Planning Research

REPORT ON

TRAFFIC VOLUMES AND CAPACITY REQUIREMENTS

FOR

POTOMAC RIVER BRIDGES AND INNER TRAFFIC LOOP

Prepared for

National Capital Planning Commission

by

Wilbur Smith and Associates
265 Church Street
New Haven, Connection

1955

New Haven, Connecticut IBRARY COPY

RETURN TO

OFFICE OF PLANNING AND PROGRAMMING DEPT. OF HIGHWAYS AND TRAFFIC GOVT. OF THE DISTRICT OF COLUMBIA

FILE NO: 35.3

TRAFFIC . PARKING . TRANSIT . HIGHWAYS

New Haven, Conn.

June 14, 1955

Mr. Harland Bartholomew, Chairman National Capital Planning Commission Washington 25, D. C.

Dear Mr. Bartholomew:

We are pleased to transmit to you our report on traffic volumes and capacity requirements for Potomac River bridges and the proposed Inner Traffic Loop. This study was authorized by the National Capital Planning Commission in an agreement dated June 26, 1954.

It is evident from the analyses and investigations that additional Potomac River crossings will be required to adequately accommodate future traffic. The recommended system of crossings includes both new central and peripheral bridges, as well as improved existing bridges. Approach and connector roads must be carefully integrated with bridge plans to provide efficient distributor facilities.

The Inner Loop should be developed as a high capacity multi-lane expressway. A substantial portion of this route is needed to accommodate traffic which would desire to use new bridges. Improvements to north-south roadways serving southwest Washington must provide capacity increases between the expressway and Constitution Avenue.

In deriving traffic requirements, we made exhaustive studies of all factors affecting traffic growths and desires. Consideration was given to population and vehicle ownership trends in the District of Columbia and its metropolitan area in Virginia and Maryland; proposals for redevelopment plans, for dispersal of governmental activities, and for the removal of temporary buildings; and finally, the need for stabilizing and directing the growth of the central business district as recommended in the Comprehensive Plan. The scope of the study was such that we were able to use previously collected data, principally that developed from the 1948 origin-destination study in our report on Highway Transportation for the Metropolitan Area of Virginia.

In reviewing the report, you will note that we have attempted to evaluate the roadway needs in terms of peak-hour traffic requirements. This is a sound highway planning approach; however, we realize that such close evaluation of needs must be reconciled or adapted to budget-ary and timing factors. A completely desirable solution is unlikely. Also, management controls cannot be overlooked as a potential means of modifying peak-hour needs.

2.

We have assumed that the automobile will not be drastically changed in functional design and relative cost before 1970. Here, again, we realize that a basically different vehicle might alter the estimates of traffic needs on which our recommendations are based.

Trends in present modes of travel have been assumed to continue until 1970. New and competing forms of transportation, and marked changes in preferences for particular modes of transportation would alter results we have anticipated. While these factors are recognized as very important, we do not believe that changes in them can be accurately enough forecast to permit their use in the calculation of future traffic patterns for the Washington Metropolitan Area.

Throughout the course of our studies we have been in close contact with the Department of Highways of the District of Columbia as well as the staff of the National Capital Planning Commission. We are grateful for all of the valuable help furnished during the conduct of the work. In addition, we appreciate the splendid assistance and cooperation of the many other governmental agencies within Virginia, the District of Columbia, and Maryland.

We hope that our work will point the way toward an early solution of a most important problem.

Respectfully submitted,

Wilbur S. Smith

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PART I

TRAFFIC AND CAPACITY NEEDS

FOR

POTOMAC RIVER CROSSINGS

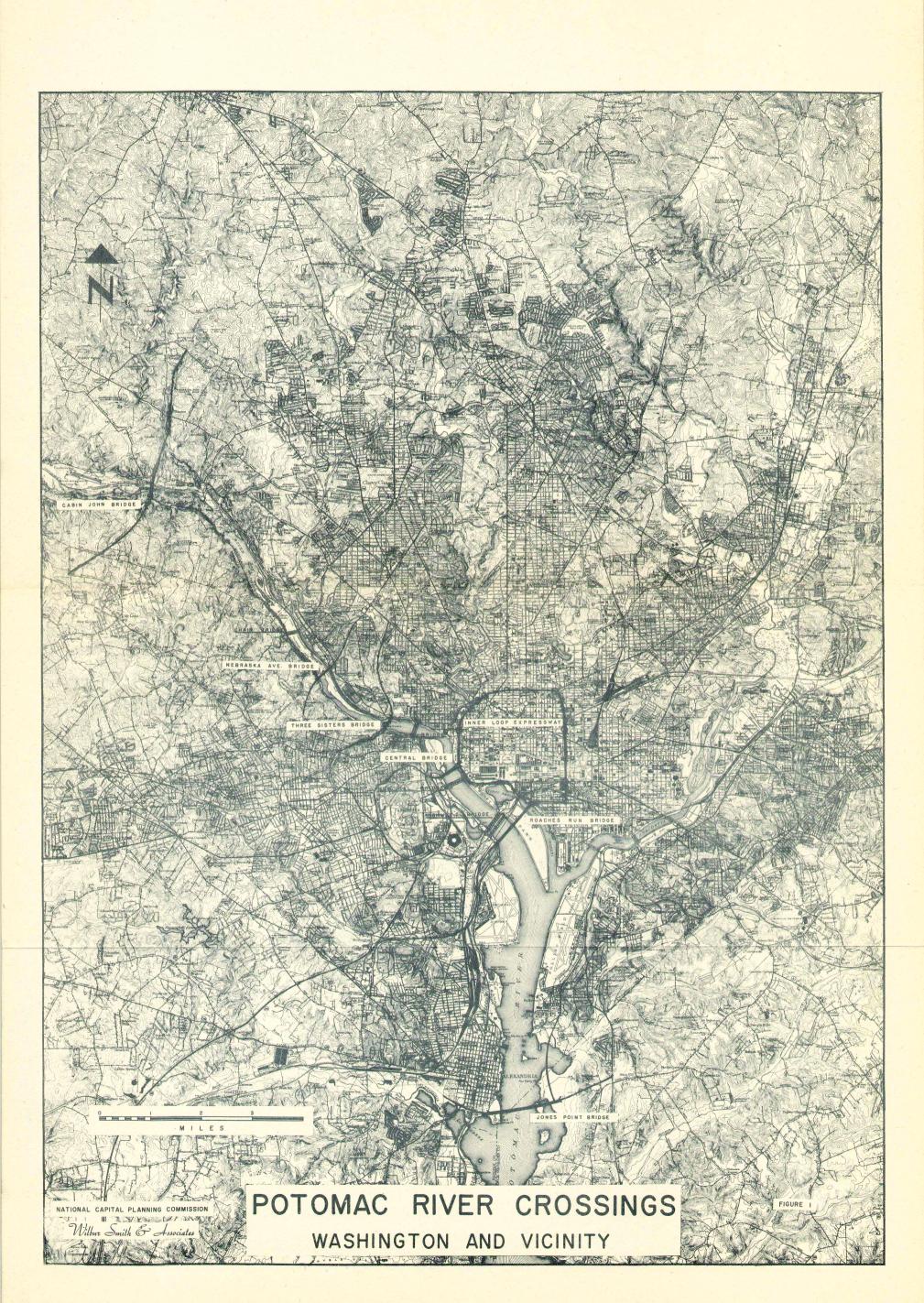
INTRODUCTION

The Potomac River traverses the Washington Metropolitan Area in a meandering course. Below Little Falls it becomes a broad waterway affected by tidal waters. Washington is located at the head of tidewater navigation; above the city the Potomac is a mere stream, below it rapidly transforms into an arm of Chesapeake Bay. Crossings are affected by the change in river width and navigation.

While not dominant economic assets in the city's development, the Potomac and Anacostia Rivers have greatly influenced the patterns of development and planning of the metropolitan area. Because of Washington's role as a "capital city", the banks of the Potomac have been devoted principally to park and recreational rather than to commercial purposes.

The river has never been a formidable barrier to the development of Greater Washington. Bridges have spanned the Potomac since the earlier periods of development and have diminished the barrier effects of the river. Figure 1 shows how the present and proposed Potomac River crossings relate to the land development and highway patterns in the Washington Metropolitan Area.

Increased Federal employment and extended use of the automobile have been instrumental in the expansion and dispersal of Washington in the last quarter century. Strong interplay has occurred between the population and settlement changes in the metropolitan area, the available Potomac River crossings, and trans-river trips. The development of the suburban areas in the Washington Metropolitan Area has accentuated the need for effective interchange of movements across the Potomac. This is particularly true since the principal employment centers are located in the central area.



Population Factors

The Washington Metropolitan Area as defined by the census encompasses the District of Columbia, Prince Georges and Montgomery Counties in Maryland, Arlington and Fairfax Counties in Virginia and the separate cities of Alexandria and Falls Church.

Metropolitan Washington is growing—in the decade between 1940 and 1950 its population increased over 50 percent, to 1,464,292 persons. Since 1940, a significant portion of the land in the metropolitan area has been urbanized. Population trends are apparent from the data shown in Table I.

The expansion of the city of Washington into adjoining areas has diminished the dominance of the central city. This is quite evident from Figure 2 which graphically portrays the relative growths of the various districts. In 1940 the central city contained 69 percent of the total population; by 1950 this value was reduced to 55 percent. Between 1940 and 1950 populations increased over 200 percent in Fairfax and Arlington Counties, Virginia, and in Prince Georges County, Maryland. Population in Montgomery County increased 96 percent; in Alexandria, the oldest community in Virginia, population grew 84 percent.

The automobile has developed Arlington into a dormitory community of Washington. It has doubled its population more than four times since 1900. Its 1953 population is estimated at 155,500, giving it a population density exceeding 7,000 persons per square mile.

Over half of the population increase in the Virginia area from 1950 to 1953 took place in Fairfax County. Growth can be expected

TABLE I

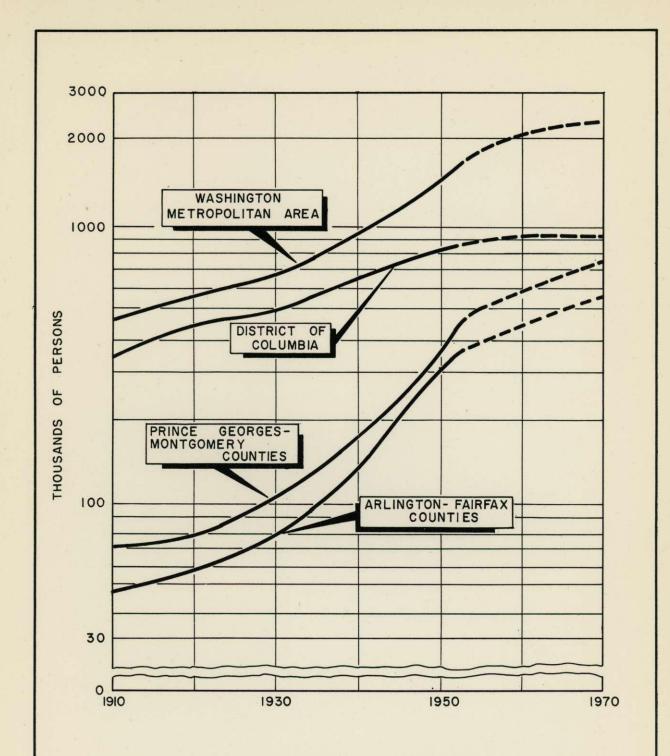
POPULATION TRENDS IN WASHINGTON METROPOLITAN AREA

Years

Census Area	1900	1910	1920	1930	1940	1950	1953	1970
Virginia								
Alexandria	14,528	15,329	18,060	24,150	33,520	61,790	75,000	103,000
Arlington County	6,430	10,321	16,040	26,615	57,040	135,450	156,000	165,000
Fairfax County	18,580	20,536	21,943	25,264	40,929	98,557	128,000	293,000
Falls Church	(Includ	led in Fair	rfax County	until 19	48)	7,535	8,200	9,000
TOTAL	39,538	46,186	56,043	76,029	131,489	303,332	367,200	570,000
District of Columbia	278,720	331,070	437,570	486,870	663,090	802,180	819,500	910,000
Maryland								
Montgomery County	30,451	32,089	34,921	49,200	83,910	164,400	212,600	304,000
Prince Georges County	29,898	36,147	43,347	60,100	84,490	194,180	278,700	416,000
TOTAL	60,349	68,236	78,268	109,300	168,400	358,580	491,300	720,000
TOTAL Washington Metropolitan Area	378,607	445,492	571,881	672,199	962,979	1,464,092	1,678,000	2,200,000
Central City as Percent of Metropolitan Area	73.5	74.4	76.5	72.5	68.8	54.7	48.8	41.3

Note--1953 and 1970 population estimates include only urbanized portions of the Fairfax, Montgomery and Prince Georges Counties as indicated in Figure 3.

W



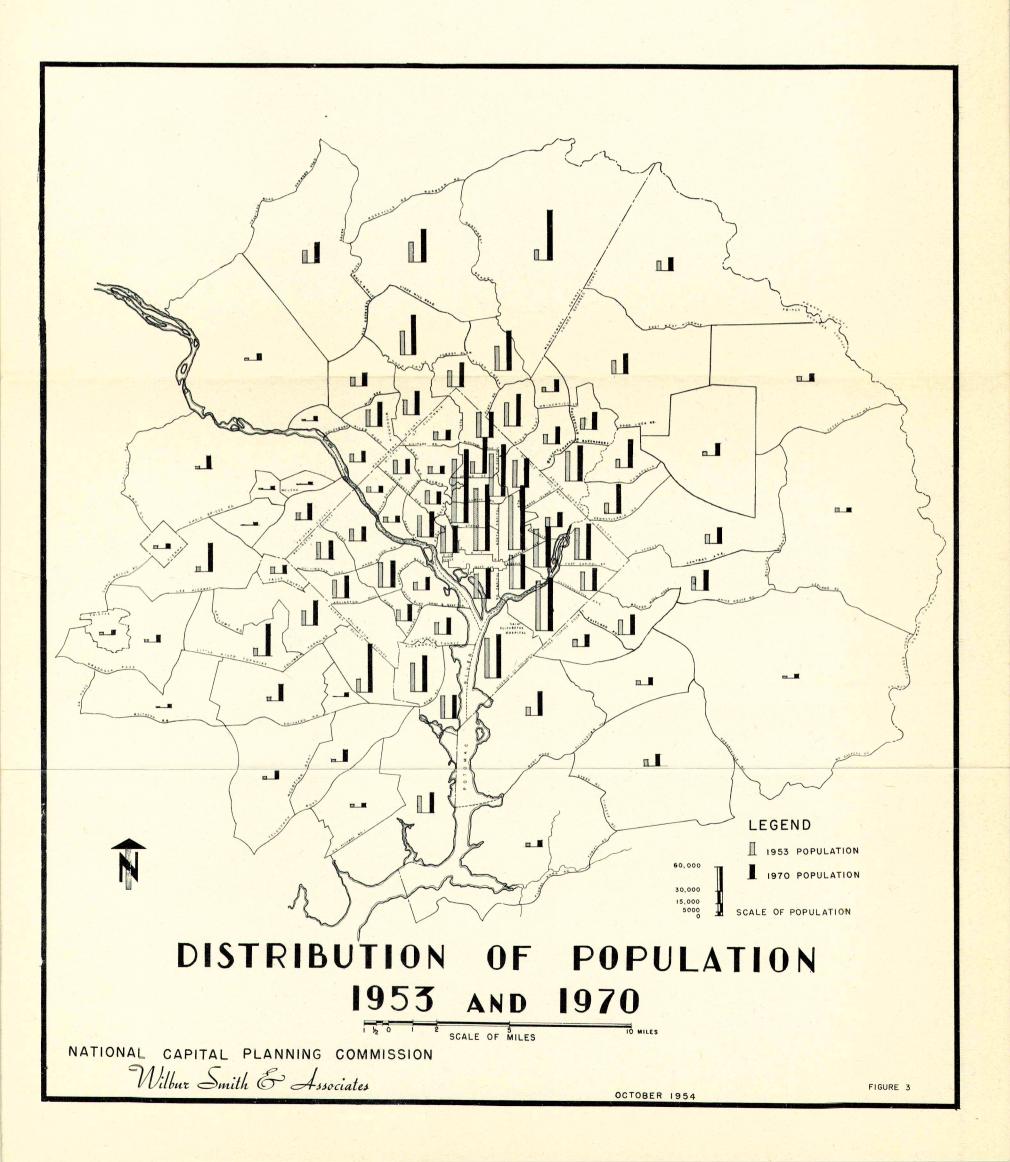
POPULATION TRENDS

NATIONAL CAPITAL PLANNING COMMISSION
Wilbur Smith & Associates

to continue in this area because of the availability of attractive vacant lands to absorb the centrifugal growth of the metropolitan area.

Future Trends—Based on available population information there were 1,678,000 persons living in the urbanized portions of the Washington Metropolitan Area in 1953. This represents an increase of about 15 percent over the 1950 population for the entire census area. Preliminary estimates for 1954 reveal that approximately one and three-quarter million persons reside in metropolitan Washington. It is anticipated that by 1970 there will be over 2,000,000 persons living in the urbanized metropolitan area, delimited in Figure 3.

The number of persons residing within the District of Columbia should become stabilized at about 900,000 persons by this year. (It should be noted that in the earlier draft of this report, an approximate value of 700,000 was indicated. This population estimate was derived after considerable research undertaken for the report on Highway Transportation in the metropolitan area of Virginia. It has been increased as a result of subsequent conferences with Highway and Planning officials.) This stabilization can be attributed to the earlier maturity of the District, and the greater attraction of the suburbs. It should be noted that there is only a very limited amount of land vacant within the District. The likely development of additional school and playground sites, the dispersal of Federal employment centers, urban redevelopment with controlled population densities, and the construction of a major highway net which will require much land for rights-of-way all will limit the increases in population.



Present and anticipated future population distributions within the various origin-destination zones in the metropolitan area are shown in Figure 3. The large population increases in peripheral suburban areas are readily apparent.

Land Use Trends

Washington is the seat of the Federal Government. The governmental character of the National Capital Region is reflected in the relatively large amount of land in public use, the major portion of which is federally owned. Other occupied land is largely devoted to residential use. There is only a scattering of heavy industrial development, found principally along the waterfront and along railroad lines.

Areas of most intense development within the metropolitan region include the District of Columbia (only about 5 percent is vacant); older parts of Alexandria, most of Arlington County, Falls Church, and Vienna, in Virginia; a small sector of Prince Georges County along Baltimore Boulevard (U. S. Route 1), and the southernmost extremity of Montgomery County, Maryland. Accordingly, future residential expansion must mainly occur in the three larger counties—Fairfax, Prince Georges, and Montgomery—beyond present urban limits.

The central business district of Washington is centrally positioned within the National Capital Region. Including most governmental and private offices and the principal retail shopping areas, it is the major attractor of persons from throughout the metropolitan area. Residential

Regional Aspects of the Comprehensive Plan. A portion of the Comprehensive Plan for the National Capital and Its Environs. National Capital Park and Planning Commission. Monograph No. 6, June 1950.

development in the District is relatively dense, particularly in the old city. A sizable amount of the high density residential districts are within walking distance of employment centers. Low density residential areas are found in the outskirts of the city.

Zoning for traffic and parking is becoming an important step in the planned development of Washington. Giving full cognizance to the effect of traffic generators on roadway and parking conditions, zoning permits off-street parking and access facilities to become an integral part of land development.

Dispersal of population has been accompanied by a corresponding expansion of retail shopping and service facilities; this appears to be the most evident change in the existing regional land use pattern. Encouraged by the freedom and flexibility of the automobile, such changes can be expected to continue.

Within the District of Columbia, much attention is being given to the elimination of blighted areas, and nonconforming land uses. The Southwest Redevelopment Area and similar projects may be effected in future years. These, and other new developments, will provide positive population control.

In Virginia, future increase in residential use is expected to take place in the Bailey's Crossroad district, at Annandale, and in the vicinity of Falls Church. In Alexandria, recent annexations have greatly increased the amount of land available for new development. Present trends indicate that most of the vacant property will be used for housing—both the single and multifamily types.

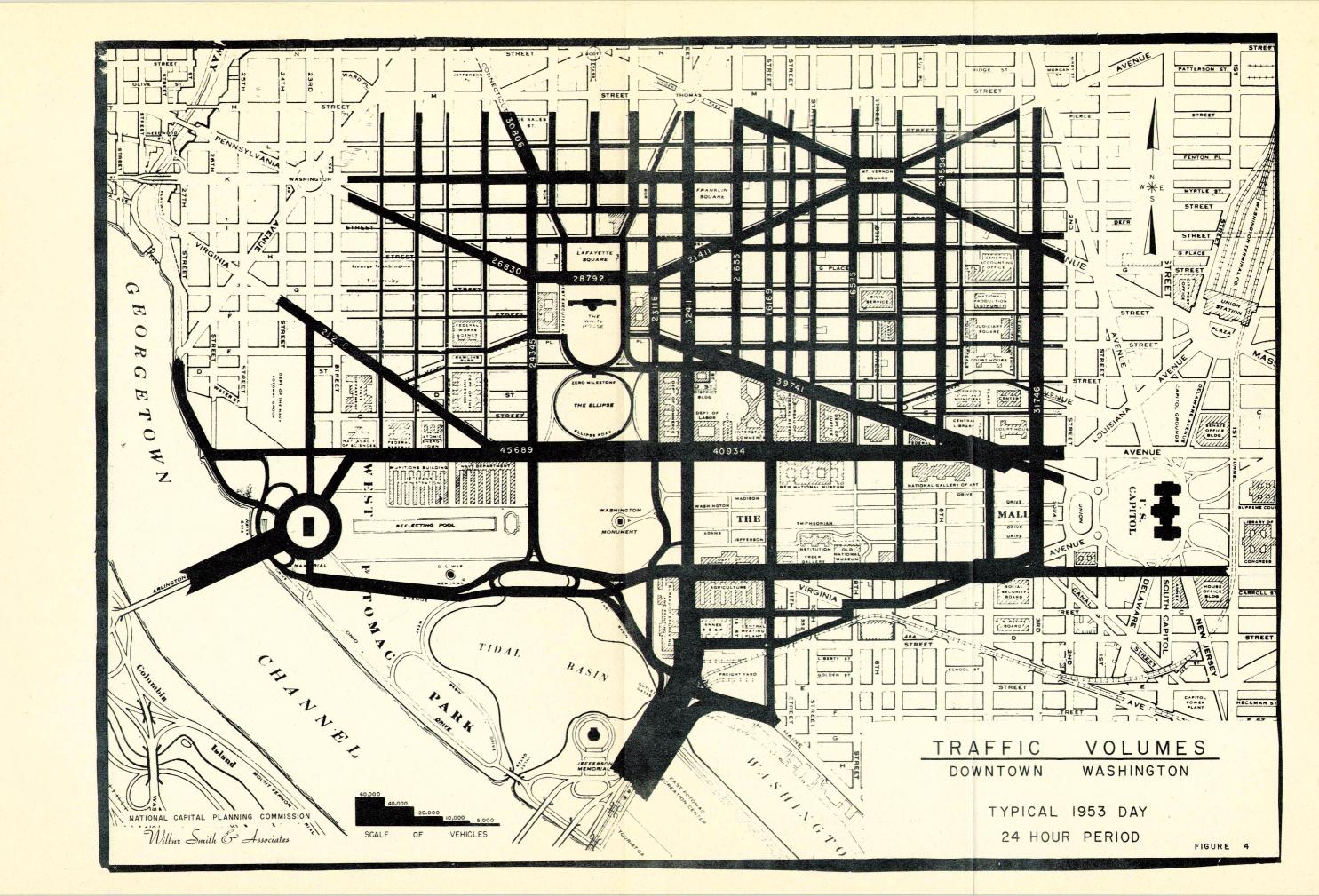
Traffic Considerations

Key trafficways converge on Washington. The concentration of traffic volumes in the central business district is graphically depicted in Figure 4. The Potomac River Crossings constitute the main corridors for travel between the District and southern and western destinations, as well as for commuters between the central city and the metropolitan area in Virginia.

Transportation in the metropolitan area is oriented strongly towards the use of private passenger vehicles; virtually all the recent suburban growth has been predicated on the automobile. Under present conditions, it is not likely that mass transportation will increase its importance as a means of suburban travel. Automobile registrations have increased rapidly in the region as shown in Figure 5. They will continue to increase, because of the prevailing trend toward higher vehicle ownership and the expanding population of the National Capital Region.

Growths in trans-river crossings have far outpaced the increases in population and vehicle registration. Since 1940 the total river crossings have more than doubled. This is readily evident from Table II which summarizes bridge crossings in recent years. In 1924, approximately 12,000 vehicles per day crossed the Potomac River on the Highway Bridge; today over 100,000 vehicles utilize the bridge daily. This corresponds to an increase of over 700 percent.

124,000 (01 1962) 19,000 (11 1961)



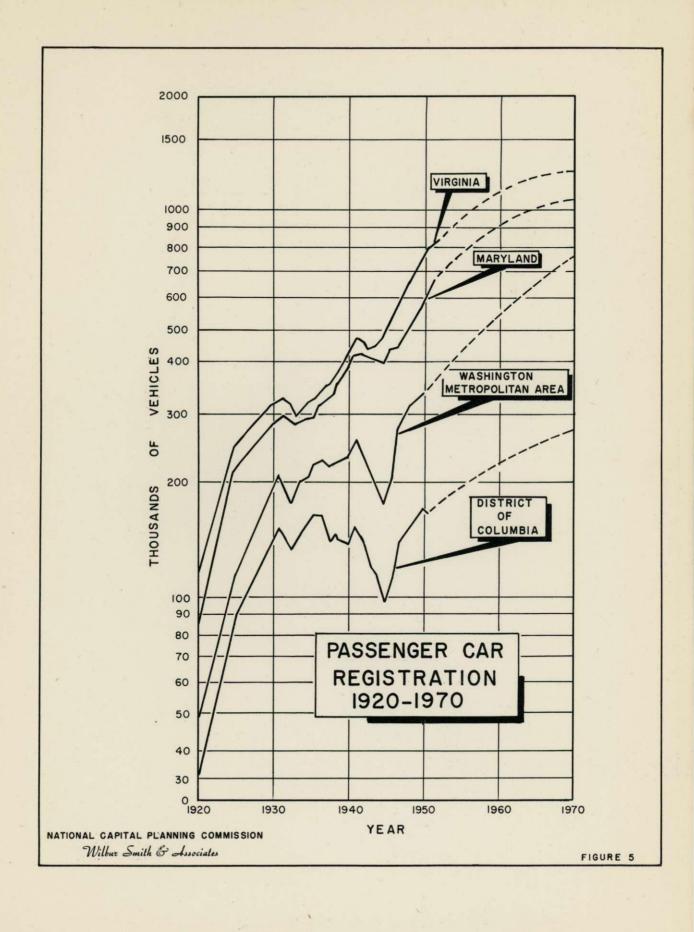


Table II

TRAFFIC GROWTHS

POTOMAC RIVER BRIDGES

1940	Year	Chain Bridge	Key Bridge	Memorial Bridge	Highway Bridge	Total Crossings	Annual Percent Increase
	1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954*	4,819 4,447 3,251 3,356 3,653 5,534 5,670 6,996 8,164 8,939 10,757 11,641 13,111 14,000	32,639 29,062 21,241 21,928 23,871 30,603 31,356 32,930 35,971 43,946 45,537 46,122 46,052 47,000	39,885 37,673 27,348 28,166 33,091 40,288 42,760 46,723 51,437 52,211 51,278 52,854 53,295 54,000	43,989 38,024 36,028 36,889 42,535 52,806 55,054 60,000 66,051 77,094 92,087 97,664 100,428 102,000	105,627 121,332 109,206 87,868 90,339 103,150 129,231 134,840 146,649 161,623 182,190 199,659 208,281 212,886 217,000	-10 -20 3 14 25 4 9 10 13 10 4 2

*Typical days based on first eleven months - 1954.

It is interesting to note, too, that traffic crossing the Potomac River has been increasing twice as rapidly as movements across the central business district cordon. Typical comparative growths are shown in Table III.

Table III
COMPARATIVE GROWTHS

	Central Bus District Co		Potomac River		
	Vehicles	Index 1953 = 1.00	Vehicles	Index 1953 = 1.00	
1947	635,195	0.84	135,000	0.63	
1953	752,141	1.00	213,000	1.00	
1970 (Ant. Normal Growth)	940,000	1.25	328,000 ×	1.54	

^{*}Based on data contained in <u>Highway Transportation in the Washington</u> Metropolitan Area of Virginia, Wilbur Smith and Associates, 1953.

Previous Studies

The need for additional traffic capacity across the Potomac River has been recognized for some time. Earlier studies, such as the Origin-Destination Survey of Central Crossings, August 1944, developed by the District Department of Highways in cooperation with the Public Roads Administration, gave primary consideration to improving the old Highway (14th Street) Bridge. These studies became crystallized in the 1945 Congressional Hearings, 2 and resulted in the construction of an additional structure at this location.

The Metropolitan Area Origin-Destination Survey of 1948 has provided a factual basis for analyzing and evaluating the highway needs

^{2/} Hearings before the Bridge Subcommittee of the Committee on Interstate and Foreign Commerce, House of Representatives, Seventy-Ninth Congress, First Session in H.R. 541, 1945.

of the Metropolitan Area. 2/ The survey was undertaken as a cooperative project of the Board of Commissioners for the District of Columbia, the State of Maryland and the Commonwealth of Virginia acting through the Advisory Committee of the Washington Metropolitan Area. It developed basic information about the magnitude and distribution of travel desires.

In 1952, the Advisory Committee of the Washington Metropolitan

Area Transportation Study submitted a detailed program of Highway

improvements for the area.4/ Recommendations were based on the detailed

traffic studies, and on cost estimates.

The 1948 origin-destination data have been utilized in recent analyses of Potomac River Crossings. In June 1952, A Report on Future Bridge Crossings of the Potomac River, Washington, D. C. by Harland Bartholomew and Associates was prepared for the National Capital Park and Planning Commission, emphasizing planning aspects relevant to new river crossings. The report recommended the construction of an Inner Ring Route, and further study of Intermediate and Outer Ring Routes, including the Alexandria and Nebraska Avenue Bridges and the Southwest Expressway. The report further recommended against construction of an "E" Street Bridge because of terminal difficulties on the District side of the river.

A Report on Potomac River Bridges, Washington, D. C., submitted to the Board of Commissioners, District of Columbia by Modjeski and Masters with Lloyd B. Reid, Traffic Consultant, July 1952, recommended the

^{3/} See Washington Metropolitan Area Transportation Study, Volumes 1-4, Regional Highway Planning Committee, 1952.

^{4/} A Recommended Highway Improvement Program for the Washington Metropolitan Area, Regional Highway Planning Committee, 1952.

construction of a central river crossing at "E" Street followed promptly with the construction of an Alexandria crossing and later with the Nebraska Avenue Bridge or "such other crossings as may be required further upstream".

Both the National Capital Planning Commission and the District of Columbia Highway Department have conducted further studies of river crossing needs.

In August 1954, the President of the United States signed H.R. 1980, a bill authorizing the construction of two bridges over the Potomac River, one from a point at or near Jones Point, Virginia, and the other from the vicinity of Constitution Avenue in the District of Columbia to the Virginia side. The President recommended that legislation be amended to preserve the setting of the Lincoln Memorial and the Arlington Memorial Bridge. It is the desire of the President that the Secretary of the Interior "keep control and jurisdiction over all park lands in the vicinity of the bridge except the actual bridge structure and the road and street surface between curbs necessary for maintenance by the District of Columbia. The Secretary of the Interior also should be authorized to approve all plans for the bridge and approach roads at both ends of the bridge since park structures and land are involved".

[&]quot;The bill, however contains serious defects which should be corrected as soon as possible. Certain of the defects can be corrected by executive action in the forms of instruction, whereas others will require amendment of the legislation." ---- "Title I of the enrolled bill ---- fails to provide statutory recognition and adjustment of the relationship of the bridge, together with its approaches and connecting roads to existing and potential improvements on park lands." -------Statement by the President, August 30, 1954.

In this regard, the Fine Arts Commission opposed construction of the bridge in November 1954 on the basis that it would detract from the beautiful setting of the Lincoln Memorial. A tunnel was recommended by that body. Studies have been subsequently initiated to determine the feasibility of a tunnel to meet the concern of the President and the Fine Arts Commission.

The President also recommends that the responsibility for the construction, maintenance and operation of the Jones Point Bridge be transferred from the Secretary of the Interior to other agencies. 6/

Purpose and Scope

This report on Traffic Volumes and Capacity Requirements for Potomac River Bridges and the Inner Traffic Loop was authorized by the National Capital Planning Commission in an agreement dated June 26, 1954. Part I of the report reviews factors affecting traffic operations on the existing Potomac River Crossings, and determines future bridge requirements based on anticipated traffic and land use patterns. Part II determines traffic needs of the Inner Loop Expressway, with especial emphasis on the Southwest Expressway loop and north-south connector streets across the Mall.

The report makes certain traffic analyses, findings, conclusions and recommendations with respect to the Commission's plan for a Potomac River bridge in the vicinity of Roaches Run and an upper central area crossing of the Potomac River.

^{6/ &}quot;There is in my opinion, no logical basis for the performance of these functions by that department since it is not a construction agency and the bridge will not primarily concern or serve areas administered by that department." Statement by the President, August 30, 1954.

The report determines the following:

- 1. Volume characteristics of 24-hour and peak hour traffic crossing the Potomac River relative to the location of existing and proposed free bridges.
- 2. The required traffic capacity and design standards for the Inner Loop Expressway, and the traffic capacity of surface streets within the Inner Loop commensurate with the existing and proposed Potomac River bridge traffic volumes.
- 3. The adequacy of the Southwest Expressway as proposed and the north-south surface streets as distributors of Roaches Run and Highway Bridge traffic to the central area, and the adequacy as evaluated in the light of anticipated southwest redevelopment.
- 4. The recommended useful and economic traffic capacity which would be desirable to develop over the Roaches Run and Highway Bridges, and over the upper central area Potomac River Bridges. Capacity needs of integrated highway approach systems serving these bridges.

Chapter II

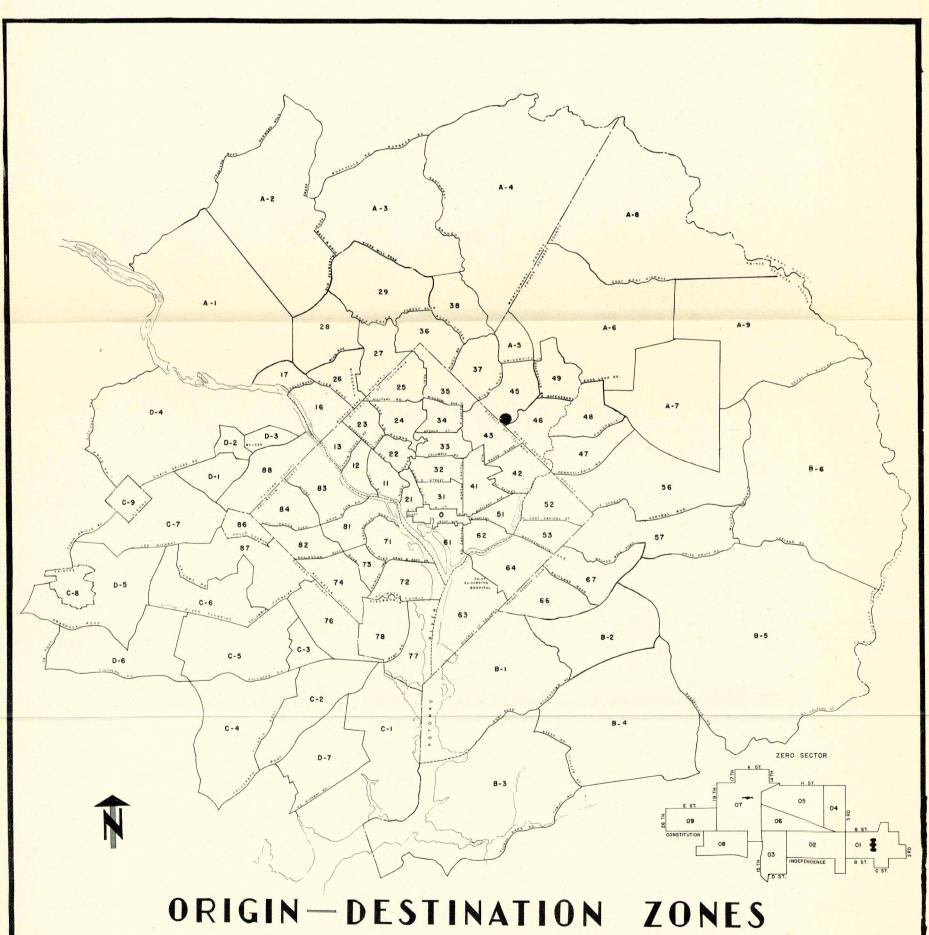
BASIC DATA

A thorough knowledge of existing traffic conditions and characteristics is a prerequisite to the solution of specific problems. When present traffic is related to the land and population patterns and trends, it is possible to derive anticipated traffic values. For this report, comprehensive field studies were undertaken to augment and update the available traffic volume and origin - destination date.

Origin - Destination Studies

A principal source of information used in all studies made in the Washington area since 1950 is the comprehensive 1948 home-interview origin-destination survey. During the 5-year period immediately following the survey, population in the metropolitan area increased by more than 50%. Accordingly, a careful zone by zone review of population changes and automobile ownership increases was made to derive the patterns of internal travel for 1953. Factors which entered into up-dating the 1948 survey included trip frequencies, travel distances, and intensities of transit use. Special adjustments were applied to key traffic generators such as business areas and governmental centers. Zones of origin and destination used in this study are indicated in Figure 6; it should be noted that they include a series of zones beyond the original limits of the 1948 survey area. \(\frac{7}{2} \)

^{7/} The 1948 origin-destination study established an arbitrary cordon which delimited the urbanized Washington metropolitan area. The area within the cordon was divided into "sectors", the central business districts being designated as sector "O". The sectors were sub-divided into 62 "districts", each being relatively homogeneous.



AND STATIONS SCALE OF MILES

NATIONAL CAPITAL PLANNING COMMISSION

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FIGURE 6

To anticipate 1970 river crossings, the 1953 origin-destination volumes have been projected to 1970 values. This has been accomplished on the basis of detailed estimates of population distribution and vehicle ownership, as affected by travel times, trip frequencies, and competing modes of travel.

Special Studies

Current traffic volume statistics for bridges and arterial highways within the studied area were obtained from the various governmental agencies responsible for traffic control, regulation and planning.

These were supplemented by special vehicular volume counts taken at key locations.

The quality of traffic operations on each of the bridges and their approach road systems was determined, with emphasis being given to the morning and evening rush periods when the greatest traffic demands develop. From these studies it has been possible to identify and evaluate the restrictive features which curtail operational efficiency. Capacities on bridges and approaches were thus established for use in appraising each of the Potomac River crossings.

Speed and delay runs were conducted during both peak and off-peak traffic conditions, so that the efficiency and fluidity of the principal streets and highways which serve bridge traffic could be determined. These studies serve the dual purpose of identifying those conditions which impede traffic flow, and of establishing the relative ease of access to each bridge from all places within the metropolitan area.

Preliminary reconnaissance surveys were made to inspect possible bridge sites along the Potomac River and to determine the feasibility

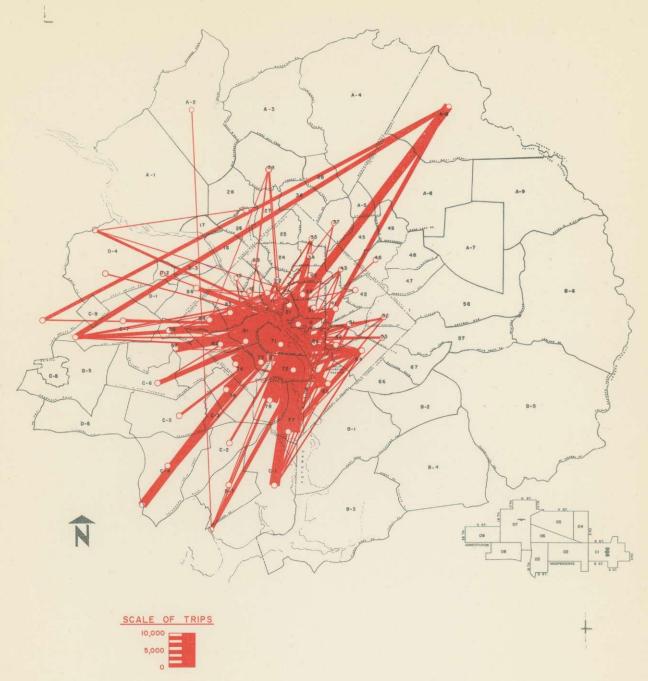
of construction at each. Reconnaissance studies included consideration of existing land uses which would be affected by new bridge locations, plus evaluation of terminal street and highway connections at both ends of each structure.

Development of Present and Future Travel Desires

Major trans-river trip desires for 1953 are graphically depicted in Figure 7. In 1953 approximately 213,000 vehicles crossed the Potomac River daily. The Washington central business district was found to attract about 30 percent of the total crossing movement. The heavily populated district to the north of downtown Washington generates another 14 percent of the total trans-river trips. About three-fourths of all 1953 crossings had origins or destinations within the District of Columbia.

The centroid of all trans-river trip desires, based on the origin-destination study was found to be about an eighth of a mile to the south of the Memorial Bridge, about a fifth of the way between the Memorial and Highway Bridges. It is evident that the greatest pull is to the north of the Mall on the Washington side; hence, it follows that the centroidal trip desire line has a northeast to southwest orientation. Increases in the settlement and trip generating potentials of Fairfax County would likely shift the centroid to the north of its present location.

The principal through trip movements in the Washington Metropolitan Area are between U. S. Route 1 in Maryland and the Shirley Highway,
U. S. Routes 29-211, and U. S. Route 50. U. S. Route 240 in Maryland is a secondary generator of through trips. The recent completion of



ALL DESIRES OVER 200 TRIPS SHOWN

MAJOR TRIP DESIRES ACROSS POTOMAC RIVER

TYPICAL 1953 DAY

the Balitmore-Washington Parkway will likely modify the through trip distributions.

The trends in total Potomac River crossings are shown in Figure 8. It is expected that by 1970 there will be approximately 328,000 vehicles crossing the Potomac River daily. This value represents a 50 percent increase over the 1953 movement of 213,000 trips.

The types of trips crossing the river in 1970, and 1953 are given in Table IV. It is anticipated that the through and external trips will be a slightly more important part of the over-all traffic pattern in 1970 than they are in 1953.

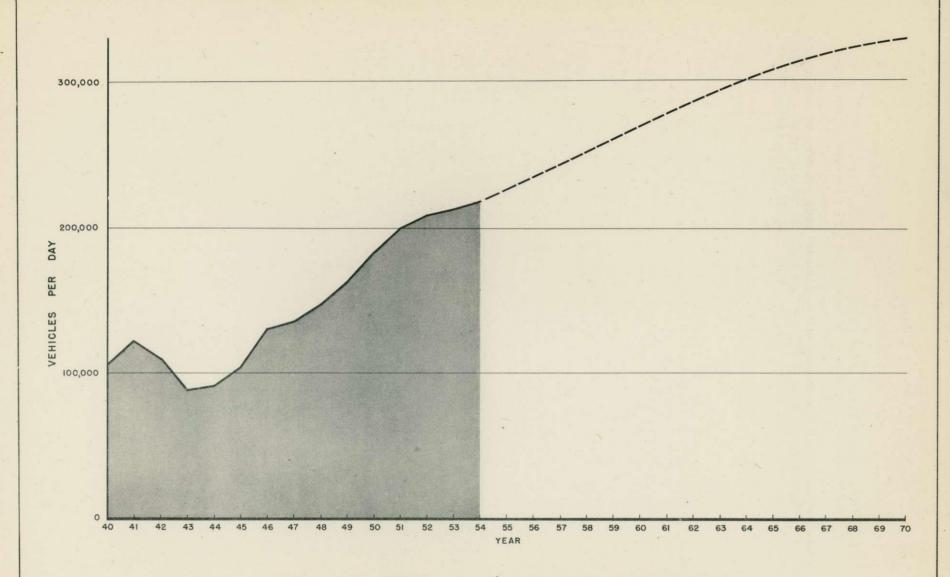
Table IV

SOURCE OF PASSENGER CAR AND TRUCK TRIPS CROSSING THE POTOMAC RIVER*

	1953		1970	
Type Trip	Number	Percent	Number	Percent
Virginia Districts of Metropolitan Area (to Metropolitan Washington				
and external Maryland Points)	195,700	91.9	299,000	91.1
External Virginia Trips				
to Metropolitan Washington	9,200	4.3	16,000	4.9
Through Trips	8,100	3.8	13,000	4.0
	213,000	100.0	328,000	100.0

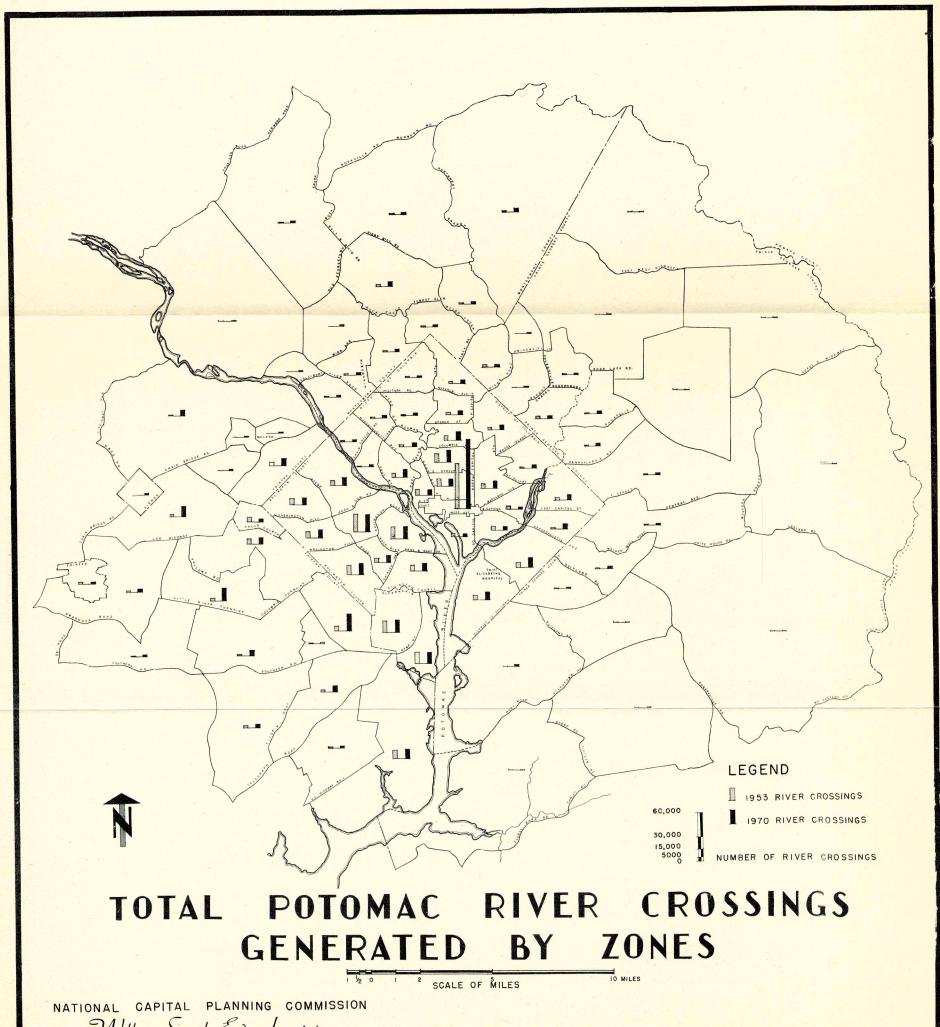
INCREASE 1970:1953 = 50 percent

^{*}Taken from data contained in <u>Highway Transportation in the Washington</u> Metropolitan Area of Virginia.



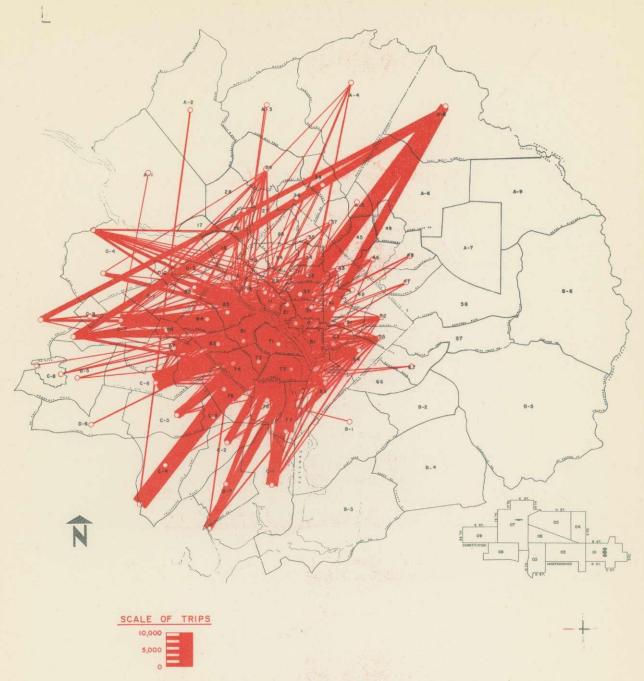
TREND OF TOTAL DAILY TRAFFIC CROSSING
THE POTOMAC RIVER

NATIONAL CAPITAL PLANNING COMMISSION
Wilbux Smith & Associates



Wilbur Smith & Associates

FIGURE 9



ALL DESIRES OVER 200 TRIPS SHOWN

MAJOR TRIP DESIRES ACROSS POTOMAC RIVER

TYPICAL 1970 DAY

Total Potomac River crossings generated by zones of origin or destination in 1970 and in 1953 are compared in Figure 9. The greatest growths in trans-river crossings will be generated in Fairfax County. This county is expected to develop the greatest population increases in the metropolitan area. The principal trans-river trip desires for 1970 are depicted in Figure 10.

Chapter III

COMPREHENSIVE PLANNING PROPOSALS

The planning of traffic and transportation facilities must be related to the general planning of land use and occupancy. Accordingly, it is essential that origin-destination data and other information which form the basis for most traffic studies be integrated with many other planning considerations in devising a sound and workable traffic plan for the Washington Metropolitan Area. Studies for the location and design of new bridges and highways must anticipate the future distribution of populations and their sources of employment. Plans for the regulation of future land use and land occupancy should evolve in conjunction with the realistic extension of transportation facilities to integrate travel and movement of goods in the entire area.

Past developments of comprehensive plans have found certain principles and concepts of transportation planning especially useful and effective. Such concepts are not static. In the field of urban traffic they are presently in a state of change. It is important, therefore, to consider the possible changes in basic concepts which might gain wide-spread acceptance in future years. Hence, conventional traffic analyses and traffic planning concepts have been augmented with considerations of land use and occupancy which affect recommendations on bridge locations and construction priorities.

General Considerations

General aims of the National Capital Planning Commission's Comprehensive Plan include the creation of satisfying healthful living conditions through the best possible arrangement of uses of land; the encouragement of a stable attractive central business area; the restoration of livability to conservation and blighted residential areas; the achievement of orderly development on urban fringe and outlying sections where the land is still vacant; and the efficient movement of persons and goods within the metropolitan area.

It is evident that the National Capital city must represent a symbol of the aspirations and accomplishments of the nation. The overall plans have been based on factual information and are constantly reviewed in light of objective values which are subject to change.

Land Uses and Generators in the Central City

Much attention in recent years has been given to the correct future development of metropolitan Washington, with especial emphasis being placed on the central city area. In its planning, full cognizance should be given to future traffic requirements.

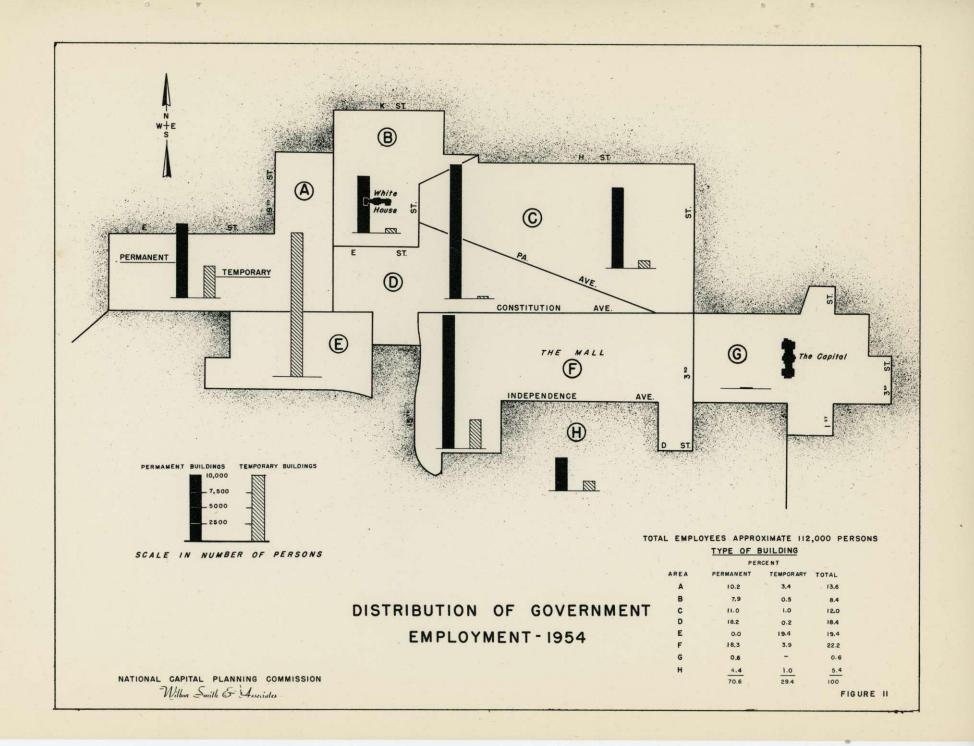
The governmental center itself is due for a re-appraisal. The removal from the governmental area of temporary office buildings erected during the war is a primary planning objective. At present more than 40,000 government workers are housed in these buildings. These workers generate high peak hour traffic movements which frequently tax available street capacities. The re-housing of these workers must be made an important consideration in planning and should be integrated with plans for the dispersion of governmental functions. Removal of the temporary government buildings along the northwestern section of the

Mall will somewhat reduce street capacity and access requirements in the western downtown area.

Dispersed development of governmental employment centers is desirable not only from a security or military standpoint, but also as a means of reducing excessive concentration, and hence congestion in the central area. Such plans impose a practical ceiling on the amount of federal employment in the central area and thus tend to stabilize it, even though there might be some new construction of federal buildings in the area. A primary objective of the National Capital Plan is a ceiling of 140,000 federal employees west of the capitol. Figure 11 shows the present distribution of federal employment in central Washington; it should be noted that approximately one-third of all federal employees are currently housed in temporary buildings.

The need for reducing urban vulnerability is becoming apparent in both private and official quarters. At present the Atomic Energy Commission recommends a 30 mile radius dispersal distance as the daily minimum dispersal for all federal Executive Branch agencies.

Trends in nongovernmental developments which are taking place at the present time are also of import. Washington is becoming the head-quarters for an ever-increasing number of business and professional associations. Private construction of office facilities has provided a great deal of new office space within the past ten years, much of it within and near the central business district in blocks located between the business center and the more exclusive residential areas to the northwest. The demands for new office space by business and professional



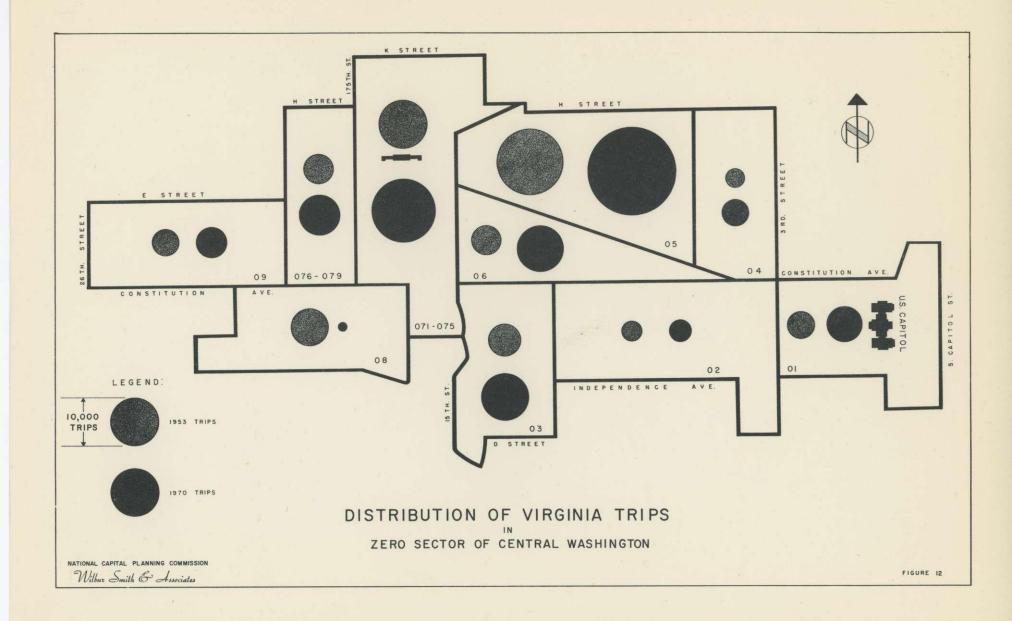
organizations is focused on the downtown area. These facilities will generate new demands for the movement and storage of automobiles.

Within the past few years, regional type shopping centers, specifically oriented to the mobile auto-borne patron, have accelerated the decentralization of retail shopping. A considerable volume of retail sales is now transacted in outlying shopping centers in the Washington metropolitan area. Some of these centers offer a wide variety of goods and a range of prices comparable to those in the downtown area. Trade is attracted to outlying centers by their proximity to potential customers and the availability of parking space.

A basic support for the future of the central area, however, is the fact that it is, and will remain, <u>central</u>. It is almost inconceivable that any suburb will ever be as readily accessible as the central business district from the entire metropolitan area. It will continue to be a focal point of traffic and parking demands.

Location of Central Business District

The focus of the central business district in downtown Washington lies between the White House and the Union Station. The main shopping district with its department stores and specialty shops extends from 7th to 15th Streets northwest and from Pennsylvania Avenue to "H" Street. As previously indicated, office buildings and a "quality" retail development are spreading to the northwest; these growths have been stimulated by their proximity to high income residential areas. Some similar new development is also taking place at the eastern perimeter of the area.



The central business district is located in the approximate center of the Washington metropolitan area. The governmental buildings adjacent to it are the largest centers of employment in the city, thus the down-town shopping district is well situated to serve a high proportion of the areas' wage earners. The governmental buildings and the White House also attract large numbers of tourists and other visitors, many of whom are drawn to the shopping center. There is every reason to believe that the central business district will continue to increase in importance as the metropolitan area grows. The increase in importance of the area will come primarily from increases in activities other than retail trade. Changes in the utilization of land will influence traffic and parking demands accordingly.

The distribution of Virginia trips in the "Zero Sector" of
Washington, which encompasses the central business district are shown
graphically in Figure 12 for both 1953 and 1970. District 05 in which
the downtown sector is located is the primary attractor; it generates
a third of all trips between Virginia commuters and the center of the
city. Table V shows the present and anticipated distribution of transriver trips in downtown Washington. The 1970 values assume some redevelopment in the southwest areas of the city (including district 03)
and the elimination of temporary governmental buildings (district 08).
By 1970, it is estimated that district 05 will generate an even higher
proportion of all downtown travel than at present.

Table V

DISBTIBUTION OF VIRGINIA TRIPS TO ZERO SECTOR
OF
CENTRAL BUSINESS DISTRICT

District1/	Percent of	Total Trips
	19532/	19703/
01	5.4	5.9
02	2.7	2.2
03	7.7	10.8
04	2.8	3.1
05	33.0	37.1
06	9.1	10.2
071-075	16.8	18.8
076-079	7.0	7.4
08	10.6	0.2
09	4.9	4.3
	100.0	100.0

Notes

Circulation System -- Thoroughfare Plans

The primary thoroughfare systems of major metropolitan areas have traditionally developed in a random piecemeal manner as the communities grew in size. When the communities were small the primary systems consisted simply of the major streets. As the urban areas expanded

Districts are shown in Figure 12.

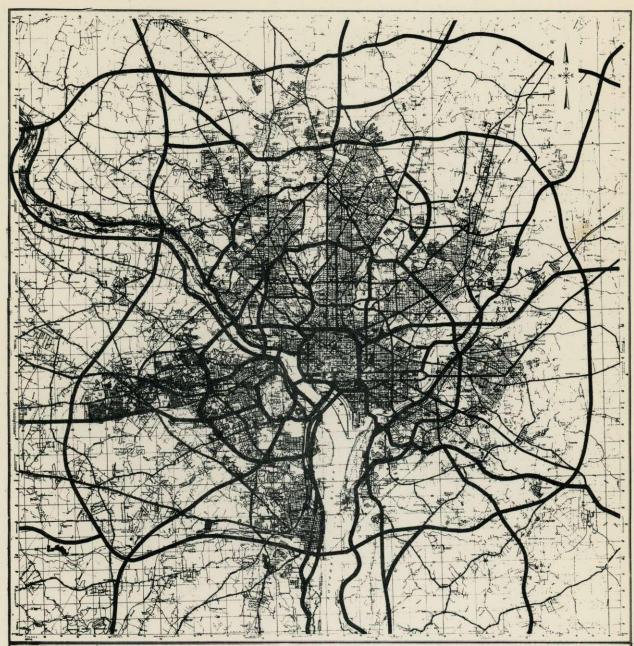
²Based on 1948 O-D Survey.

³Assumes elimination of temporary government buildings and effectuation of Southwest Redevelopment Project.

the relative importance of specialized major and minor streets became evident and a larger variety of thoroughfares were developed. Primary thoroughfares in the modern metropolis should consist of a system of express highways designed to limited access standards with separation of intersections and crossings and with control of abutting access. They may include parkway features to enhance their attractiveness to the road user. These freeway type facilities should be supplemented with adequate secondary roads, together forming a comprehensive continuous road net.

A number of plans and programs have been set forth for the development of a major thoroughfare system for metropolitan Washington. Some studies have been quite comprehensive and have attempted to establish an integrated network of roads and bridges which would serve the entire area. The most comprehensive of these studies are those of the National Capital Planning Commission, first published in 1950, and the "Recommended Highway Improvement Program" prepared by the Regional Highway Planning Committee in 1952 as an outgrowth of the 1948 origin-destination study. Both have been supplemented in part by studies of highway needs at specific locations.

Proposed Regional Thoroughfare Plan of the National Capital Planning Commission is shown in Figure 13. Utilizing the existing elements of a comprehensive system, the plan develops an extensive system of radial and circumferential thoroughfares, of which express highways and parkways are the key elements. Three "ring roads" serve to intercept radial traffic—an inner loop around the central business district of Washington, an intermediate loop, and an outer ring road in Maryland and Virginia. The plan calls for four new bridges across the Potomac River to provide the trans—river links in the pattern.



NATIONAL CAPITAL REGION

PROPOSED REGIONAL THOROUGHFARE PLAN

DOMINANT THOROUGHFARES

MAJOR HIGHWAYS

PARKWAYS

MAJOR HIGHWAYS

Wilbur Smith & Associates

NATIONAL CAPITAL PLANNING COMMISSION
MARCH 1954

FIGURE 13

The construction of a Constitution Avenue Bridge, approved in a recent resolution by the National Capital Planning Commission, has now been authorized by Congress. Other principal features of the thoroughfare plan also approved by the Commission include the widening of Key Bridge, the development of the Inner Loop Expressway and the construction of a Roaches Run Bridge.

Improvements indicated in the program of the Regional Highway
Committee of Washington have been designed to increase the capacities
of the street systems in downtown Washington and in congested suburban
centers, of important radials, and of crosstown and cross-county routes.
It also recommends the eventual construction of an outer-circumferential
highway about the Washington area and corrective treatments for principal trafficways in the metropolitan area. Relevant to Potomac River
Crossings, and the Inner Loop Expressway, the Committee's program is in
substantial accord with, and designed to carry out, the objectives of
the Comprehensive Plan.

It is evident that integration of the various proposals, programs, and plans is necessary in order to complete a well-rounded highway and street system. Continuity of capacity and fluidity are requisite.

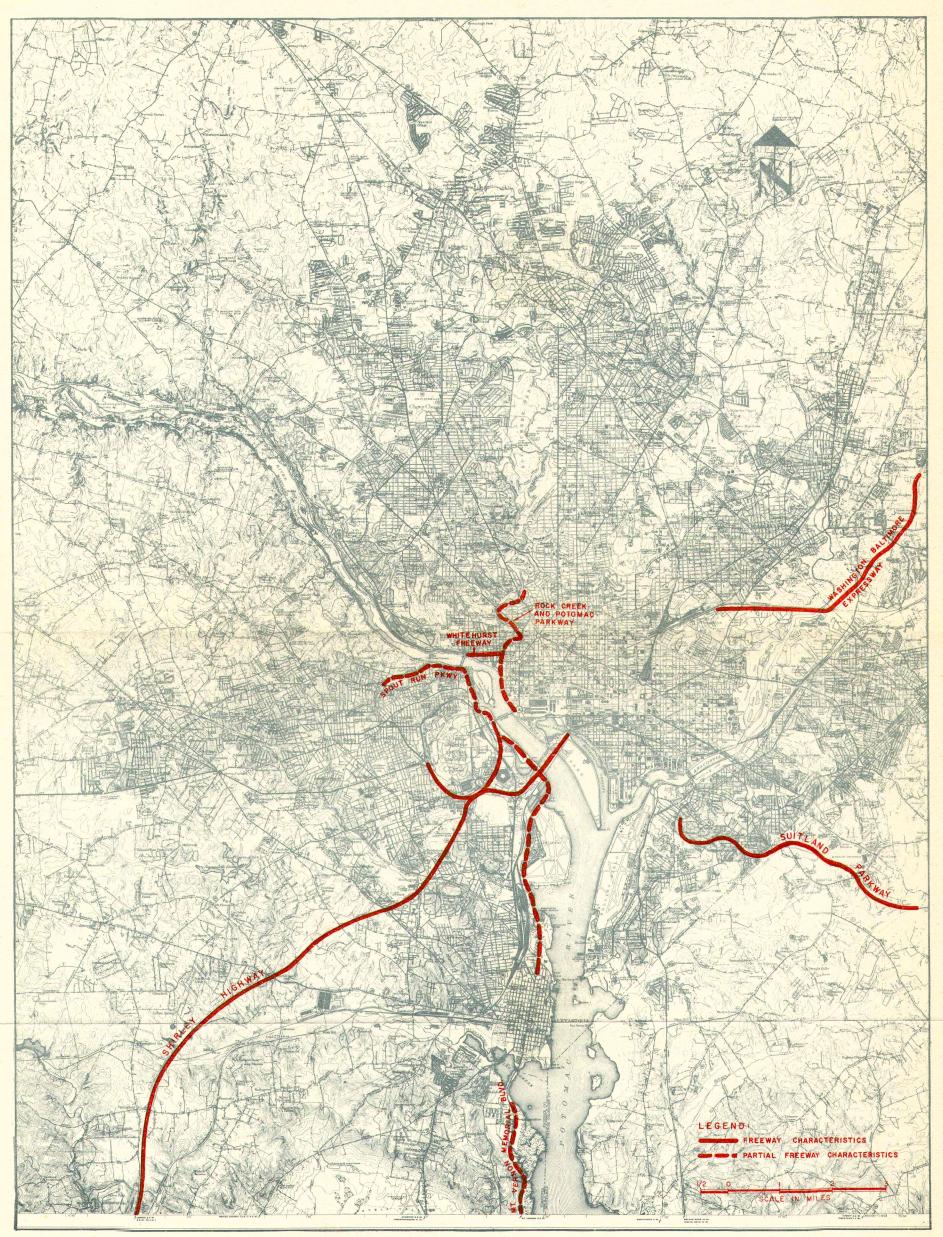
The specific needs of this study required that an estimate be made of 1970 traffic demands in the Washington Metropolitan Area. The time required to travel between origin and destination—from home to work, from work to shopping, etc.—is a basic element in the generation of travel by either automobile or bus. It has been necessary, therefore, to anticipate the degree to which an express highway network will have been completed to serve the metropolitan area by 1970, and to estimate the time required to travel on it from one zone to another.

Existing elements of a comprehensive highway plan are shown in Figure 14. Typical of the expressways are the Baltimore-Washington Parkway, Suitland Parkway, Shirley Highway and the Pentagon network. The Rock Creek and Potomac Parkway, the Mount Vernon Memorial Boulevard and the George Washington Memorial Parkway have partial expressway characteristics. The Kenilworth Avenue improvement and the East Capitol Street Bridge are now under contract. Further sections of the Washington-Annapolis Expressway and the Washington National Pike are now scheduled for early construction.

The Commission's proposed thoroughfare plan published in 1950 is now being studied by concerned highway and planning agencies in light of more recent studies and new information. The portions of the plan which appear to be most likely of acceptance and realization by 1970 are shown in Figure 15. It is this system of expressways which forms the basis for the 1970 estimates of traffic interchange in the Washington area. This system includes the extension of the George Washington Memorial Parkway both in the Maryland and Virginia sides to Cabin John, the Inner and Outer Circumferentials and the Fort Drive Link in the Intermediate Circumferential between Sargent Road and just south of Kenilworth expressway.

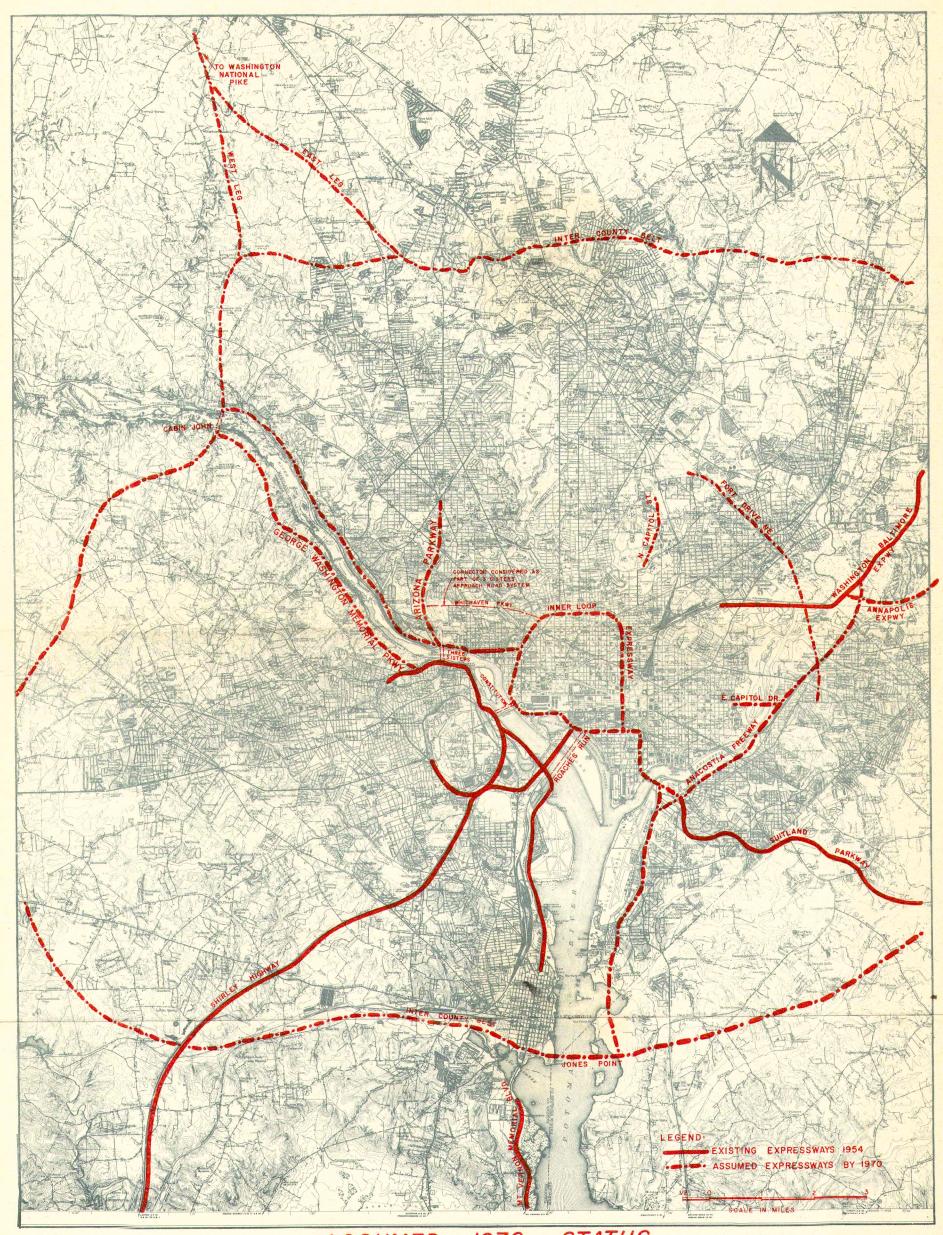
Possible Effects of Proposed Federal Highway Legislation on Route Planning

The possibilities of legislative action in the immediate future which might modify the scope of anticipated construction programs cannot be overlooked. There are strong indications that Congress is preparing to enact highway legislation which will greatly increase the tempo of highway construction in and around large metropolitan areas, particularly those routes designated as part of the National Inter-regional Highway



EXISTING ELEMENTS

METROPOLITAN EXPRESSWAY SYSTEM



ASSUMED 1970 STATUS
METROPOLITAN EXPRESSWAY SYSTEM

System. If the tentative proposals thus far announced were to be enacted, even in part, it is clear that funds for new highway construction would be available in much larger amounts than those on which the present plans are based.

If an accelerated program of highway construction takes place in the Washington Metropolitan area and the highways anticipated for 1970 are built before that date, traffic volumes will undoubtedly increase more rapidly than the forecasts indicate.

Chapter IV

POTOMAC RIVER BRIDGES

Increased river crossing demands are a reflection of the suburbanization of Virginia, and of the development of traffic generators, such as the Pentagon, on the Virginia side. River crossings have more than doubled in the last 15 years; at present (1954) there are 217,000 transriver trips. By 1970, based on normal growths, it has been shown that the total crossings will be about 328,000 daily.

Existing Bridges

Analysis of traffic characteristics and operations of existing bridges is a prerequisite to the determination of future bridge needs.

Accordingly, performance of the four vehicular bridges currently spanning the Potomac River--Highway Bridge, Memorial Bridge, Key Bridge, and Chain Bridge--have been studied. General characteristics of these bridges are summarized in Table VI.

Table VI

PHYSICAL CHARACTERISTICS: POTOMAC RIVER BRIDGES

Bridge	Year Open to Traffic	Pavement Width	Lanes	Type Span
Highway - Old (14th Street)	1903	40	3	Movable
New	1950	50	4	Movable
Memorial	1932	60	6	Movable
Key	1924	50	4	Fixed
Chain	1938	30	2	Fixed

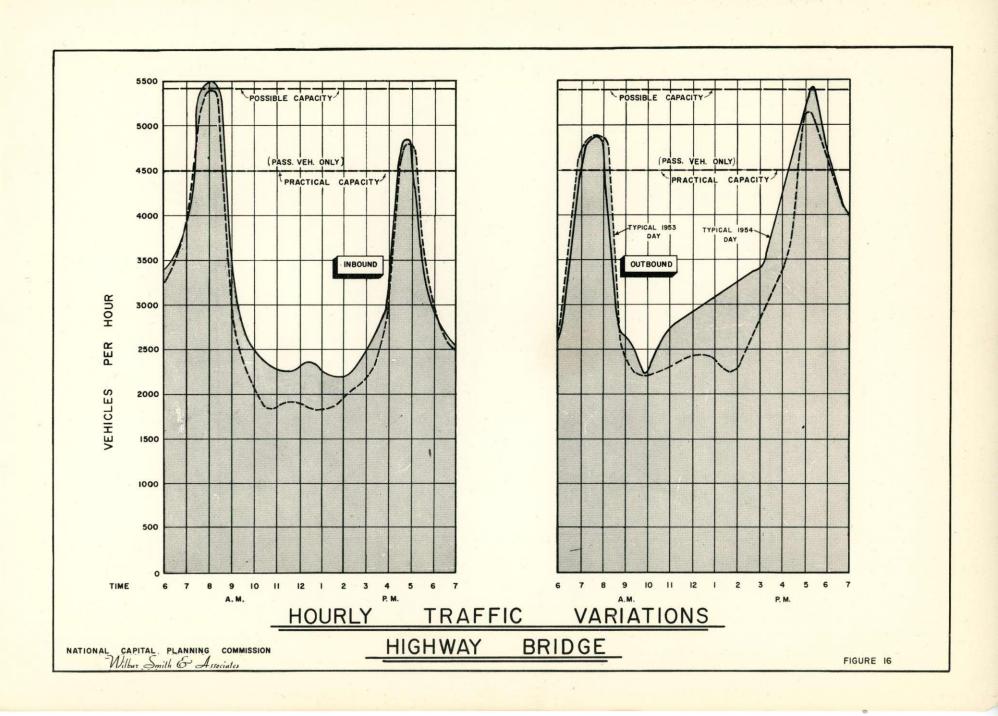
<u>Highway Bridge</u> - The Highway Bridge is the principal and most direct connector between central Washington and Alexandria. The original bridge, with its 40 foot roadway was erected in 1903. In 1927, when crossings

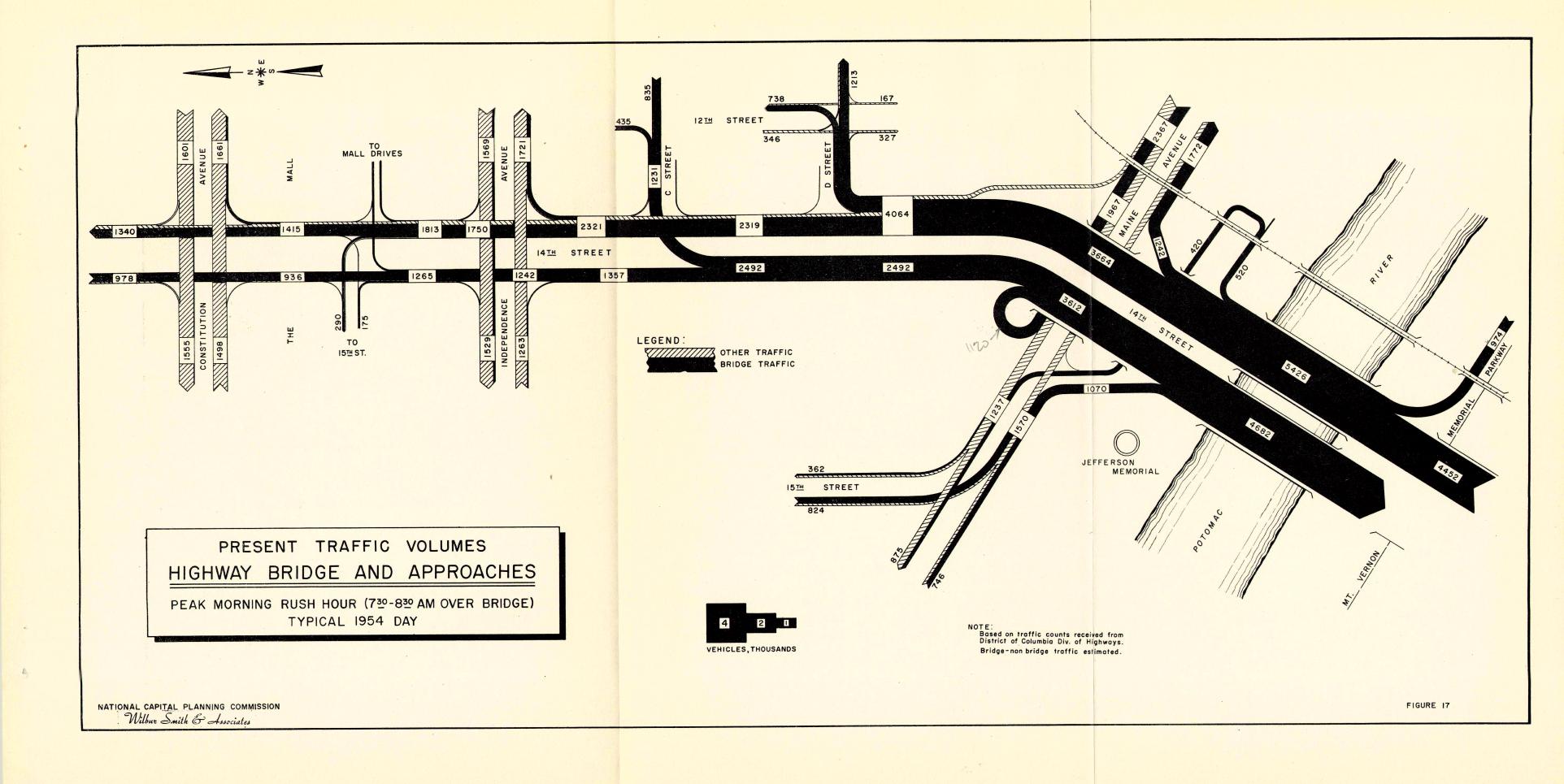
totaled 12,000 daily, the street railway tracks were removed and the bridge resurfaced. The bridge roadway carried two lanes of traffic in each direction prior to 1950 when a companion Highway Bridge with a fifty foot roadway was placed in operation to the south of the original structure. The new bridge provides four lanes of traffic inbound, while the old bridge carries three outbound lanes.

On a typical 1954 weekday, the Highway Bridge carried between 100,000 and 107,000 vehicles. Hourly traffic variations on the bridge are indicated in Figure 16 for typical 1953 and 1954 days. Peak directional volumes were found to approximate 5,400 vehicles per hour--inbound during the morning rush period and outbound during the evening rush. Effects of Virginia employment centers (viz the Pentagon) are evident from the pronounced secondary "counter rush" peak values.

A detailed traffic flow diagram for the Highway Bridge, and its Washington approaches (14th Street and connectors) is presented in Figure 17 for a typical morning rush hour. The dispersion of bridge traffic to Maine Avenue, D Street, Independence Avenue and 15th Street is readily apparent. Only about 15 percent of the total inbound bridge traffic crosses Constitution Avenue northbound on 14th Street.

Maximum lane capacity of the Highway Bridge was determined to be about 1,800 vehicles per hour. The practical lane capacity for the bridge was found to be 1,500 vehicles per hour. In Virginia, the Highway Bridge has limited success connections with the Mount Vernon and Shirley Memorial Highways, U. S. Route 1 and the Pentagon Road net. The capacity of these roads is sufficient to accommodate all Virginia-bound bridge traffic.



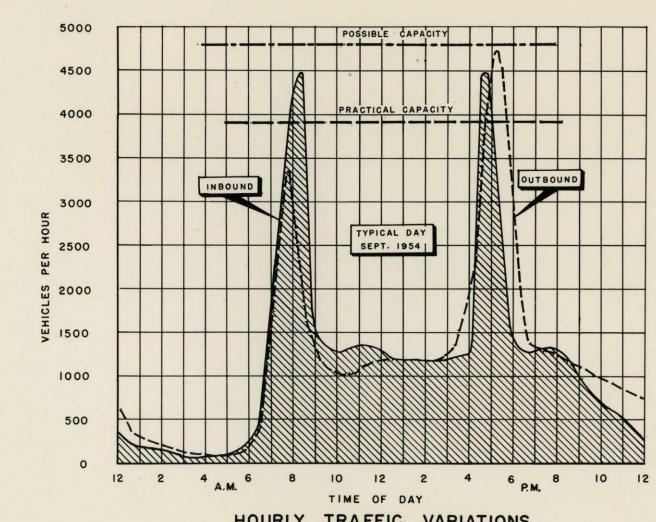


In Washington, except for a devious turnoff to 15th Street, the four inbound lanes must converge to three before reaching the off ramp at Maine Avenue. This restrictive cross section prevents full utilization of the inbound roadway. The <u>effective</u> inbound bridge capacity is reduced to three lanes, and backups of traffic into Virginia frequently result. It should also be noted that 14th Street (three lanes each way) is saturated during periods of maximum bridge traffic. Traffic signals at "C" Street and Independence Avenue impede the steady flow inbound. Insufficient bridge capacity during peak evening hours often develops traffic backups of southbound traffic across the Mall on 14th Street.

Memorial Bridge - The Arlington Memorial Bridge was opened to traffic in 1932. It is centered upon an axis connecting the Lincoln Memorial in Washington with the Memorial entrance to Arlington National Cemetery. The bridge connects major parkways and roadways on the Virginia side with Constitution Avenue, Independence Avenue, 23rd Street, and the extension of Rock Creek and Potomac Parkway on the Washington side of the river.

Fifty-four thousand vehicles use the Memorial Bridge on a typical weekday. Peak directional volumes amount to about 4,400 vehicles per hour, inbound towards Washington in the morning and outbound to Virginia in the evening. Typical hourly traffic variations are shown in Figure 18 and pinpoint the preponderance of peak hour flows. Bridge capacity values are also indicated.

The traffic flow patterns on Memorial Bridge and its environs are depicted in Figure 19 for a typical peak morning rush hour. The intermingling of bridge and other movements is readily apparent. Over 30 percent of all inbound bridge traffic travels north on 23rd Street.

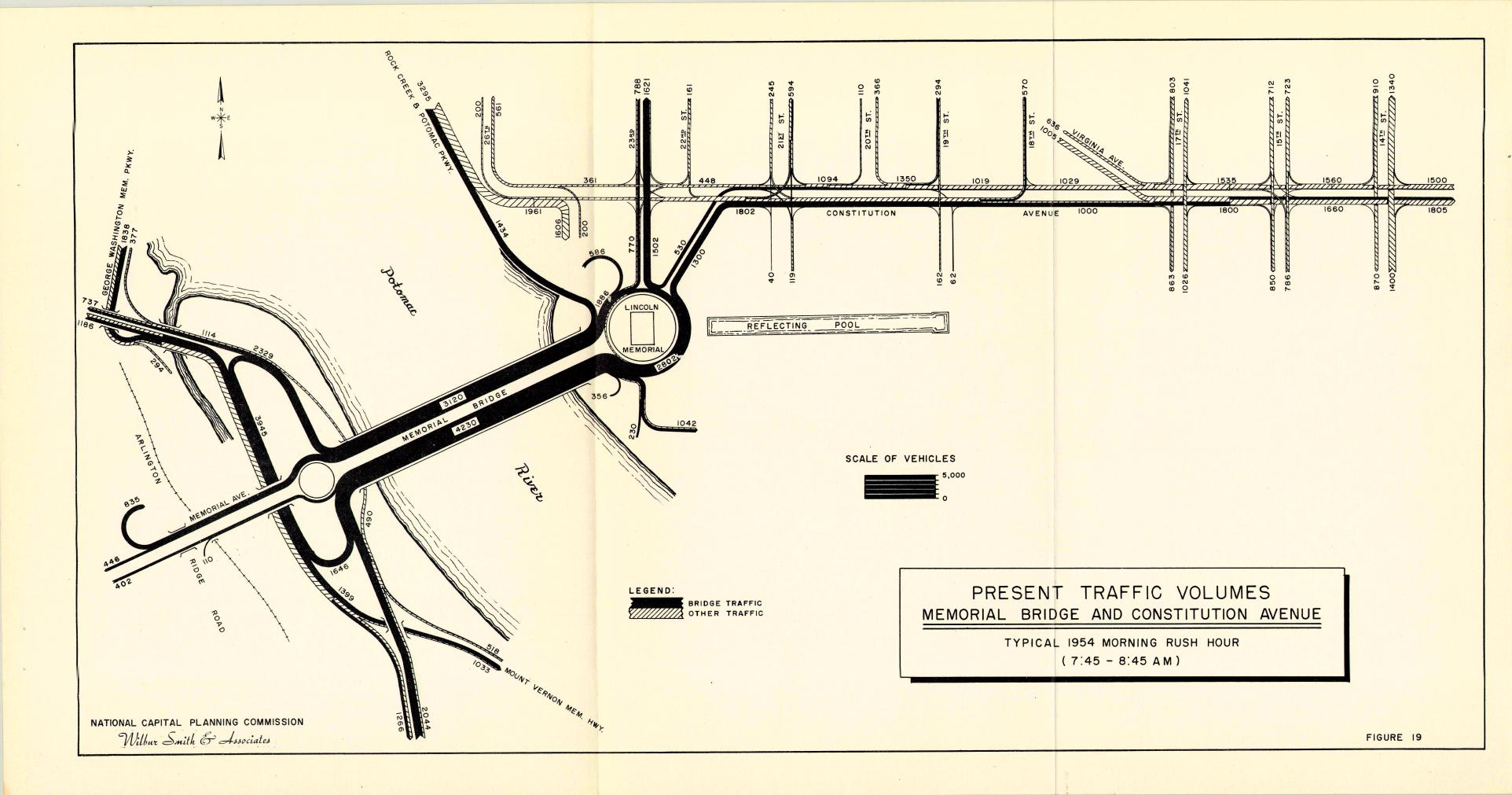


HOURLY TRAFFIC VARIATIONS

MEMORIAL BRIDGE

NATIONAL CAPITAL PLANNING COMMISSION

Wilbur Smith & Associates



Bridge traffic on Constitution Avenue at 14th Street is only about 15 percent of the total inbound crossings.

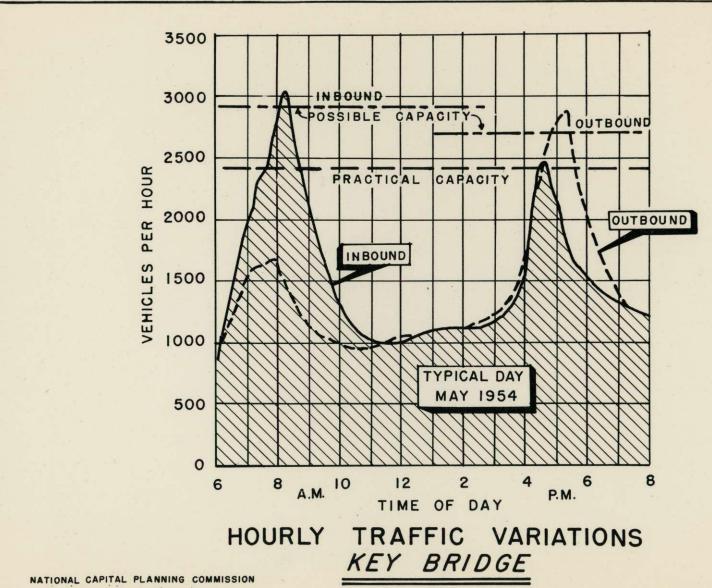
The Memorial Bridge, in terms of lane densities, is the lightest travelled bridge even though its maximum per lane flows of 1,500 vehicles per hour exceed optimum capacity value. Short turning radii on the traffic circles at both ends of the Memorial Bridge, particularly at the Lincoln Memorial, restrict speed and develop critical weaving conflicts.

Key Bridge - The Francis Scott Key Bridge, Georgetown, was completed in 1924 replacing an old iron bridge constructed in 1888. The bridge has a 50 foot roadway, with a double streetcar track in the center. There are two moving lanes of traffic in each direction of travel. The bridge connects with the Whitehurst Freeway and "M" Street on the District side of the Potomac River. In Virginia a traffic circle connects Lee Highway (U.S. 29-211) and local streets to the bridge. The local streets serve as connectors to Wilson Boulevard.

The Key Bridge currently carries 47,000 vehicles daily. Hourly traffic variations as related to bridge capacities are indicated in Figure 20. Peak directional flows approach 2,700 vehicles per hour.

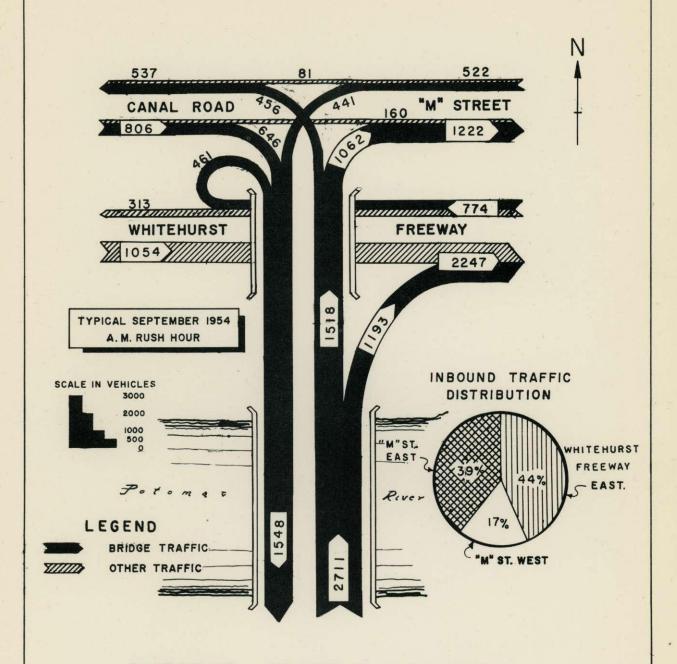
The traffic flow patterns on the Washington approach of the bridge are graphically depicted in Figure 21 for a typical 1954 morning peak hour. Approximately 80 percent of all inbound movements are destined to the east. The greater number of these vehicles utilize the Whitehurst Freeway.

Capacity restrictions on both the Washington and Virginia approaches prevent the Key Bridge from developing a possible lane capacity in excess of about 1,400 vehicles per lane. As shown in Figure 20 this saturation



William Smith & Associates

FIGURE 20



PRESENT TRAFFIC VOLUMES

KEY BRIDGE

NATIONAL CAPITAL PLANNING COMMISSION
Wilbur Smith & Associates

FIGURE 21

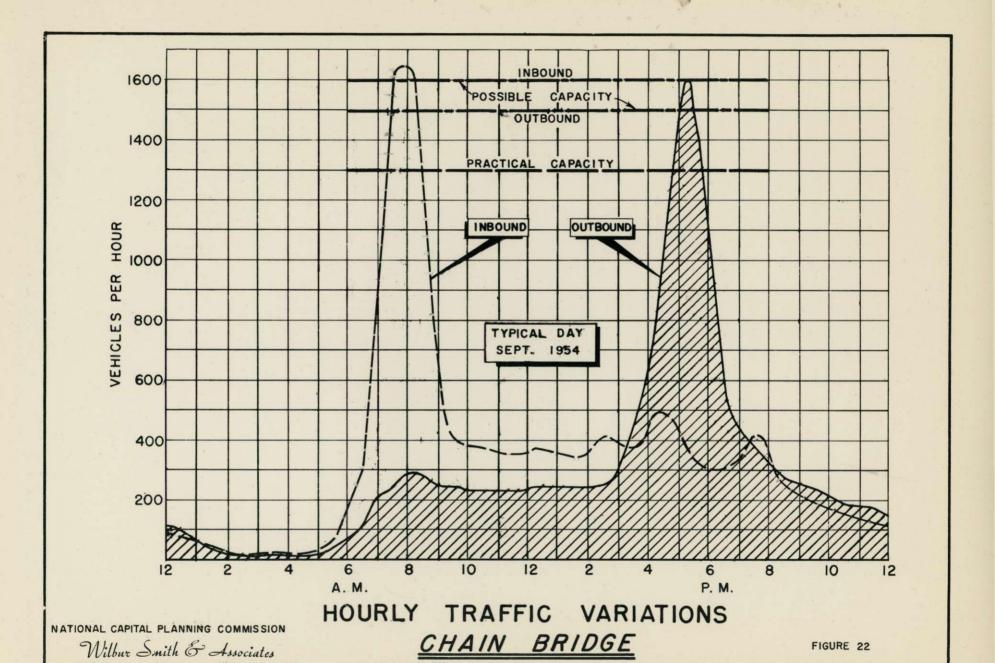
capacity is frequently equalled. Traffic backups onto the bridge in the morning hour from the eastern terminus of the Whitehurst Freeway often impede bridge traffic flows. Similarly the signalized operations at "M" Street cannot efficiently accommodate the approaching steady flows. In the evening rush period westbound freeway traffic backs up across the outbound ramp from the signalized intersection at Canal Road. Similarly, the traffic circle at Virginia and nearby traffic signal operations decrease possible bridge capacities. Some capacity restrictions result from street railway operation on the bridge roadway. They appear to be relatively minor when compared to the restrictive conditions on the bridge approaches.

Chain Bridge - The Chain Bridge, located upstream and farthest removed from central Washington, was first built in 1797. The present bridge has been in operation since 1938 and superseded five earlier structures.

The Chain Bridge has a thirty foot wide roadway; one lane of traffic moves in each direction. In Virginia the bridge connects with Glebe Road, Military Road, and Route 123. It connects with Canal Road in the District south of the river. There are 14,000 Potomac River crossings over the bridge on a typical 1954 day.

Hourly traffic variations for the Chain Bridge, and bridge capacities are shown in Figure 22. Flows are relatively minor when compared to the loadings on the other river crossings. Movements during the peak hour exhibit pronounced directional tendencies. Peak hour directional volumes approximate 1,500 vehicles.

The sharp curvature on the Washington side of the bridge, and the intersection of Route 123 and Glebe Road on the Virginia side of the



Potomac River with its restricted sight distance reduce the possible bridge capacity to about 1,500 vehicles per lane per hour. This value is reached during peak hours.

General Traffic Characteristics of Existing Bridges. The existing Potomac River Bridges must also be analyzed as a system of river crossings. The location and general accessibility of each bridge as related to desire lines of travel and the traffic attractiveness or capacity of the bridge will determine the proportion of trans-river trips that will use any given facility.

The distribution of the present trans-river crossings are summarized in Table VII. Almost half of the 217,000 daily crossings, and about 40 percent of the total peak hour directional movement of 14,000 vehicles use the Highway Bridge. There is relatively equal usage throughout the day of the Memorial and Chain Bridges, with a somewhat heavier share of the total peak hour crossings on the Memorial Bridge.

TABLE VII

RELATIVE UTILIZATION POTOMAC RIVER BRIDGES

1954

Bridge	Daily Traffic <u>Vehicles</u>	% of Total Crossings	Peak Inbo <u>Vehicles</u>	Hour und % of Total	Outbo	Hour ound % of Total
Highway	102,000	47.0	5,400	38.8	5,350	38.4
Memorial	54,000	24.9	4,230	30.4	4,420	31.7
Key	47,000	21.7	2,660	19.3	2,670	19.2
Chain	14,000	_6.4	1,600	11.5	1,490	10.7
TOTAL	2,17,000	100.0	13,890	100.0	13,930	100.0

The traffic composition of vehicles crossing the Potomac River is summarized in Table VIII. Passenger cars comprise over 85 percent of the total movement across all bridges.

Peak hour directional movements are compared with the total daily river crossings for each of the existing bridges in Table IX. Inbound trips in the morning peak hour and outbound trips in the evening peak hour each constitute over 6 percent of the total daily crossings. Peak hour traffic ranges from 5 percent of the total daily movements across the Highway Bridge to 11 percent of the total daily Chain Bridge traffic.

TABLE VIII

TRAFFIC COMPOSITION
POTOMAC RIVER BRIDGES

Type Vehicle	Bri 1948	thway dge 1953	Memo Bri	nt of Torial idge 1953	Ke	ey Ldge	Bri	ain Idge 1954
Passenger Vehicles	84.6	87.8	97.2	97.4	83.7	87.0	90.8	93.2
Single Unit Trucks	9.4	7.8	0.4	0.5	12.1	10.6	8.7	6.3
Combination Trucks	3.2	2.9	0.0	0.0	1.8	0.8	0.3	0.3
Buses	2.8	1.5	2.4	2.1	2.4	1.6	0.2	0.2
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Equivalent Passenger Vehicles	106	105	100	101	106	104	103	102

TABLE IX

PEAK HOUR TRAFFIC CHARACTERISTICS POTOMAC RIVER BRIDGES 1954

			Hour ound	Peak Hour Outbound		
			% of Daily		% of Daily	
Bridge	Daily Traffic	Vehicles	Total	Vehicles	Total	
Highway	102,000	5,400	5.3	5,350	5.2	
Memorial	54,000	4,230	7.8	4,420	8.2	
Key	47,000	2,660	5.6	2,670	5.6	
Chain	14,000	1,600	11.5	1,490	10.6	
TOTAL	217,000	13,890	6.4	13,930	6.4	

Peak hour traffic is slightly more concentrated on the bridges than on the adjacent street net in the District. As shown in Table X evening peak hour traffic leaving the inner cordon area of central Washington represents about 5 percent of the total daily movements. In evaluating all peak hour traffic flows it must be remembered that 15 and 30 minute peaks within the hour often have greater intensities than the indicated hourly values.

By relating the traffic demands placed on a facility to the available capacity, its adequacy can be determined. Accordingly, capacity values for the existing bridges and their approaches were calculated. 8/Consideration was given to the number and efficiency of moving lanes, nature and extent of interferences, vehicular headways, and related operational factors which influence capacities.

Present bridge and approach capacities are summarized in Table XI.

The minor variances between inbound and outbound capacities result

^{8/} The following capacity criteria in accord with the Highway Capacity Manual were employed: maximum, possible, or saturation capacity represents the greatest sustained hourly loading that a facility can accommodate under prevalent conditions of operations. Optimum or practical capacity represents the maximum desired loading.

from the critical approach conditions. The combined present <u>possible</u> directional capacity of the four bridges and their approaches approximates 14,500 vehicles per hour. The maximum <u>optimum</u> directional loading is about 12,000 vehicles per hour for the bridges and approaches.

Present total peak hour directional loadings approximate 14,000 vehicles.

The potential capacities of the bridges, if restrictive approach conditions were eliminated, are also indicated. The most marked capacity increase is that of the inbound span of the Highway Bridge.

Full utilization of all four lanes would increase present capacities about a third.

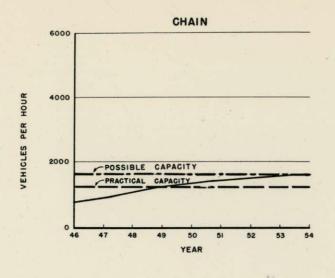
Trends in inbound peak hour Potomac River Bridge traffic are compared with available capacities in Figure 23. It is significant to note that the practical capacities of all bridge systems have been exceeded in recent years.

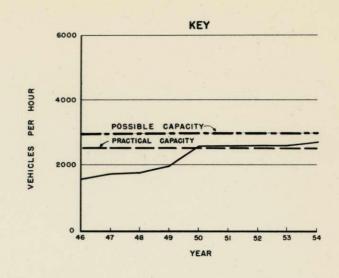
Table X

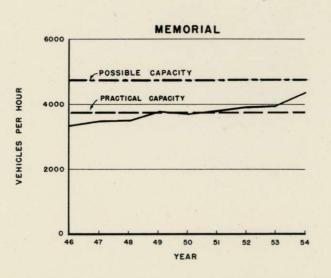
PEAK HOUR TRAFFIC IN CENTRAL WASHINGTON
AS PERCENT OF TOTAL ADT-1953

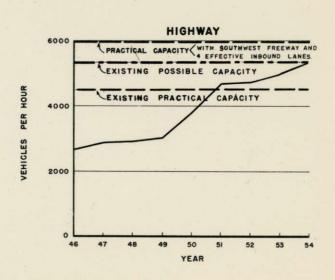
	A.M. R	ush Hour	P.M. Rush Hour		
	Inbound	Outbound	Inbound	Outbound	
South Side Inner Cordon	4.5%	4.8%	4.1%	4.7%	
West Side Inner Cordon	5.6	4.3	3.2	6.7	
North Side Inner Cordon	4.9	3.4	2.9	5.0	
East Side Inner Cordon	4.7	3.7	2.9	5.0	
Entire Cordon Area*	5.0%	3.8%	3.2%	5.2%	

^{*}Cordon extends south of Constitution, West of 21st, North of L Street, East of Third Street.









TRENDS IN INBOUND PEAK HOUR POTOMAC RIVER BRIDGE TRAFFIC

NATIONAL CAPITAL PLANNING COMMISSION

Wilbux Smith & Associates

Table XI
PRESENT BRIDGE CAPACITIES

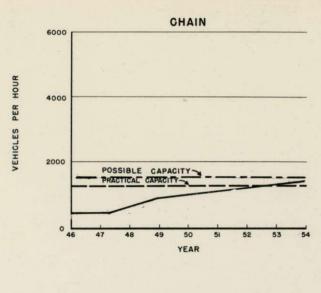
BRIDGE:	HIGH	WAY*	MEM IN	ORIAL	CHA	.IN*	KEY IN	* OUT	TOTAL IN	* OUT
	TIA	001	TIV	001	IN	001	TIV	001	TIM	001
Possible O Bridge &			4,800	4,800	1,600	1,500	2,900	2,700	14,700	14,400
Possible C										
Bridge On	7,200	5,400	4,800	4,800	1,800	1,800	3,400	3,400	17,200	15,400
Practical Capacity Bridge and Approaches										
	4,500	4,500	3,900	3,900	1,300	1,300	2,400	2,400	12,100	12,100
Peak Hour Loading				3.8						
1954	5,400	5,350	4,230	4,420	1,600	1,490	2,660	2,670	13,890	13,930

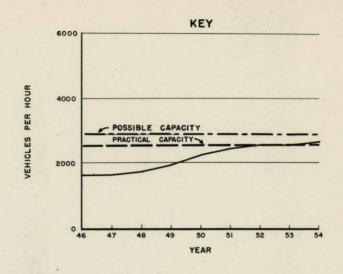
^{*}Commercial vehicles would reduce these capacities slightly.

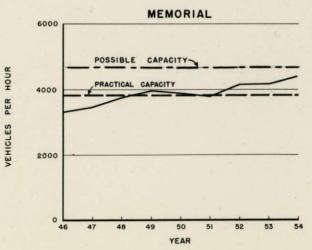
Trends in outbound peak hour Potomac River Bridge traffic as related to capacities are shown in Figure 24. The patterns of growth are similar to those for inbound traffic.

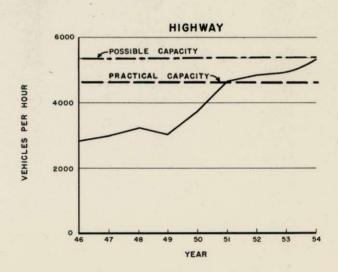
Approximate daily capacities have also been determined from the present (1954) relationships between peak hour directional loadings and average daily flows. These capacity values have been superimposed over the trends of average daily traffic crossing the Potomac River on existing bridges and are graphically summarized in Figure 25. The need for additional bridge capacity is evident!

The traffic sufficiencies for the existing Potomac River bridges and their approaches are indicated in Table XII. Peak hour volumes are expressed as a percent of available capacities. It is readily apparent





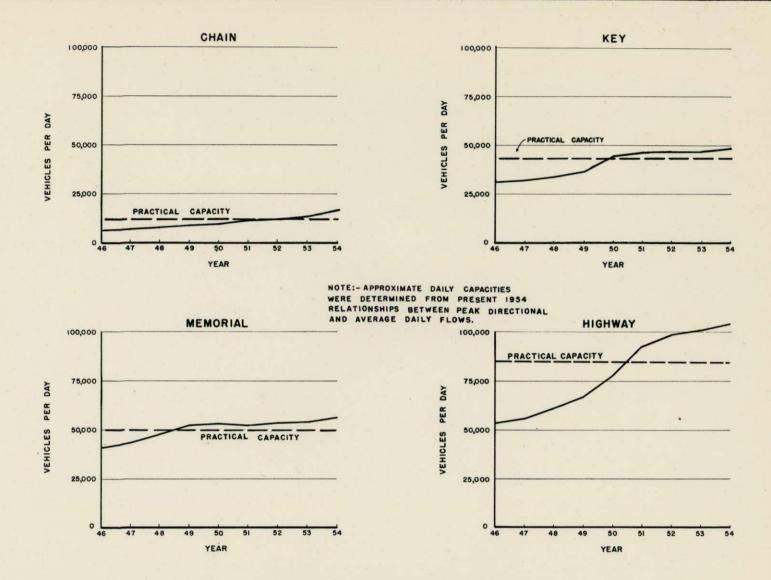




TRENDS IN OUTBOUND PEAK HOUR POTOMAC RIVER BRIDGE TRAFFIC

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FIGURE 24



TRENDS IN DAILY POTOMAC RIVER BRIDGE TRAFFIC

NATIONAL CAPITAL PLANNING COMMISSION
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that the practical capacities of all four bridges are exceeded during

peak traffic hours. Possible or saturation capacity values are reached

during both peaks on the Highway Bridge, and are approached on all the

other structures. The Memorial Bridge appears to be the least overloaded.

The sufficiency of the Potomac River Crossings is summarized in Table XIII. The seriousness of the bridge problem, and the need for additional river crossings, is evident. At the present time the directional peak hour traffic exceeds the combined "practical capacity" of all bridges. The peak hour loads are within 95 percent of the possible capacity of the combined bridges. Peak hour congestion involving river crossings can be expected to reach the "breaking point" - complete saturation - in approximately one year.

TABLE XII
TRAFFIC SUFFICIENCIES
POTOMAC RIVER BRIDGES*

	PEAK	PEAK HOUR VOLUME AS PERCENT OF AVAILABLE CAPACITY					
	INBO	DUND	OUTBO	OUTBOUND			
	<u>A</u>	<u>B</u>	<u>A</u>	B			
Highway Bridge	120	100	119	100			
Memorial Bridge	108	88	114	93			
Key Bridge	111	92	112	99			
Chain Bridge	122	100	114	99			

A - Practical Capacity B - Possible Capacity

^{*}As affected by restrictive approach conditions.

TABLE XIII PRESENT TRAFFIC SUFFICIENCY* POTOMAC RIVER BRIDGES

	Inbound	Outbound
Total Volume-Typical 1954 Day Peak Hourly Flow	13,890	13,930
Practical Capacity	12,100	12,100
Sufficiency	114	114
Possible Capacity	14,700	14,400
Sufficiency	94	96

*Volume as percent of capacity.

Future Bridge Needs

It has been previously indicated that, based on normal growth trends, there will be about 328,000 vehicles crossing the Potomac River daily by 1970. This value represents an increase of approximately 50 percent over present crossings. If attractive and fully adequate systems of approach roads can be provided, the desired crossings can be expected to approach 393,000 daily.

To effectively meet peak hour demands and to accommodate reasonable trip requirements, the minimum lane requirements will be fourteen additional lanes within the next 16 years. This assumes that the new bridges will be located so as to permit direct and effective travel between motorists' principal points of origins and destinations and that all lanes will be utilized. It is evident that their locations will have to conform with natural travel patterns. The new bridges will have to be located so that their capacity can be served by approach roads on each side of the river.

Approach road nets must be carefully integrated with bridge plans. Inadequate approach highways, or required circuitous travel will greatly reduce

the practical effectiveness of a bridge. Improper locations can mean, therefore, that more lane capacities will be required.

Accepted Proposed Bridges on Outer Circumferential

Comprehensive plans for new Potomac River Bridge crossings should give cognizance to both capacity and access needs. Bridges should be constructed not only to eliminate capacity deficiencies, but also at those locations where they will become integral links of primary regional trafficways. A balanced system of Potomac River crossings should contain both central and peripheral bridges.

Highway as well as planning officials have already agreed on the construction of the Jones Point and Cabin John Bridges as part of the Greater Washington outer circumferential route. This is an accepted condition in the report.

Jones Point Bridge - The location for a river crossing at Alexandria has been one of the Regional proposals of the Comprehensive Plan. Bill H.R. 1980, signed by the President, authorized the Jones Point Bridge. The Jones Point crossing site is located south of the central district of Alexandria. Traffic analyses reveal that a four-lane bridge would meet traffic demands although it is understood a 6-lane structure has been contemplated. In Virginia the bridge would have interchange with the Mount Vernon Memorial Highway, Jefferson Davis Highway and Telegraph Road, and, via an extension, with the Shirley Highway. If the proposed Potomac River expressway is developed it would likely provide access to the bridge. In Maryland the bridge would have interchange with the proposed George Washington Memorial Parkway, Indian Head Road, and eventually be extended eastward as part of the Outer Circumferential.

The bridge would provide a valuable traffic service by affording a much needed by-pass of central Washington. It would permit direct routing between southwestern portions of the Metropolitan area and southeastern Washington, and eliminate virtually all the reverse movements currently negotiated over the Highway and south Capitol Street Bridges. Similarly, the connection to the Shirley Highway would attract traffic which would otherwise be required to traverse the Pentagon Road net. It would encourage suburbanization and would provide a "dispersed development" crossing of the Potomac River.

Cabin John Bridge - The Cabin John Bridge would span the Potomac in the vicinity of Cabin John Park about 8 miles northwest of central Washington. It would have contact with Route 193 in Virginia and MacArthur Boulevard in Maryland. It would also connect the George Washington Memorial Parkway on both sides of the Potomac River. The bridge would be an integral link in the Outer Circumferential. It would tap new areas and stimulate their development.

Preliminary traffic studies indicated that there are insufficient traffic potentials to justify its construction at present. In light of the recent plans by Maryland to expedite the construction of the Outer Circumferential, it is reasonable to expect substantial increases in the bridge's future traffic potentials. Accordingly, it is desirable that rights-of-way be reserved at the present time for the bridge approaches in both Virginia and Maryland.

New Proposed River Crossings Considered

Highway and planning agencies recognize the need for the construction of new intermediate and central Potomac River Crossings. Three general locations have been considered:

- (1) a downstream central location in the vicinity of Roaches Run or Hains Point;
- (2) a midstream central location in the vicinity of Constitution

 Avenue; and
- (3) an upstream intermediate crossing between the Key and Chain Bridges.

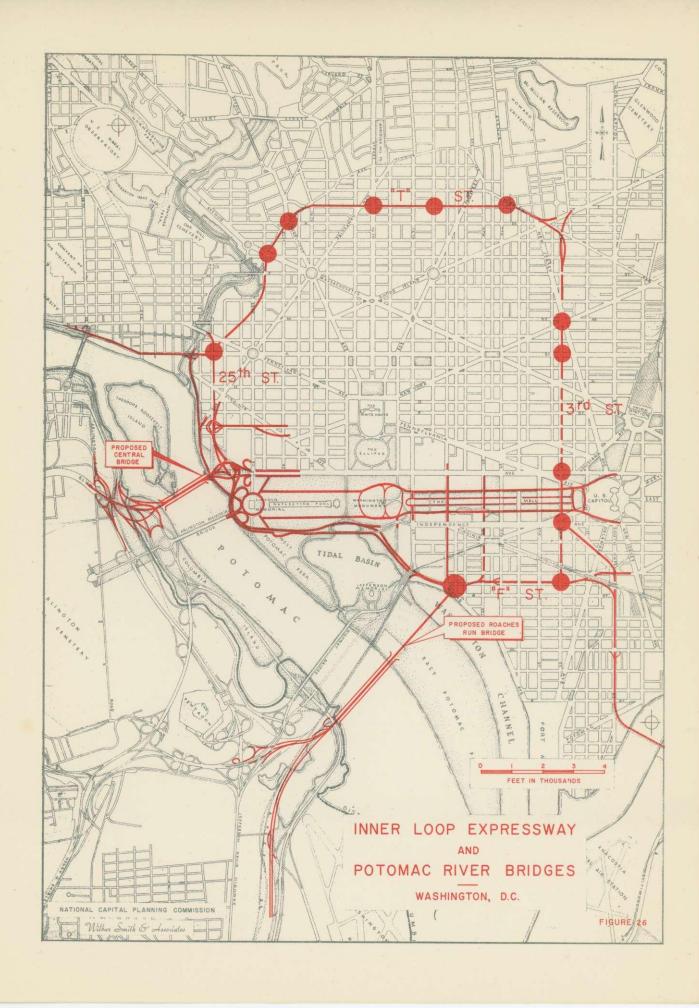
Tentative locations and alinements of the Roaches Run and Constitution

Avenue River Crossings are shown in Figure 26.

Roaches Run - The planned Roaches Run Crossing would be located in the vicinity of Roaches Run approximately 800 feet down stream of the railroad bridge; and would be a six-lane facility. The bridge would connect directly with the Southwest Expressway leg of the Inner Loop, and 12th Street in Washington and have interchange with Mount Vernon Memorial Highway and the Pentagon road network on the Virginia side via high type connectors.

By development of the Four Mile Run Expressway between the bridge and the Shirley Highway much trans-river traffic could be intercepted before reaching the Pentagon road net and conveyed directly to the bridge. The Four Mile Run Expressway integrates well into the planned Intermediate Circumferential in the Virginia metropolitan area. The contemplated Potomac River Expressway to Alexandria can be readily tied into the bridge.

Advantages -- Attractive interchanges can readily be provided on both approaches to the bridge. The facility can be expected to provide substantial relief to the heavy traveled Highway Bridge. It can advantageously serve densely populated sectors of the metropolitan area;



about two-thirds of the people in the Virginia metropolitan area currently live south of Arlington Boulevard. It is readily possible to integrate the bridge approach roads with the Southwest Expressway, and Southwest Redevelopment Plans. Opportunities exist for providing off-street parking areas in proximity of bridge approaches. It should be noted that these plans would increase the traffic attractibility of the southwest portions of central Washington. Via the Southwest Expressway Bridge traffic would have free flowing access to the South Capitol Street as well as to the Third Street leg of the Inner Loop Expressway. The bridge would provide all-weather express access to the National Airport. It provides direct access to the central shopping district and areas to the east. Much of the land required for the bridge approaches is under Federal ownership and can be readily committed to a bridge location at any time.

<u>Disadvantages</u> -- Increased north-south traffic flows on surface streets tributary to the bridge can be expected to develop needs for additional capacity at intersections along Constitution Avenue. The anticipated north-south flows and required capacities are developed fully in Part II of this report.

Constitution Avenue Bridge - The proposed Constitution Avenue Bridge is located about 1200 feet north of the Arlington Memorial Bridge. It connects with George Washington Parkway, Arlington Boulevard and the Jefferson Davis Highway on the Virginia side in a series of high capacity type interchanges. On the Washington side the bridge would have complete interchange with the west leg of the Inner Belt Expressway and would have a direct connection to Constitution Avenue. Twenty-third Street would be carried over Constitution Avenue thereby increasing the capacity of

both roadways. Integrated with the new bridge are new Mall roads which would serve the Memorial Bridge traffic, and reduce existing weaving maneuvers. An attractive contact between the Belt Expressway and a widened "E" Street Mall roadway would be provided.

Advantages -- The bridge provides a <u>direct</u> central crossing for Arlington Boulevard, Washington Memorial Parkway, and Lee Highway traffic approaching from the west and north. The bridge would attract vehicles currently using Memorial and Key Bridges relieving capacity problems on these facilities. It provides attractive access to the west central area. Virtually all of the land required for bridge approaches is under Federal ownership.

<u>Disadvantages</u> -- Converging traffic from Virginia Avenue onto Constitution east of the bridge is likely to develop capacity problems on the street, even with widening.

To separate Memorial and Constitution Avenue Bridge traffic, the Mall has been converted into a through trafficway to Ninth Street, thereby increasing traffic movements on the Mall roadway. The Constitution Avenue Bridge serves areas presently occupied by temporary buildings whose future access needs are likely to decrease. The bridge will not substantially relieve the traffic loadings on the Highway Bridge. The attractive interchange provided with Arlington Boulevard will likely develop increased traffic loads on the Virginia thoroughfare which is currently saturated during peak traffic hours. It should be noted that between 1948 and 1952 traffic volumes in Arlington Boulevard increased about 140 percent. Normal increases in local Virginia traffic alone will tax the capacities to be provided by the planned widening.

The additive bridge traffic would aggravate this condition and restrict operations on the roadway. To repeat, present trans-river traffic combined with the rapidly growing intra-Virginia traffic would absorb the capacity of this important expressway as rapidly as it is provided.

The Commission of Fine Arts has clearly set forth the impact of the structure on central area aesthetics. The Commission states that if a crossing must be provided at this location that it should be a tunnel. This type facility would be very costly although it would connect with the same road network as a bridge.

E Street Bridge - Early plans for a central crossing also considered a bridge connecting Arlington Boulevard with E Street in the vicinity of the E Street Inner Loop interchange. This bridge was superceded by the Constitution Avenue Bridge.

Three Sisters Bridge - The proposed Three Sisters Bridge would span the Potomac River over the Three Sisters Island. It would connect with Canal Road, MacArthur Boulevard, Foxhall Road and the planned Glover Archbold Parkway on the Washington side. On the Virginia side it would connect with the existing Washington Memorial Parkway, and its planned extension in a "bulb" type interchange. The proposed eastwest expressway serving the Falls Church area would be linked with the existing spur of the Washington Parkway to Lee Highway. The proposed Whitehaven Parkway in Washington about a mile to the north of the bridge would serve as a major east-west distributor.

Advantages -- The Three Sisters Bridge would strategically "intercept" Washington bound traffic from northwestern Virginia areas which would otherwise use Key, Central, or Memorial Bridges. That is, the "traffic shed" of the Three Sisters Bridge includes many of the

fastest growing areas in the Metropolitan region. This will occur to an even greater extent when the east-west expressway becomes completed. The bridge would permit direct and efficient trans-river movements to northwest Washington from all of metropolitan Virginia. This is a function which none of the existing bridges provides. The planned Intermediate Circumferential could easily utilize the bridge. Possibilities exist for connecting the bridge with the Inner Loop.

Disadvantages -- For the Three Sisters Bridge to offer maximum traffic service to trans-river crossings it should have a limited access connection via the Whitehaven Parkway to the Inner Loop. This necessitates an extension of the Whitehaven Parkway most likely through several blocks of relatively expensive residences and buildings, to connect with the Inner Loop at about Florida and Connecticut Avenues. The bridge will not serve traffic traveling to and from central Washington as efficiently as a more central crossing. Unless Canal Road is developed (Potomac River frame) to expressway/standards and the present bottlenecks of the Whitehurst interchange at the standards are removed, Three Sisters Bridge traffic will tend to overload these roadways during peak inbound periods.

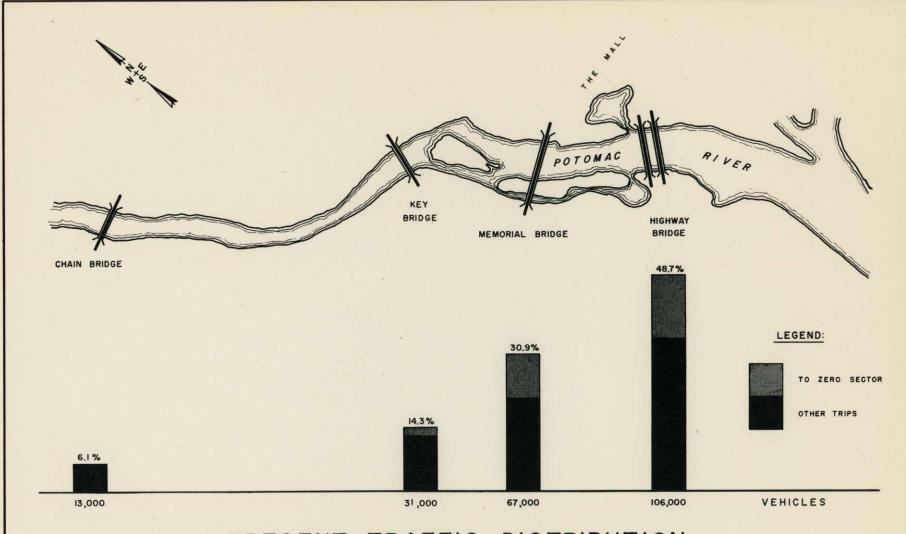
Nebraska Avenue - The Nebraska Avenue crossing of the Potomac River is located about midway between the Three Sisters and the Chain Bridges. The facility would be almost entirely an intermediate crossing and would not develop the traffic potentials of the Three Sisters. Field studies indicate that it would be difficult to provide attractive and economical connections on the Virginia side.

Traffic Potentials of Potomac River Crossings

The present trans-river crossing desires were related to the transportation services afforded by the available road net of metropolitan Washington. The amount of traffic potential to any bridge depends on the relative time and distance savings, and the quality of flow over the given facility as compared with competing routes, and its relation to vehicle origins and destinations. Motorists can be expected to seek out the easiest route from their origins to their destinations. The diversion factors that have been employed give due cognizance to that component of traffic which is potential to several alternate facilities. Origin-destination characteristics of central Washington were analyzed in detail.

Assignments of 1954 average daily traffic volume to the existing bridges are summarized in Table XIV. The actual traffic flows on the existing bridges are also indicated. In general, there is a reasonable correspondence between the actual and assigned crossings. It should be noted that the traffic assigned to the Key Bridge is considerably lighter than the volumes recorded on the facility. This crossing appears unattractive when trip desires are considered, chiefly because of its indirect approach connections and its poor orientation. The present loadings are to a considerable extent resultant from the extreme traffic pressures on more direct crossings and their approaches. In this regard the Key Bridge is used as an alternate route for the Memorial Bridge.

The desire traffic loadings on each bridge are shown graphically in Figure 27. Trip desires to the zero sector are also indicated. It is interesting to note that over 35 percent of all trips assigned to the Memorial and Highway Bridges are between Virginia and downtown Washington.



PRESENT TRAFFIC DISTRIBUTION

BASED ON TRANSRIVER TRIP DESIRES

NATIONAL CAPITAL PLANNING COMMISSION
Wilbur Smith & Associates

TYPICAL 1954 DAY

FIGURE 27

Table XIV

PRESENT TRAFFIC DISTRIBUTION

TYPICAL 1954 DAY

Bridge	Effec- tive <u>Lane</u>	Approx. Daily Practical Capacity*	Actual Count Daily Traffic	Percent of Total Crossings	Assigned Daily Traffic	Percent of Total Crossings
Highway	6	85,000	102,000	47.0%	106,000	48.7%
Memorial	6	50,000	54,000	24.9	67,000	30.8
Key	4	43,000	47,000	21.7	31,000	14.3
Chain	2	12,000	14,000	6.4	13,000	6.2
TOTAL			217,000	100.0	217,000	100.0

^{*}Capacities are based on the relation of existing peak hour directional volumes to total daily traffic.

Present trans-river crossings projected to 1970 approximate 328,000 vehicles daily. As new bridges and approach road systems are placed into operation they will generate new traffic trips. This generated traffic is additive to normal projected volumes. Accordingly, the <u>total</u> anticipated 1970 trans-river crossings, assuming the development of new Potomac River bridges has been estimated at 393,000 trips daily. This value is used in subsequent traffic assignments.

Anticipated 1970 traffic volumes have been assigned to existing and proposed bridges. Assignments were predicated on the completion of certain highway improvements, delineated in Figure 15. They have assumed the planned Outer Potomac Crossings at Cabin John and Jones Point, and an intermediate new crossing at Roaches Run. With these bridges in place, anticipated loadings were determined for the entire system of Potomac River crossings assuming (1) a central Constitution Avenue

Bridge and (2) a Three Sisters Bridge. Traffic values are indicated in Table XV. These distributions by desire would remain essentially the same if a lesser total of trips is considered. The Three Sisters location was considered preferential to the Nebraska Avenue site because it can be more readily integrated into overall highway plans.

A study of this table shows that the maximum percentage of traffic on any one bridge is about half the present percentage. A more equitable overall distribution of traffic is attained. Over 85 percent of all transriver crossings would use central or intermediate bridges; only 15 percent of the total traffic is potential to Jones Point, Chain and Cabin John Bridges.

Traffic demands would be served best by either the Constitution Avenue or Three Sisters Bridge. Either crossing would attract about one-quarter of the total transriver trip demands. Either facility would divert appreciable volumes from existing adjacent bridges. The Roaches Run Bridge would substantially reduce overall loadings on the Highway Bridge.

The Constitution Avenue crossing attracts considerably more traffic than the Memorial Bridge because of its ability to "intercept" trans-river trips approaching from western and northern Virginia areas. It affords relief to Memorial and Key Bridges. Similarly the Three Sisters crossing attracts significantly greater volumes than Key Bridge because of more direct roadway connection. It provides greatest relief to Key and Chain Bridges, although it diverts traffic from Memorial Bridge as well.

Table XV
ANTICIPATED 1970 TRAFFIC DISTRIBUTION

OF

POTOMAC RIVER CROSSINGS

Based on Trip Desires

BRIDGE	CENT OUT!	TRAL CROSSING AND ER CROSSINGS	THREE SISTERS CROSSING AND OUTER CROSSINGS		
	Daily Traffic	Percent of Total Crossings	Daily Traffic	Percent of Total Crossings	
Jones Bridge	29,000	7.4	29,000	7.4	
Roaches Run	51,500	13.1	52,500	13.3	
Highway	93,500	23.8	96,500	24.6	
Memorial	53,200	13.5	76,200×	19.4	
Constitution	95,000	24.1			
Key	44,000	11.2	18,000	4.6	
Three Sisters		-	101,000	25.7	
Chain	17,500	4.5	12,000	3.0	
Cabin John	9,300	2.4	7,800	2.0	
TOTAL	393,000	100.0	393,000	100.0	

^{*}Exceeds the practical capacity of bridge. Traffic would distribute to Key and other bridges where excess capacity is available.

In assigning traffic it has been assumed that the Roaches Run and Constitution Avenue or Three Sisters Bridges would provide three moving lanes in each direction, while the outer bridges would be four lane facilities. Assigned loadings to the Three Sisters or Constitution Avenue Bridges appear to exceed optimum capacity values. There is a tendency for traffic to distribute itself in accord with available capacities. Hence the traffic excess or overload has been re-allocated

in order to determine the actual traffic volumes on each of the Potomac River crossings. Anticipated 1970 volumes based on trip desires and capacities are summarized in Table XVI. Highway and the Constitution Avenue or Three Sisters Bridges will carry the heaviest flows: Figure 28 graphically summarizes and compares the anticipated 1970 traffic loadings on the Potomac River Bridges.

Table XVI
ANTICIPATED 1970 TRAFFIC DISTRIBUTION

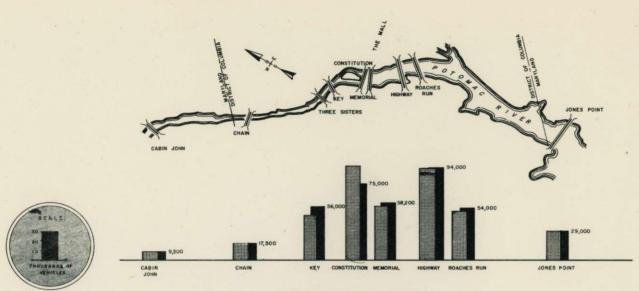
OF

POTOMAC RIVER BRIDGE CROSSINGS Based on Trip Desires as Related to Bridge Capacities

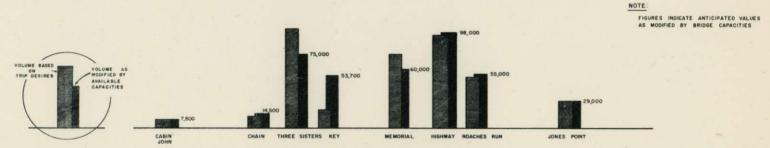
Bridge	Lanes	Approx. Daily Practical Capacity*	Central Crossings and Outer Crossings Daily Traffic	% of Total Crossings	Three Sist Crossings and Outer Crossings Daily Traffic	ers % of Total Crossings
Jones Point	4	50,000	29,000	7.4	29,000	7.4
Roaches Run	6	75,000	54,000	13.7	55,000	14.0
Highway	8	100,000	94,000	23.9	98,000	24.9
Memorial	6	60,000	58,200	14.8	60,000	15.3
Constitution	6	75,000	75,000	19.1	-	
Key	6	75,000	56,000	14.2	53,700	13.6
Three Sisters	s 6	75,000		-	75,000	19.1
Chain	2	20,000	17,500	4.5	14,500	3.7
Cabin John	4	50,000	9,300	2.4	7,800	2.4
TOTAL			393,000	100.0	393,000	100.0

^{*}Assumes that peak hourly directional movements will be 6 percent of total daily crossings.

For Memorial and Chain Bridges, a 7 percent value has been used.



WITH CONSTITUTION AVE. CROSSING



WITH THREE SISTERS CROSSING

ANTICIPATED 1970 TRAFFIC DISTRIBUTION

POTOMAC RIVER CROSSINGS

NATIONAL CAPITAL PLANNING COMMISSION
Willow Smith & Associates

Chapter V

RECOMMENDATIONS

Long-range plans for Potomac River Crossings can be made from the data and analyses presented. Also, other improvements essential to efficient use of the bridges are apparent. In evaluating bridge requirements, consideration has been given to a system of river crossings. When existing bridges are modernized, care should be taken to insure no reductions in crossing capacities during construction periods.

Coincident with the improvement of existing bridges, and their approaches, and taking precedence over the construction of new central crossings, it is essential that additional street capacity be provided on the Washington side of the river. Roadways are currently taxed during peak hours and cannot accommodate the additional loadings which would result from increased bridge capacity.

1. Inner Loop Expressway

The Inner Loop Expressway distributor should be developed before any new central bridge is built. Trafficwise, this is a most desired objective. It is realized, however, that the magnitude of this undertaking limits its early achievement. It is recommended, therefore, that the key sections of the Expressway—the Southwest Expressway, the western leg, and the 3rd Street leg between the Southwest Expressway and a point to the immediate north of Constitution Avenue—be developed prior to or, at the latest, in conjunction with the new central bridges.

2. Improvements to Existing River Crossings and Approaches

Capacities of existing bridges and their approaches can be readily increased. Existing bridges should be improved as follows:

Highway Bridge - A new four-lane span should be constructed to replace the original Highway Bridge which has outlived its structural utility. This new span would be located in about the same alinement as the structure it will replace. This improvement is being considered by the District of Columbia Department of Highways. The inbound bridge should be connected to the Inner Loop via Main Avenue or by other means which permits full utilization of the four inbound lanes. These improvements will increase the bridge capacity about 25 percent. The plans to depress 14th Street under Independence Avenue and the Mall are good, and will increase both north-south and east-west capacities. Long-range plans should develop north-south one-way operations through the Central area. Pairing of 14th and 15th Streets as a one-way system between Massachusetts Avenue and 14th and Madison Drive would substantially improve operations through the downtown area and should be considered.

Memorial Bridge - By modification of the ramp connections on the Virginia side of the river, the capacity of several weaving sections can be improved. Improvements on the Washington side are in part contingent on the development of a Constitution Avenue crossing. The present weaving maneuvers at the Lincoln Memorial should be reduced by making Bacon Drive a one-way eastbound roadway and by increasing its radius at Constitution Avenue, or by a similar functional treatment. Pending the grade separation of 23rd Street at Constitution Avenue, westbound bridge traffic should turn left at 24th Street extended and merge with bridge-bound traffic on the

Loop from Ohio Drive. These improvements should increase optimum Memorial Bridge capacities about 10 percent.

Key Bridge - Street railway operation on this bridge should be replaced with buses and the existing streetcar tracks removed as planned. The bridge should be widened to provide three moving lanes in each direction by including the cantilevering of the south walk. Efficient interchanges accommodating all important movements should be provided between Key Bridge and George Washington Memorial Parkway at Rosslyn. Initially a one-way street system over existing right-of-way should connect Arlington Boulevard to Key Bridge with grade separations developed at Arlington and Wilson Boulevards. Long range plans should provide for a limited access north-south connector to Arlington Boulevard. On the Washington side a grade separated interchange at "M" Street should be constructed. 35th and 34th Streets should be developed as one-way connectors through the western fringe of Georgetown to Wisconsin Avenue and the planned Whitehaven Parkway.

Plans to develop Canal Road as an expressway extension of the Whitehurst Freeway will eliminate the present congested operations at their intersection. The improvement of "K" Street as an eastern extension of the Whitehurst Freeway will eliminate the present bottleneck at the eastern terminus and permit over a 30 percent increase of inbound freeway capacity. For maximum stability and flexibility of operations attractive connectors should be developed between the Whitehurst Freeway and the Inner Loop. The widening of Key Bridge and the improvement of its approaches should increase the

crossing capacity over 15 percent. Both the widening of the Key Bridge and the improvement of Canal Road are included in the Highway Department's program.

Chain Bridge - The planned improvement of Canal Road will improve the bridge approach on the Washington side. In Virginia, widening of the nearby intersection, including the provision of increased sight distance, is desirable. About a 10 percent increase in bridge capacity would be realized after these improvements are effected.

3. New Potomac River Crossings

The analyses of traffic growth and origin-destination data reveal that by 1970 a minimum of 14 additional bridge lanes will be required, assuming that the lanes are all positioned in accord with drivers' desire lines of travel. Recommended improvements to the Highway and Key Bridge will provide four new lanes. New river crossings are required to provide the ten other lanes. Inasmuch as full capacity usage cannot be achieved on all bridges, additional lanes will be required to provide capacities commensurate with principal travel patterns.

- 1. New bridges must have adequate approach and distributor connections on both sides of the river. At present a relatively flexible road net exists on the Virginia side.
 - 2. While the acceptance of the outer loop bridges at Jones Point and Cabin John is desirable from the standpoint of regional development and accessibility, the bridges would divert relatively small proportions of traffic and thereby would not provide substantial relief for the more centrally located crossings. Four lane roadways would adequately accommodate

traffic demands at each crossing beyond 1970 but additional lanes might be justified as part of long range plans. These bridges will become increasingly important in the future access pattern for the metropolitan area. It is essential, therefore, that their rights-of-way be now procured.

- 3. Roaches Run must be developed as a separate new facility and not merely as another bridge to replace the old Highway Bridge. It should provide six lanes.
- 4. A new upstream six lane crossing should be provided. The development of either the Constitution Avenue or Three Sisters Bridge or a bridge somewhere between these two locations with adequate approaches and connectors would afford maximum traffic service.
 - (a) Both bridges would have about the same overall traffic effects on the system of Potomac River crossings and would relieve existing crossings.
 - (b) The Constitution Avenue Bridge would be better adapted for trips to or from the central area of Washington. The Three Sisters Bridge would receive its greatest usage by other than downtown oriented trips, and would relieve other central bridges from this type of travel.
 - (c) The Three Sisters Bridge appears to have better long range planning possibilities. It permits a north to south transriver movement removed from the central area. Its Virginia approaches are removed from the heavy peak hour loadings in the Pentagon Road net.

It is better suited to new highway development: the planned expressway serving the Falls Church area in Virginia which will tap some of the fastest growing sections of the metropolitan region would link directly into the bridge. Similarly, the bridge would attract traffic from areas served by the George Washington Memorial Parkway extension. The bridge can and should be integrated with the intermediate circumferential route. To effect this in Washington the Glover Archbald Parkway should be extended northward to Nebraska and Wisconsin Avenues.

- (d) For either the Constitution Avenue or Three Sisters
 Bridge, direct limited access connections to the Inner
 Loop Expressway should be provided. To achieve this
 for the Three Sisters Bridge the planned Whitehaven
 Parkway would have to be developed between the Inner
 Loop and the Glover Archbald Parkway.
- 5. Even with the proposed system of bridges, by 1970 all motorists would not be able to cross where they prefer during peak hours, although there would be sufficient total reserve capacity. In any large metropolitan area it is never possible to accommodate all trip desires, and some redistribution of traffic is necessary.
- 6. Anticipated traffic requirements and assignments have been predicated on optimum capacities. 2/ Higher capacity values are

^{9/} Practical lane capacity values approximating 1,500 vehicles per steady flow lane per hour were assumed.

currently attained on existing bridges and can be expected to develop on new facilities as pressures mount. Thus, the use of conservative capacity criteria represents a reserve insofar as future bridge requirements are concerned.

Schedule

In programming proposed Potomac River Bridge improvements, it is evident that primary attention should be turned to central crossings. Outer bridges should be built subsequently as funds become available, although their rights-of-way should be reserved at the present time.

The authorization by Congress for the Jones Point Bridge would give the bridge a high priority in the overall program of river crossings.

In scheduling improvements, new lanes have been added in accord with drivers' desires, and to achieve an equitable distribution of the total crossing capacity. While surplus lanes would be provided at some locations, particularly at the outer bridges, there would be little excess capacity on the central bridges. It must be remembered that bridges should, in accord with Bureau of Public Roads' policies, provide sufficient capacities for a thirty-year period.

The recommended scheduling of improvements follow. Priorities have given cognizance to the traffic needs; however the ease of effectuation of the various bridge projects has also been considered.

IMMEDIATE PROGRAM

- A. Improvement and Replacement of Existing Bridges
 - 1. Replace the Old Highway Bridge Span and improve the Washington approaches so as to develop four effective lanes in each direction. It has been indicated that the old iron trestle will need replacement, structurally, in the very near future. The new structure would be developed on approximately the same alinement.
 - 2. Widen the Key Bridge and improve its approach interchanges on both sides of the Potomac River.
 - 3. Improve the approaches to the Memorial Bridge.

B. New Construction

- 1. Reserve the rights-of-way for the Jones Point and Cabin John bridges.
- 2. Build the Inner Loop Expressway, giving priority to the Southwest Expressway, to a Third Street Expressway connector to a point to the north of Constitution Avenue and to the west leg.
- 3. Construct a new upper central Potomac River crossing at the
 Three Sisters or Constitution Avenue locations or somewhere
 between these two locations.
- 4. Initiate by 1957, coordinate with the Southwest Expressway, the construction of the Roaches Run Bridge. The two should be placed in operation at the same time. If adequate approach road connectors could be developed on the Virginia side, the Roaches Run Bridge could be constructed earlier.

FUTURE PROGRAM

- 1. Improve the approaches to the Chain Bridge.
- 2. Initiate by 1960 the construction of the Jones Point Bridge.
- 3. Initiate by 1968 the construction of the Cabin John Bridge.

Bridge improvement scheduling must, of course, be integrated into the overall highway plans for the metropolitan area. In light of this, some modifications in the recommended construction sequence may be necessary. PART II

THE INNER TRAFFIC LOOP

INTRODUCTION

Part II of the authorized study involves the development of volume and capacity data for the Inner Loop Expressway and north-south connector roads. This aspect of the work required the use of the traffic volume and origin-destination data developed in the Bridge and Metropolitan Area studies. Comprehensive new travel data were not available.

The Inner Loop Expressway as conceived by the National Capital Planning Commission will encompass central Washington and serve as a controlled access circumferential. Through planned connections with existing streets and other major highway facilities, the roadway will serve to distribute traffic around and into the central area of the city from all approaches. It is comparable to inner expressway facilities currently planned in many large cities.

The concept of such a distributional roadway circumscribed around the central area of a city is not new. It was a primary street planning objective even before the automotive era, as is typified in the "Inner Quadrangle" of the Burnham Plan for Chicago. Boston, New York, Cleveland, London, and Kansas City are among the metropolitan areas that embody new circumferential roadways in their street plans and systems.

In Washington, the need for the Inner Loop Expressway has been apparent. "The lack of wide continuous crosstown streets in the 1898 highway plan, and the finger-like pattern of the park, public and semi-public land use areas has encouraged development of radial routes and retarded the development of crosstown routes." In common with other

^{10/} Moving People and Goods - A Portion of the Comprehensive Plan for the National Capital and its Environs - National Capital Park and Planning Commission - Washington, D. C. Monograph No. 5 June 1950.

cities, Washington's system of radial highways has received the greatest amount of improvement. It is evident that an efficient internal circulation system must provide ring or circumferential routes that augment the radial ways. Studies by the National Capital Planning Commission reveal that about 25 percent of the persons entering the downtown area in rush periods are passing through; this statistic clearly pinpoints the need for an attractive circumferential bypass facility.

General Planning Considerations

The Inner Loop will encompass the central business district of Washington as the innermost of three complete circumferential routes planned for the metropolitan area by the National Capital Planning Commission. It will be circumscribed around the existing gridiron street net in the central area, and will intercept the key radials that converge on downtown Washington. It will be a dominant thoroughfare in both of these street patterns.

A comprehensive study has been recently authorized by the District of Columbia Highway Department to determine the detailed location, alinement, and design of the route. Many policy decisions remain to be made concerning interchanges and connectors. It is understood that the route would form an approximate circle with a radius of slightly over one mile from the White House, as shown in Figure 26. On the west the route would follow Twenty-Fifth Street N.W. and Riverside Drive, on the north "S" or "T" Streets, on the east Third Street and New Jersey Avenue, and on the south Independence Avenue and "F" Street southwest. The Southwest Expressway forms part of the southern leg of the Inner Loop and will traverse "F" Street in general alinement.

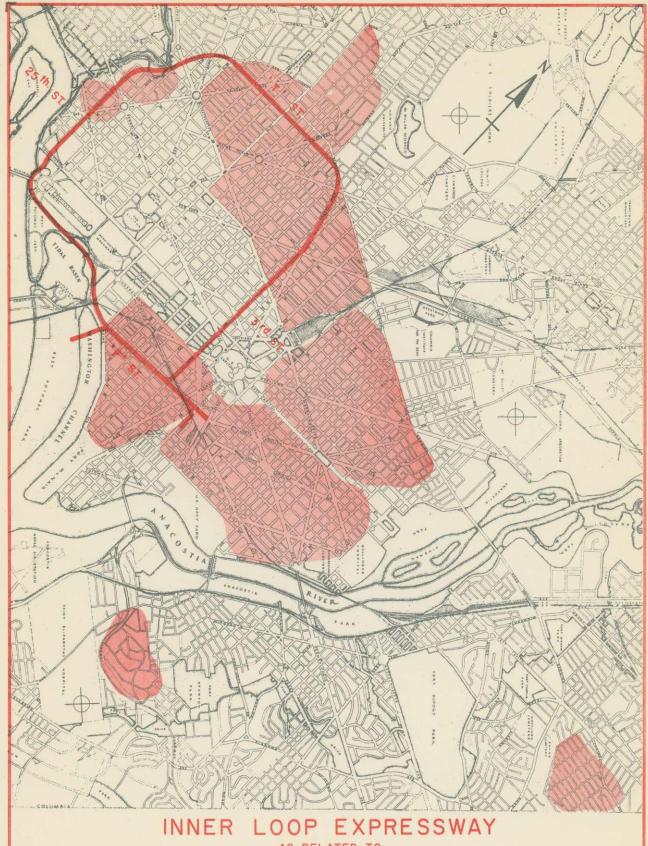
The development of the Inner Loop Expressway affords excellent opportunities to combine traffic, transportation and parking with land use planning.

The Inner Loop traverses many of the existing areas in Washington which are blighted or near blighted in character; see Figure 29. It straddles many of the 11 areas which have been recently recommended to the District Commissioners as targets for a 10-year program of redevelopment and renovation. These areas contain some 65,000 dwelling units, a fourth of the city's total; some 20,000 are substandard or dilapidated. They include southwest Washington where urban redevelopment is already underway.

Traffic Considerations

Present roadways in central Washington are currently taxed during peak hours. To provide progressive traffic movements on key arteries such as Constitution and Pennsylvania Avenues, it is necessary to restrict cross-street capacities. The capacities of major routes are, in turn, limited by their intersections with each other. Heavily traveled diagonals, such as Maryland, Massachusetts and Pennsylvania Avenues, create many complex, plaza-type intersections with severe capacity restrictions.

In deriving traffic needs it is essential that traffic conditions during peak morning and evening rush periods be given careful consideration. Inadequate traffic capacities during these peak travel hours develop congested operations which often have impeditive effects on "near-peak" hours. Accordingly, it is essential that new and improved roadway facilities provide relief for rush hour traffic flows if they are to be



AS RELATED TO

REDEVELOPMENT AREAS

NATIONAL CAPITAL PLANNING COMMISSION
Wilbur Smith & Associates

FIGURE 29

of lasting value. Traffic requirements based on lesser volumes would fall short of providing the necessary relief. 11/

It is evident that all sections of the Inner Loop must provide sufficient capacities to meet anticipated peak hour loadings, and also provide a "reservoir of capacity" for adjacent surface streets. The expressway should become the foundation of the master highway plan.

Accordingly, it follows that the Inner Loop Expressway should be a multilane limited access facility and that it be continuous in character, design and capacity. It must be remembered that an Inner Loop facility at grade, when superimposed on the street pattern of downtown Washington, could not develop sufficient capacities nor permit attractive and fluent movements.

<u>Functional Objectives</u> - The traffic services and values of the Inner Loop Expressway have been long recognized by the National Capital Planning Commission. Most of the following functional objectives have been set forth in their Comprehensive Plan. The Inner Loop Expressway should:

- 1. serve to carry traffic around central Washington;
- 2. facilitate the distribution of traffic within the central area;
- equalize accessibility to all sides of the central business district;
- serve as a connector and distributor between key radials, presentfuture;

^{11/} Roadway facilities designed to accommodate lesser traffic loadings would become unduly congested at <u>least</u> four hours daily. This is readily apparent from the analysis of present volume characteristics and traffic operations over existing Potomac River Bridges set forth in Part I.

- afford attractive ingress and egress into strategically located peripheral parking areas;
- 6. relieve all-purpose business streets as the primary trafficways in the central business district; and
- 7. serve traffic origins and destinations in areas adjacent to central Washington.

Scope - The study endeavors to relate the proposed Expressway to new bridge crossings and to other important developments which will have a direct bearing upon the traffic generating characteristics of the Washington Metropolitan Area - particularly the central area of the city. Needs of the Southwest Expressway and connectors have been given special consideration. Further information on inner loop capacities and capacity recommendations for intersecting streets will be forthcoming from the Highway Department's study currently underway.

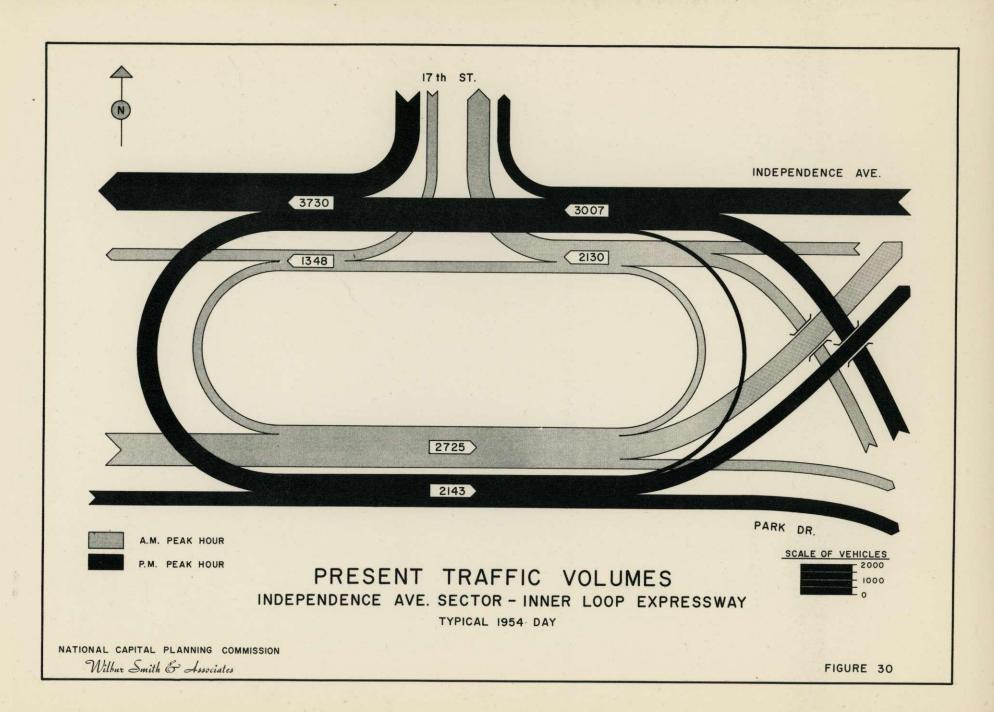
THE INNER TRAFFIC LOOP

Many of the streets that the Inner Loop would follow, or parallel, are essentially local in character. Third Street, the approximate location of the east leg, is currently heavily traveled and serves as an easterly bypass of central Washington. However, its capacity and attractiveness as a trafficway are limited by the numerous signalized intersections along its extent.

Only one segment of the existing roadways that the Inner Loop would follow has partial expressway characteristics. Such partial expressways would include Ohio Drive, Independence Avenue, and Maine west of 14th Street. This connector, traversing Federal park land, affords some control of access and permits relatively fluent movements in both directions of travel. The present traffic volumes along the route at the elliptical rotary junction with 17th Street are depicted in Figure 30. Maximum directional flows exceed 3,000 vehicles during peak hours. Heavy weaving movements during rush periods limit capacities and saturate the intersection. It is evident that this sector cannot absorb additional traffic unless improved.

Traffic Usage

Anticipated 1970 traffic loadings on the Inner Loop Expressway have been determined. In developing these values, consideration has been given normal population and traffic growths, probable changes in land use and travel patterns, and new bridge crossings. These factors and how they affect present trip desires and flow patterns have been discussed in detail in Part I.



Present traffic volumes potential to the Southwest Expressway have been derived. If the Expressway were in operation today, it could be expected to carry about 75,000 vehicles daily and its peak hour directional volume would approximate 3,700 vehicles. Based on a maximum desired lane capacity of 1,500 vehicles per hour, six limited access lanes (three in each direction) would be required to accommodate indicated traffic volumes. This would allow some excess capacity.

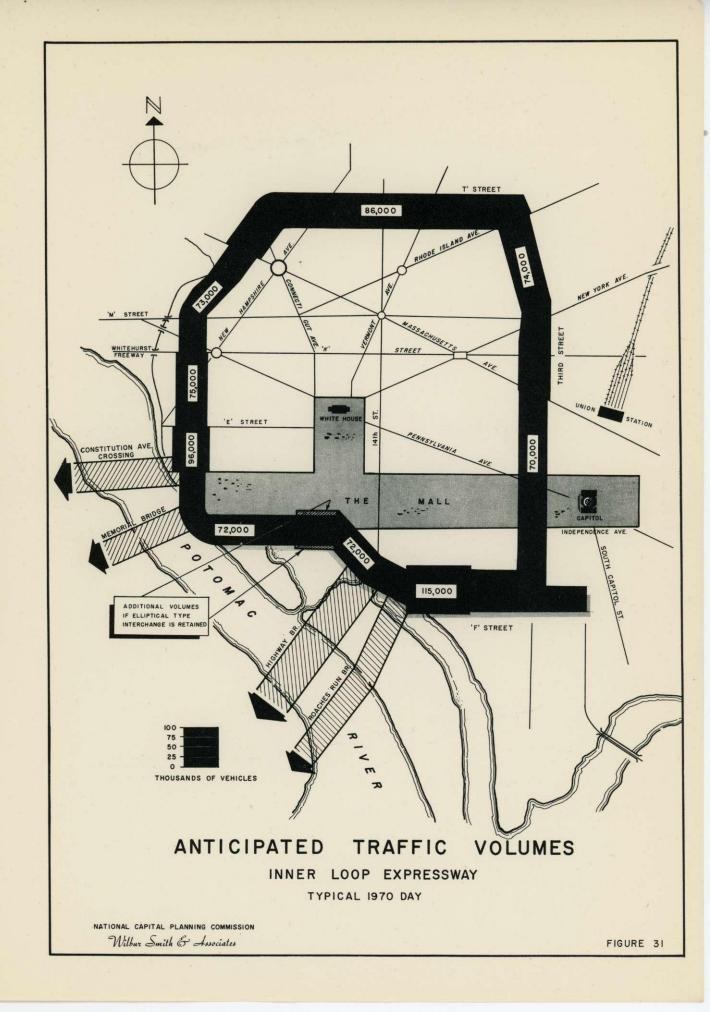
Anticipated 1970 daily traffic volumes on the Inner Loop Expressway are shown in Figure 31. It is reasonable to assume that the entire Loop would be in operation by that year and that flows on it would have become stabilized. It must be remembered that these values would likely be modified to conform with the final expressway design.

In determining anticipated traffic volumes for 1970 it has been assumed that:

- 1. the Highway Bridge would be improved to provide four effective moving lanes in each direction;
- 2. the Roaches Run Bridge would be developed as a <u>new six lane</u> facility;
- 3. the Jones Point Bridge would be built;
- 4. urban redevelopment would occur in Southwest Washington; and,
- 5. a new upper central Potomac River crossing would be developed, probably at Constitution Avenue.

It has also been assumed that during peak hours the Highway Bridge, the Roaches Run Bridge, and the other central river crossings would be loaded to their practical capacity.

The average anticipated 1970 traffic volumes for the Southwest Expressway would exceed 100,000 vehicles per day. With the construction of a



Constitution Avenue River crossing, the volumes might be as great as 120,000 vehicles per day. Peak directional volumes in 1970 for this section of the Expressway would range from 5,300 to 5,900 vehicles, depending on the construction of a Constitution Avenue crossing.

The daily 1970 traffic volumes on the west leg of the Inner Loop Expressway would range from 70,000 to 100,000 vehicles, assuming the development of a Constitution Avenue crossing. The heaviest movements can be expected to occur between Constitution Avenue and "E" Street and would approximate 96,000 vehicles daily. Peak directional volumes would be about 5,700 vehicles per hour.

It is anticipated that the north leg of the Inner Loop would serve about 85,000 vehicles per day, with peak hour directional volumes of about 4,300 cars. These vehicles can be expected to use both express and service roads. Volumes on this section of the expressway would be substantially the same if a Three Sisters Bridge, rather than a Constitution Avenue facility were constructed.

The anticipated traffic volumes for the east (Third Street) leg of the Inner Traffic Loop would average about 75,000 vehicles a day, with peak directional loadings approaching 4,000 vehicles.

Lane Requirements

Traffic volumes take on added significance when related to capacity values. A maximum possible lane capacity approximating 1,700 vehicles per lane per hour should be attained on the Inner Loop Expressway. Frequent merging, diverging and weaving areas will likely prevent achievement of higher values. Lane requirements for the expressway should be based on a practical capacity of 1,500 vehicles per lane per hour. This is an

accepted capacity standard for continuous flow in urban areas and has been widely used in the Washington Metropolitan Area.

The 1970 lane requirements, as related to anticipated traffic volumes on the Inner Loop Expressway, are summarized in Table XVII. A six lane expressway should accommodate anticipated traffic demands, except for sections of expressway adjacent to the Constitution Avenue and Roaches Run River crossings where 8 steady flow lanes will be required. A multilane expressway providing these lane requirements will efficiently accommodate 1970 peak hour loadings, and provide some excess capacity for future growths. Parallel service roads will likely carry sizable flows on many sections of the Inner Loop, thereby representing a factor of capacity reserve.

The Southwest Expressway between Twelfth and Third Streets would provide some surplus in "possible capacity" even at the anticipated peak hour volumes in 1970. However, the provision of a lesser lane capacity would obviously be inadequate for sound highway planning and design.

Initial construction of a 6 lane limited access roadway with expansion to 8 lanes prior to 1970 will provide the necessary capacities.

Table XVII

LANE REQUIREMENTS INNER LOOP EXPRESSWAY

	Approx. Daily	Peak Hour Dir.	Express Lanes Required In Each	Sufficiency* Practical Capacity		Sufficiency* Possible Capacity	
Section of Route	Flow	Flow	Direction				
West Leg							
Constitution Ave. to "E" St.	96,000	5,700	4	6,000	95	6,800	84
"E" St. to Mass. Ave.	74,000	4,300	3	4,500	96	5,100	85
North Leg							
"T" St Rhode Island Ave.	86,000	4,300	3	4,500	96	5,100	85
East Leg							
Rhode Island Avenue - Mass. Ave. Mass. Ave. to "F" St.	74,000 70,000		3 * 3**	4,500 4,500	82 78**	5,100 5,100	73 69**
South Leg							
Constitution Ave Roaches Run Bridge Southwest Expressway	72,000 115,000		3 4	4,500 6,000	80 99	5,100 6,800	71 87

^{*}Volumes as percent of capacity.

^{**}Values across the Mall, based on desires, would approximate 3,000. However, limitations in capacity on north-south streets should increase peak loads to about 4,000 vehicles.

^{***}Volumes and lane requirements at 17th Street are contingent on interchange design. An elliptical type treatment would require additional lane capacity.

Priority of Development

Expressway has been indicated emphatically in Part I. Immediate attention should be furnished those key sections of Expressway which will be principal avenues of approach or connectors to new Potomac River Crossings. Accordingly, it is recommended that the Southwest Expressway, the West (25th St.) Leg, and the 3rd Street Leg between the Southwest Expressway and a point north of Constitution Avenue be developed prior to, or at the latest in concurrence with, new central river crossings. Remaining sections of the Inner Loop should be completed prior to 1965. A tentative priority follows:

Immediate Construction

- 1. Southwest Expressway (Highway Bridge to S. Capitol St.)
- 2. West (25th St.) Leg (Memorial Bridge to "M" Street)
- 3. East (Third St.) Leg (Southwest Expressway to "E" Street)

Subsequent Construction

- 1. South Leg (Memorial Bridge to Highway Bridge)
- 2. Third Street Leg ("E" Street to Rhode Island Ave.)
- 3. West Leg ("M" Street to Massachusetts Ave.)
- 4. North Leg (Massachusetts Ave. to Rhode Island Ave.)

DISTRIBUTION PROBLEMS FROM SOUTH AND WEST

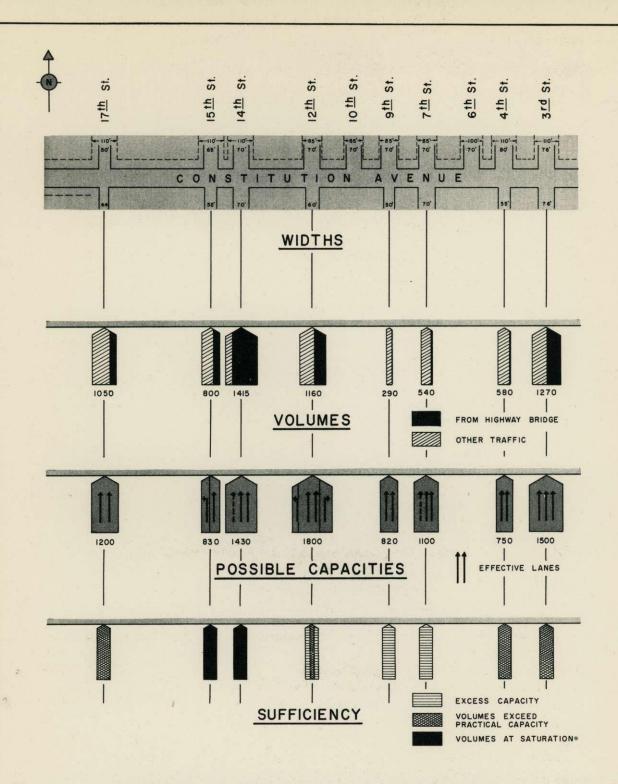
The distribution of vehicles entering the central area from the south and west have been given special consideration. Future traffic needs of north-south roadways entering the central business district from the south have been ascertained.

Present Traffic Flows Across Mall

A review of the existing patterns of traffic movement across the Mall reveals that over 150,000 vehicles crossed the Mall on a typical 1953 day; see Table XVIII. The greatest traffic magnitudes were found on Third and 14th Streets, each carrying about 20 percent of the total daily volume. During the peak rush hours, about 7,000 vehicles cross the Mall in each direction of travel. While total movements in the evening rush period are slightly greater than morning rush hour loadings, it is believed that the impact of Highway Bridge traffic is greatest inbound during the morning hour. (See the hourly traffic variations set forth in Figure 16.) In the evenings, traffic generators in Washington represent the largest source of traffic origins.

Present traffic flows at Constitution Avenue, by corridors of travel, are summarized in Table XIX. It is apparent that the greatest concentrations of traffic occur on 14th, 15th and 17th Streets, inbound during the morning rush and outbound during the evening rush period. At these times, almost half of all trans-Mall traffic travels in this westerly corridor.

The impact of Highway Bridge traffic on total north-south flows is evident from Figure 32 which shows present traffic operations across the Mall during a typical 1954 rush hour. Bridge traffic comprises about



PRESENT TRAFFIC OPERATIONS

NORTH-SOUTH STREETS AT CONSTITUTION AVE.

TYPICAL 1954 DAY
PEAK MORNING RUSH HOUR
INBOUND

NATIONAL CAPITAL PLANNING COMMISSION

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Table XVIII

NORTH-SOUTH TRAFFIC VOLUMES AT CONSTITUTION AVENUE*

Average 1953 Weekday

		Northbound AM Hour Vehicles	% of Total	Northbound PM Hour Vehicles	% of Total	Southbound AM Hour Vehicles	% of Total	Southbound PM Hour Vehicles	% of Total	Total Daily Movement Vehicles	% of Total
74	3rd St.	1,130	16.6	1,328	18.0	1,223	19.8	1,511	21.0	31,208	20.6
	4th St.	505	7.4	732	9.9	510	8.3	500	6.9	11,411	7.5
	7th St.	540	7.9	636	8.7	633	10.3	615	8.5	13,151	8.6
	9th St.	278	4.1	371	5.1	423	6.8	391	5.5	7,290	4.8
	12th St.	1,157	17.0	1,293	17.5	681	11.1	751	10.5	20,375	13.5
	14th St.	1,208	17.9	924	12.6	929	15.0	1,164	16.2	29,404	19.4
	15th St.	801	11.8	778	10.5	833	13.5	1,116	15.4	17,102	11.3
	17th St.	1,046	15.4	801	10.9	831	13.4	1,146	16.0	19,697	13.0
	21st St.	127	1.9	498	6.8	109	1.8			1,893	1.3
	Total	6,792	100.0	7,361	100.0	6,172	.100.0	7,194	100.0	151,531	100.0

^{*}Inner Cordon - Annual Weekday Averages 1953.

Table XIX

NORTH-SOUTH TRAFFIC DISTRIBUTION AT CONSTITUTION AVE.

Average 1953 Weekday

			Corridors 7th-9th		
Northbound - AM Peak Hour	Vehicles	3rd-4th 1,635	-12th 1,975	14th-15th -17th-21st 3,182	Total 6,792
	%	29.0	29.0	47.0	100.0
Northbound - PM Peak Hour	Vehicles	2,060	2,300	3,001	7,361
	%	27.9	31.3	40.8	100.0
Southbound - AM Peak Hour	Vehicles	1,733	1,737	2,702	7,172
	%	28.1	28.2	43.7	100.0
Southbound - PM Peak Hour	Vehicles	2,011	1,757	3,426	7,194
	%	27.9	24.5	47.6	100.0
24 Hours	Vehicles	42,619	40,816	68,096	151,531
Both Directions	%	28.1	26.9	45.0	100.0

40 percent of total flows. A comparison of traffic volumes and capacities indicates an overall traffic sufficiency. Inbound north-south traffic was found to use 75 percent of the available possible capacity during the morning rush hour. It should be noted that congestion is apparent along 17th, 15th, and 14th Streets which are currently operating at or near their possible capacities.

Southwest Redevelopment

It is essential that adequate road, parking, and mass transit facilities be provided in conjunction with the Southwest Redevelopment. It is understood that the southwest area as envisioned by Webb and Knapp would contain about the same residential population that it has at present. About 15,000

additional persons would be attracted into the area daily, mostly to the new office buildings that are proposed. About 40 percent can be expected to come by transit, and the remainder by car. The development would generate about 9,000 vehicle trips daily of which approximately a third would be transriver in character. Translated into peak hour movements, between 2,000 and 2,500 trips would be made into the area during the morning rush period. Motorists would come from all points of the compass and would be dispersed on all approach streets. Most of these vehicles would travel a direction counter to prevailing bridge flows.

The plans call for 1,500,000 square feet of office buildings. At least 3,000 parking spaces should be provided to meet this need. Additional parking should be provided in accord with the attractiveness of other key generators.

Southwest Expressway

The Southwest Expressway will serve as a distributor for Roaches
Run and Highway Bridges, and also serve as a principal approach roadway
to the Southwest Redevelopment Area. It is this expressway that makes
the provision of additional bridge capacity feasible.

It is essential that attractive ramps be provided between the Expressway and north-south streets, so that full usage can be made of the connector streets. Ramps should be amply designed for weaving, merging, and storage of traffic. Assignment of traffic to surface streets will, of course, depend on the detailed traffic designs. These plans at present are fluid.

Street Capacity and Volumes

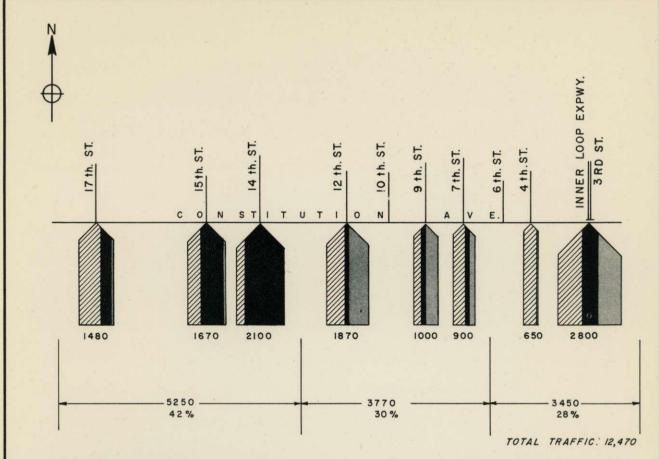
Anticipated inbound traffic volumes on north-south roadways across the Mall are shown in Figure 33 for a typical 1970 morning rush hour. 12/
Indicated values can be considered as somewhat liberal. The total northbound movement approximates 12,000 vehicles. The impact of Highway and Roaches Run Bridge traffic on total flows is readily apparent: 4,200 vehicles (34%) come from the Highway Bridge and 3,000 vehicles (24%) come from the Roaches Run Bridge, respectively.

In deriving lane requirements it must be realized that lane capacity is a variable concept. It is affected by such determinants as the operational efficiencies (present and potential) of the streets involved, the spatial and traffic patterns of intersecting streets, and the quality of operations desired.

It is estimated that by 1970 about 8 steady flow lanes would be required across the Mall to accommodate the peak inbound (A.M.) hour traffic between 17th and 3rd Streets, based on maximum optimum lane loadings. A similar number of lanes would likely be required to accommodate the peak "outbound" movement during the evening rush period. These directional lane requirements are roughly the equivalent of about 25 surface lanes.

It appears that about 42 percent of the inbound lane demand would be required west of 13th Street (14th, 15th and 17th Streets). While desired 1970 traffic volumes in this sector might exceed optimum lane

^{12/ (1)} Non-Highway Bridge traffic has been increased in accord with normal growths in downtown Washington. (2) Highway and Roaches Run Bridges were loaded to their practical capacities. (3) Bridge traffic was added to determine composite volumes.



OTHER TRAFFIC
FROM HIGHWAY BRIDGE
FROM ROACHES RUN BRIDGE

HIGHWAY BRIDGE 4200 - 34 %

ROACHES RUN BRIDGE 3000 - 24%

OTHER 5270 42%

LANES REQUIRED: 8 EXPRESSWAY OR 25 SURFACE

NOTE:

THESE VOLUMES SHOW DESIRED PATHS OF TRAVEL, AND WOULD BE MODIFIED BY AVAILABLE CAPACITIES.

ANTICIPATED TRAFFIC VOLUMES

NORTH - SOUTH STREETS AT CONSTITUTION AVENUE

TYPICAL 1970 DAY PEAK MORNING RUSH HOUR

INBOUND

NATIONAL CAPITAL PLANNING COMMISSION
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FIGURE 33

loadings, even with indicated improvements, some excess capacity will exist to the east of 13th Street (12th to 3rd Streets) and would be able to accommodate the "overflow" loadings. About 30 percent of the lane capacity is required between 13th and 6th Streets and appears attainable. The balance of capacity would be required between 6th and 2nd Streets. This capacity would be provided by development of the 3rd Street leg of the Inner Loop Expressway; a minimum of three limited access lanes in each direction should be provided.

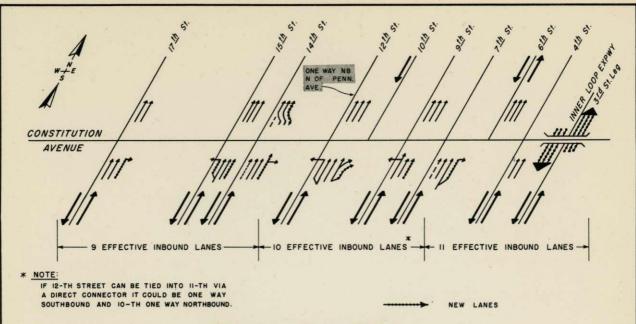
North-South Connectors

It has been indicated that improved access from Virginia on the Highway Bridge, and the planned Roaches Run Bridge, related to traffic increases resulting from normal growths and urban redevelopment, will require increases in north-south capacities across Independence Avenue. the Mall and Constitution Avenue. Coincident with the development of the Southwest Expressway, and by completion of the Roaches Run Bridge, it is essential that the Third Street Leg of the Inner Loop Expressway be completed across Constitution and Pennsylvania Avenues. Six limited access lanes should be provided with possible future expansion to eight. The roadway would provide an increase of 25 percent over the present lane capacities across the Mall between the Washington Monument and the Capitol. The continuation of the Southwest Expressway along Third Street would afford an attractive and time saving route into the central business district. This east leg of the Inner Loop would encourage a redistribution of north-south traffic volumes principally in accord with capacities available.

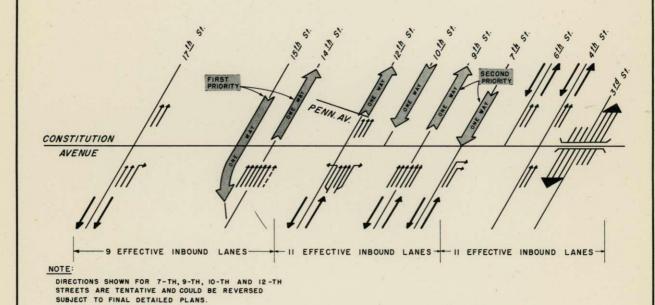
Plans have been set forth by the National Capital Planning Commission for the underpassing of north-south streets under Independence Avenue and the Mall. These plans provide attractive traffic services south of the Mall and encourage continuous movements to and from the Highway and Roaches Run Bridges. It is essential that these plans be integrated with traffic treatments along Constitution Avenue so as to assure sufficiency and continuity of capacity. Improved north-south traffic treatments must be effected at Constitution Avenue. Civic and governmental land use make difficult the development of grade separated interchanges. Accordingly, traffic regulatory techniques must be employed to achieve the needed capacity increases. Sufficient rightsof-way, however, are available for the flaring of intersection approaches to achieve capacity increases. A comprehensive north-south one-way system should be considered as a long range traffic objective. Suggested traffic operations are shown in Figure 34; both two-way and one-way plans are indicated:

1. Additional approach lanes should be provided on <u>Fourteenth</u>, <u>Fifteenth</u>, and <u>Seventeenth Streets</u> at their intersections with Constitution Avenue. Some widening will likely be required. <u>Fourteenth and Fifteenth Streets</u> could be developed as a one-way system between Thomas Circle and Fourteenth Street south of Constitution Avenue. Five (or possibly six) lanes in each direction could be provided with total capacities commensurate with the six lane limited access system to the south. <u>13</u>/ The

^{13/} The roadways are 65 and 70 feet wide respectively north of Constitution Avenue, on 110 foot rights-of-way.



TWO WAY OPERATIONS



ONE WAY OPERATIONS

POSSIBLE FUTURE TRAFFIC OPERATIONS NORTH - SOUTH STREETS AT CONSTITUTION AVE.

INBOUND

NATIONAL CAPITAL PLANNING COMMISSION
Wilbur Smith & Associates

- system would (1) increase existing north-south capacities on these streets by more than 20 percent, (2) permit easier signal timing, (3) facilitate left turns, and (4) simplify transition movements in the environs of the White House. If street railway operation is retained on Fourteenth Street, some additional trackage will be required along Fifteenth Street.
- 2. Twelfth Tenth One-Way System Twelfth Street will receive increased usage, because of its direct connection to the Roaches Rum Bridge. Some flaring of its southern approach to Constitution Avenue is desirable. The directions of the present Twelfth Tenth one-way system could be reversed, particularly if a direct connector to Eleventh Street can be provided. The reversal would reduce left turns off of Constitution Avenue at Twelfth Street, and simplify the restrictive signal phasing.
- 3. <u>Ninth Street Extension</u> Integrated with the relocation of the Smithsonian Buildings, Ninth Street should be extended from Independence Avenue across the Mall to connect the Southwest Expressway with the central business district.
- 4. Ninth Seventh One-Way System Long range plans should consider the removal of street car tracks on these streets and the conversion of them to one-way operations north of Constitution Avenue. When instituted, this system will provide substantial capacity gains.

With the construction of the Southwest Expressway and the Southwest Redevelopment Project, consideration should be given to the restriction of certain traffic movements on Maryland and Virginia Avenues. These can be achieved through conventional traffic engineering techniques.

In retrospect, proper traffic treatments at Constitution Avenue and the development of the Third Street leg of Inner Loop Expressway will probably provide the required 1970 north-south lane capacity. The operational treatments can be effected with relative ease and will provide the much needed continuity and consistency in capacity on north-south streets.

PART III

SUMMARY AND CONCLUSIONS

SUMMARY AND CONCLUSIONS

This comprehensive report on the Potomac River Crossings and the Inner Traffic Loop has been based on an evaluation and appraisal of all factors affecting traffic growths and desires. It has considered population shifts in the District of Columbia and its metropolitan area, vehicle ownership trends, redevelopment plans, dispersal of government activities, removal of temporary buildings, and changes in the land use patterns in the area.

River Crossings

At present there are about 217,000 trans-river crossings daily. By 1970, it is anticipated that there will be about 328,000 crossings daily. If an attractive and extensive system of approach roads can be provided, the desired crossings would approach 393,000.

The seriousness of the bridge problem is evident. At the present time, the directional peak hour traffic exceeds the combined "practical capacity" of all the bridges, and approaches the possible capacity of the combined bridges and their approach road systems.

To effectively meet peak hour demands and to accommodate reasonable trip requirements, a minimum of fourteen additional lanes will be needed by 1970. This value assumes that new bridges will be located so as to permit direct and effective travel between motorists' principal points of origins and destinations. New bridges will have to be located so that they conform with natural travel patterns. Improper locations would mean, therefore, that more lane capacity will be required.

The recommended system of Potomac River Crossings includes both new central and peripheral bridges, as well as improved existing bridges. Most transriver trip demands are and will be essentially central in nature; only 15 percent of the total (1970) crossings would desire to use Jones Point, Cabin John, or Chain Bridges. The new central bridges will afford capacity relief; other bridges will provide new access and encourage development of new areas. Approach and connector roads must be integrated with river crossings. It has been recommended that:

- key sections of the Inner Loop Expressway be built prior to,
 or concurrently with, new central crossings;
- (2) existing bridges and their approach roads be improved including the widening of the Key Bridge, and the replacement of the iron trestle Highway Bridge;
- (3) a new upstream six-lane crossing be constructed at the Constitution Avenue or Three Sisters location or somewhere between these two sites;
- (4) Roaches Run Bridge be developed as a separate new facility, and not as a replacement for the iron trestle Highway Bridge;
- (5) Jones Point and Cabin John Bridges be constructed as part of long range crossing plans, and that their rights-of-way be procured now; and
- (6) primary attention be given to central crossings in scheduling bridge improvements.

The Inner Loop Expressway

The Inner Loop Expressway will encompass central Washington and should become an integral part of area highway plans. It should be a limited access facility, continuous in character, design and capacity.

It is anticipated that by 1970, traffic volumes on the various sections of the Expressway will range from 70,000 to 120,000 vehicles daily. Provision of six steady flow lanes, with several eight lane sections in proximity of Constitution Avenue and the Roaches Run Bridge, will provide sufficient capacities to meet peak demands.

By 1970, about eight steady flow lanes, or their equivalent, will be required across the Mall to accommodate peak inbound A.M. hour traffic between Seventh and Third Streets, based on maximum optimum lane loadings. A similar number of lanes would likely be required to accommodate the peak "outbound" movement during the evening rush periods. Indicated traffic treatments on north-south streets at Constitution Avenue, and the development of the Third Street leg of the Inner Loop Expressway should provide this needed lane capacity.

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