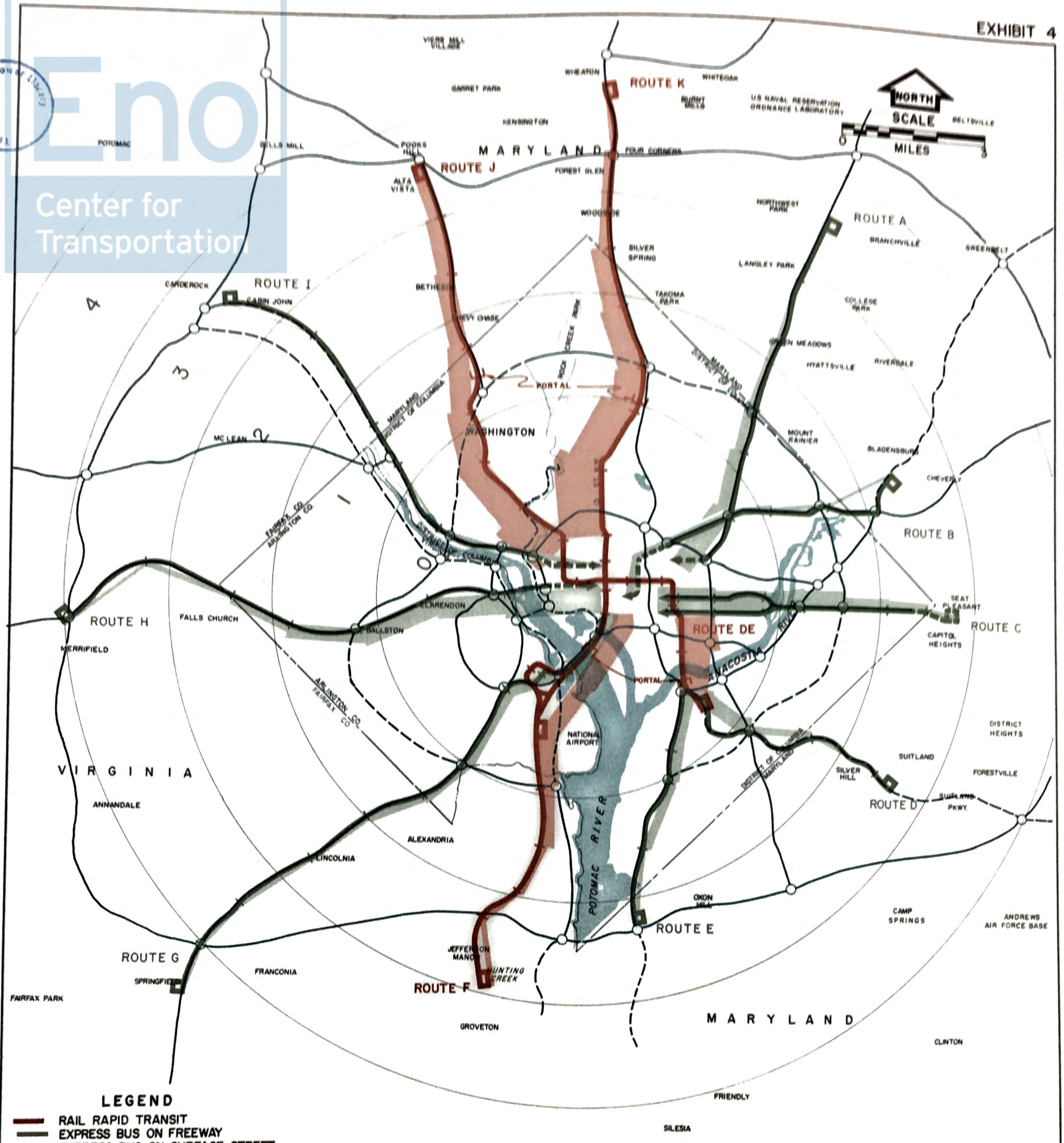
LEGEND

- FREEWAY OR PARKWAY
- EXISTING SURFACE ARTERIAL
- PLANNED ARTERIAL (NEW ROUTE)
- PLANNED WIDENING OR IMPROVEMENT
- NEWLY PROPOSED WIDENING OR IMPROVEMENT
- * PLANNED FOR DEVELOPMENT BETWEEN SURFACE ARTERIAL AND FREEWAY STANDARDS

Eno
Center for Transportation

EXHIBIT 4



LEGEND

- RAIL RAPID TRANSIT
- EXPRESS BUS ON FREEWAY
- EXPRESS BUS ON SURFACE STREET
- STATION
- PLANNED OR EXISTING FREEWAY
- PLANNED OR EXISTING PARKWAY
- FARE ZONE BOUNDARY
- 2 FARE ZONE NUMBER

SCALE

10,000
20,000
30,000
40,000

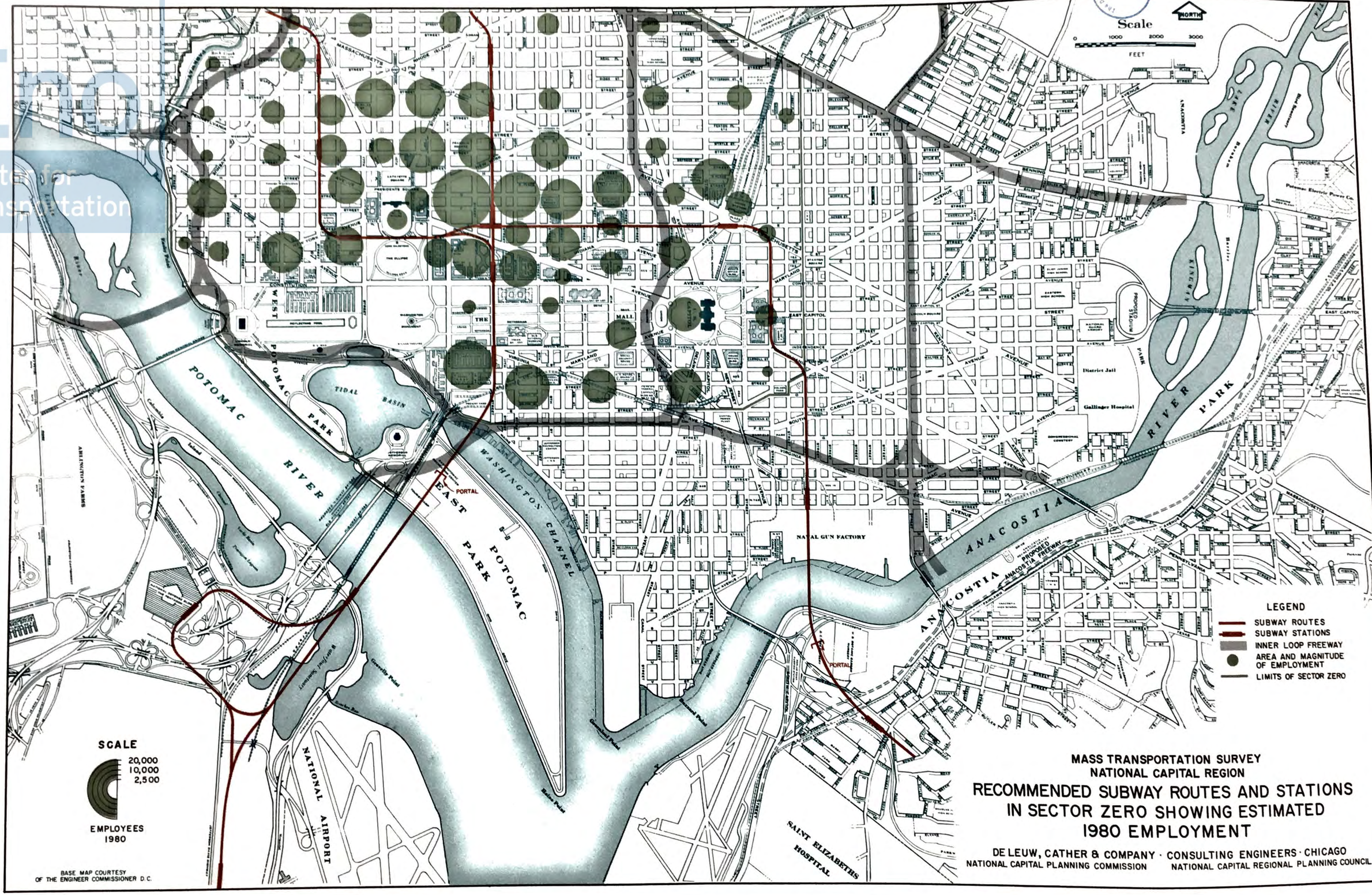
PASSENGER TRIPS
PEAK-HOUR — ONE WAY

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

PLAN IV- RECOMMENDED EXPRESS BUS AND RAIL RAPID TRANSIT PLAN WITH RECOMMENDED FREEWAYS- 1980

DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO
NATIONAL CAPITAL PLANNING COMMISSION NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

EXHIBIT 5



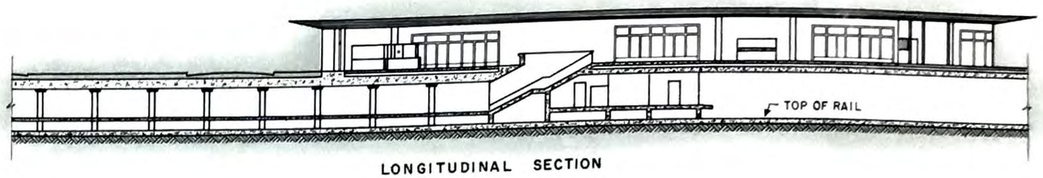
MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

RECOMMENDED SUBWAY ROUTES AND STATIONS IN SECTOR ZERO SHOWING ESTIMATED 1980 EMPLOYMENT

DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO
NATIONAL CAPITAL PLANNING COMMISSION NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

Center for Transportation

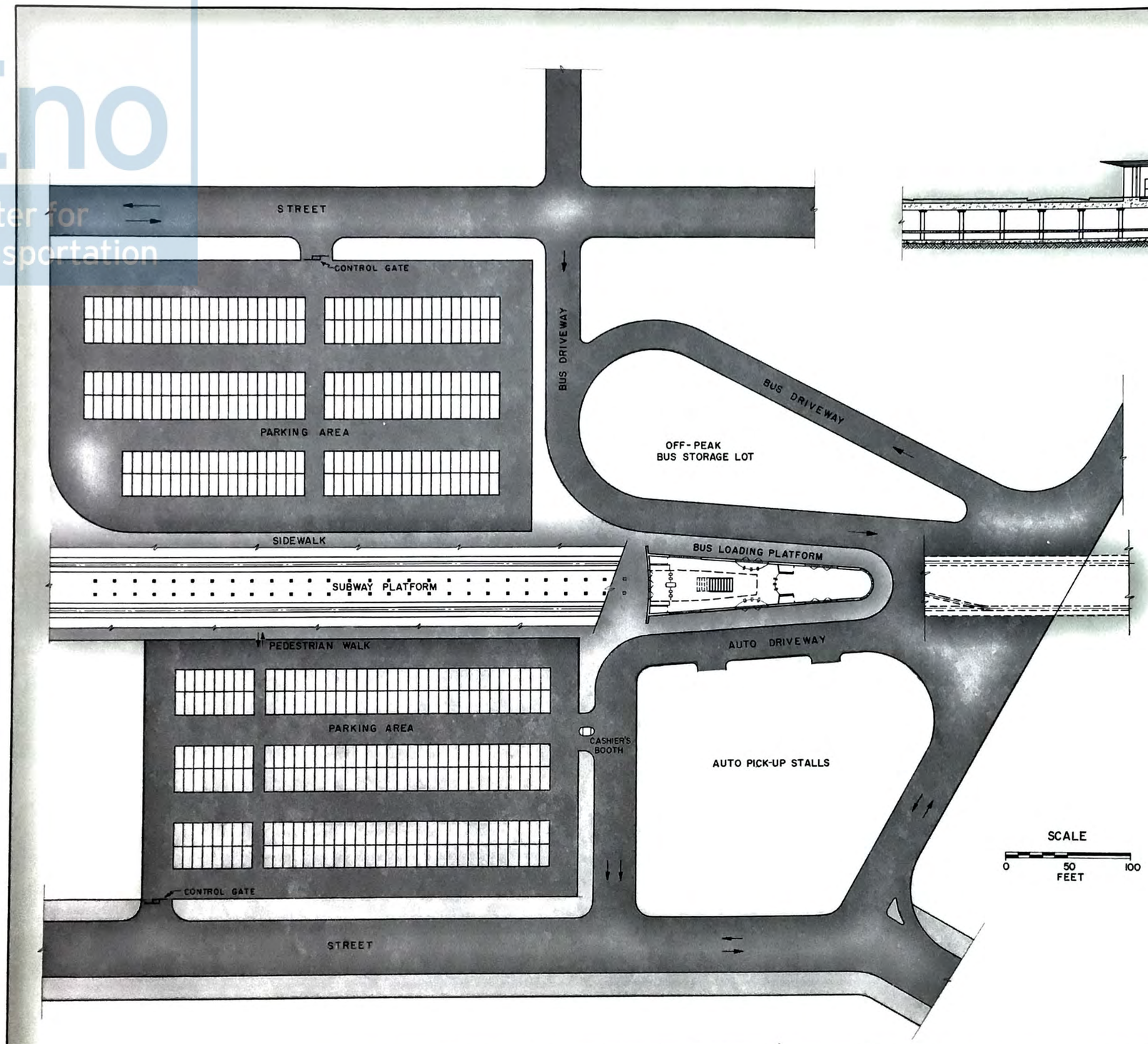
Eno
Center for Transportation



LONGITUDINAL SECTION

SCALE
0 FEET 50

The Dwight D. Eisenhower Library



SCALE
0 FEET 50 100

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

TYPICAL BUS-TO-RAIL TRANSFER TERMINAL

DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO
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EXHIBIT 7

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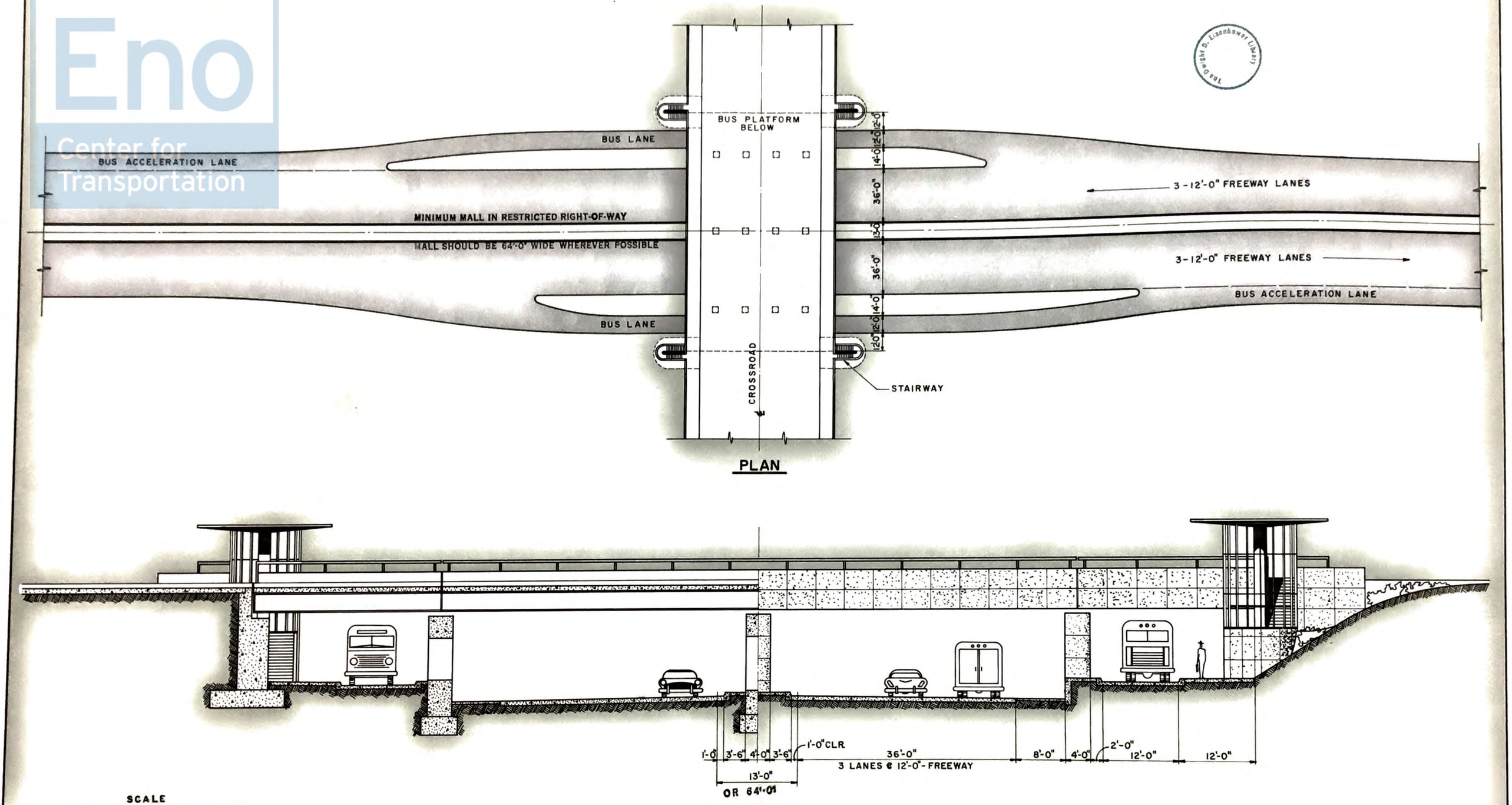
Dwight D. Eisenhower Library



PLAN

SECTION

SCALE

PLAN 0 40 80

SECTION 0 5 10 20

FEET

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

TYPICAL BUS STATION ON A FREEWAY

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NATIONAL CAPITAL PLANNING COMMISSION NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

EXHIBIT 8

Eno
Center for Transportation

SURVEY AREA BOUNDARY

NORTH

SCALE
0 5
MILES

GAITHERSBURG
OLNEY
SANDY SPRING
MARYLAND
DARNESTOWN
HUNTING HILL
WHEATON
MUIRKIRK
SILVER SPRING
COLLEGE PARK
CARDEROCK
MONTGOMERY COUNTY-MARYLAND
DISTRICT OF COLUMBIA
MOUNT RAINIER
ANACOSTIA R.
CAPITOL HEIGHTS
FALLS CHURCH
ARLINGTON COUNTY-VIRGINIA
FAIRFAX COUNTY-VIRGINIA
DISTRICT OF COLUMBIA
PRINCE GEORGE COUNTY-MARYLAND
FAIRFAX
VIRGINIA
ANNANDALE
ALEXANDRIA
POTOMAC RIVER
MEADOWS
CAMP SPRINGS
ANDREWS
CIRCUMFERENTIAL
HUNTING CREEK
SILESIA
MARYLAND
LORTON
MOUNT VERNON
SURVEY AREA BOUNDARY

LEGEND

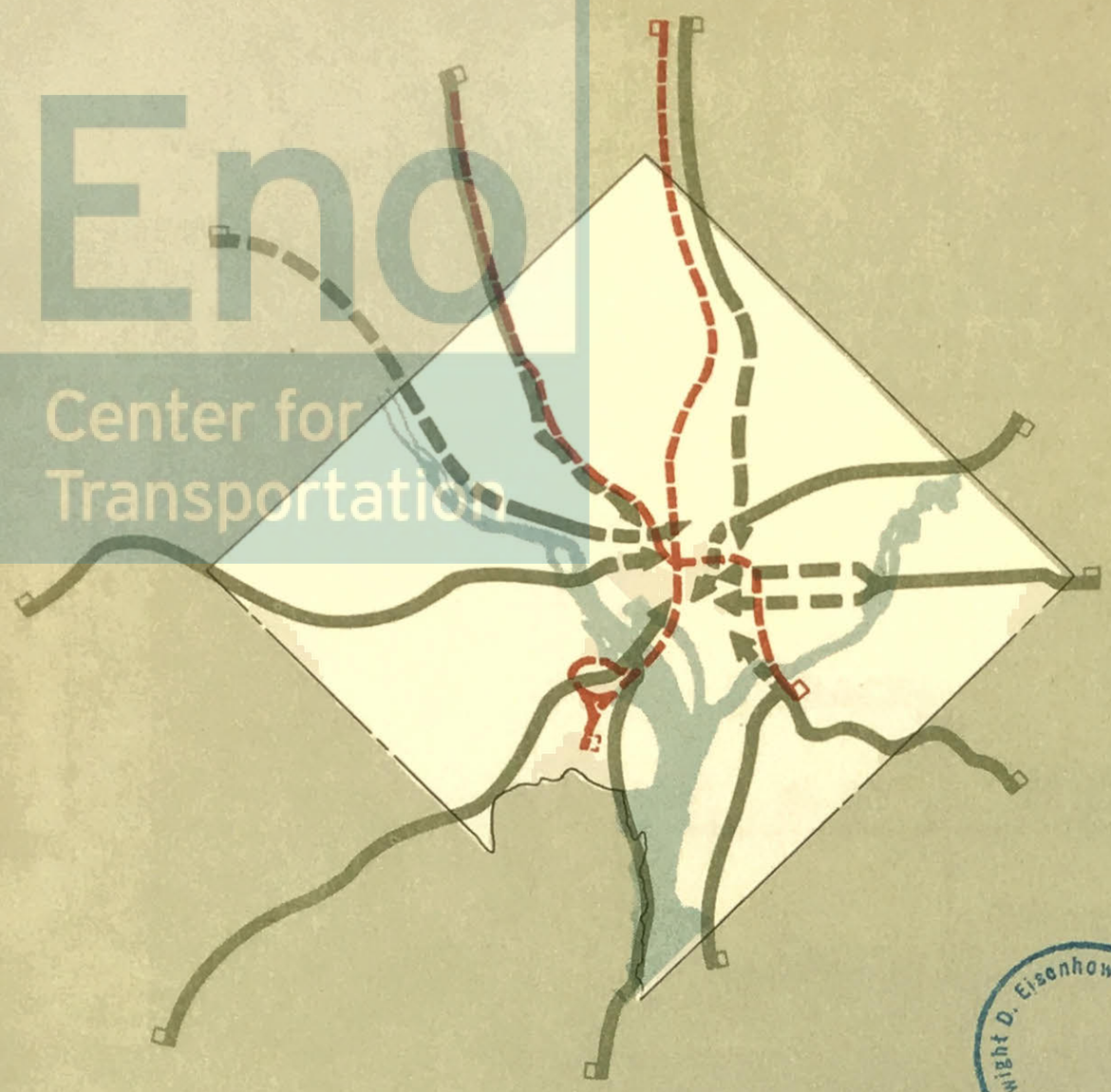
FREEWAY } EXISTING TO REMAIN
PARKWAY } UNCHANGED SHOWN IN BLACK
W EXISTING, TO BE WIDENED OR IMPROVED
TO BE CONSTRUCTED OR WIDENED BETWEEN
THROUGH 1965
1966 - 1970
1971 - 1975
1976 - 1980
* SEE NOTE ON EXHIBIT 2

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

RECOMMENDED STAGES OF FREEWAY AND PARKWAY CONSTRUCTION

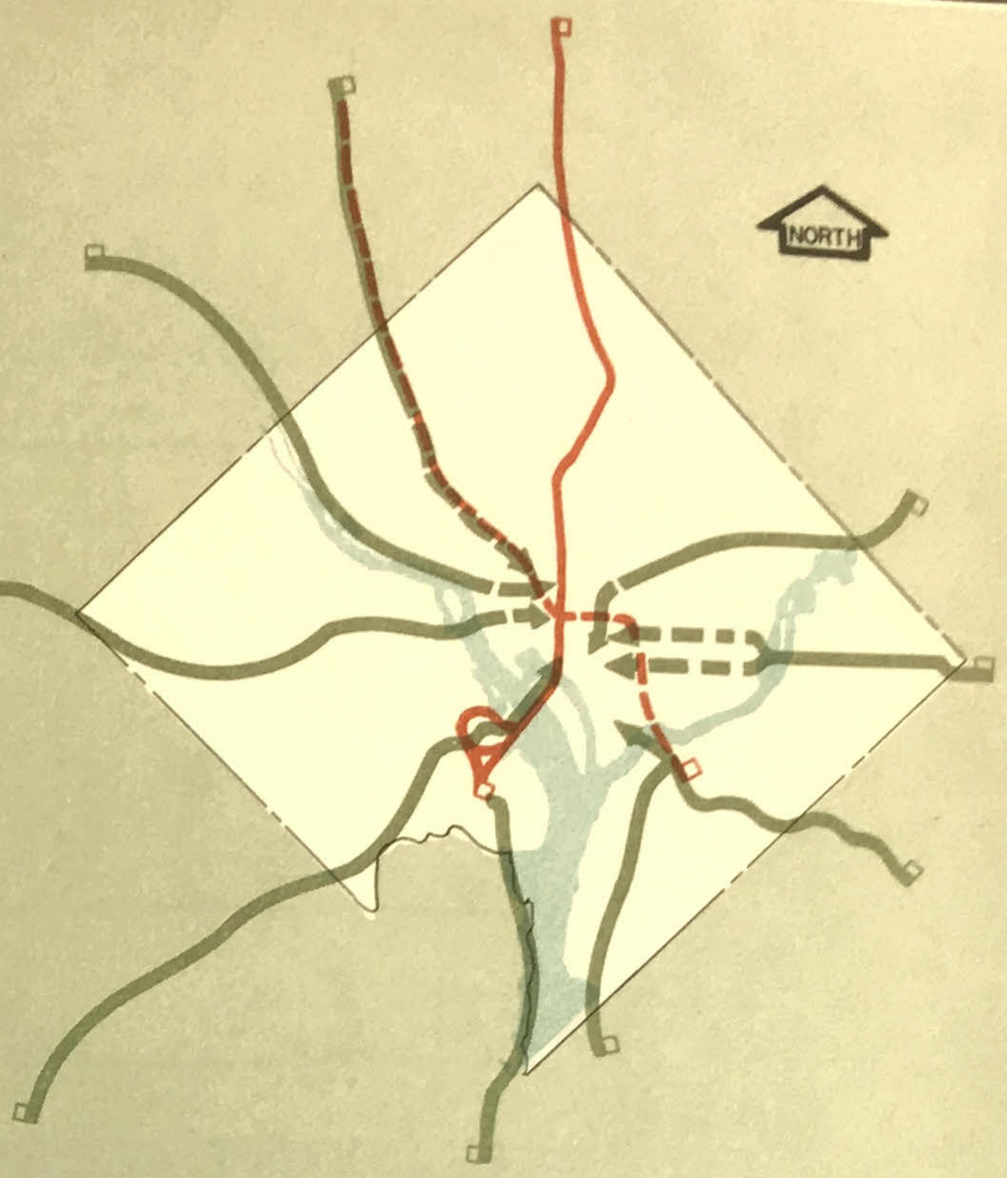
DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO
NATIONAL CAPITAL PLANNING COMMISSION NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

Eno
Center for Transportation

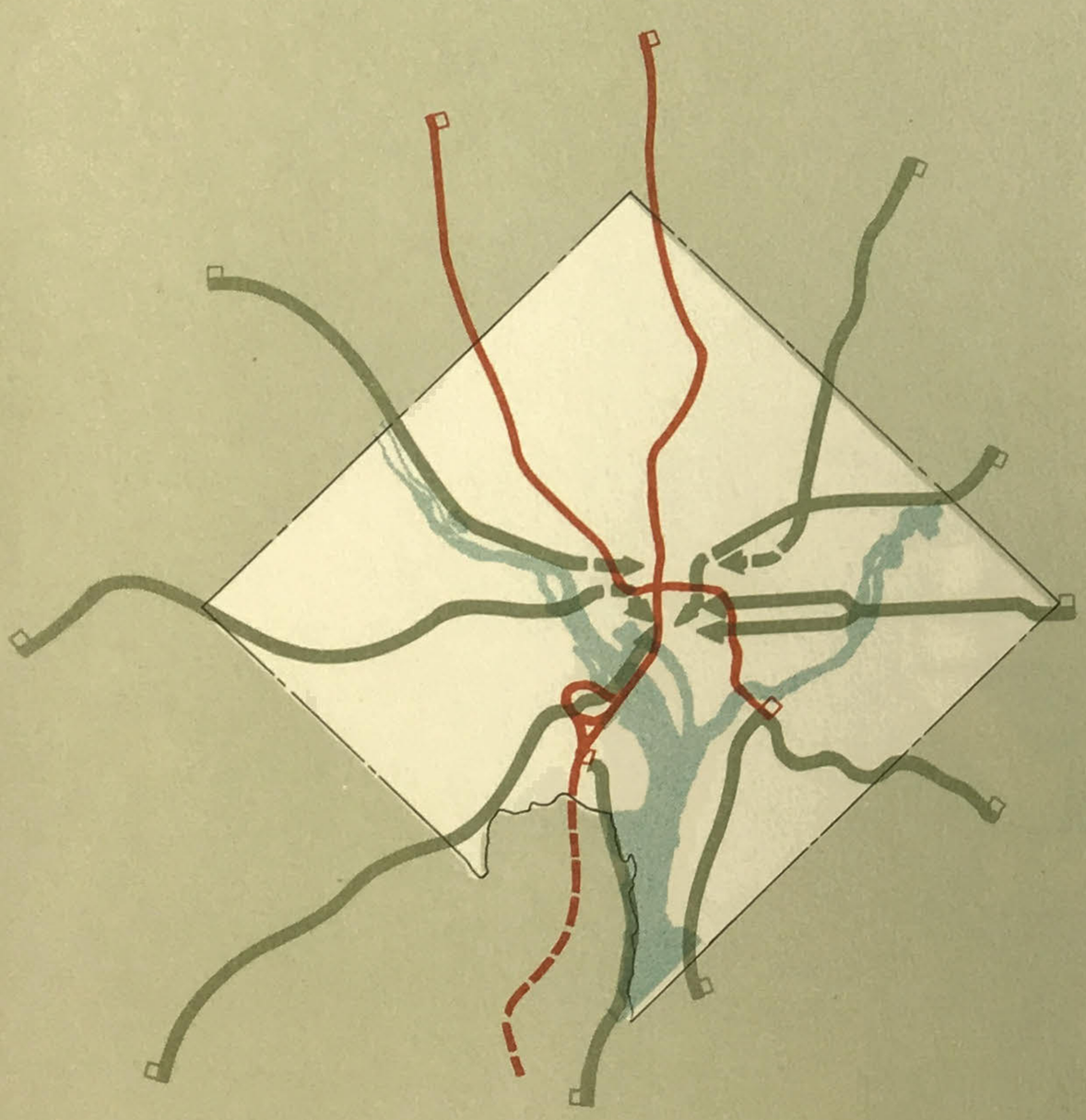


THROUGH 1965

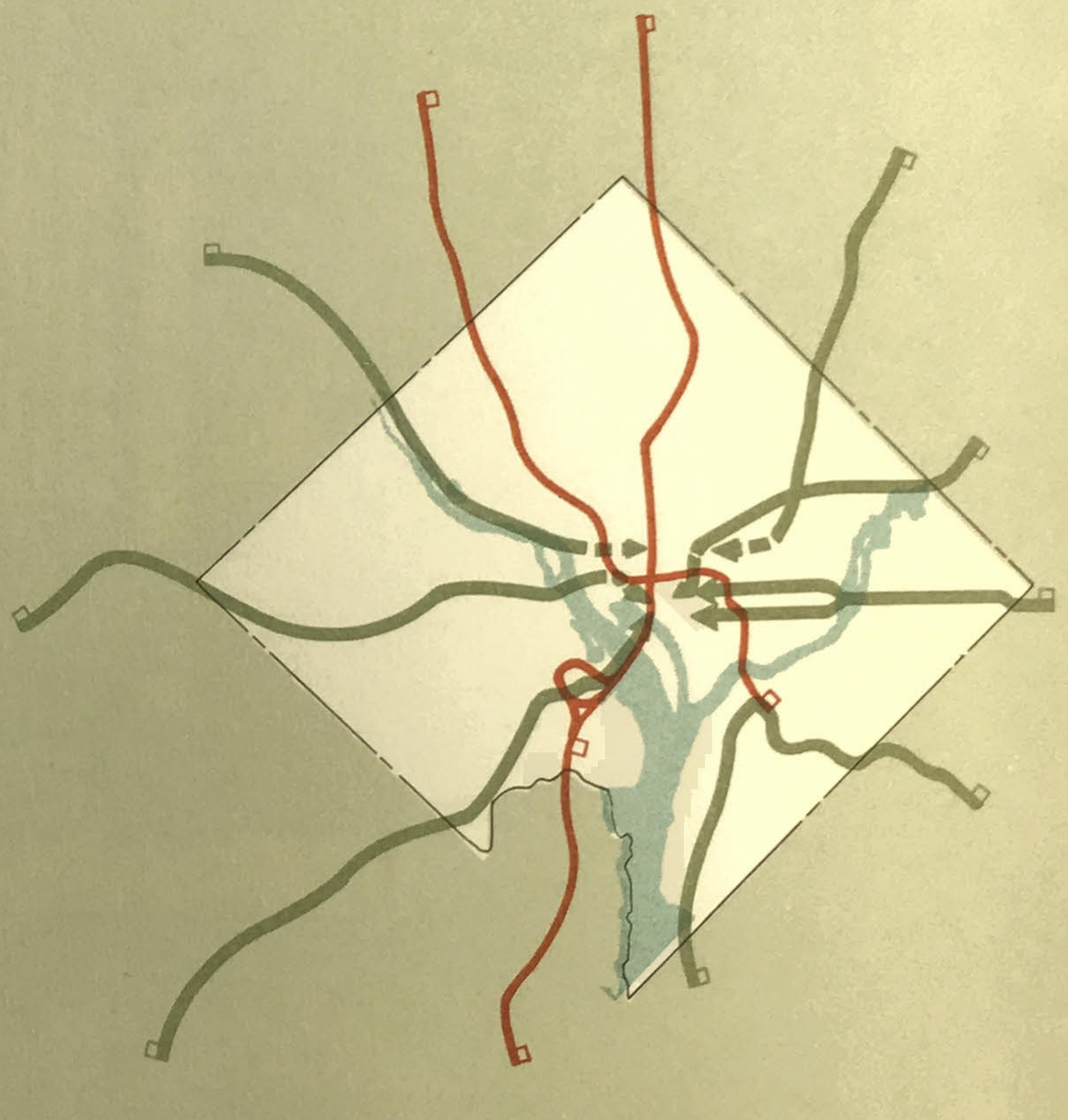
The Dwight D. Eisenhower Library



1966 – 1970



1971 - 1975



1976 – 1980

LEGEND

- RAIL RAPID TRANSIT
- EXPRESS BUS ON FREEWAY LANES
- EXPRESS BUS ON SURFACE STREET
- RAIL RAPID TRANSIT UNDER CONSTRUCTION

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

PLAN IV - RECOMMENDED EXPRESS BUS AND RAIL RAPID TRANSIT PLAN AT FIVE-YEAR INTERVALS

DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO
NATIONAL CAPITAL PLANNING COMMISSION NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

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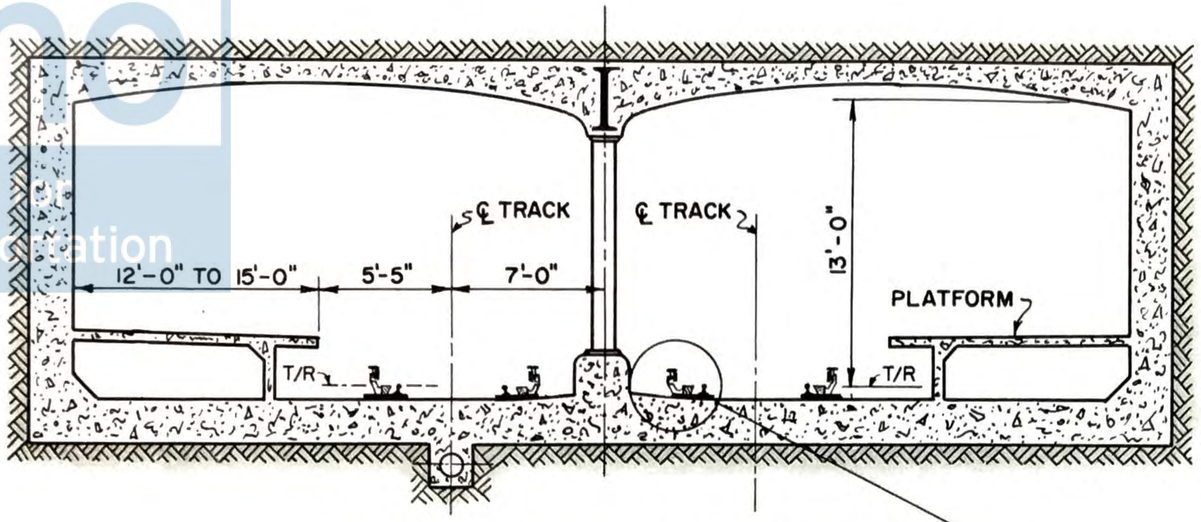
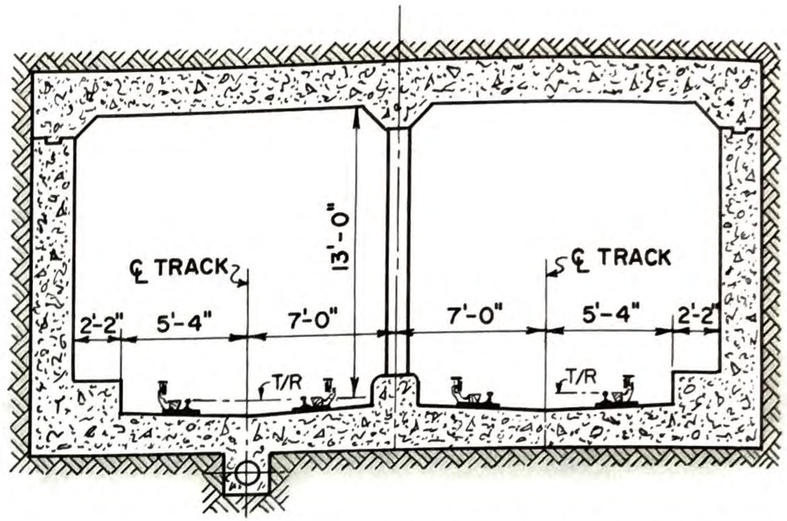
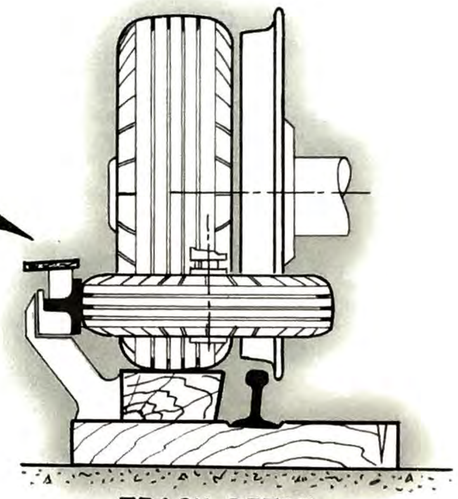
Center for
Transportation



SIDE PLATFORM STATION – CUT-AND-COVER



TYPICAL SECTION BETWEEN STATIONS – CUT-AND-COVER



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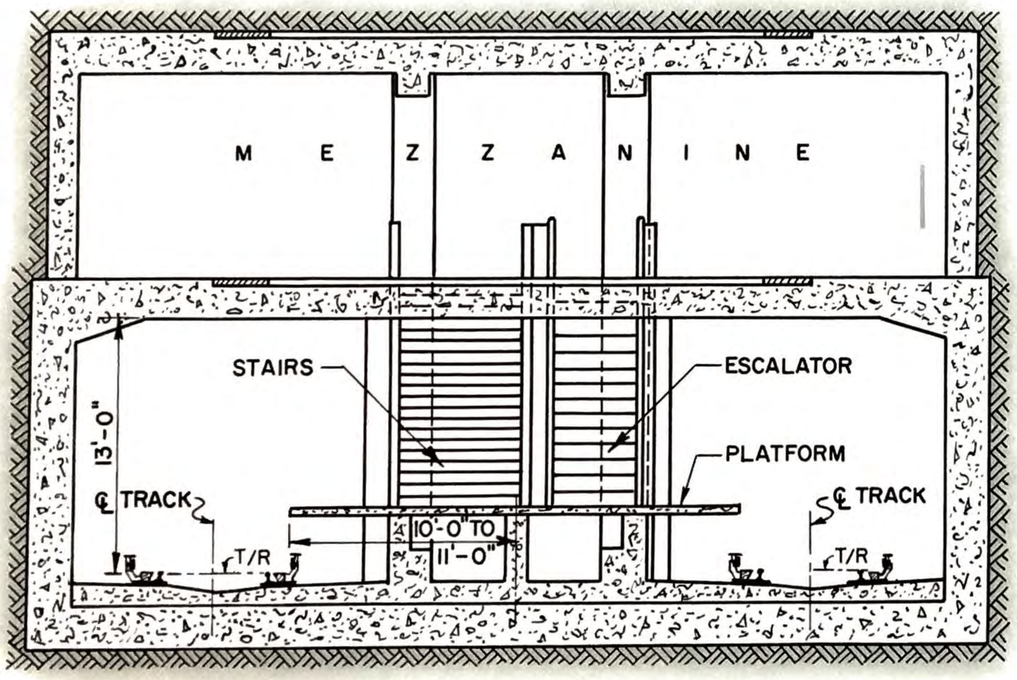


CENTER PLATFORM STATION WITH MEZZANINE

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

TYPICAL SUBWAY CROSS SECTIONS

DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO

NATIONAL CAPITAL PLANNING COMMISSION NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

EXHIBIT 11

Eno
Center for Transportation

SURVEY AREA BOUNDARY

SCALE
0 5
MILES

BRINK
GUNNEN
LAYTONSVILLE
SUNSHINE
BROOKVILLE
REDLAND
OLNEY
SANDY SPRING
GAITHERSBURG
WASHINGTON GROVE
DARNESTOWN
HUNTING HILL
ROCKVILLE
LAYHILL
SENECA
VIERS MILL VILLAGE
GARRET PARK
WHEATON
KENSINGTON
U.S. NAVAL RESERVATION ORDNANCE LABORATORY
BURNT MILLS
FAIRLAND
MUIRKIRK
BELTSVILLE
DICKERSONVILLE
DRANESVILLE
POTOMAC
BELLS MILL
BRANCHVILLE
GREENBELT
SILVER SPRING
LANGLEY PARK
COLLEGE PARK
GLENN DALE
CABIN JOHN
BETHESDA
CHEVY CHASE
TAKOMA PARK
CARDEROCK
GLEN ECHO
RIVERDALE
HYATTSVILLE
LANHAM
MC LEAN
MOUNT RAINIER
BLADENSBURG
ARDMORE
VIENNA
SEAT PLEASANT
CAPITOL HEIGHTS
LARGO
FALLS CHURCH
OAKTON
MERRIFIELD
RITCHIE
DISTRICT HEIGHTS
FORESTVILLE
FAIRFAX
NATIONAL AIRPORT
SUITLAND
SILVER HILL
ANNANDALE
MORNINGSIDE
MEADOWS
ALEXANDRIA
CAMP SPRINGS
ANDREWS AIR FORCE BASE
WOODYARD
SPRINGFIELD
GROVETON
COAST GUARD RADIO STATION
FRIENDLY
SILESIA
FORT HUNT
FORT WASHINGTON
LORTON
FORT BELVOIR MILITARY RESERVATION
MOUNT VERNON
OCCOQUAN
WOODBRIDGE

MONTGOMERY COUNTY - MARYLAND
DISTRICT OF COLUMBIA
FAIRFAX COUNTY - ARLINGTON COUNTY
ARLINGTON COUNTY - FAIRFAX COUNTY - VIRGINIA
ROCK CREEK PARK
POTOMAC RIVER
DISTRICT OF COLUMBIA - PRINCE GEORGES COUNTY - MARYLAND
VIRGINIA
MARYLAND

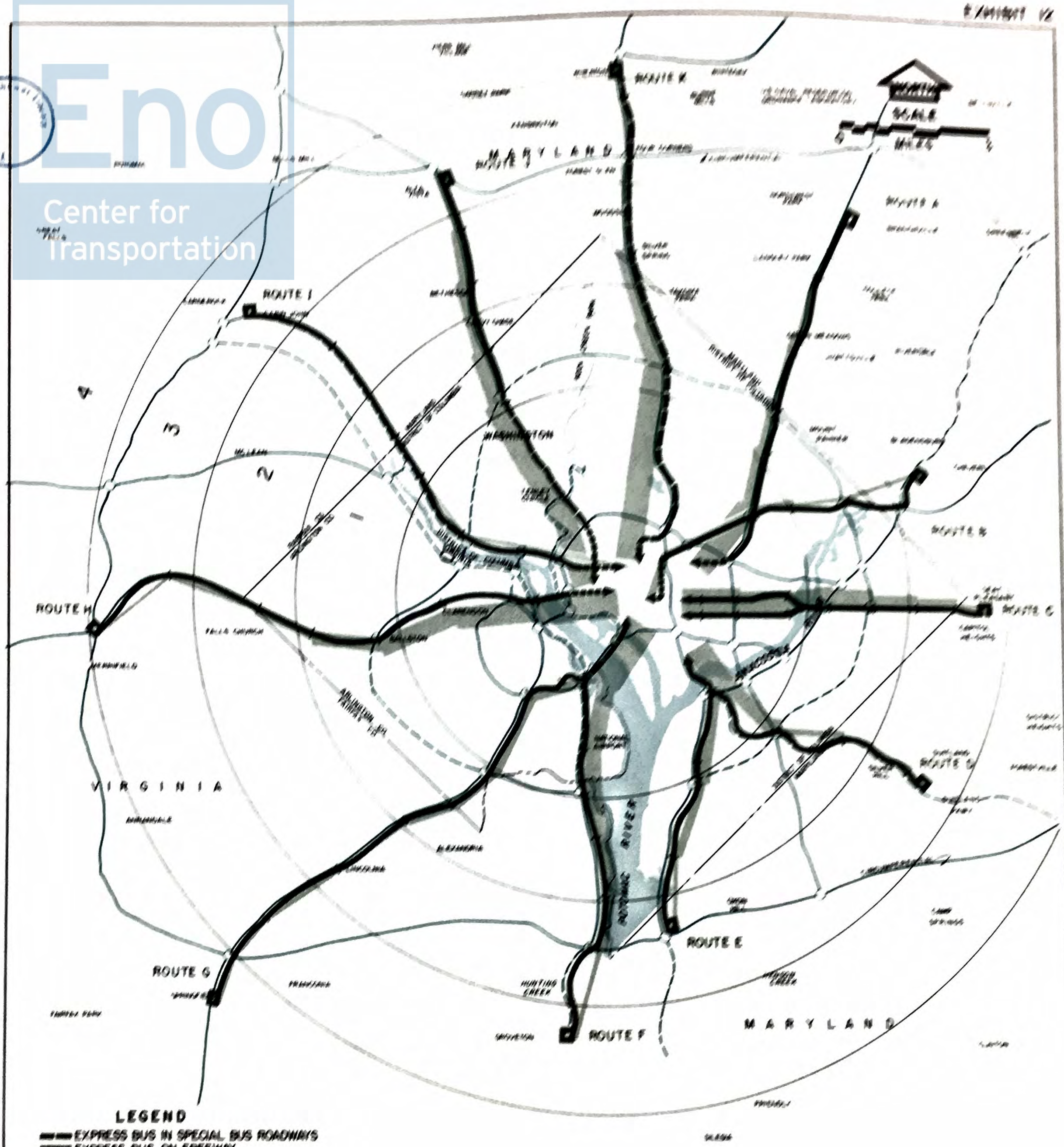
LEGEND
FREEWAY OR PARKWAY
O NUMBER OF LANES REQUIRED

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

PLAN I - AUTO DOMINANT HIGHWAY SYSTEM SHOWING NUMBER OF LANES REQUIRED IN 1980

DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO
NATIONAL CAPITAL PLANNING COMMISSION NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

Eno
Center for Transportation



LEGEND

- EXPRESS BUS IN SPECIAL BUS ROADWAYS
- EXPRESS BUS ON FREEWAY
- EXPRESS BUS ON SURFACE STREET
- STATION
- PLANNED OR EXISTING FREEWAY
- PLANNED OR EXISTING PARKWAY
- 2 FARE ZONE BOUNDARY
- 2 FARE ZONE NUMBER

SCALE

10,000
20,000
30,000
40,000

PASSENGER TRIPS
PEAK-HOUR - ONE WAY

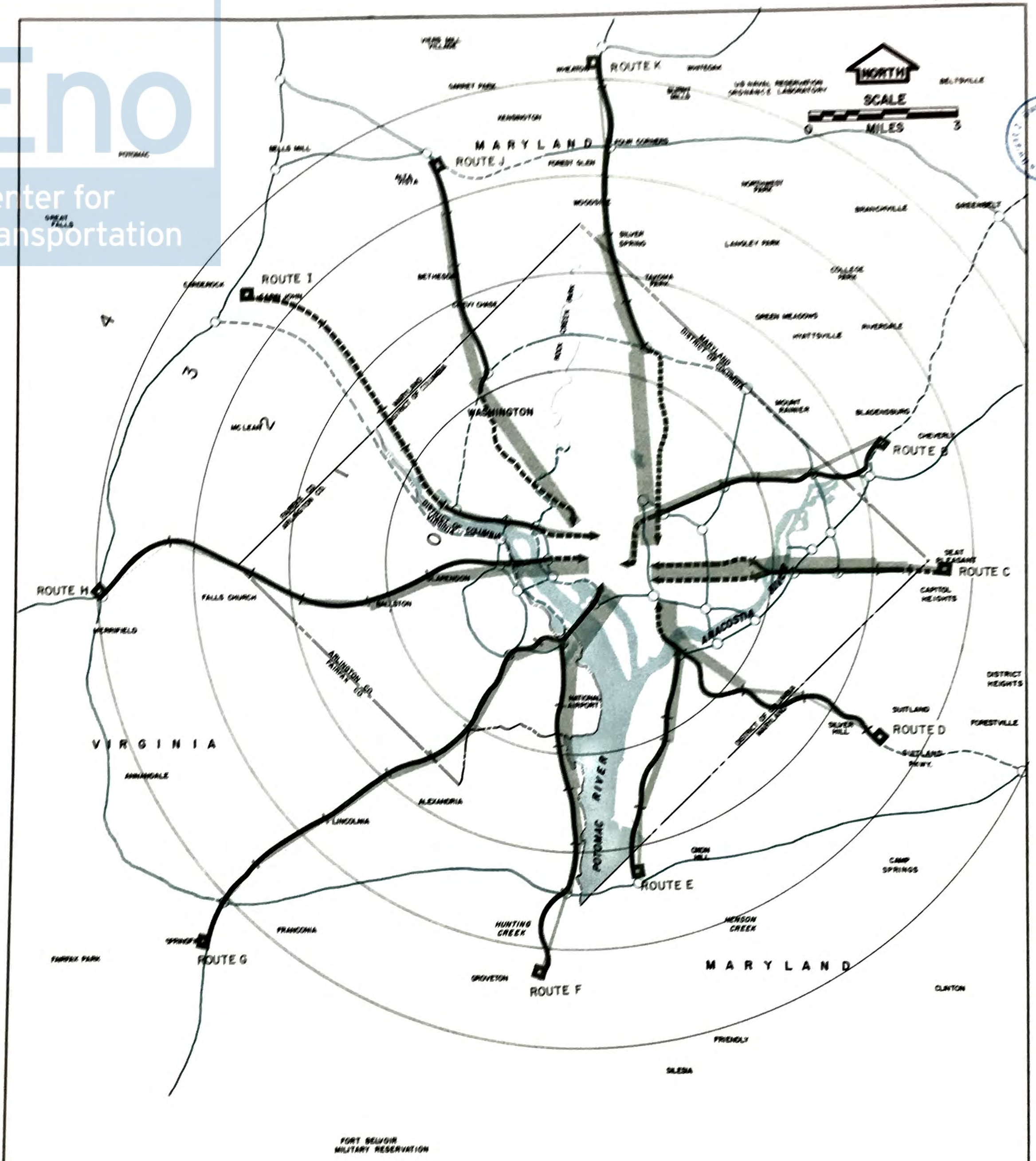
MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

PLAN II - ALL - EXPRESS BUS RAPID TRANSIT PLAN WITH RECOMMENDED FREEWAYS - 1980

DE LEUW, CATHER & COMPANY · CONSULTING ENGINEERS · CHICAGO
NATIONAL CAPITAL PLANNING COMMISSION NATIONAL CAPITAL REGIONAL PLANNING COUNCIL

Eno
Center for Transportation

EXHIBIT 13



SCALE

10,000
20,000
30,000
40,000

PASSENGER TRIPS
PEAK-HOUR - ONE WAY

LEGEND

- EXPRESS BUS ON FREEWAY
- EXPRESS BUS ON SURFACE STREET
- STATION
- PLANNED OR EXISTING FREEWAY
- PLANNED OR EXISTING PARKWAY
- FARE ZONE BOUNDARY
- 2 FARE ZONE NUMBER

MASS TRANSPORTATION SURVEY
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PLAN IV - RECOMMENDED RAPID TRANSIT PLAN WITH RECOMMENDED FREEWAYS - 1965

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EXHIBIT 14

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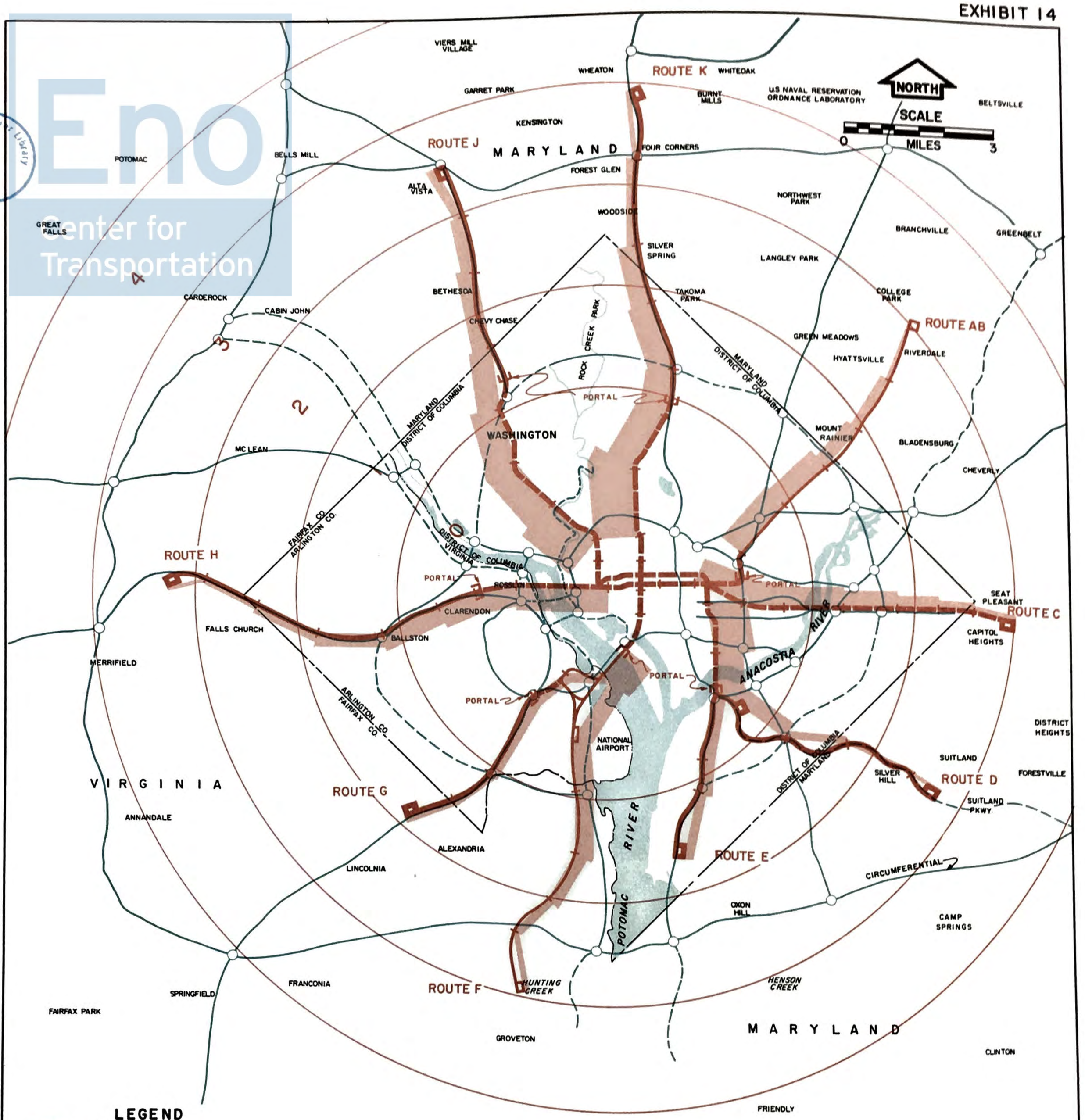

LEGEND

- SUBWAY
- RAIL WITHIN FREEWAY RIGHT-OF-WAY
- RAIL ON PRIVATE RIGHT-OF-WAY
- STATION
- PLANNED OR EXISTING FREEWAY
- PLANNED OR EXISTING PARKWAY
- FARE ZONE BOUNDARY
- 2 FARE ZONE NUMBER

SCALE

10,000
20,000
30,000
40,000

PASSENGER TRIPS
PEAK-HOUR – ONE WAY

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

PLAN III – ALL-RAIL RAPID TRANSIT PLAN WITH RECOMMENDED FREEWAYS – 1980

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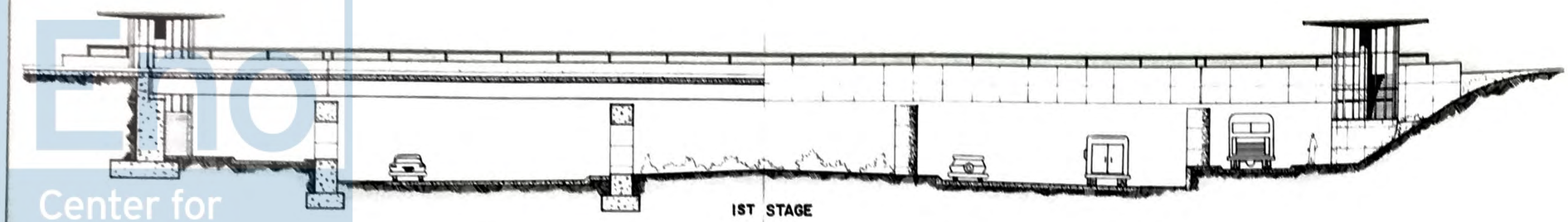

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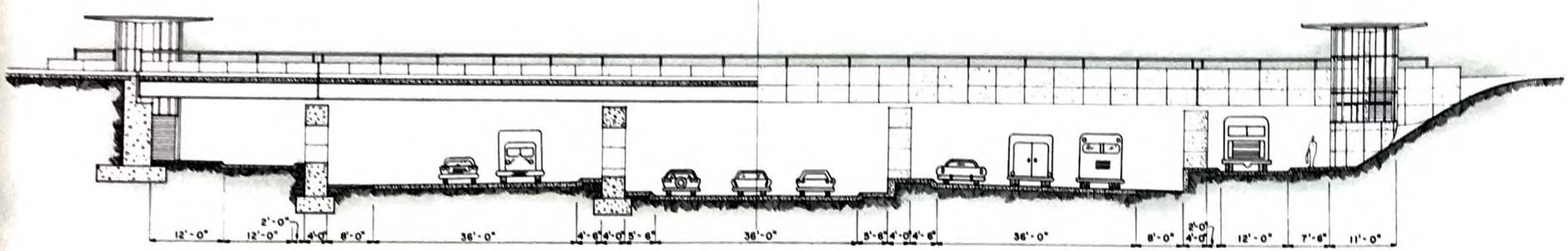

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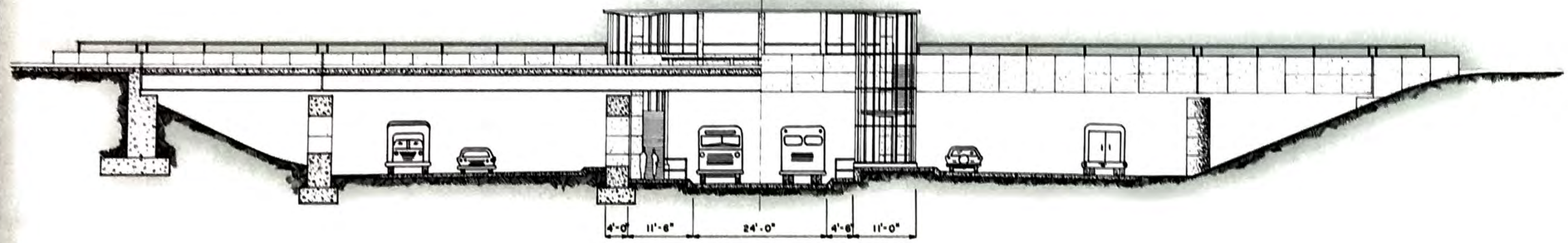

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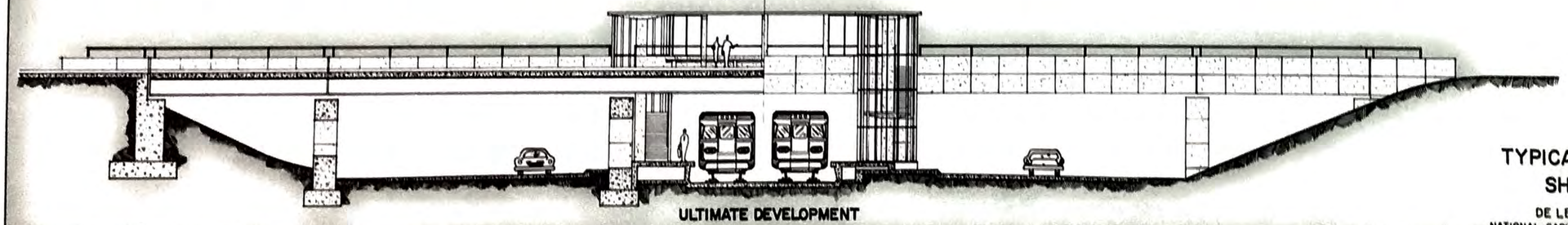

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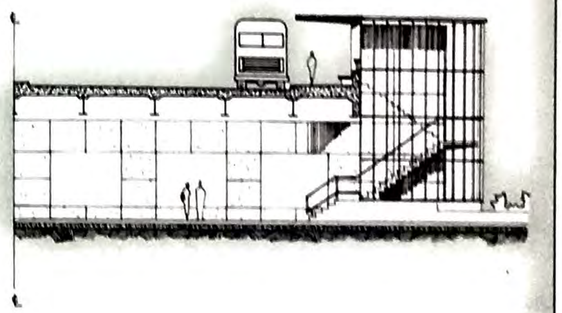

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TYPICAL CROSS SECTION THROUGH FREEWAY SHOWING STAGES OF DEVELOPMENT

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PLATES

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LIST OF PLATES

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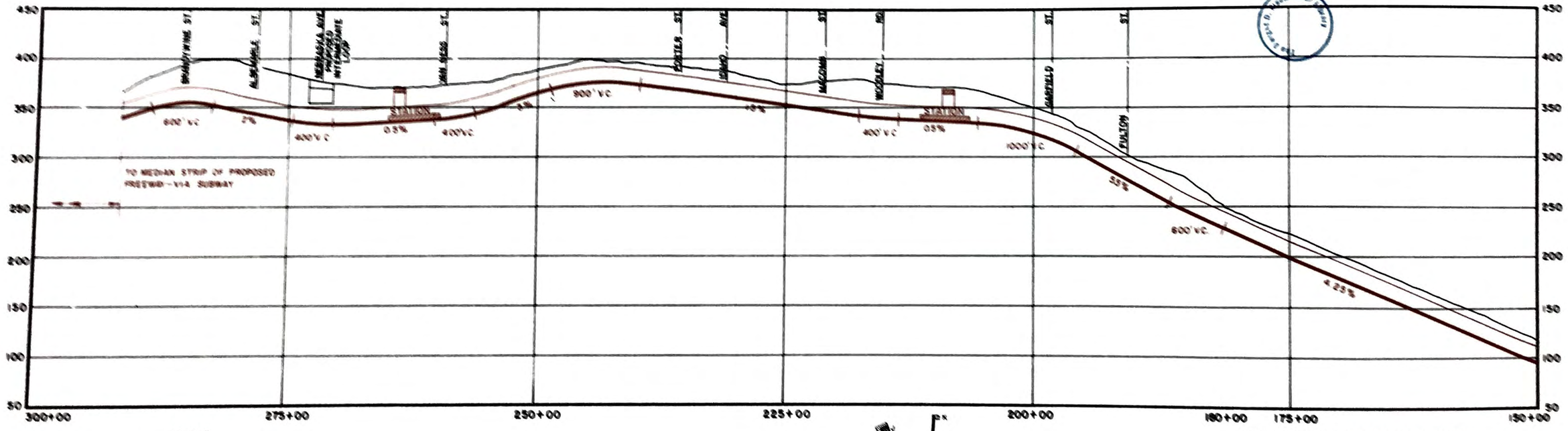

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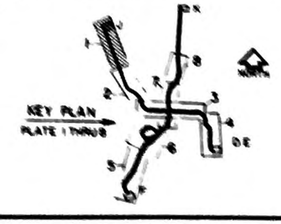

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION
PLAN AND PROFILE
ROUTE J - STA. 291+50 TO STA. 30+00

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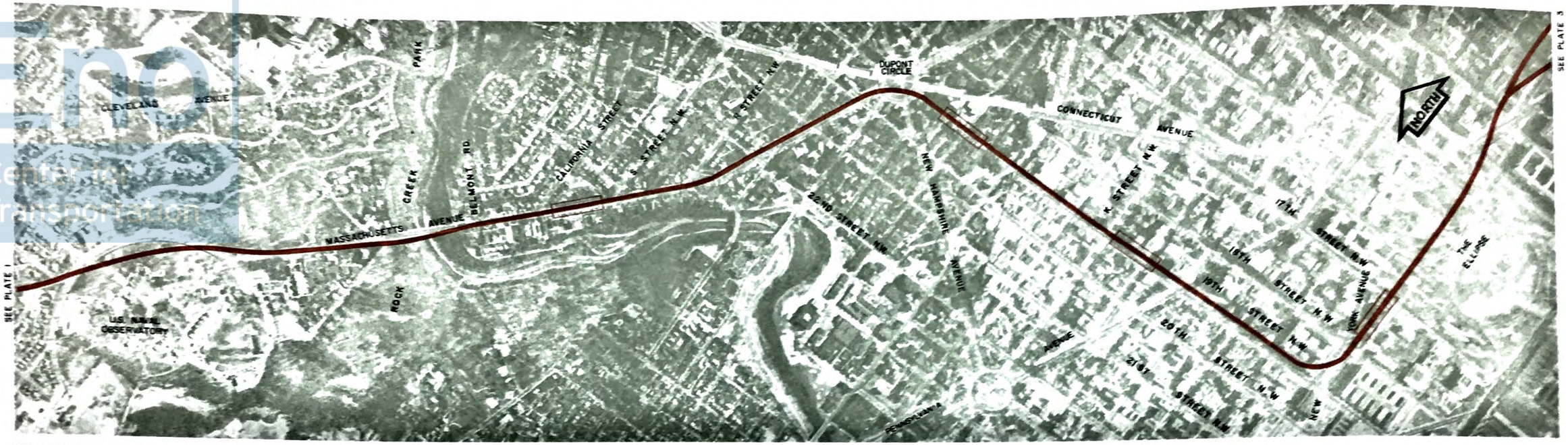

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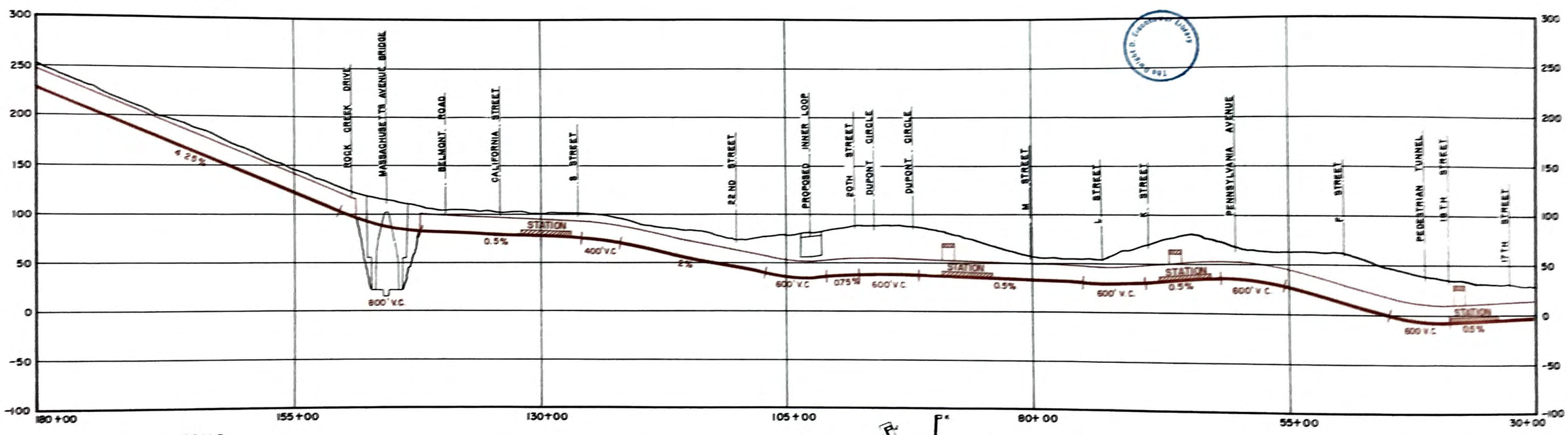

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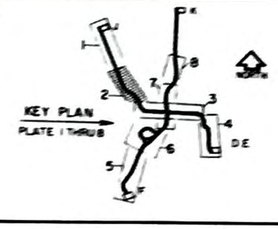

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION
PLAN AND PROFILE
ROUTE J - STA. 180+00 TO STA. 30+00

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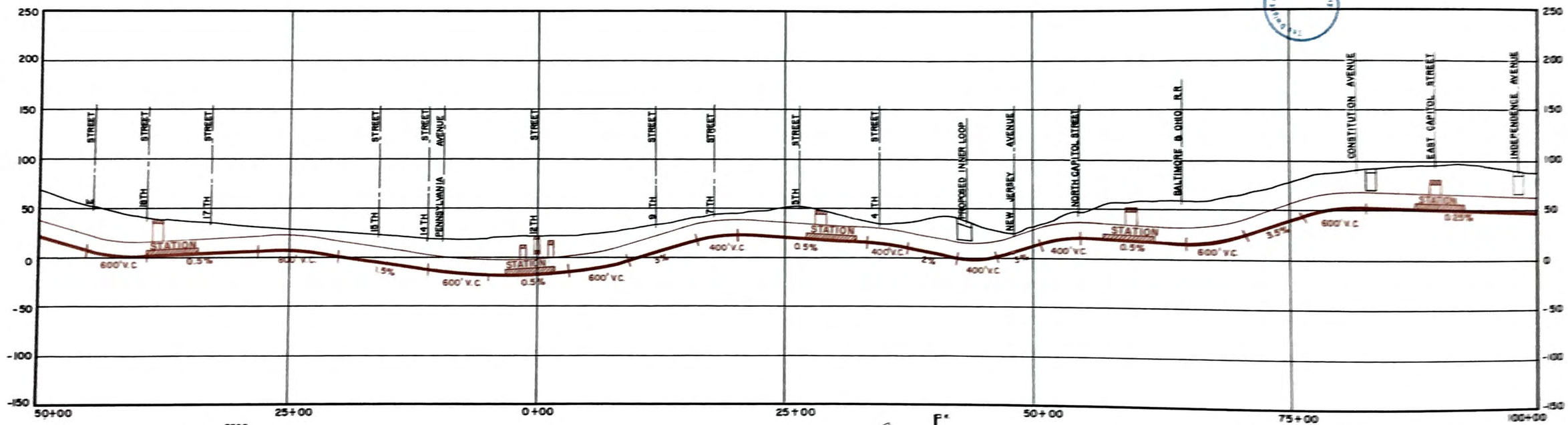

SCALE 3000

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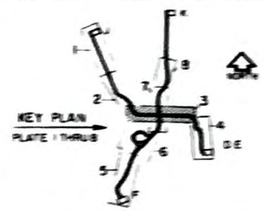
VERTICAL 0 50 100 200 FEET

← ROUTE J — ROUTE DE →



MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

PLAN AND PROFILE

ROUTE J - STA. 50+00 TO STA. 0+00
ROUTE DE - STA. 0+00 TO STA. 100+00

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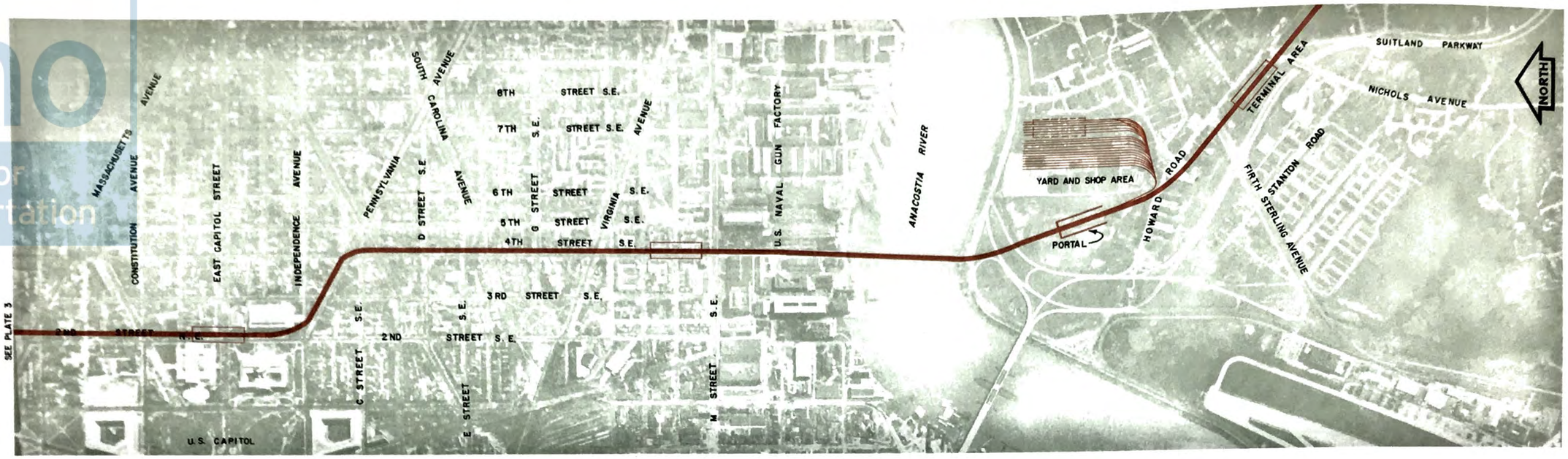

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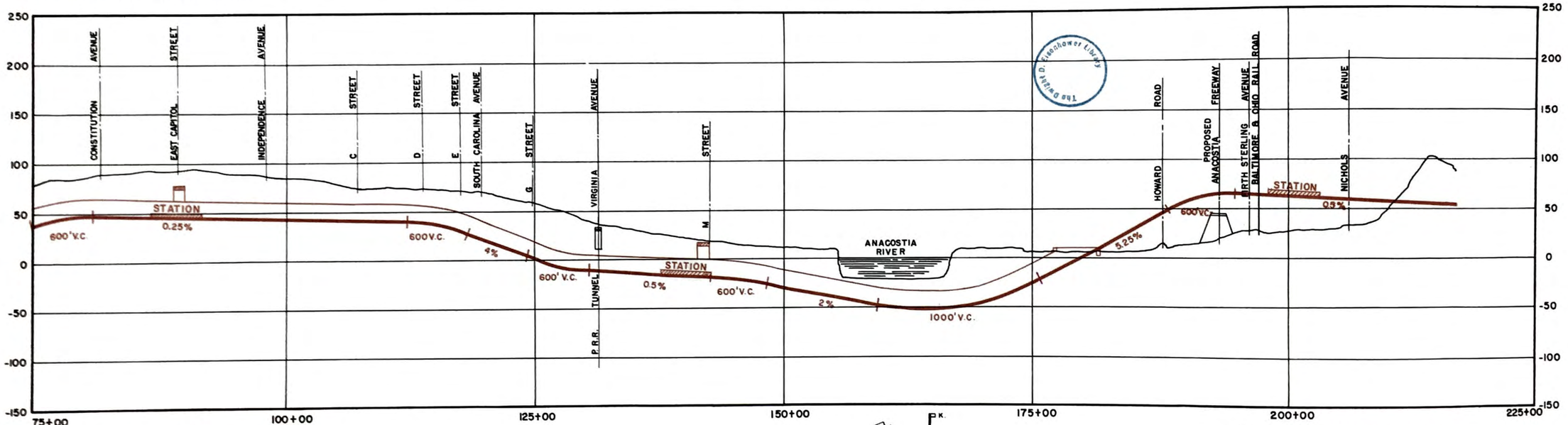

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SCALE

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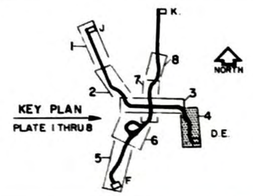

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION

PLAN AND PROFILE
ROUTE DE- STA. 75+00 TO ANACOSTIA TERMINAL

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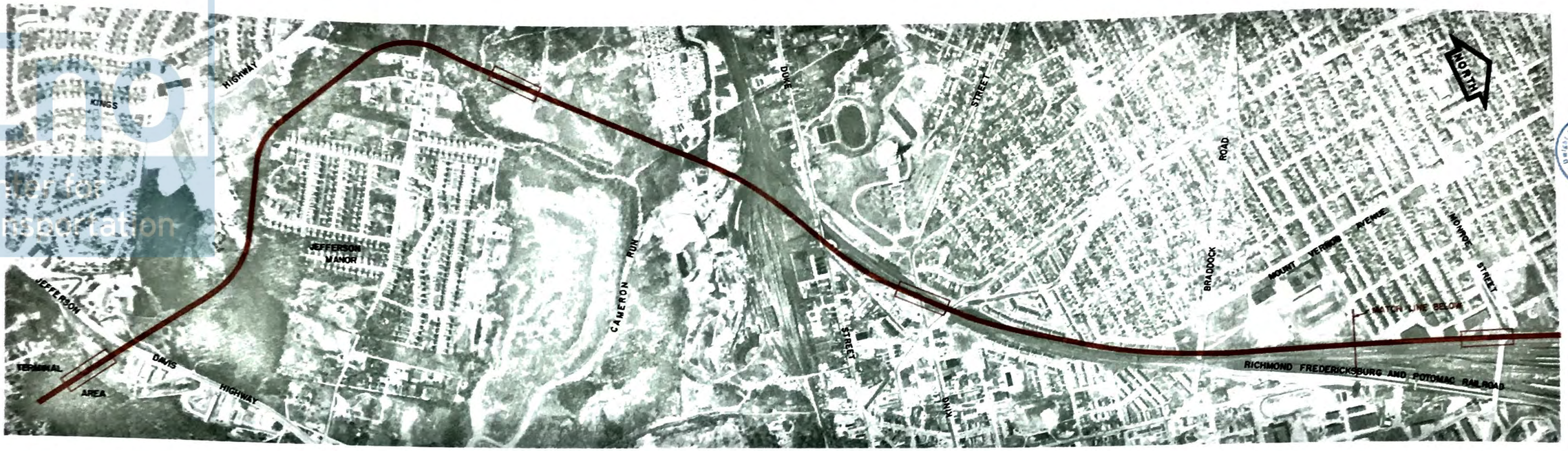

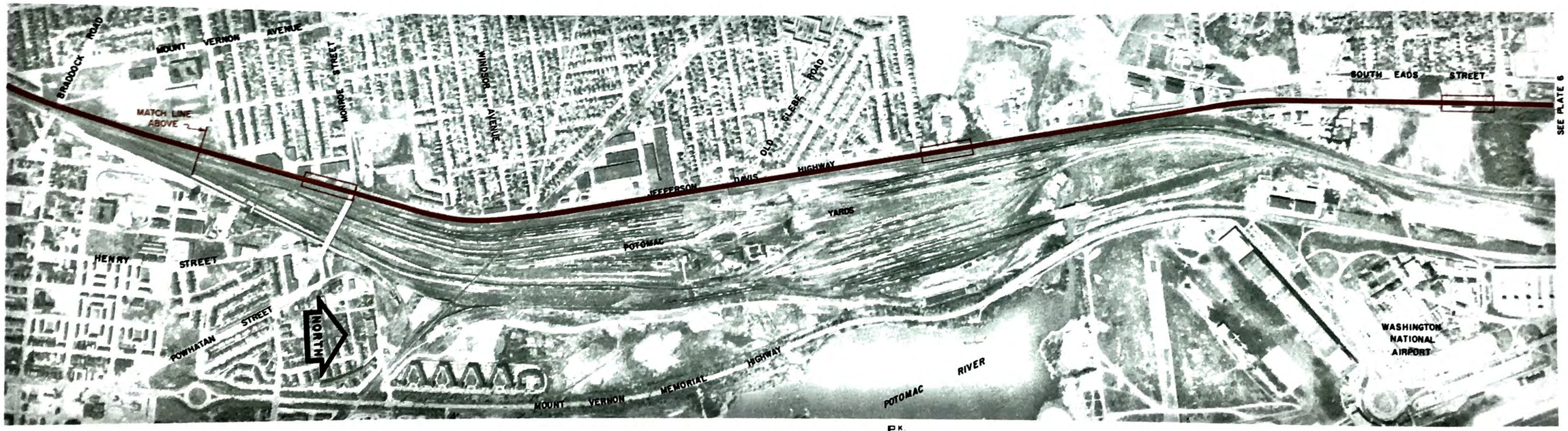

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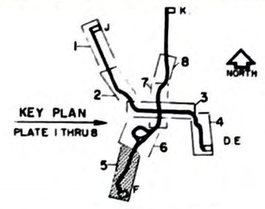

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION
PLAN - ROUTE F
JEFFERSON MANOR TERMINAL TO
WASHINGTON NATIONAL AIRPORT STATION

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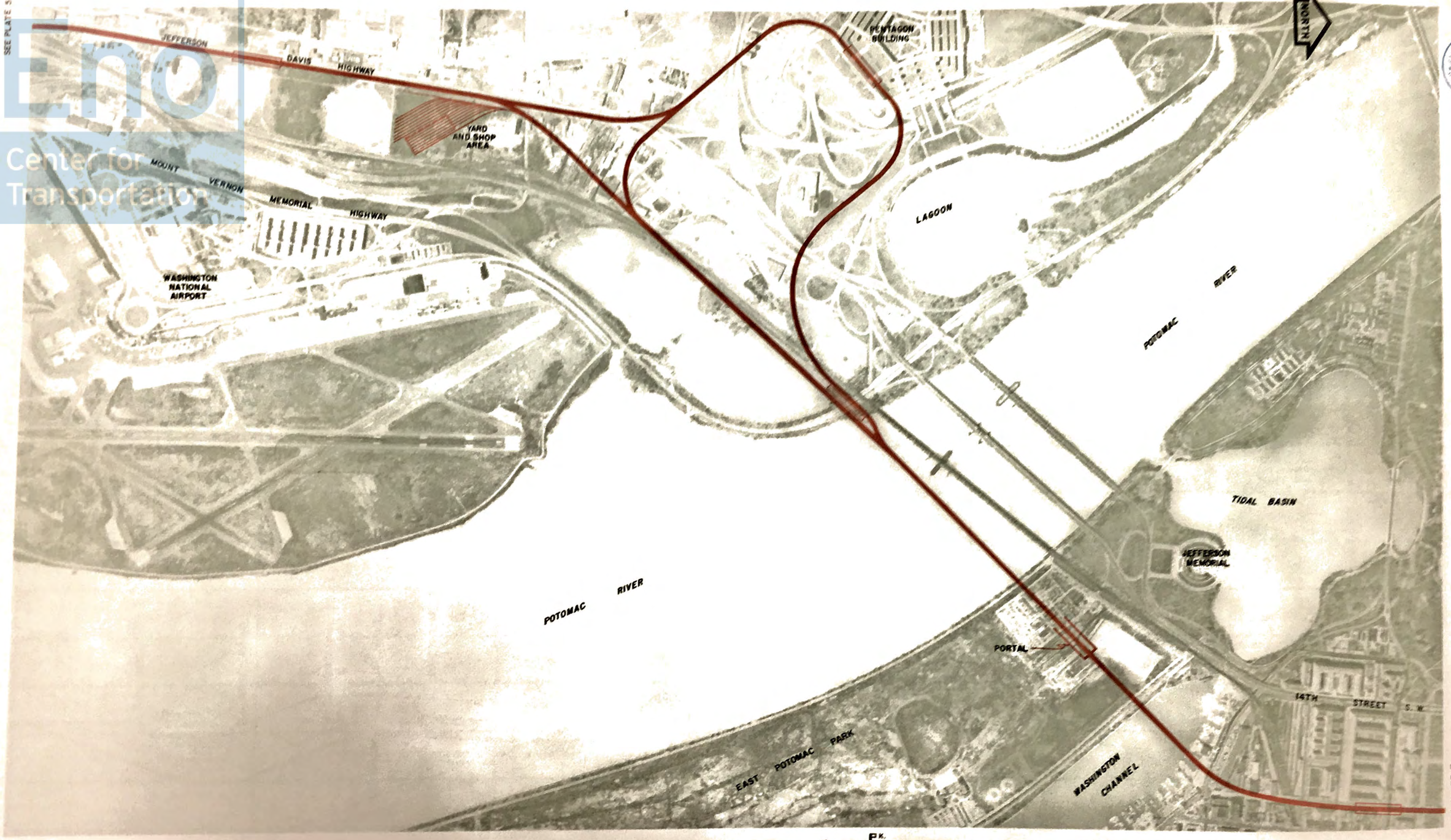
SEE PLATE 5



SEE PLATE 7

SCALE

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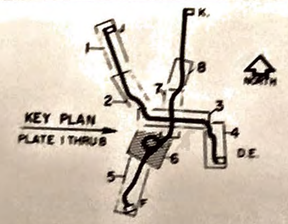

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION
PLAN - ROUTE F
WASHINGTON NATIONAL AIRPORT STATION
BUREAU OF ENGRAVING STATION

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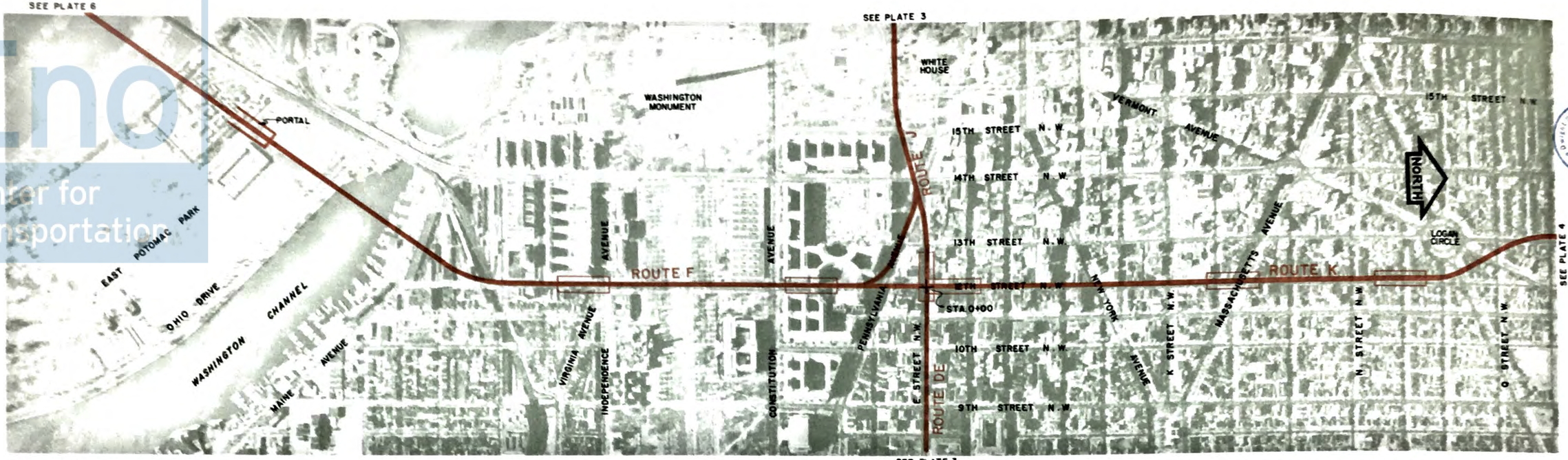

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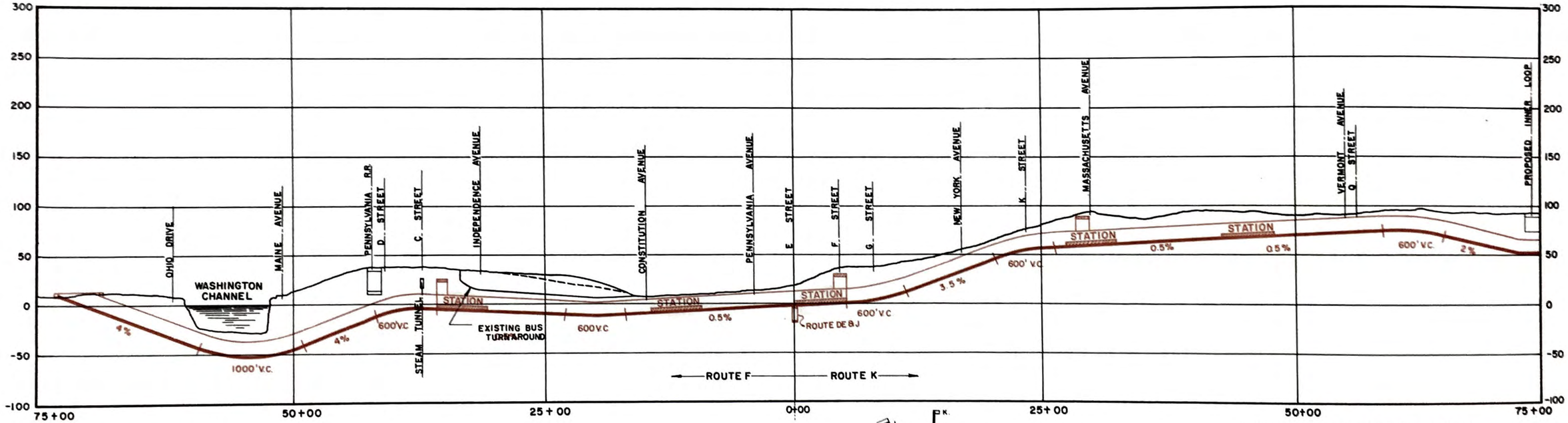

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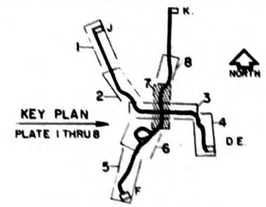

MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION
PLAN AND PROFILE
ROUTE F- EAST POTOMAC PARK TO STA. 0+00
ROUTE K- STA. 0+00 TO STA. 75+00

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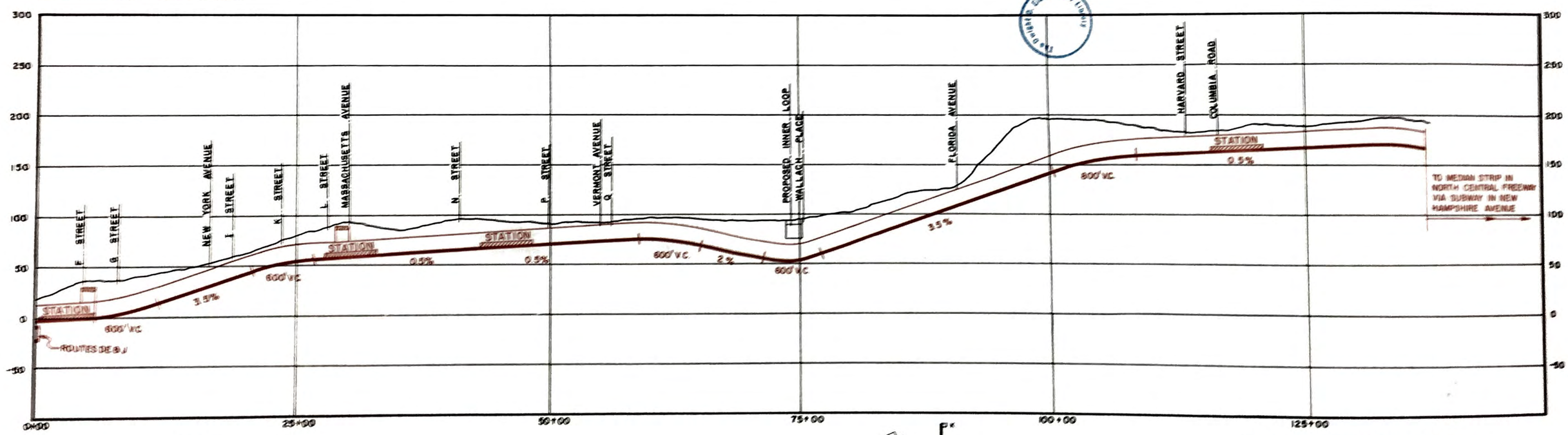
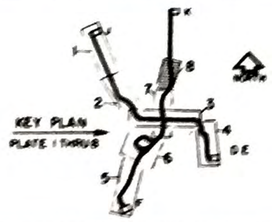


SCALE

HORIZONTAL 0 500 1000 2000 FEET

VERTICAL 0 50 100 200 FEET



MASS TRANSPORTATION SURVEY
NATIONAL CAPITAL REGION
PLAN AND PROFILE
ROUTE K - STA. 0+00 TO STA. 136+75

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APPENDIX A

TABLE A-1

PLAN IV—1980 RECOMMENDED SYSTEM
ESTIMATED CONSTRUCTION COST OF FREEWAYS, PARKWAYS AND MAJOR STREETS

			Interstate				Other				Total	
			Planned		Added		Planned		Added			
Jurisdiction	Type	Existing Lane-Miles	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)
DISTRICT OF COLUMBIA	Freeways	47	135	$325,300	5	$25,350	48	$127,300	115	$235,250	354	$ 714,500
	Parkways	34	4	12,650*	-	-	35	44,300	55	72,900	129	129,450
	Major Streets	-	-	-	-	-	-	18,400	-	9,400	-	27,800
MARYLAND Montgomery County	Freeways	31	129	56,350	-25	-11,700	39	34,700	95	73,400	236	162,750
	Parkways	1	18	7,000#	-6	-2,350	18	7,200	-	-	36	11,850
	Major Streets	-	-	-	-	-	-	62,850	-	2,600	-	65,450
Prince Georges County	Freeways	14	220	71,650	-44	-14,200	18	7,900	23	7,250	235	143,450
	Parkways	37	-	-	-	-	4	3,100	26	4,350	31	22,450
	Major Streets	-	-	-	-	-	-	30,150	-	700	-	30,850
VIRGINIA Alexandria	Freeways	12	24	33,250	-	-	-	-	27	67,250	63	100,400
	Parkways	-	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	7,550	-	350	-	7,900
Arlington County	Freeways	49	49	62,650	-	5,250	-	-	27	46,550	123	116,400
	Parkways	21	-	-	-	-	27	12,600	21	46,300	59	55,400
	Major Streets	-	-	-	-	-	-	13,300	-	500	-	13,800
Fairfax County	Freeways	31	156	125,900	2	3,200	-	-	54	34,800	243	163,900
	Parkways	22	-	-	-	-	22	10,300	4	1,100	48	11,400
	Major Streets	-	-	-	-	-	-	27,550	-	100	-	27,650
TOTAL	Freeways	197	755	$712,250	-72	$37,000	155	$165,900	331	$476,250	1,410	$1,401,400
	Parkways	134	22	19,650	-6	-2,350	107	73,100	106	124,750	365	220,150
	Major Streets	-	-	-	-	-	-	167,800	-	13,650	-	181,450
GRAND TOTAL		331	781	$731,900	-78	$34,650	262	$405,800	437	$614,750	1,775	$1,785,400

*-Theodore Roosevelt (Constitution Avenue) Bridge.
#-Existing portion of Circumferential Highway through Rock Creek Park.
Also See Footnote.

TABLE A-2

PLAN IV—RECOMMENDED SYSTEM—PERIOD THROUGH 1965
ESTIMATED CONSTRUCTION COST OF FREEWAYS, PARKWAYS AND MAJOR STREETS

		Interstate				Other				Total	
		Planned		Added		Planned		Added			
Jurisdiction	Type	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)
DISTRICT OF COLUMBIA	Freeways	119	$263,250	5	$26,050	40	$ 31,450	60	$126,500	224	$ 307,250
	Parkways	4	12,650*	-	-	20	23,500	26	41,150	50	77,300
	Major Streets	-	-	-	-	-	18,400	-	9,400	-	27,800
MARYLAND Montgomery County	Freeways	129	56,350	-32	-12,050	7	4,100	51	67,600	155	116,000
	Parkways	18	7,000#	-6	-2,350	-	-	-	-	12	4,650
	Major Streets	-	-	-	-	-	62,850	-	2,600	-	65,450
Prince Georges County	Freeways	220	71,650	-51	-13,250	18	7,900	4	1,950	191	67,650
	Parkways	-	-	-	-	2	700	-	-	2	700
	Major Streets	-	-	-	-	-	30,150	-	700	-	30,850
VIRGINIA Alexandria	Freeways	24	33,250	-	-	-	-	16	43,200	40	76,450
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	7,550	-	350	-	7,900
Arlington County	Freeways	49	62,650	-	5,250	-	-	9	17,150	58	85,050
	Parkways	-	-	-	-	12	6,600	-	-	12	6,600
	Major Streets	-	-	-	-	-	13,300	-	500	-	13,800
Fairfax County	Freeways	156	125,900	2	3,200	-	-	23	8,800	181	137,900
	Parkways	-	-	-	-	17	7,050	-	-	17	7,050
	Major Streets	-	-	-	-	-	27,550	-	100	-	27,650
TOTAL	Freeways	697	$612,450	-76	$ 9,200	65	$103,450	163	$265,200	849	$ 990,300
	Parkways	22	19,650	-6	-2,350	51	37,850	26	41,150	93	96,300
	Major Streets	-	-	-	-	-	167,800	-	13,650	-	181,450
GRAND TOTAL		729	$632,100	-82	$ 6,850	116	$309,100	189	$320,000	942	$1,268,050

*-Theodore Roosevelt (Constitution Avenue) Bridge.
#-Existing portion of Circumferential Highway through Rock Creek Park.
Also See Footnote.

TABLE A-3

PLAN IV—RECOMMENDED SYSTEM—PERIOD 1966-1980
ESTIMATED CONSTRUCTION COST OF FREEWAYS, PARKWAYS AND MAJOR STREETS

		Interstate				Other				Total	
		Planned		Added		Planned		Added			
Jurisdiction	Type	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)	Lane-Miles	Cost (Add 000)
DISTRICT OF COLUMBIA	Freeways	16	$62,650	-	$ -	8	$95,850	26	$ 39,450	50	$197,950
	Parkways	-	-	-	-	16	24,400	29	30,750	45	55,150
	Major Streets	-	-	-	-	-	-	-	-	-	-
MARYLAND Montgomery County	Freeways	-	-	7	350	39	22,350	29	6,700	65	29,400
	Parkways	-	-	-	-	18	7,200	-	-	18	7,200
	Major Streets	-	-	-	-	-	-	-	-	-	-
Prince Georges County	Freeways	-	-	-	-	-	-	-	-	-	-
	Parkways	-	-	-	-	6	2,600	9	4,750	15	7,350
	Major Streets	-	-	-	-	-	-	-	-	-	-
VIRGINIA Alexandria	Freeways	-	-	-	-	-	-	-	-	-	-
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
Arlington County	Freeways	-	-	-	-	-	-	13	26,400	13	26,400
	Parkways	-	-	-	-	3	5,000	-	-	3	5,000
	Major Streets	-	-	-	-	-	-	-	-	-	-
Fairfax County	Freeways	-	-	-	-	-	-	-	-	-	-
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
TOTAL	Freeways	16	$62,650	7	$350	47	$49,200	55	$ 72,550	128	$204,750
	Parkways	-	-	-	-	45	37,000	38	35,500	83	72,500
	Major Streets	-	-	-	-	-	-	-	-	-	-
GRAND TOTAL		16	$62,650	7	$350	92	$86,200	96	$128,050	215	$277,250

Also See Footnote.

FOOTNOTE: Tables A-1 A-2 A-3 — Events subsequent to the publishing of the "Estimate of Cost of Completing the National System of Interstate and Defense Highways" on July 1, 1957, have dictated certain substitutions or alignment changes (which would alter to some extent the previously published estimate) as indicated on Exhibits 1 and 2 and as summarized below:

1. Northeast Route (more direct alignment--estimate included in table).
2. Replacement for U.S. 240 in Maryland and District of Columbia (temporarily removed from official program--if one of other routes shown is eventually selected, estimated cost will have to be transferred between appropriate columns in table).
3. Replacement for U.S. 50 in Virginia (revised alignment under study since previously published estimates--estimate for this route included in table is for the alignment under study).

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TABLE A-4

[illegible] SYSTEM—PERIOD [illegible]
ESTIMATED CONSTRUCTION COST OF FREEWAYS, PARKWAYS AND MAJOR STREETS

Jurisdiction	Type	Interstate Planned Lane-Miles	Interstate Planned Cost (Add 000)	Interstate Added Lane-Miles	Interstate Added Cost (Add 000)	Other Planned Lane-Miles	Other Planned Cost (Add 000)	Other Added Lane-Miles	Other Added Cost (Add 000)	Total Lane-Miles	Total Cost (Add 000)
DISTRICT OF COLUMBIA	Freeways	-	$ -	-	$ -	-	-	[illegible]	$ [illegible]	[illegible]	$ [illegible]
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
MARYLAND Montgomery County	Freeways	-	-	-	-	-	-	-	-	-	-
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
Prince Georges County	Freeways	[illegible]	[illegible]	-	[illegible]	-	-	[illegible]	[illegible]	[illegible]	[illegible]
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
VIRGINIA Alexandria	Freeways	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
Arlington County	Freeways	-	-	-	-	-	-	-	-	-	-
	Parkways	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]
	Major Streets	-	-	-	-	-	-	-	-	-	-
Fairfax County	Freeways	-	-	-	-	-	-	-	-	-	-
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
TOTAL	Freeways	[illegible]	$[illegible]	-	$[illegible]	-	-	[illegible]	$ [illegible]	[illegible]	$[illegible]
	Parkways	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]
	Major Streets	-	-	-	-	-	-	-	-	-	-
GRAND TOTAL		[illegible]	$[illegible]	-	$[illegible]	-	-	[illegible]	$[illegible]	[illegible]	$[illegible]

NOTE: Events subsequent to the publishing of the "Estimate of Cost of Completing the National System of Interstate and Defense Highways" on July 1, 1957, have dictated certain substitutions or alignment changes (which would alter to some extent the previously published estimates) as indicated on Exhibits 1 and 2 and as summarized below:

Northeast Route (more direct alignment—estimate included above).
(Other routes in above category not affected in this stage of construction.)

TABLE A-5

PLAN IV—[illegible] SYSTEM—PERIOD 1970-1980
ESTIMATED CONSTRUCTION COST OF FREEWAYS, PARKWAYS AND MAJOR STREETS

Jurisdiction	Type	Interstate Planned Lane-Miles	Interstate Planned Cost (Add 000)	Interstate Added Lane-Miles	Interstate Added Cost (Add 000)	Other Planned Lane-Miles	Other Planned Cost (Add 000)	Other Added Lane-Miles	Other Added Cost (Add 000)	Total Lane-Miles	Total Cost (Add 000)
DISTRICT OF COLUMBIA	Freeways	-	-	-	-	-	$ -	1	$ 3,300	1	$ 3,300
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
MARYLAND Montgomery County	Freeways	-	-	-	-	43	17,250	23	9,100	66	26,350
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
Prince Georges County	Freeways	-	-	-	-	-	-	27	4,200	27	4,200
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
VIRGINIA Alexandria	Freeways	-	-	-	-	-	-	-	-	-	-
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
Arlington County	Freeways	-	-	-	-	-	-	5	4,350	5	4,350
	Parkways	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	-	-	-	-
Fairfax County	Freeways	-	-	-	-	-	-	32	26,000	32	26,000
	Parkways	-	-	-	-	11	3,250	4	1,100	15	4,350
	Major Streets	-	-	-	-	-	-	-	-	-	-
TOTAL	Freeways	-	-	-	-	43	$17,250	60	$43,650	103	$60,900
	Parkways	-	-	-	-	11	3,250	21	5,300	32	8,550
	Major Streets	-	-	-	-	-	-	-	-	-	-
GRAND TOTAL		-	-	-	-	54	$20,500	81	$48,950	135	$69,450

TABLE A-6

PLAN I—1980 AUTO-DOMINANT SYSTEM
ESTIMATED CONSTRUCTION COST OF FREEWAYS, PARKWAYS AND MAJOR STREETS

Jurisdiction	Type	Existing Lane-Miles	Interstate Planned Lane-Miles	Interstate Planned Cost (Add 000)	Interstate Added Lane-Miles	Interstate Added Cost (Add 000)	Other Planned Lane-Miles	Other Planned Cost (Add 000)	Other Added Lane-Miles	Other Added Cost (Add 000)	Total Lane-Miles	Total Cost (Add 000)
DISTRICT OF COLUMBIA	Freeways	47	139	$685,300	46	$873,450	48	$827,300	224	$625,700	494	$1,142,550
	Parkways	24	4	12,650*	-	-	36	44,300	91	133,400	155	190,350
	Major Streets	-	-	-	-	-	-	18,400	-	26,100	-	44,500
MARYLAND Montgomery County	Freeways	50	128	56,350	-25	-11,200	35	34,700	108	112,450	352	192,300
	Parkways	2	18	7,000#	-4	-2,350	18	7,200	-	-	36	11,850
	Major Streets	-	-	-	-	-	-	62,850	-	2,600	-	65,450
Prince Georges County	Freeways	24	332	114,100	-5	25,200	18	7,300	15	7,250	384	152,450
	Parkways	57	-	-	-	-	8	3,100	35	13,500	100	17,300
	Major Streets	-	-	-	-	-	-	38,150	-	700	-	38,850
VIRGINIA Alexandria	Freeways	22	24	33,250	-	-	-	-	27	67,150	63	100,400
	Parkways	-	-	-	-	-	-	-	-	-	-	-
	Major Streets	-	-	-	-	-	-	7,550	-	350	-	7,900
Arlington County	Freeways	47	49	62,650	3	11,950	-	-	24	42,700	128	117,300
	Parkways	21	-	-	-	-	17	22,600	31	56,350	69	78,950
	Major Streets	-	-	-	-	-	-	13,300	-	2,800	-	16,100
Fairfax County	Freeways	1	156	125,900	20	24,650	-	-	73	24,300	250	165,450
	Parkways	18	-	-	-	-	28	10,300	-	-	56	10,300
	Major Streets	-	-	-	-	-	-	27,550	-	1,300	-	28,850
TOTAL	Freeways	187	796	$718,250	39	$822,250	155	$865,300	461	$770,150	1,616	$2,870,450
	Parkways	136	22	19,650	4	-2,350	107	76,100	157	203,650	406	295,050
	Major Streets	-	-	-	-	-	-	167,800	-	33,850	-	201,650
GRAND TOTAL		323	811	$737,900	3	$819,900	262	$[illegible]	618	$1,107,650	2,092	$[illegible]

*—Theodore Roosevelt (Constitution Avenue) Bridge.
#—Existing portion of Circumferential Highway through Rock Creek Park.
Also See Footnote.

TABLE A-7

DIRECTIONAL DISTRIBUTION FACTORS
FOR FREEWAYS AND PARKWAYS

Type of Movement	Location	Directional Split
Radial	From Inner Loop to Intermediate Loop	60% - 40%
Radial	From Intermediate Loop to Limits of Study	65% - 35%
Circumferential	All	55% - 45%

FOOTNOTE: Table A-6 Events subsequent to the publishing of the "Estimate of Cost of Completing the National System of Interstate and Defense Highways" on July 1, 1957, have dictated certain substitutions or alignment changes (which would alter to some extent the previously published estimate) as indicated on Exhibits 1 and 2 and as summarized below:

1. Northeast Route (more direct alignment—estimate included in table).
2. Replacement for U.S. 240 in Maryland and District of Columbia (temporarily removed from official program—if one of other routes shown is eventually selected, estimated cost will have to be transferred between appropriate columns in table).
3. Replacement for U.S. 50 in Virginia (revised alignment under study since previously published estimates—estimate for this route included in table is for the alignment under study).

TABLE A-8

RADIAL ARTERIAL STREET CAPACITY--
1980 RECOMMENDED HIGHWAY SYSTEM

Corridor	Screen Line 1				Screen Line 2			
	1955 ADT	1955 Practical Capacity	1980 ADT	1980 Practical Capacity	1955 ADT	1955 Practical Capacity	1980 ADT	1980 Practical Capacity
1	27,300	40,000	43,000	54,000	58,100	76,000*	47,000	58,000
2	55,000	76,000	107,000	110,000	89,500	100,000	108,000	108,000
3	77,400	85,000	85,000	85,000	89,900	96,000	78,000	96,000
4	72,000	104,000	125,000	125,000	85,300	89,000	102,000	149,000
5	75,900	118,000*	80,000	100,000	78,500	81,000	85,000	120,000
6	23,400	48,000	65,000	75,000	120,800	135,000*	75,000	75,000
7	53,500	102,000*	50,000	66,000	87,100	105,000*	-	-
8	28,100	29,000	23,000	29,000	53,500	50,000*	-	-
9	91,500	117,000*	71,000	71,000	100,000	100,000*	46,000	60,000
10	21,000	27,000	17,000	27,000	20,000	22,000	14,000	22,000
11	43,000	43,000	50,000	50,000	73,500	63,000	60,000	80,000
12	27,000	40,000	32,000	40,000	34,000	38,000	26,000	49,000
13	19,000	20,500	2,100	32,500	12,000	10,000	2,000	10,000

*-1955 Practical Capacity includes existing freeway or parkway which has been deleted from the 1980 Practical Capacity for arterial streets.

TABLE A-8a

RADIAL ARTERIAL STREETS INCLUDED IN EACH CORRIDOR
FOR STREET CAPACITY STUDY

Screen Line 1--At Limits of Original Ten-Mile Square

Corridor	Arterials
1	MacArthur Boulevard Massachusetts Avenue River Road 46th Street
2	Wisconsin Avenue Reno Road Connecticut Avenue Oregon Avenue
3	16th Street Georgia Avenue Blair Road Piney Branch 5th Street Kansas Avenue
4	New Hampshire Avenue Riggs Road Sargent Road Michigan Avenue Rhode Island Avenue
5	Bladensburg Road New York Avenue Kenilworth Avenue Minnesota Avenue Sheriff Road Baltimore-Washington Parkway
6	Grant Street E. Capitol Street Central Avenue Benning Road
7	Pennsylvania Avenue Suitland Road Branch Avenue Naylor Road Suitland Parkway
8	Wheeler Road S. Capitol Street
9	Mt. Vernon Memorial Parkway U. S. 1 Russel Road Seminary Road Shirley Highway
10	Walter Reed Drive Columbia Pike
11	U. S. 50 Wilson Boulevard
12	Washington Boulevard Lee Highway
13	Old Dominion Drive Chain Bridge Road

TABLE A-8b

RADIAL ARTERIAL STREETS INCLUDED IN EACH CORRIDOR
FOR STREET CAPACITY STUDY

Screen Line 2--At Approximate Distance from White House
Shown Beneath Number of Each Corridor

Corridor	Arterials
1 2.6 Miles	Canal Road Reservoir Road Tunlaw Road Cathedral Drive Massachusetts Avenue
2 3.2 Miles	Wisconsin Avenue Woodley Road Reno Road Porter Street Tilden Street Connecticut Avenue
3 3.7 Miles	16th Street 14th Street 13th Street Georgia Avenue Illinois Avenue 5th Street
4 3.5 Miles	Kansas Avenue New Hampshire Avenue N. Capitol Street Michigan Avenue 13th Street Rhode Island Avenue
5 3.5 Miles	Bladensburg Road New York Avenue West Virginia Avenue Baltimore-Washington Parkway
6 3.8 Miles	Benning Road Bridge E. Capitol Street Bridge
7 3.0 Miles	Sousa Bridge Anacostia Bridge
8 2.8 Miles	S. Capitol Street Bridge
9 3.7 Miles	Mt. Vernon Memorial Parkway U. S. 1 Mt. Vernon Avenue Shirley Highway
10 3.6 Miles	Columbia Pike
11 3.6 Miles	Pershing Road U. S. 50 Wilson Boulevard Fairfax Drive
12 3.7 Miles	Washington Boulevard Lee Highway
13 3.5 Miles	Lorcum Lane

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APPENDIX B

The Dwight D. Eisenhower Library

TABLE B-1

PLAN IV--1980 RECOMMENDED PLAN (RAIL PORTION)
ESTIMATED CONSTRUCTION COST BY ROUTE AND TYPE OF CONSTRUCTION

Type of Construction	Units	Unit Cost	Route DE Quantity	Route DE Cost (Add 000)	Route F Quantity	Route F Cost (Add 000)	Route F Extension Quantity	Route F Extension Cost (Add 000)	Route J Quantity	Route J Cost (Add 000)	Route K Quantity	Route K Cost (Add 000)	Total Quantity	Total Cost (Add 000)
Cut-and-Cover	LF	$2,450	11,950	$51,450	3,710	$ 9,950	-	$ -	25,310	$ 67,050	16,250	$ 43,050	57,220	$151,600
Mezzanine Station	LF	5,000	2,800	11,000	500	2,500	-	-	2,800	14,000	1,500	7,500	7,000	35,000
Side Platform Station	LF	4,000	-	-	500	2,000	-	-	500	2,000	1,000	4,000	2,000	8,000
Tunnel	LF	2,900	4,550	12,600	3,440	10,000	-	-	500	1,450	1,200	3,500	9,490	27,550
Structure	LF	600	1,450	1,000	7,350	4,400	3,100	1,850	640	400	-	-	12,740	7,650
Structure Station	LF	1,800	-	-	500	600	-	-	-	-	-	-	500	600
Open Cut or Fill	LF	500	-	-	5,900	4,450	22,100	11,050	-	-	-	-	31,000	15,500
Open Cut Station	LF	1,000	-	-	500	500	2,000	2,000	-	-	-	-	2,500	2,500
Median Strip	LF	400	-	-	-	-	-	-	21,200	8,500	31,700	12,700	52,900	21,200
Median Strip Station	LF	800	-	-	-	-	-	-	1,500	1,200	2,000	1,600	3,500	2,800
River Bridge	LF	2,700	-	-	2,800	5,950	-	-	-	-	-	-	2,200	5,950
Pentagon Station	LF	1,000	-	-	950	950	-	-	-	-	-	-	950	950
Terminals (Including Parking)	LS	-	-	-	750	-	-	750	-	750	-	750	-	3,000
Undergrounding and Special Work	LS	-	-	-	3,000	-	-	3,000	-	4,000	-	3,000	-	18,000
Transfer Facilities	LS	-	-	-	1,900	-	-	-	-	100	-	-	-	2,350
Additional Right-of Way and Easements	LS	-	-	-	500	-	-	200	-	600	-	300	-	2,000
				$62,400		$46,950		$18,850		$100,050		$ 76,400		$304,650
Contingencies				12,500		9,400		3,750		20,000		15,300		60,950
Engineering				7,500		5,650		2,250		12,000		9,150		36,550
TOTAL*				$82,400		$62,000		$24,850		$132,050		$100,850		$402,150
Through 1965			$15,800	(19%)	$24,000	(39%)	$ -	-	$ 27,000	(20%)	$ 35,000	(35%)	$101,800	(25%)
Through 1970			57,600	(70%)	62,000	(100%)	-	-	55,300	(42%)	100,850	(100%)	275,750	(69%)
Through 1975			82,400	(100%)	62,000	(100%)	7,700	(31%)	132,050	(100%)	100,850	(100%)	385,000	(96%)
Through 1980			82,400	(100%)	62,000	(100%)	24,850	(100%)	132,050	(100%)	100,850	(100%)	402,150	(100%)

*-Does not include yards, shops and rolling stock.

TABLE B-2

PLAN IV--RECOMMENDED PLAN--(RAIL PORTION)
ESTIMATED CONSTRUCTION COST BY STAGE, ROUTE AND POLITICAL JURISDICTION

Stage	Route	Estimated Construction Cost--(Thousands of Dollars) Maryland: District of Columbia	Maryland: Montgomery County	Maryland: Prince Georges County	Virginia: Alexandria	Virginia: Arlington County	Virginia: Fairfax County	Total
Through 1965	DE	$ 15,800	$ -	-	-	$ -	-	$ 15,800
	F	13,400	-	-	-	10,600	-	24,000
	J	22,400	4,600	-	-	-	-	27,000
	K	30,300	4,700	-	-	-	-	35,000
		$ 81,900	$ 9,300	-	$10,600	-	-	$101,500
1966-1970	DE	$ 41,800	$ -	-	-	$ -	-	$ 41,800
	F	29,050	-	-	-	8,950	-	38,000
	J	28,200	100	-	-	-	-	28,300
	K	58,900	6,950	-	-	-	-	65,850
		$157,950	$ 7,050	-	-	$ 8,950	-	$173,950
1971-1975	DE	$ 24,800	$ -	-	$ -	$ -	$ -	$ 24,800
	F*	-	-	-	4,800	950	1,950	7,700
	J	68,700	8,050	-	-	-	-	76,750
		$ 93,500	$ 8,050	-	$ 4,800	$ 950	$1,950	$109,250
1976-1980	F*	$ -	$ -	-	$12,050	$ 1,400	$3,700	$ 17,150
TOTAL**		$333,350	$24,400	-	$16,850	$21,900	$5,650	$402,150

*-Extension of Rail Route F South of Airport Transfer Terminal.
**-Includes contingencies and engineering. Does not include yards, shops and rolling stock.

TABLE B-3

PLAN IV--RECOMMENDED PLAN (EXPRESS BUS PORTION)
ESTIMATED CONSTRUCTION COST
BY STAGE, ROUTE AND TYPE OF CONSTRUCTION

Stage	Route	Intermediate Stations Number	Intermediate Stations Cost (Add 000)	Terminals Number	Terminals Cost (Add 000)	Total (Add 000)
Through 1965	B	2	$ 900	1	$ 450	$ 1,350
	AB	1	450	-	-	450
	C	6	2,700	1	450	3,150
	D	3	1,350	1	450	1,800
	E	3	1,350	1	450	1,800
	DE	1	450	-	-	450
	F	5	2,250	1	450	2,700
	G	8	3,600	1	450	4,050
	FG	1	450	-	-	450
	H	6	2,700	1	450	3,150
	I	1	450	-	-	450
	J	3	1,350	1	450	1,800
	K	5	2,250	1	450	2,700
Total--Through 1965		45	$20,250	9	$4,050	$24,300
1966-1970	I	4	1,800	1	450	2,250
1971-1975	A	4	1,800	1	450	2,250
	C	4	1,800	-	-	1,800
1976-1980	-	-	-	-	-	-
TOTAL*		57	$25,650	11	$4,950	$30,600

*-Includes contingencies and engineering. Does not include shops, garages and rolling stock.

TABLE B-4

PLAN IV--RECOMMENDED PLAN--(EXPRESS BUS PORTION)
ESTIMATED CONSTRUCTION COST BY STAGE, ROUTE AND POLITICAL JURISDICTION

Stage	Route	Estimated Construction Cost--(Thousands of Dollars) Maryland: District of Columbia	Maryland: Montgomery County	Maryland: Prince Georges County	Virginia: Alexandria	Virginia: Arlington County	Virginia: Fairfax County	Total
Through 1965	B	$ 900	$ -	$ 450	$ -	$ -	$ -	$ 1,350
	AB	450	-	-	-	-	-	450
	C	2,700	-	450	-	-	-	3,150
	D	450	-	1,350	-	-	-	1,800
	E	1,350	-	450	-	-	-	1,800
	DE	450	-	-	-	-	-	450
	F	-	-	-	1,800	450	450	2,700
	G	-	-	-	1,350	1,350	1,350	4,050
	FG	-	-	-	-	450	-	450
	H	-	-	-	-	2,250	900	3,150
	I	450	-	-	-	-	-	450
	J	450	1,350	-	-	-	-	1,800
	K	900	1,800	-	-	-	-	2,700
Total--Through 1965		$ 8,100	$3,150	$2,700	$3,150	$4,500	$2,700	$24,300
1966-1970	I	900	1,350	-	-	-	-	2,250
1971-1975	A	450	-	1,800	-	-	-	2,250
	C	1,800	-	-	-	-	-	1,800
1976-1980	-	-	-	-	-	-	-	-
TOTAL*		$11,250	$4,500	$4,500	$3,150	$4,500	$2,700	$30,600

*-Includes contingencies and engineering. Does not include shops, garages and rolling stock.

TABLE B-5

PLAN II--ALL-BUS PLAN
ESTIMATED CONSTRUCTION COST
BY ROUTE AND POLITICAL JURISDICTION

Route	Estimated Construction Cost--(Thousands of Dollars) Maryland: District of Columbia	Maryland: Montgomery County	Maryland: Prince Georges County	Virginia: Alexandria	Virginia: Arlington County	Virginia: Fairfax County	Total
A	$ 450	$ -	$1,800	$ -	$ -	$ -	$ 2,250
B	900	-	450	-	-	-	1,350
AB	450	-	-	-	-	-	450
C	4,500	-	450	-	-	-	4,950
D	450	-	1,350	-	-	-	1,800
E	1,350	-	450	-	-	-	1,800
DE	450	-	-	-	-	-	450
F	3,900	-	-	1,800	450	450	6,600
G	3,900	-	-	1,350	1,350	1,350	7,950
FG	-	-	-	-	450	-	450
H	-	-	-	-	2,250	900	3,150
I	1,350	1,350	-	-	-	-	2,700
J	18,500	1,350	-	-	-	-	19,850
K	24,050	10,350	-	-	-	-	34,400
TOTAL*	$60,250	$13,050	$4,500	$3,150	$4,500	$2,700	$88,150

*-Includes contingencies and engineering. Does not include shops, garages and rolling stock.

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TABLE B-6

PLAN III--ALL-RAIL PLAN
ESTIMATED CONSTRUCTION COST BY ROUTES AND TYPES OF CONSTRUCTION

Type of Construction	Units	Unit Cost	Route AB Quantity	Route AB Cost (Add 000)	Route C Quantity	Route C Cost (Add 000)	Route D Quantity	Route D Cost (Add 000)	Route E Quantity	Route E Cost (Add 000)	Route F Quantity	Route F Cost (Add 000)	Route G Quantity	Route G Cost (Add 000)	Route H Quantity	Route H Cost (Add 000)	Route J Quantity	Route J Cost (Add 000)	Route K Quantity	Route K Cost (Add 000)	Total Quantity	Total Cost (Add 000)
Cut and Cover	LF	$2,650	4,400	$11,650	22,700	$ 60,150	11,950	$ 31,650	-	$ -	3,710	$ 9,850	3,600	$ 9,550	7,100	$18,800	25,310	$ 67,050	16,250	$ 43,050	95,080	$251,750
Mezzanine Station	LF	5,000	-	-	3,000	15,000	2,200	11,000	-	-	500	2,500	500	2,500	500	2,500	2,800	14,000	1,500	7,500	11,000	55,000
Side Platform Station	LF	4,000	-	-	-	-	-	-	-	-	500	2,000	-	-	-	-	500	2,000	1,000	4,000	2,000	8,000
Tunnel	LF	2,900	-	-	5,600	16,250	4,350	12,600	-	-	3,440	10,000	-	-	6,000	17,400	500	1,450	1,200	3,500	21,090	61,200
Structure	LF	600	-	-	-	-	1,650	1,000	-	-	10,450	6,250	-	-	-	-	640	400	-	-	12,740	7,650
Structure Station	LF	1,200	-	-	-	-	-	-	-	-	500	600	-	-	-	-	-	-	-	-	500	600
Open Cut or Fill	LF	500	27,350	13,700	-	-	23,200	11,600	15,700	7,850	31,000	15,500	18,000	9,000	-	-	-	-	-	-	115,250	57,650
Open Cut Station	LF	1,000	2,500	2,500	-	-	2,000	2,000	1,000	1,000	2,500	2,500	1,000	1,000	-	-	-	-	-	-	9,000	9,000
Median Strip	LF	400	2,600	1,050	-	-	-	-	-	-	-	-	-	-	32,900	13,150	21,200	8,500	31,700	12,700	88,400	35,400
Median Strip Station	LF	800	-	-	-	-	-	-	-	-	-	-	-	-	2,500	2,000	1,500	1,200	2,000	1,600	6,000	4,800
River Bridge	LF	2,700	-	-	-	-	-	-	-	-	2,200	5,950	-	-	-	-	-	-	-	-	2,200	5,950
Pentagon Station	LF	1,000	-	-	-	-	-	-	-	-	950	950	-	-	-	-	-	-	-	-	950	950
Terminals (Excluding Parking)	LS	-	-	750	-	750	-	750	-	600	-	750	-	600	-	750	-	750	-	750	-	6,450
Underpinning and Special Work	LS	-	-	1,500	-	4,000	-	3,000	-	-	-	8,000	-	2,000	-	3,000	-	4,000	-	3,000	-	28,500
Transfer Facilities	LS	-	-	-	-	-	-	1,900	-	-	-	350	-	-	-	-	-	100	-	-	-	2,350
Additional Rights-of-Way and Easements	LS	-	-	500	-	500	-	400	-	-	-	600	-	300	-	600	-	600	-	300	-	3,800
Additional E Street Tracks	LS	-	-	4,100	-	4,100	-	4,100	-	4,100	-	-	-	-	-	5,150	-	5,150	-	-	-	26,700
				$35,750		$100,750		$ 80,000		$13,550		$65,800		$24,950		$63,350		$105,200		$ 76,400		$565,750
Contingencies				7,150		20,150		16,000		2,700		13,150		5,000		12,650		21,050		15,300		113,150
Engineering				4,300		12,100		9,600		1,600		7,900		3,000		7,600		12,600		9,150		67,850
TOTAL*				$47,200		$133,000		$105,600		$17,850		$86,850		$32,950		$83,600		$138,850		$100,850		$746,750

*-Does not include yards, shops and rolling stock.

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TABLE B-7

PLAN III--ALL-RAIL PLAN
ESTIMATED CONSTRUCTION COST BY ROUTE AND POLITICAL JURISDICTION

	Estimated Construction Cost--(Thousands of Dollars)						
		Maryland		Virginia			
Route	District of Columbia	Montgomery County	Prince Georges County	Alexandria	Arlington County	Fairfax County	Total
AB	$ 34,050	$ -	$13,150	$ -	$ -	$ -	$ 47,200
C	113,700	-	19,300	-	-	-	133,000
D	94,600	-	11,000	-	-	-	105,600
E	17,850	-	-	-	-	-	17,850
F	42,450	-	-	16,850	21,900	5,650	86,850
G	-	-	-	4,250	28,700	-	32,950
H	36,500	-	-	-	40,750	6,350	83,600
J	126,100	12,750	-	-	-	-	138,850
K	89,200	11,650	-	-	-	-	100,850
TOTAL*	$554,450	$24,400	$43,450	$21,100	$91,350	$12,000	$746,750

*-Includes contingencies and engineering. Does not include yards, shops and rolling stock.

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TABLE 3-8

PLAN IV--1980 RECOMMENDED PLAN

EXPRESS BUS STATION SUMMARY

Route	Number	Location or Area Served
A	1*	New York Avenue
	2	16th Street N.E.--South Dakota Avenue
	3	Intermediate Loop
	4	Green Meadows
	5	University of Maryland
	Terminal	Brookville--Northwest Park
B	1*	Northeast Route
	2	Hladensburg Road
	3	Intermediate Loop
	Terminal	Hladensburg--Cheverly
C	1-1A	Southeast Hall Route
	2-2A	11th Street Leg--Inner Loop Freeway
	3-3A	Armory--Anacostia Park
	4	Anacostia Freeway
	5	Intermediate Loop
	6	Division Avenue
	7	Southern Avenue
	Terminal	Suit Plesasant
D	1	Intermediate Loop
	2	Branch Avenue
	3	Suitland--Census Bureau
	Terminal	Suitland
E	1	Naval Air Station
	2	Bolling Air Force Base
	3	Naval Research Laboratory
	Terminal	Circumferential Highway--Forest Heights
G	1	Pentagon
	2	Navy Annex
	3	Intermediate Loop--Four Mile Run
	4	Leesburg Turnpike
	5	Seminary Road
	6	Little River Turnpike--Annandale
	7	Bluell Road--Indian Springs
	8	Circumferential Highway
	Terminal	Springfield
H	1	George Washington Memorial Parkway
	2	North Kirkwood Road
	3	Intermediate Loop
	4	Washington Boulevard--Lexington Street
	5	West Falls Church
	6	Leesburg Turnpike (Virginia 7)
	Terminal	Circumferential Highway--Merrifield
I	1	Key Bridge--Georgetown University
	2	Bluell Road
	3	Wells Bridge
	4	Tenleytown--Friendship Area
	5	Zero Zero
	Terminal	Wells Zero

*Express stations shared with other bus routes.

RAIL STATION SUMMARY

Route	Number	Location or Area Served	Type
All	A	12th and H Streets N.W.	Mezzanine
RE	1	Judiciary Square	Mezzanine
	2	Union Station	Mezzanine
	3	Capitol-East Mall	Mezzanine
	4	Gun Factory	Mezzanine
	Terminal	Southeast District of Columbia	
F	1	Federal Triangle	Side Platform
	2	Bureau of Engraving and Printing--Agriculture--South Mall	Mezzanine
	3	Pentagon Transfer	Structure
	4	Pentagon	-
	5	Airport Transfer Terminal	Open Cut
	6	Intermediate Loop	Open Cut
	7	North Alexandria	Open Cut
	8	Duke Street--South Alexandria	Open Cut
	9	Circumferential Highway	Open Cut
	Terminal	Jefferson Manor	
J	1	17th and 16th Streets N.W.	Mezzanine
	2	K Street N.W.	Mezzanine
	3	DuPont Circle	Mezzanine
	4	California and S Street	Side Platform
	5	Massachusetts-Wisconsin Avenues	Mezzanine
	6	Tenley Circle--Intermediate Loop	Mezzanine
	7	Friendship Heights--District of Columbia Line	Median Strip
	8	East-West Highway--Bethesda	Median Strip
	9	Naval Medical Center and National Institute of Health	Median Strip
	Terminal	Rooks Hill	
K	1	Massachusetts Avenue	Mezzanine
	2	P Street--Logan Circle	Side Platform
	3	Columbia Road--Harvard Street	Side Platform
	4	Illinois Avenue--Grant Circle	Mezzanine
	5	Intermediate Loop--Missouri Avenue	Median Strip
	6	Georgia Avenue--Army Medical Center	Median Strip
	7	Georgia Avenue--Silver Spring	Median Strip
	8	Circumferential Highway	Median Strip
	Terminal	Wheaton Area	

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APPENDIX C

Eno Center for Transportation

TABLE C-1 ESTIMATED OPERATING REVENUES AND MAINTENANCE AND OPERATING EXPENSES ALTERNATE TRANSIT PLANS WITH RECOMMENDED SYSTEM OF HIGHWAYS--1980

	Annual Revenues and Expenses (Thousands of Dollars)		
	Plan II All Express Bus	Plan III All Rail Rapid Transit	Plan IV Combined Bus and Rail
Operating Revenues			
Rapid Transit Revenues	$50,050	$63,600	$62,750
Less Revenues Allocated to Feeder Service	3,650	11,700	11,250
Total	$46,400	$51,900	$51,500
Maintenance and Operating Expenses			
Express Buses	$37,300	$ -	$20,650
Rail Rapid Transit	-	31,000	17,900
Total	$37,300	$31,000	$38,550
Net Revenues			
Before Fixed Charges on Shops, Garages and Yards	$ 9,100	$20,900	$12,950
Less Fixed Charges on Shops, Garages and Yards*	900	1,300	1,250
Total	$ 8,200	$19,600	$11,700

*Fixed charges on 35-year, 5% bonds for $7,500 per acre for shops and garages and $10,000 per 3-car articulated unit for shops and yards.

TABLE C-2

PLAN II
TRANSIT ROUTE CHARACTERISTICS OF ALL-BUS PLAN--1980

Route	Direction from CBD	Location	Outer Terminal (Suburb)	Length in Round Trip Miles from CBD	Heaviest Load Point* 1980 Passengers 24-Hour Total Both Ways	1980 Passengers Peak Hour One-Way	Peak Hour One-Way Buses	Headway in Seconds
A	NE	Northeast Freeway	Branchville	18.5	61,940	9,291	155	23
B	NE	Baltimore-Washington Parkway and New York Avenue	Bladensburg	13.6	30,890	4,634	77	47
C	E	E. Capitol Street	East Pleasant	13.8	101,055	15,158	253	14
D	SE	Suitland Parkway	Suitland	16.2	67,050	10,058	168	21
E	S	Anacostia Freeway	-	16.3	48,320	7,248	121	30
F	S	Potomac River Drive	Alexandria	18.6	82,935	12,440	207	17
G	SW	Shirley Highway	Springfield	24.5	46,940	7,041	117	31
H	W	Interstate Route 66	Merrifield (Falls Church)	23.4	95,940	14,391	240	15
I	NW	George Washington Memorial Parkway--Maryland	Cabin John	20.1	18,497	2,775	46	78
J	NW	Wisconsin Avenue	Bethesda	21.0	101,191	15,179	253	15
K	N	North-Central Freeway	Wheaton	21.6	101,580	15,237	254	14
Total				207.6	756,338	113,452	1,891	

*-Based on elimination or restrictions on the use of certain close-in stations as discussed in the text.

TABLE C-3

PLAN III
TRANSIT ROUTE CHARACTERISTICS OF ALL-RAIL PLAN--1980

Route	Direction from CBD	Location	Outer Terminal (Suburb)	Length in Round Trip Miles from CBD	Heaviest Load Point 1980 Passengers 24-Hour Total Both Ways	1980 Passengers Peak Hour One-Way	Peak Hour One-Way Units	Headway in Minutes
AB	NE	Baltimore & Ohio Railroad	College Park	16.3	117,635	17,645	50*	2-1/4
C	E	E. Capitol Street	East Pleasant	14.4	101,055	15,158	60*	2-2/3
D	SE	Suitland Parkway	Suitland	17.0	87,729	13,159	60*	3
E	S	Anacostia Freeway	District	13.9	67,666	10,150	46*	3
F	S	Richmond, Fredericksburg and Potomac Railroad	Alexandria	18.1	82,935	12,440	57	3
G	SW	Shirley Highway	Alexandria	14.6	46,940	7,041	32	4
H	W	Interstate Route 66	Merrifield (Falls Church)	20.0	95,940	14,391	66	3
J	NW	Wisconsin Avenue	Bethesda	19.9	168,330	25,250	115	2
K	N	13th Street N.W.--Baltimore & Ohio Railroad	Kensington	20.3	179,145	26,872	122	1-1/2
Total				154.5	947,375	142,106	[illegible]	

*-These would be combined into two- and three-unit trains.

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TABLE C-4

PLAN IV
TRANSIT ROUTE CHARACTERISTICS OF RECOMMENDED PLAN--1955

Route	Direction from CBD	Location	Outer Terminal (Suburb)	Length in Round Trip Miles from CBD	Heaviest Load Points* 1955 Passengers 24-Hour Total Both Ways	Peak Hour One-Way	Peak Hour One-Way Buses	Headway in Seconds
B	NE	Baltimore-Washington Parkway and New York Avenue	Bladensburg	13.6	24,195	3,629	60	60
C	E	E. Capitol Street	Seat Pleasant	13.8	46,469	6,973	116	31
D	SE	Suitland Parkway	Suitland	15.2	43,162	6,474	108	33
E	S	Anacostia Freeway	-	16.3	38,027	5,704	95	38
F	S	Potomac River Drive	Alexandria	12.6	37,879	8,682	145	25
G	SW	Shirley Highway	Springfield	24.5	42,599	6,390	107	34
H	W	Interstate Route 66	Merrifield (Falls Church)	23.4	55,602	8,790	147	25
I	NW	George Washington Memorial Parkway--Maryland	-	20.1	14,142	2,121	35	103
J	NW	Wisconsin Avenue	Bethesda	21.0	51,293	8,554	143	25
K	N	North Central Freeway	Wheaton	21.6	56,888	3,990	165	22
Total				189.1	448,456	67,267	1,121	

*-Based on elimination or restrictions on the use of certain close-in stations as discussed in the text.

TABLE C-5

PLAN IV
TRANSIT ROUTE CHARACTERISTICS OF RECOMMENDED PLAN--1980

Route	Direction from CBD	Location	Outer Terminal (Suburb)	Length in Round Trip Miles from CBD	Heaviest Load Points** 1980 Passengers 24-Hour Total Both Ways	Peak Hour One-Way	Peak Hour One-Way Units or Buses	Headway
			RAIL ROUTES				(Units)*	(Minutes)
12	SE	2nd and 4th Streets S.E.	District	7.5	155,395	23,309	196	2
F	S	Richmond, Fredericksburg and Potomac Railroad	Alexandria	18.1	82,935	12,440	57	3
J	NW	Wisconsin Avenue	Bethesda	19.9	152,619	22,893	104	2
K	N	13th Street N.W. and North Central	Wheaton	20.3	179,145	26,872 Total Units	122 389	1-1/2
			BUS ROUTES				(Buses)	(Seconds)
A	NE	Northeast Freeway	Branchville	18.5	61,960	9,291	155	23
B	NE	Baltimore-Washington Parkway and New York Avenue	Bladensburg	13.6	30,990	4,634	77	47
C	E	E. Capitol Street	Seat Pleasant	13.8	101,055	15,158	253	14
D	SE	Suitland Parkway	Suitland	9.0	67,050	10,058	168	21
E	S	Anacostia Freeway	-	9.9	48,220	7,248	121	30
G	SW	Shirley Highway	Springfield	24.5	46,940	7,041	117	31
H	W	Interstate Route 66	Merrifield (Falls Church)	23.4	95,940	14,391	240	15
I	NW	George Washington Memorial Parkway--Maryland	-	20.1	18,497	2,775	46	78
Total				198.6	1,040,726	156,110	1,177 Total Buses	

*-Units would be combined into two- and three-unit trains.
**-Based on elimination or restrictions on the use of certain close-in stations on specific bus routes as discussed in the text.

Eno Center for Transportation

TABLE I-6

PLAN II
NUMBER OF PASSENGERS BY TRANSIT ROUTES
BETWEEN FARE ZONES FOR THE ALL-EXPRESS BUS PLAN--1980

24-Hour Weekday--Both Ways

Route	Fare Zone	Routes A and B	Route A			Route B		Route C			Routes D and E	Route D		Route E		Routes F and G	Route F		Route G				Route H				Route I				Route J				Route K					Total
		0	1	2	3	1	2	0	1	2	0	1	2	1	2	0	1	2	1	2	3	4	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	4	
Sector Zero		51,885	10,000	15,839	9,012	-	14,591	16,940	19,810	17,773	13,075	29,265	7,113	18,660	8,962	18,349	23,136	9,243	10,608	-	-	12,239	14,746	17,842	14,195	8,352	2,505	3,878	3,024	2,195	23,912	21,166	20,294	23,203	42,530	12,592	40,317	6,250	6,300	48,498
A and B	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	197	170	-	-	1,243	1,685	-	-	1,600	1,400	-	-	-	-
A	1		-	135	1,235	-	1,260	-	380	400	1,525	3,340	360	-	400	810	1,200	450	520	-	-	525	-	1,215	655	640	-	94	205	149	-	186	1,576	1,730	-	-	286	44	45	17,770
	2			-	-	-	-	2,646	895	-	1,070	750	-	740	-	395	665	-	-	-	-	-	360	470	-	-	56	30	-	-	694	295	-	-	-	-	-	-	-	7,311
	3				-	-	-	846	250	-	[illegible]	440	-	455	-	275	435	-	-	-	-	-	230	300	-	-	33	20	-	-	398	195	-	-	-	-	-	-	-	3,378
B	1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2						-	1,525	475	-	990	735	-	705	-	415	675	-	-	-	-	-	375	475	-	-	54	31	-	-	631	309	-	-	-	-	-	-	-	5,774
C	0							-	2,730	1,495	270	-	430	895	500	1,040	1,475	550	700	-	-	705	-	1,390	705	690	-	106	207	150	1,125	209	1,589	1,749	6,765	-	2,635	408	412	20,770
	1								-	495	1,285	-	190	680	235	760	1,200	505	545	-	-	600	-	1,250	695	565	185	243	192	139	2,215	1,907	1,476	1,388	-	2,785	2,132	330	333	18,839
	2									-	940	455	-	1,000	-	260	1,010	-	-	-	-	-	555	605	-	-	72	16	-	-	903	164	-	-	1,600	190	-	-	-	4,327
D and E	0										-	1,150	700	-	805	1,285	1,735	550	850	-	-	665	760	730	745	540	330	96	180	131	2,510	189	1,385	1,464	4,695	-	5,464	846	895	2,655
D	1											700	600	1,080	425	1,155	1,755	400	540	-	-	450	920	1,010	520	375	70	323	132	96	1,985	2,722	1,013	1,079	1,730	4,195	1,190	184	186	21,121
	2												-	275	-	440	420	-	-	-	-	-	200	270	-	-	37	27	-	-	458	273	-	-	825	350	-	-	-	2,292
E	1													-	960	765	1,000	420	520	-	-	485	-	1,040	585	435	-	217	152	110	1,235	428	1,168	1,190	-	-	1,277	198	200	11,131
	2														-	505	450	-	-	-	-	-	240	250	-	-	43	33	-	-	572	327	-	-	965	445	-	-	-	2,282
F and G	0															545	2,220	980	945	-	-	2,100	1,405	1,105	865	425	141	145	123	90	1,584	930	950	1,227	3,400	1,340	1,526	236	238	17,535
F	1																-	1,555	390	-	-	-	1,875	910	880	455	109	163	183	133	1,446	1,052	1,405	1,579	3,155	1,840	1,014	157	159	13,859
	2																	-	-	-	-	-	410	460	-	-	52	34	-	-	638	341	-	-	700	625	1,624	252	254	4,952
G	1																		-	-	-	-	385	-	-	-	82	44	-	-	688	441	-	-	1,500	900	496	77	77	2,502
	2																			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3																				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4																					-	670	150	-	-	61	40	-	-	764	395	-	-	890	750	-	-	-	2,066
H	0																						-	-	1,195	420	119	88	127	92	1,751	622	973	963	-	-	896	139	140	5,774
	1																							-	215	185	124	80	137	99	1,006	595	1,047	1,157	2,830	1,475	1,426	221	223	6,834
	2																								-	-	145	47	-	-	1,490	463	-	-	1,505	825	-	-	-	1,480
	3																									-	63	69	-	-	532	686	-	-	1,200	750	-	-	-	1,568
I	0																										-	-	-	-	-	-	-	-	-	193	193	30	30	446
	1																											-	-	-	144	-	-	-	264	44	4	-	1	49
	2																												-	-	383	341	-	-	-	-	-	-	-	341
	3																													-	276	247	-	-	-	-	-	-	-	247
J	0																														-	1,431	2,936	2,328	-	327	1,878	290	294	-
	1																															-	2,620	1,942	1,411	86	42	6	7	4,703
	2																																-	-	-	-	-	-	-	-
	3																																	-	-	3,385	2,814	436	440	-
K	0																																		-	-	-	-	-	-
	1																																			-	3,173	492	495	4,160
	2																																				-	-	-	-
	3																																					-	-	-
	4																																						-	-
Total		-	10,000	15,974	10,247	-	15,851	21,955	24,450	20,163	-	36,845	9,393	24,490	12,307	25,714	35,641	14,103	14,768	-	-	17,104	22,371	28,741	20,510	12,542	3,951	5,728	4,482	3,253	-	34,294	34,111	37,207	-	29,385	58,231	9,024	9,100	62,855

LEGEND

000 Number of trips used in estimating revenues, equipment requirements, and maintenance and operating expenses.

000 Number of trips between Sector Zero and stations which were eliminated or restricted to directional use. These trips are assumed to be lost to the rapid transit system.

000 Number of intra-line trips between eliminated stations and other stations on Routes J and K. These trips are assumed to be lost to the rapid transit system.

000 Number of through trips using the rapid transit system to and from Sector Zero, but transferring to local buses to reach the vicinity of stations eliminated or restricted to directional use. These trips are included in the black figures under the appropriate rapid transit route.

000 Number of trips originally assigned between pairs of stations, both of which were eliminated or restricted to directional use. These trips are assumed to be lost to the rapid transit system.

TABLE I-6

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TABLE C-7

PLAN III
NUMBER OF PASSENGERS BY TRANSIT ROUTES
BETWEEN FARE ZONES FOR THE ALL-RAIL RAPID TRANSIT PLAN--1980

24-Hour Weekday--Both Ways

TABLE C-7

Route	Fare Zone	Route AB				Route C			Routes D and E	Route D		Route E	Routes F and G	Route F		Route G	Route H				Route J				Route K				Total
		0	1	2	3	0	1	2	0	1	2	1	0	1	2	1	0	1	2	3	0	1	2	3	0	1	2	3	
	Sector Zero	30,095	8,475	23,865	11,880	8,780	16,390	14,430	13,675	25,550	5,830	24,850	12,100	16,800	7,355	17,490	12,235	13,275	10,455	6,080	25,890	21,085	23,156	21,739	42,530	10,865	32,975	10,265	467,515
AB	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,440	1,855	-	-	1,600	1,400	-	-	6,295
A	1		-	970	1,560	-	390	400	1,525	3,340	360	420	810	1,200	450	1,045	-	1,215	655	640	-	280	1,930	1,730	-	-	286	89	19,295
	2			-	-	3,880	1,195	-	1,780	1,285	-	1,230	660	1,105	-	-	605	785	-	-	1,200	545	-	-	-	-	-	-	14,210
	3				-	1,195	385	-	900	650	-	670	425	670	-	-	360	460	-	-	660	335	-	-	-	-	-	-	6,650
C	0					-	2,730	1,495	270	-	430	1,395	1,040	1,475	550	1,405	-	1,390	705	690	1,125	315	1,946	1,749	6,765	-	2,635	820	28,930
	1						-	495	1,205	-	190	915	760	1,200	505	1,145	-	1,250	695	565	2,400	2,150	1,807	1,388	-	2,785	2,132	663	22,250
	2							-	840	455	-	1,000	260	1,010	-	-	555	605	-	-	975	180	-	-	1,600	190	-	-	7,670
D and E	0								-	1,150	700	805	1,265	1,735	550	1,515	760	730	745	540	2,900	285	1,696	1,464	4,695	-	5,464	1,701	28,700
D	1									700	600	1,505	1,155	1,755	400	990	920	1,010	520	375	2,055	3,045	1,241	1,079	1,730	4,195	1,190	370	24,835
	2										-	275	440	420	-	-	200	270	-	-	495	300	-	-	825	350	-	-	3,575
E	1											960	1,270	1,450	420	1,005	240	1,290	585	435	1,850	1,005	1,430	1,190	965	445	1,277	398	16,215
F and G	0												545	2,220	980	3,045	1,405	1,105	865	425	1,725	1,075	1,163	1,227	3,400	1,340	1,526	474	22,520
F	1													-	1,555	390	1,875	910	880	455	1,555	1,215	1,721	1,579	3,155	1,840	1,014	316	18,460
	2														-	-	410	460	-	-	690	375	-	-	700	625	1,624	506	5,390
G	1															-	1,055	150	-	-	1,595	980	-	-	2,390	1,650	496	154	8,410
H	0																-	-	1,195	420	1,870	710	1,192	963	-	-	896	279	7,525
	1																	-	215	185	1,130	675	1,883	1,157	2,830	1,475	1,426	444	10,820
	2																		-	-	1,635	510	-	-	1,505	825	-	-	4,475
	3																			-	595	755	-	-	1,200	750	-	-	3,300
J	0																				-	1,575	3,597	2,328	-	520	2,071	644	10,735
	1																					-	3,208	1,942	1,675	130	46	14	7,015
	2																						-	-	-	-	-	-	-
	3																							-	-	-	-	-	-
K	0																								-	3,385	2,814	876	7,075
	1																									-	3,173	987	4,160
	2																										-	-	-
	3																											-	-
Total		30,095	8,475	24,235	13,440	13,795	21,030	16,820	20,195	33,130	8,110	34,025	20,730	31,040	12,765	28,030	20,620	24,905	17,515	10,810	51,785	39,190	45,370	39,535	77,565	32,770	61,045	19,000	756,025

NOTE: Number of trips shown in this table were used in estimating revenues, equipment requirements, and maintenance and operating expenses.

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PLAN IV
NUMBER OF PASSENGERS BY TRANSIT ROUTES
BETWEEN FARE ZONES FOR THE RECOMMENDED PLAN--1965

24-Hour Weekday--Both Ways

Route	Fare Zone	Route B			Route C			Routes D and E	Route D		Route E		Routes F and G	Route F			Route G				Route H				Route I			Route J				Route K					Total
		0	1	2	0	1	2	0	1	2	1	2	0	1	2	3	1	2	3	4	0	1	2	3	0	1	2	0	1	2	3	0	1	2	3	4	
	Sector Zero	-	4,167	11,994	-	23,297	10,335	-	25,467	2,660	17,580	8,711	17,526	21,463	-	6,548	15,206	-	4,816	2,752	14,125	15,139	6,654	5,997	5,478	-	3,340	1,202	-	14,797	14,426	10,744	35,793	21,367	16,044	10,209	1,880	313,924
		13,665			6,348			9,514					762															17,707									
B	0	-	163	1,343	-	8,021	673	-	-	247	798	821	1,066	940	-	388	687	-	188	809	550	546	850	363	214	-	160	73	-	615	1,191	409	-	880	685	551	74	1,506
	1	-	192		-	91	52	-	457	50	252	46	138	181	-	54	132	-	30	35	117	117	71	75	45	-	40	20	-	217	283	100	-	410	62	39	5	3,311
					50			891					117															853				780					
	2		-		-	-	-	-	619	-	531	-	472	508	-	-	243	-	-	-	279	353	-	-	114	-	-	-	-	250	-	-	-	40	-	-	-	3,409
					158			618					380															505				67					
C	0				-	-	50	-	457	50	252	46	138	181	-	54	132	-	30	35	117	117	71	75	180	-	40	20	-	362	883	100	-	646	62	39	5	50
													117															853									
	1				-	-	366	-	-	125	-	92	729	804	-	292	587	-	185	197	491	150	302	324	181	-	162	89	-	491	1,218	383	-	876	600	270	54	8,968
								1,008					335															941				3,089					
	2				-	-	-	294	294	-	620	-	442	472	-	-	214	-	-	-	254	293	-	-	87	-	-	-	496	531	-	-	914	855	-	-	-	4,062
D and E	0							-	246	414	-	258	880	885	-	266	602	-	151	167	434	446	251	252	241	-	124	70		520	937	326		884	540	271	54	918
																												805				2,539					
D	1								-	143	-	14	1,638	1,174	-	272	794	-	152	169	818	724	252	254	326	-	125	70	20	1,036	937	327	146	1,591	540	272	55	11,682
																																	60	-	-	-	1,291
	2								-	-	86	-	318	239	-	-	106	-	-	-	136	141	-	-	36	-	-	-	20	169	-	-	1,641	910	500	425	52	8,038
																												133				112	48	-	-	-	1,819
E	1										-	20	795	732	-	195	534	-	92	104	439	438	265	255	232	-	136	64	7	544	968	338	1,641	910	500	425	52	8,038
												-																	162	-	-		48	-	-	-	1,819
	2												718	298	-	-	142	-	-	-	210	204	-	-	37	-	-	-		744	1,078	421		1,014	542	405	52	16,111
F and G	0												1,667	4,308	-	1,041	1,848	-	656	307	-	398	688	459	369	254	-	166	92	1,882	187	449	158	3,189	333	240	192	86	
																							311	138	101	97		60	89								
F	1													-	-	344	302	-	123	218	-	-	416	294	318	179	-	143	85	1,100	577	1,137	382	2,145	1,020	600	478	58	6,674
	2															-	-	-	-	-	-	-	58	-	-	49	-	-	-	160	197	-	-	396	201	-	-	-	591
	3																86	-	-	-																	
G	1																	-	220	100	-	-	-	214	144	-	58	43	671	421	572	190	1,570	747	310	168	28	3,215
	2																																				
	3																																				
	4																				22	-	-	-	24	-	-	-	115	-	-	90	56	-	-	-	817
																					5	-	-	-	31	-	-	-	136	-	-	137	70	-	-	-	242
H	0																	-	384	330	199	-	57	47	2,359	487	752	241	1,058	575	330	264	32	3,698
	1																	-	-	143	142	-	39	63	664	426	338	273	1,803	572	425	330	36	2,787
																									496	232	-	-	630	322	-	-	-	673
	2																	-	-	-	119	-	-	-	41	393	-	-	237	147	-	-	-	581
	3																								47											
I	0																									-	96	164	31	32	40	44	7	383
	1																									-	-	-	895	-	-	-	-	-
	2																																				
	3																																				
J	0																									-	835	382	683	-	-	227	83	69	-	
	1																										495	492	948	-	-	-	-	-	987	
	2																																				
	3																																				
K	0																															-	3,064	1,002	2,000	-	
	1																																-	1,471	1,011	341	2,823
	2																																				
	3																																				
	4																																				
Total		-	4,330	13,589	-	23,388	10,803	-	27,083	3,392	19,069	9,141	24,443	30,179	-	8,746	20,194	-	6,274	3,882	16,869	18,748	8,681	8,279	7,718	-	4,266	1,775	-	21,985	22,300	14,055	-	30,913	21,464	13,914	2,600	397,960

LEGEND

000 Number of trips used in estimating revenues, equipment requirements, and maintenance and operating expenses.

000 Number of trips between Sector Zero and stations which were eliminated or restricted to directional use. These trips are assumed to be lost to the rapid transit system.

000 Number of intra-line trips between eliminated stations and other stations on Routes J and K. These trips are assumed to be lost to the rapid transit system.

000 Number of through trips using the rapid transit system to and from Sector Zero, but transferring to local buses to reach the vicinity of stations eliminated or restricted to directional use. These trips are included in the black figures under the appropriate rapid transit route

Number of trips originally assigned between pairs of stations, both of which were eliminated or restricted to directional use. These trips are assumed to be lost to the rapid transit system.

Eno
Center for Transportation

TABLE C-9

PLAN IV
NUMBER OF PASSENGERS BY TRANSIT ROUTES
BETWEEN FARE ZONES FOR THE RECOMMENDED PLAN--1980

24-Hour Weekday--Both Ways

TABLE C-9

Route	Fare Zone	Routes A and B	Route A			Route B		Route C			Route DE	Route D		Route E		Routes F and G	Route F		Route G				Route H				Route I				Route J				Route K				Total
		0	1	2	3	1	2	0	1	2	0	1	2	1	2	0	1	2	1	2	3	4	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	
	Sector Zero	30,095	8,475	14,075	8,000	-	13,070	8,780	16,390	14,430	13,675	25,550	5,830	17,425	7,425	12,100	16,800	7,355	7,570	-	-	9,920	12,235	13,275	10,455	6,080	2,175	3,374	2,461	1,786	25,155	19,566	18,909	21,739	44,130	12,265	32,975	10,265	443,715
A and B	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	197	170	-	-	1,243	1,685	-	-	1,600	1,400	-	-	-
A	1	-	135	1,235	-	1,160	-	390	400	1,525	3,340	360	-	420	810	1,200	450	520	-	-	525	-	1,215	655	640	-	94	205	149	-	186	1,576	1,730	-	-	286	89	19,295
	2		-	-	-	-	-	2,645	895	-	1,070	760	-	740	-	395	665	-	-	-	-	-	360	470	-	-	56	30	-	-	694	295	-	-	-	-	-	-	9,075
	3			-	-	-	-	845	150	-	620	440	-	455	-	275	435	-	-	-	-	-	230	300	-	-	33	20	-	-	392	195	-	-	-	-	-	-	4,390
B	1				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2					-	-	1,525	475	-	990	735	-	705	-	415	675	-	-	-	-	-	375	475	-	-	54	31	-	-	631	309	-	-	-	-	-	-	7,395
C	0																																						
	1							-	2,730	1,495	270	-	430	895	500	1,040	1,475	550	700	-	-	705	-	1,390	705	690	-	106	207	150	1,125	209	1,589	1,749	6,765	-	2,635	820	28,930
	2								-	495	1,205	-	190	680	235	760	1,200	505	545	-	-	600	-	1,250	695	565	185	243	192	139	2,215	1,907	1,476	1,388	-	2,785	2,132	663	22,250
										-	840	455	-	1,000	-	260	1,010	-	-	-	-	-	555	605	-	-	72	16	-	-	903	164	-	-	1,600	190	-	-	7,670
DE	0										-	1,150	700	-	805	1,265	1,735	550	850	-	-	665	760	730	745	540	330	96	180	131	2,570	189	1,385	1,464	4,695	-	5,464	1,701	28,700
D	1											700	600	1,080	425	1,155	1,755	400	540	-	-	450	920	1,010	520	375	70	323	132	96	1,985	2,722	1,013	1,079	1,730	4,195	1,190	370	24,835
	2												-	275	-	440	420	-	-	-	-	-	200	270	-	-	37	27	-	-	458	273	-	-	825	350	-	-	3,575
E	1													-	960	765	1,000	420	520	-	-	485	-	1,040	585	435	-	217	152	110	1,235	428	1,168	1,190	-	-	1,277	398	12,385
	2														-	505	450	-	-	-	-	-	240	250	-	-	43	33	-	-	572	327	-	-	965	445	-	-	3,830
F and G	0															545	2,220	980	945	-	-	2,100	1,405	1,105	865	425	141	145	123	90	1,584	930	950	1,227	3,400	1,340	1,526	474	22,520
F	1																-	1,555	390	-	-	-	1,875	910	880	455	109	163	183	133	1,446	1,052	1,405	1,579	3,155	1,840	1,014	316	18,460
	2																	-	-	-	-	-	410	460	-	-	52	34	-	-	638	341	-	-	700	625	1,624	506	5,390
G	1																		-	-	-	-	385	-	-	-	82	44	-	-	688	441	-	-	1,500	900	496	154	4,690
	2																			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3																			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4																				-	-	670	150	-	-	61	40	-	-	764	395	-	-	890	750	-	-	3,720
H	0																						-	-	1,195	420	119	88	127	92	1,751	622	973	963	-	-	896	279	7,525
	1																						-	215	185	124	80	137	99	1,006	595	1,047	1,157	2,830	1,475	1,426	444	10,820
	2																							-	-	145	47	-	-	1,490	463	-	-	1,505	825	-	-	4,475
	3																								-	63	69	-	-	532	686	-	-	1,200	750	-	-	3,300
I	0																										-	-	-	-	-	-	-	-	-	193	193	60	446
	1																											-	-	-	144	-	-	-	264	44	4	1	457
	2																												-	-	383	341	-	-	-	-	-	-	724
	3																													-	278	247	-	-	-	-	-	-	525
J	0																														-	1,431	2,936	2,328	-	327	1,878	584	9,484
	1																														-	-	2,620	1,942	1,411	86	42	13	6,114
	2																																-	-	-	-	-	-	-
	3																																	-	-	-	-	-	-	-
K	0																																		-	3,385	2,814	876	7,075
	1																																		-	-	3,173	987	4,160
	2																																				-	-	-
	3																																					-	-
Total		-	8,475	14,210	9,235	-	14,230	13,795	21,030	16,820	20,195	33,130	8,110	23,255	10,770	20,730	31,040	12,765	12,580	-	-	15,450	20,620	24,905	17,515	10,810	3,951	5,320	4,099	2,975	48,639	34,314	37,047	39,535	77,565	32,770	61,045	19,000	725,930

LEGEND

000 Number of trips used in estimating revenues, equipment requirements, and maintenance and operating expenses.

000 Number of trips between Sector Zero and stations which were eliminated or restricted to directional use. These trips are assumed to be lost to the rapid transit system.

000 Number of through trips using the rapid transit system to and from Sector Zero, but transferring to local buses to reach the vicinity of stations eliminated or restricted to directional use. These trips are included in the black figures under the appropriate rapid transit route.

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APPENDIX D

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TABLE D-1

PARKING SPACES AVAILABLE IN SECTOR ZERO IN 1955 AND ESTIMATE OF PRESENT SPACES WHICH WILL STILL BE USABLE IN 1965 AND 1980

District Number	Spaces Available--1955*			Present Spaces Which Will Still be Usable in 1965			Present Spaces Which Will Still be Usable in 1980		
	Curb	Off-Street	Total	Curb	Off-Street	Total	Curb	Off-Street	Total
01	6,070	8,860	14,930	5,500	9,100	14,600	4,600	6,200	10,800
02	1,140	2,780	3,920	1,000	1,700	2,700	900	100	1,000
03	2,840	7,720	10,560	2,600	6,400	9,000	2,100	5,100	7,200
04	3,780	5,330	9,110	3,400	4,700	8,100	2,800	4,000	6,800
05	890	9,950	10,840	800	8,700	9,500	700	6,700	7,400
06	4,640	12,510	17,150	4,200	11,100	15,300	3,500	9,200	12,700
07	2,100	5,710	7,810	1,900	5,400	7,300	1,600	4,100	5,700
08	3,150	11,720	14,870	2,900	10,400	13,300	2,600	8,400	11,000
09	1,890	4,920	6,810	1,700	4,000	5,700	1,400	3,000	4,400
Total	26,500	69,500	96,000	24,000	61,500	85,500	20,200	46,800	67,000

*-Source: Motor Vehicle Parking Agency of the District of Columbia.

TABLE D-2

AUTO-DRIVER TRIPS WITH DESTINATIONS IN SECTOR ZERO--1980
AUTO-DOMINANT AND RECOMMENDED PLANS

District Number	Percentage of Total Trips to Each District		Auto-Driver Trips With Destinations in Sector Zero--24-Hour Period--1980					
			Auto-Dominant Plan			Recommended Plan		
	Worker	Non-Worker	Worker	Non-Worker	Total	Worker	Non-Worker	Total
01	11.7	10.5	16,280	23,630	39,910	10,890	23,000	33,890
02	0	1.1	0	2,480	2,480	0	2,410	2,410
03	10.9	8.4	15,170	18,900	34,070	10,140	18,400	28,540
04	4.8	3.7	6,680	8,330	15,010	4,470	8,100	12,570
05	24.3	36.9	33,810	83,040	116,850	22,600	80,810	103,410
06	17.9	14.8	24,900	33,310	58,210	16,650	32,410	49,060
07	10.7	7.1	14,890	15,980	30,870	9,950	15,550	25,500
08	14.3	13.9	19,900	31,280	51,180	13,300	30,440	43,740
09	5.4	3.6	7,510	8,100	15,610	5,020	7,880	12,900
Total	100.0	100.0	139,140	225,050	364,190	93,020	219,000	312,020

NOTE: Basic data furnished by Wilbur Smith & Associates.

TABLE D-3

PLAN I--AUTO-DOMINANT PLAN
ESTIMATE OF PARKING SPACE SUPPLY AND DEMAND IN SECTOR ZERO--1980

District Number	Number of Spaces Required			Spaces Available in 1955 Still Usable in 1980			Net New Spaces Required -- 1955 to 1980		
	Long-time	Short-time	Total	Long-time	Short-time	Total	Long-time	Short-time	Total
01	12,200	5,000	17,200	8,500	2,300	10,800	3,700	2,700	6,400
02	0	500	500	500	500	1,000	(500)*	0	(500)*
03	11,400	4,100	15,500	5,600	1,600	7,200	5,800	2,500	8,300
04	5,000	1,800	6,800	5,000	1,800	6,800	0	0	0
05	25,300	17,300	42,600	3,500	3,900	7,400	21,800	13,400	35,200
06	18,700	7,100	25,800	9,500	3,200	12,700	9,200	3,900	13,100
07	11,200	3,500	14,700	4,300	1,400	5,700	6,900	2,100	9,000
08	14,900	6,600	21,500	7,400	3,600	11,000	7,500	3,000	10,500
09	5,600	1,800	7,400	3,500	900	4,400	2,100	900	3,000
Total	104,300	47,700	152,000	47,800	19,200	67,000	56,500	28,500	85,000

*-Number of spaces in () indicates excess in long-time parking space available for parkers having destinations in adjoining districts.

TABLE D-4

PLAN IV--RECOMMENDED PLAN
ESTIMATE OF PARKING SPACE SUPPLY AND DEMAND IN SECTOR ZERO--1980

District Number	Number of Spaces Required			Spaces Available in 1955 Still Usable in 1980			Net New Spaces Required--1955 to 1980		
	Long-time	Short-time	Total	Long-time	Short-time	Total	Long-time	Short-time	Total
01	8,200	4,800	13,000	8,500	2,300	10,800	(300)*	2,500	2,200
02	0	500	500	500	500	1,000	(500)*	0	(500)
03	7,600	3,900	11,500	5,600	1,600	7,200	2,000	2,300	4,300
04	3,300	1,700	5,000	5,000	1,800	6,800	(1,700)*	(100)**	(1,800)
05	16,900	16,600	33,500	3,500	3,900	7,400	13,400	12,700	26,100
06	12,500	6,800	19,300	9,500	3,200	12,700	3,000	3,600	6,600
07	7,500	3,300	10,800	4,300	1,400	5,700	3,200	1,900	5,100
08	10,000	6,400	16,400	7,400	3,600	11,000	2,600	2,800	5,400
09	3,800	1,700	5,500	3,500	900	4,400	300	800	1,100
Total	69,800	45,700	115,500	47,800	19,200	67,000	21,900	26,600	48,500

*-Number of spaces in () indicates excess in long-time parking space available for parkers having destinations in adjoining districts.
**-Number of spaces in () indicates excess in short-time parking space available for long-time parkers having destinations in adjoining districts. (Total new long-time space requirements are reduced by this amount.)

TABLE D-5

AUTO-DRIVER TRIPS WITH DESTINATIONS IN SECTOR ZERO--1965
AUTO-DOMINANT AND RECOMMENDED PLANS

District Number	Percentage of Total Trips to Each District		Auto-Driver Trips With Destinations in Sector Zero--24-Hour Period--1965					
			Auto-Dominant Plan			Recommended Plan		
	Worker	Non-Worker	Worker	Non-Worker	Total	Worker	Non-Worker	Total
01	11.7	10.5	15,490	13,760	29,250	10,940	19,650	30,590
02	0	1.1	-	2,170	2,170	-	2,080	2,080
03	10.9	8.4	14,510	10,850	25,360	9,640	15,720	25,360
04	4.8	3.7	5,510	7,510	12,800	4,260	6,900	11,160
05	28.5	36.0	37,850	72,040	109,890	21,480	69,060	90,540
06	17.0	14.8	20,570	29,230	49,800	15,880	27,700	43,580
07	10.7	7.1	14,260	14,050	28,310	9,460	13,290	22,750
08	14.5	13.0	19,440	27,480	45,900	12,640	26,010	38,650
09	5.4	5.6	6,200	7,120	13,320	4,770	6,740	11,510
Total	100.0	100.0	134,790	197,680	332,450	88,590	187,150	275,540

NOTE: Basic data furnished by Wilbur Smith & Associates.

TABLE D-6

PLAN I--AUTO-DOMINANT PLAN
ESTIMATE OF PARKING SPACE SUPPLY AND DEMAND IN SECTOR ZERO--1965

District Number	Number of Spaces Required			Spaces Available in 1955 Still Usable in 1965			Net New Spaces Required--1955 to 1965		
	Long-time	Short-time	Total	Long-time	Short-time	Total	Long-time	Short-time	Total
01	10,000	4,400	14,400	10,200	4,400	14,600	(200)*	-	(200)*
02	-	400	400	2,300	400	2,700	(2,300)*	-	(2,300)*
03	9,400	3,600	13,000	7,500	1,500	9,000	1,900	2,100	4,000
04	4,100	1,600	5,700	6,500	1,600	8,100	(2,400)*	-	(2,400)*
05	21,000	15,200	36,200	4,700	4,800	9,500	16,300	10,400	26,700
06	15,400	6,200	21,600	10,800	4,500	15,300	4,600	1,700	6,300
07	9,300	3,000	12,300	6,000	1,300	7,300	3,300	1,700	5,000
08	12,300	5,800	18,100	8,100	5,200	13,300	4,200	600	4,800
09	4,600	1,600	6,200	4,100	1,600	5,700	500	-	500
Total	86,100	41,800	127,900	60,200	25,300	85,500	25,900	16,500	42,400

*-Number of spaces in () indicates excess in long-time parking space available for parkers having destinations in adjoining districts.

TABLE D-7

PLAN IV--RECOMMENDED PLAN
ESTIMATE OF PARKING SPACE SUPPLY AND DEMAND IN SECTOR ZERO--1965

District Number	Number of Spaces Required			Spaces Available in 1955 Still Usable in 1965			Net New Spaces Required--1955 to 1965		
	Long-time	Short-time	Total	Long-time	Short-time	Total	Long-time	Short-time	Total
01	7,800	4,100	11,900	10,200	4,400	14,600	(2,400)*	(300)**	(2,700)
02	-	400	400	2,300	400	2,700	(2,300)*	-	(2,300)
03	7,800	3,400	10,600	7,500	1,500	9,000	(300)*	1,900	1,600
04	3,800	1,500	4,700	6,500	1,600	8,100	(3,300)*	(100)**	(3,400)
05	16,100	14,200	30,300	4,700	4,800	9,500	11,400	9,400	20,800
06	11,800	5,900	17,700	10,800	4,500	15,300	1,000	1,400	2,400
07	7,100	2,900	10,000	6,000	1,300	7,300	1,100	1,600	2,700
08	9,500	5,400	14,900	8,100	5,200	13,300	1,400	200	1,600
09	3,600	1,400	5,000	4,100	1,600	5,700	(500)*	(200)**	(700)
Total	66,300	39,200	105,500	60,200	25,300	85,500	6,100	13,900	20,000

*-Number of spaces in () indicates excess in long-time parking space available for parkers having destinations in adjoining districts.

**-Number of spaces in () indicates excess in short-time parking space available for long-time parkers having destinations in adjoining districts. (Total new long-time space requirements are reduced by this amount.)

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APPENDIX E

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U. S. DEPARTMENT OF COMMERCE
Bureau of Public Roads
Washington 25, D.C.

July 7, 1958

Circular Memorandum To: Regional Engineers

From: E. H. Holmes, Assistant Commissioner

Subject: Expressway Usage--directional movements

In connection with the planning and design of some sections of urban expressways on the interstate highway system, consideration is being given to the use of reversible lanes. The value of reversible lanes is, of course, dependent upon the directional split of the traffic, and we are in urgent need of information on the directional movements on existing limited access expressways in urban and suburban areas.

We are particularly interested in knowing the hourly directional volumes during the weekday morning and evening peaks, but would also like this information for other periods if there are times when the hourly volumes are significantly high, either in one or both directions as on holidays or week ends. For example there may be periods when volumes are somewhat below the peak but are nearly evenly divided in which the capacity in each direction may be approached. We should like to know these directional volumes for several points along the expressway together with information on the adjacent land uses between the points so that changes in the proportions of directional volumes may be studied in relation to access points and traffic generators near or between those points.

Undoubtedly much information on directional volumes on existing expressways has already been collected by the States or by the cities and is readily available. If so, will you please supply it as soon as possible. If the available information is not sufficient to be representative of all sections of the expressways, and there are significant differences in the proportions of directional volumes on the various sections, or if good examples of heavy flow, whether unevenly divided or not, exist but on which traffic volume data are not available please arrange with the States involved to obtain and supply the desired information if possible.

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U. S. DEPARTMENT OF COMMERCE
Bureau of Public Roads
Washington 25, D.C.

August 8, 1958

Circular Memorandum To: Regional and Division Engineers

From: G. M. Williams, Assistant Commissioner

Subject: Reverse-flow Operation on Freeways

The traffic volumes that have been estimated for many sections of the Interstate System are of such magnitude as to emphasize the necessity for designing these facilities in a manner that will assure maximum efficiency in lane utilization. Under suitable circumstances, separate roadways for reverse-flow operation are among the devices that may be employed to accomplish this objective in the larger urban areas where cost per lane usually is high.

The subject of reverse-flow operation is discussed in the AASHO Urban Policy. Pages 280-285 discuss reverse flow on expressways at grade, pages 353-356 discuss it for depressed freeways, and page 434 for elevated freeways. Warrants are listed only on page 282 which are specifically for expressways at grade but essentially they are basic conditions that are applicable to freeways as well. The following requirements are particularly pertinent:

1. A directional distribution during peak hours that is substantially unbalanced, on the order of 2 to 1.

2. A directional traffic volume that would require more than 3 lanes to be in operation in one direction during periods of peak volumes.

3. A large portion of the peak-hour traffic travels a substantial distance, say 3 miles or more, between principal points of entry and exit with little or no need for intermediate interchange.

4. Terminals of the reverse-flow roadway that can be suitably arranged to transfer traffic between it and the conventional one-way roadway in either direction or to nearby highways.

Where conditions are suitable, consideration should be given to designing freeways with separate reverse-flow roadways. Where there are to be large future volumes initial construction could omit the reverse-flow roadway, so that during the first few years the highway would be in keeping with the volume and not give the appearance of over design as might be the case if all lanes are constructed initially. In addition, the pattern of traffic could be re-examined when it is necessary to add the reverse-flow roadway.

The principle of reverse flow cannot be applied indiscriminately. It is apparent from the above requirements that the conditions under which it is applicable may not exist in many cities of intermediate size or smaller. Also, analysis for future traffic must take into account changes in land use which could change the imbalance in existing traffic. Experience in some cities indicates that unforeseen land improvements both within a city and in suburbs may develop which, by concurrently producing high traffic volumes in a direction opposite to the direction of movement of the peak-hour traffic, diminish or eliminate the advisability of use of reverse-flow roadways. Accordingly, this probability should be considered in planning and designing a freeway or an expressway so that there is flexibility in operation and possibility of later making alterations to meet changing traffic patterns.

Please arrange to review at the very earliest preliminary stage the plans for those Interstate System highways and other freeways or expressways estimated to require more than three through-traffic lanes in each direction to determine if it is possible and practicable to provide all or a portion of the additional directional capacity required above three lanes by means of a separate reverse-flow roadway to accommodate the directional peak-hour volumes. For example, a total of six lanes on three roadways, one of which would be for reverse-flow operation to provide four lanes in one direction during peak hours, might provide the total capacity needed for a considerable future period and at a lesser cost than to provide two roadways of four lanes each either initially or by stages.

The initial step, of course, is adequate traffic information which has been stressed and requested in Assistant Commissioner Holmes' circular memorandum of July 7, 1958.