Draft Environmental Impact Statement

Center Leg Inner Loop Freeway

H Street and Massachusetts Avenue to New York Avenue

Department of Transportation
Federal Highway Administration

July 1972

Prepared By
District of Columbia
Department of Highways and Traffic

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

Prepared by

DISTRICT OF COLUMBIA
DEPARTMENT OF HIGHWAYS AND TRAFFIC

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

ADMINISTRATIVE ACTION

for

INTERSTATE ROUTE 95, CENTER LEG, BETWEEN
MASSACHUSETTS AVENUE AND NEW YORK AVENUE, NORTHWEST
IN THE
DISTRICT OF COLUMBIA

THIS HIGHWAY IMPROVEMENT IS PROPOSED FOR FUNDING UNDER
TITLE 23, U. S. C.
THIS STATEMENT FOR THE IMPROVEMENT WAS DEVELOPED IN
CONSULTATION WITH THE FEDERAL HIGHWAY ADMINISTRATION
AND IS SUBMITTED PURSUANT TO:

SECTION 102 (2) (C)
PUBLIC LAW 91-190

____________ ________________________

Date T. F. Airis, Director, Department of
Highways and Traffic, District of Columbia

CLEARED BY FHWA FOR CIRCULATION AND COMMENTS

____________ ________________________

Date

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DRAFT ENVIRONMENTAL IMPACT STATEMENT

A. ADMINISTRATIVE ACTION

(X)	Draft	( )	Final
(X)	Environmental Statement		
( )	Combination Environmental/Section 4(f) Statement		

B. DESCRIPTION OF PROJECT

The Project, the final and the northern most segment of the Center Leg of the Inner Loop Freeway, will initially consist of four lanes of depressed roadway and ultimately will consist of nine lanes for a total distance of 2100 feet in the District of Columbia. Of this total length, 1200 feet will comprise a tunnel section and air-rights platform on which an urban renewal housing project has been proposed to relocate persons displaced by nearby urban redevelopment projects. This segment will initially complete the connection between the Southwest Freeway (Inner Loop) and New York Avenue and ultimately will connect the proposed New York Avenue Industrial Freeway to the north of the existing New York Avenue.

C. ENVIRONMENTAL IMPACTS

1. Ground water table will be disturbed, but the situation will not endanger any existing or planned future potable water supplies.

2. Carbon monoxide concentrations will not exceed the national air quality standards in the vicinity of the Project in 1975 or 1990.

3. Hydrocarbon and nitrogen oxides concentrations will exceed standards in the study area in 1975 primarily due to background concentrations which are also expected to exceed the standards.

4. By 1990, hydrocarbon and nitrogen oxides levels of concentration will be below the maximum standard throughout the study area due primarily to statutory vehicle emission control.

5. The size of the area which will be affected by traffic noise from the Project will be reduced by the tunnel cover to slightly more than half of what it would be if the Project were constructed as an open depressed roadway.

6. A great impact due to construction noise involving pile driving operations will be witnessed approximately 300 to 400 feet in every direction from the construction area.

7. The combination of a depressed freeway segment and air-rights development over the tunneled section will enhance the existing aesthetic character of the Site as it exists today.

8. 192 families, including 73 low income families, were displaced by the early implementation of the Project in 1966.

9. 28 large family housing units were made available very shortly thereafter to those displaced families applying for replacement housing.

10. 32 businesses were permanently displaced, while four others have been temporarily allowed to continue.

11. The proposed air-rights development will provide 7600 square feet of commercial space.

12. As the last segment of the Center Leg to be built, the opening of this segment and the entire Center Leg will relieve the heavily congested current U. S. Alternate 1 in downtown Washington.

D. ALTERNATIVES

1. Location Alternatives. Location alternatives were not considered for several reasons, including that the Center Leg has been under construction since early 1966 and this Project is the last segment to be built.

2. No-Action Alternative. The Center Leg would cease at Massachusetts Avenue instead of New York Avenue and the proposed New York Avenue Freeway. Traffic between Massachusetts and New York Avenues would congest Second and Third Streets. Metropolitan transportation plan objectives would not be fully realized. Urban renewal plans would have to be modified.

3. Alternatives of Scope. These alternatives included an open depressed section the entire length of the section and the 1200' tunnel and platform will provide for the joint development air-rights urban renewal project with the Department of Housing and Urban Development. The air-rights project will provide housing for 300 formerly displaced families.

4. Alternatives of Design. Two basic depressed highway designs were originally considered; a retained-cut method and an open cut method. Initially, the 900-foot section north of the tunnel will be in an open cut with some lengths retained by walls. Ultimately, the entire length will be a retained-cut section.

E. REVIEW AGENCIES

Comments on the Draft Environmental Impact Statement for Center Leg of the Inner Loop Freeway from H Street and Massachusetts Avenue to New York Avenue are requested from the following Local, Regional and Federal agencies:

Local and Regional Agencies

1. Executive Office
   Budget and Executive Management
   Government of the District of Columbia
   District Building
   Washington, D. C. 20004

   (the Clearinghouse for City Government)

2. Director
   D. C. Department of Environmental Services
   415 12th Street, N . W.
   Washington, D. C. 20004

3. Executive Director
   National Capital Planning Commission
   1325 G Street, N. W.
   Washington, D. C. 20005

4. Metropolitan Washington Council of Governments
   1225 Connecticut Avenue, N. W.
   Washington, D. C. 20036

   (the Regional Clearinghouse)

Federal Agencies

1. Council of Environmental Quality
   722 Jackson Place, N. W.
   Washington, D. C. 20006

2. Assistant Secretary for Defense
   (Health & Environment)
   Room 3-E 172
   The Pentagon
   Washington, D. C.

3. Deputy Assistant Secretary
for Environmental Affairs
U. S. Department of Commerce
Washington, D. C. 20230

4. Assistant Secretary for Health and Science Affairs
U. S. Department of Health, Education and Welfare
HEW North Building
Washington, D. C. 20202

5. Regional Administrator
U. S. Department of Housing and Urban Development
ATTENTION: Environmental Clearance Officer
Curtis Building
Sixth and Walnut Streets
Philadelphia, Pennsylvania 19106

6. Deputy Assistant Secretary for Programs
U. S. Department of Interior
Washington, D. C. 20240

7. Assistant Secretary for Environmental
and Urban Systems
U. S. Department of Transportation
Washington, D. C. 20590

8. Director of Impact Statements Office
U. S. Environmental Protection Agency
1626 K Street, N. W.
Washington, D. C. 20160

9. Director
U. S. Office of Economic Opportunity
1200 19th Street, N. W.
Washington, D. C. 20506

10. Office of the Secretary
Department of Agriculture
Washington, D. C. 20250

11. Division Engineer
Federal Highway Administration
425 13th Street, N. W.
Washington, D. C. 20004

INTRODUCTION

The purpose of this Draft Statement is to document the comprehensive analysis of all probable environmental effects, and to review all feasible alternatives to the proposed action. The Statement is in accordance with the National Environmental Policy Act of 1969, all other pertinent highway acts, and all subsequent administrative and department guidelines.

The proposed action involves the construction of the final portion of the Center Leg of the Inner Loop Freeway (See Figure 1 following this page). It includes the extension of the depressed highway from Massachusetts Avenue and H Street to New York Avenue, and a deck covering between H Street and K Street. Two ventilation towers are proposed for the covered highway section. The physical boundaries and the proposed facilities are detailed herein.

The analysis conducted includes all possible human and natural environmental factors and all items specifically required by statutory and administrative regulations.

1.0 DESCRIPTION OF THE PROPOSED PROJECT

1.01 HISTORY

As early as 1950, a master plan titled "Comprehensive Plan for the National Capital and Its Environs" proposed by the National Capital Park and Planning Commission featured the Center Leg of the Inner Loop Freeway as part of the Capital's freeway and parking system. This plan represents the official origins of the Center Leg.

In 1959, under an Act of Congress, the National Capital Planning Commission and the Regional Planning Council prepared a report titled "The Mass Transportation Study Report for the National Capital Region". This study, which established a comprehensive plan for the region's highways and rail transit, included the Center Leg-Inner Loop Freeway as part of a major north-south thoroughfare route.

The report titled "Policies Plan for the Year 2,000, The Nation's Capital" prepared in 1961 by the National Capital Planning Commission and the National Capital Regional Planning Council reaffirmed the recommendations of the above mentioned mass transportation study with regard to the Center Leg as a north-south thoroughfare route.

The report titled "Recommendations on Transportation in the National Capital Region" prepared in 1962 by the National Capital Transportation Agency also included the Center Leg as a recommended section of the freeway system complementing the proposed mass transit system.

Then, in 1964, the District of Columbia Department of Highways and Traffic retained Tippetts-Abbett-McCarthy-Stratton, Engineers and


LOCATION MAP
0'
3000'
PROJECT AREA
NEW YORK AVE.
"K" ST.
DOWNTOWN
CENTER LEG
MASS. AVE.
INNER LOOP
FREEWAY
NATIONAL ZOOLOGICAL PARK
POTOMAC
RIVER
WASHINGTON CHANNEL
EAST POTOMAC PARK
ANACOSTIA
RIVER
THE MALL
DISTRICT OF COLUMBIA
GRAVELLY POINT
FORT McNAIR
BUZZARDS POINT
GREENLEAF POINT
WASHINGTON NAVY YARD
UNION STATION
LINCOLN PARK
STANTON PARK
TRINITY COLLEGE
GLENWOOD CEMETERY
PROSPECT HILL CEMETERY
ST. MARY'S CEMETERY
HOWARD UNIVERSITY
GALLAUDET COLLEGE
FARRAGUT SQUARE
FRANKLIN PARK
LAFAYETTE PARK
THE WHITE HOUSE
THE ELLIPSE
U.S. CAPITOL
WASHINGTON NATIONAL AIRPORT
Figure 1

Architects from New York City, to prepare a preliminary study of the Center Leg of the Inner Loop Freeway. Two alternate depressed highway schemes were studied by TAMS, one with retaining walls, the other with sloped embankments. As a result of that study, the retaining wall cut alternative was adopted since it was considered more adaptable to future land use requirements, required less space to construct and, since all major street crossings were to be bridged, it did not provide a major physical or psychological barrier through the center of the City.

A problem of major concern that faced the District of Columbia Department of Highways and Traffic, as well as the Bureau of Public Roads was to find suitable relocation housing for families living in the path of proposed construction. This was especially true in the case at hand as the route traverses an area of relatively high density residential use adjacent to the City's central business district (CBD). In all, the proposed construction of the Center Leg segment between Massachusetts and New York Avenues has displaced a total of 146 dwellings involving 192 families and 32 businesses. Only four businesses are left operating on the Site. There are no occupied dwelling units left on the Site.

At first, community leaders vigorously opposed the Center Leg freeway when it became manifest that suitable replacement housing was not available within the existing community. This situation led to a series of studies concerning this problem initiated by the Engineer Commissioner of the District of Columbia and the Director of the Department of Highways and Traffic. From these studies, it became evident that a possible solution to the problem of suitable replacement housing was to provide air-rights housing in joint development with the freeway project. The permanent displacement of site residents was hoped to be avoided by constructing housing and site improvements over the freeway.

In 1967, Tippetts-Abbett-McCarthy-Stratton (TAMS), under contract with the Department of Highways and Traffic conducted a study to consider the feasibility of developing air-rights housing from H to K Street between 2nd and 3rd Streets over that portion of the Center Leg. That study concluded that the development of air-rights housing was economically feasible and environmentally suitable. At a conference called later that year this concept was endorsed by officials of the Redevelopment Land Agency, the National Capital Housing Authority, and the Bureau of Public Roads.

The TAMS report recommended that the Redevelopment Land Agency (RLA) associated with the U. S. Department of Housing and Urban Development (HUD), initiate an urban renewal program on the 5.4 acre, two-block study site. Accordingly, the National Capital Planning Commission approved an amendment to the plans for the adjacent Northwest Urban Renewal Project No. 1 making the new Site a part of the larger urban renewal project.

To overcome the legal problems of land ownership and roadway easement, the Redevelopment Land Agency will acquire all the land within the Site of the proposed joint development project and will grant the District of Columbia Department of Highways and Traffic a three-dimensional easement for construction of the freeway in a tunnel or enclosure. It was further agreed that, for purposes of economic development, the cost of the tunnel would be considered as part of the freeway cost and financed jointly by the District of Columbia Department of Highways and Traffic and the U.S. Department of Transportation, Bureau of Public Roads.

The final link in the implementation process designed to insure the economic feasibility of the Project will be for the RLA to "write down" the land acquisition and site preparation costs and then sell the Site in the usual manner for housing development. In this instance, the private sponsor is the Mount Carmel Baptist Church which is located on the Site and which will establish a housing corporation in its name for the construction of the proposed air-rights project. A tentative financial commitment has been obtained through the Department of Housing and Urban Development, Federal Housing Administration, Section 221 (d) (3) program. This program was enacted by Congress to assist private housing developers to provide housing for households displaced by urban renewal operations. At this time, however, no private developer has been designated.

During this interim period of the planning phase, the Federal Aid Highway Act of 1968, which called for completion of Washington D. C.'s freeway network, was enacted. As it applied to the Center Leg section, the Act required that work commence thirty days from August 23, 1968. In their report to the Congress, the interested agencies recommended that the work proceed in accordance with the requirements of the Act.

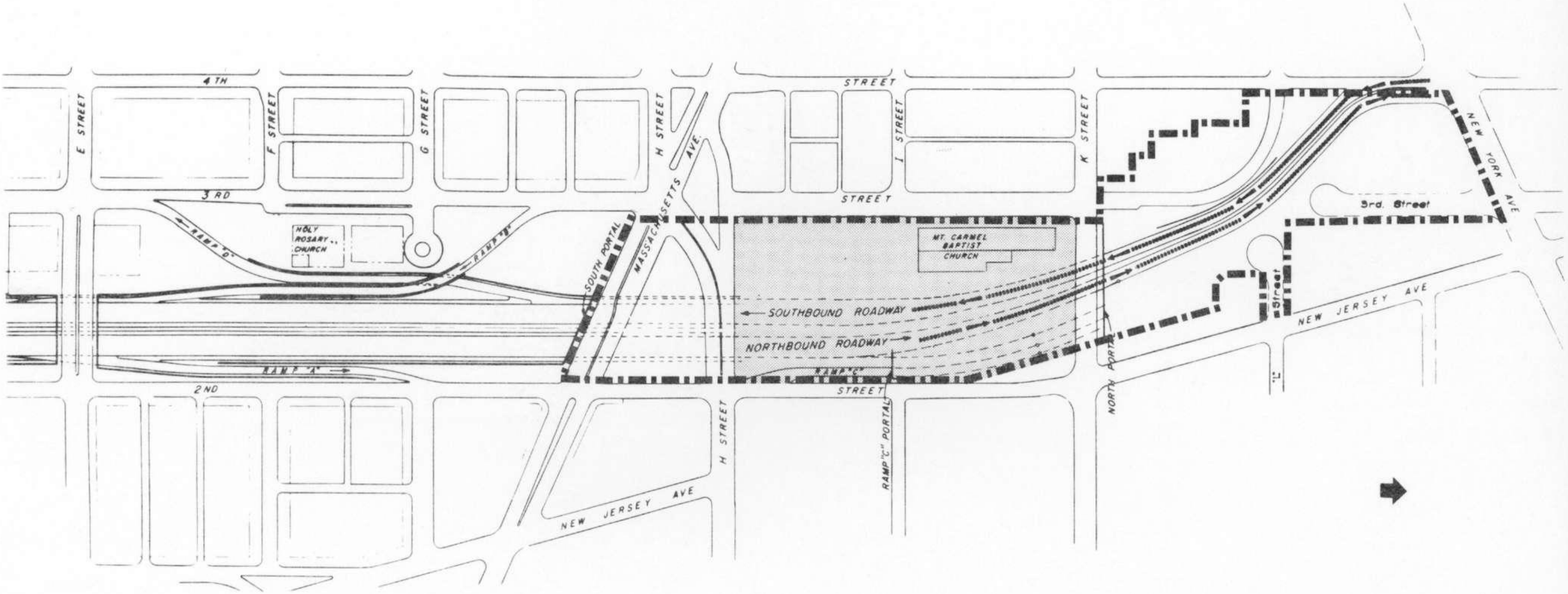
In May 1969, the RLA signed a contract to proceed with the conceptual design studies for the proposed air-rights housing project. Under that contract agreement, a joint venture consisting of the firms of Harry Weese and Associates, Fry and Welch, and Tippetts-Abbett-McCarthy-Stratton are serving as the housing consultants. The final concept of the joint venture called for 300 housing units to be constructed on a two block long conceret deck over the freeway that will serve as the housing project's foundation. By means of public meetings, presentations, and design reviews, the joint venture was able to coordinate their study with the community, and, in particular, the officials of the Mount Carmel Baptist Church. As a result, many of the communities' views regarding the development of the Project are reflected in the adopted plan.

In October 1971 the Department of Highways and Traffic authorized TAMS to proceed with the final design of the vehicular tunnel section from Massachusetts Avenue to K Street as well as the open cut section from K Street to New York Avenue. The design is currently underway with frequent and close coordination with the joint venture architects to assure that the tunnel development remains compatible with the future housing plans and vice versa.

1.02 DESCRIPTION

The Project as referred to in this Draft Statement is that portion of the Center Leg-Inner Loop Freeway extending from Massachusetts Avenue (between Second and Third Streets) to New York Avenue at the corner of Fourth Street. The Project does not include the proposed air-rights development. The Project Area is defined on Figures 2 and 3 following this page.

Measured along its centerline, the total length of the proposed segment is 2,100 feet of which 1,200 feet is tunnel and 900 feet is a temporary connection to New York Avenue. The segment is included in Section 23 (b) of the Federal-Aid Highway Act of 1968 that considers the Center Leg a part of the existing and committed metropolitan highway system.



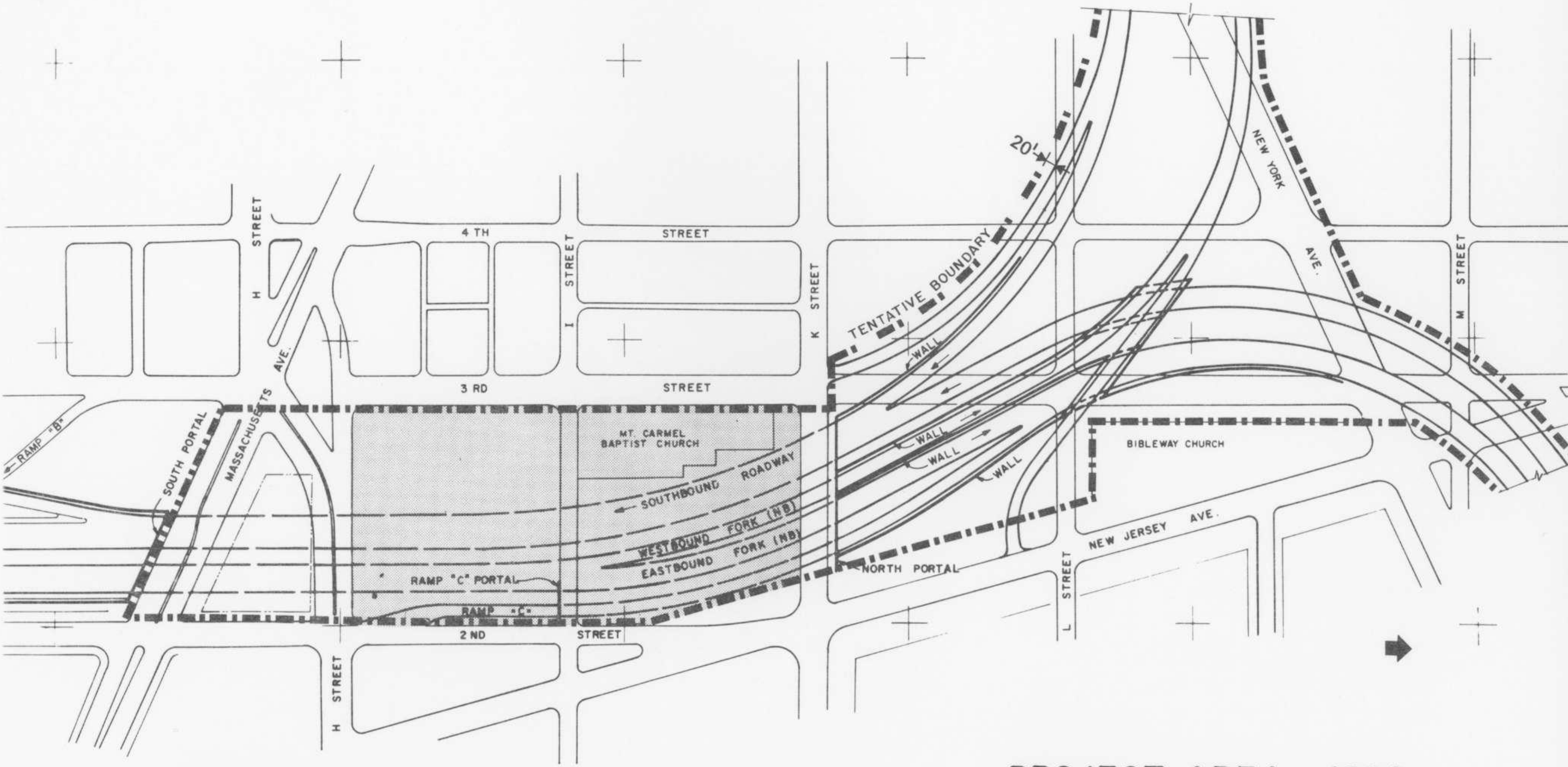
LEGEND

- Project Area Boundary
- Air-Rights Project

0 400'

PROJECT AREA - 1975

Figure 2



LEGEND

Project Area Boundary

Air-Rights Project

0 300

PROJECT AREA - 1990

Figure 3

Upon completion of this segment, the Center Leg will provide a depressed, high speed, north-south controlled access freeway connection between Southwest Freeway I-95 and I-695 and New York Avenue. It is expected to relieve traffic on Alternate U. S. Route One (Sixth Street), the major current north-south truck route located in the heavily congested downtown sector of the City.

The initial connection between the north tunnel portal and New York Avenue will be temporary and in open cut with side slopes at a maximum of 2:1 (two horizontal to one vertical). Some retaining walls will be provided. Pedestrian access to the freeway will be prohibited by protective fencing.

Initially, the Third Street connection between K Street and New York Avenue will be discontinued. Instead, beginning at K Street, Third Street will curve to join L Street to the west. The Third Street portion south of New York Avenue will terminate at cul-de-sac. Similarly, the L Street connection between New Jersey Avenue and Third Street will be discontinued and the remaining portion west of New Jersey Avenue will terminate at cul-de-sac. (See Figure 2.) All vacant land will be landscaped.

Design provisions are being made to accommidate a future interchange connection with the proposed New York Avenue Industrial Freeway. This future connection is in accordance with the recommendations of the National Capital Planning Commission contained in its 1969 publication of "Elements of the Comprehensive Plan for the National Capital". (See Figure 3.)

The initial phase of development is scheduled to open to traffic in 1975 with two lanes of traffic in each direction. The northbound and southbound tunnel tubes will initially be constructed wide enough to ultimately provide 4 and 5 lanes respectively, required to accommodate traffic volumes expected by 1990 after the Project is connected to the New York Avenue Industrial Freeway. The average daily traffic forecasts for this section are 35, 240 in 1975 and 53, 981 in 1990. These numbers compare with the 24-hour average weekday volume of 20,400 vehicles currently using U. S. Alternate Route 1. The following table gives the traffic volumes forecasted by the Department of Highways and Traffic for 1975 and 1990.

TRAFFIC FORECASTS

(Center Leg, Between Massachusetts and New York Avenues)

Hour	%Weekly ADT	1975 Hourly Volume VPH	2000 Hourly Volume VPH
12 pm - 1 am	1.5	529	
1 - 2	0.8	282	432
2 - 3	0.4	141	216
3 - 4	0.3	106	162
4 - 5	0.4	141	216
5 - 6	1.5	529	810
6 - 7	6.1	2,150	3,293
7 - 8	10.0	3,524	5,398
8 - 9	8.2	2,890	4,426
9 - 10	5.3	1,868	2,861
10 - 11	4.1	1,445	2,213
11 - 12	4.4	1,551	2,375
12 am - 1 pm	4.5	1,586	2,429
1 - 2	4.6	1,621	2,483
2 - 3	5.1	1,797	2,753
3 - 4	6.8	2,396	3,671
4 - 5	8.5	2,995	4,588
5 - 6	7.5	2,643	4,049
6 - 7	5.3	1,868	2,861
7 - 8	4.2	1,480	2,267
8 - 9	3.1	1,092	1,673
9 - 10	2.9	1,022	1,565
10 - 11	3.0	1,057	1,619
11 - 12	2.6	916	1,404

The portion of the Project between the Massachusetts Avenue and K Street bridges will be covered by a structural deck to permit the development of urban renewal replacement housing by utilizing the air-rights above the freeway. The finished top of the tunnel deck will generally match the existing street levels. The proposed air-rights development, is included in the urban renewal project known as Northwest One and

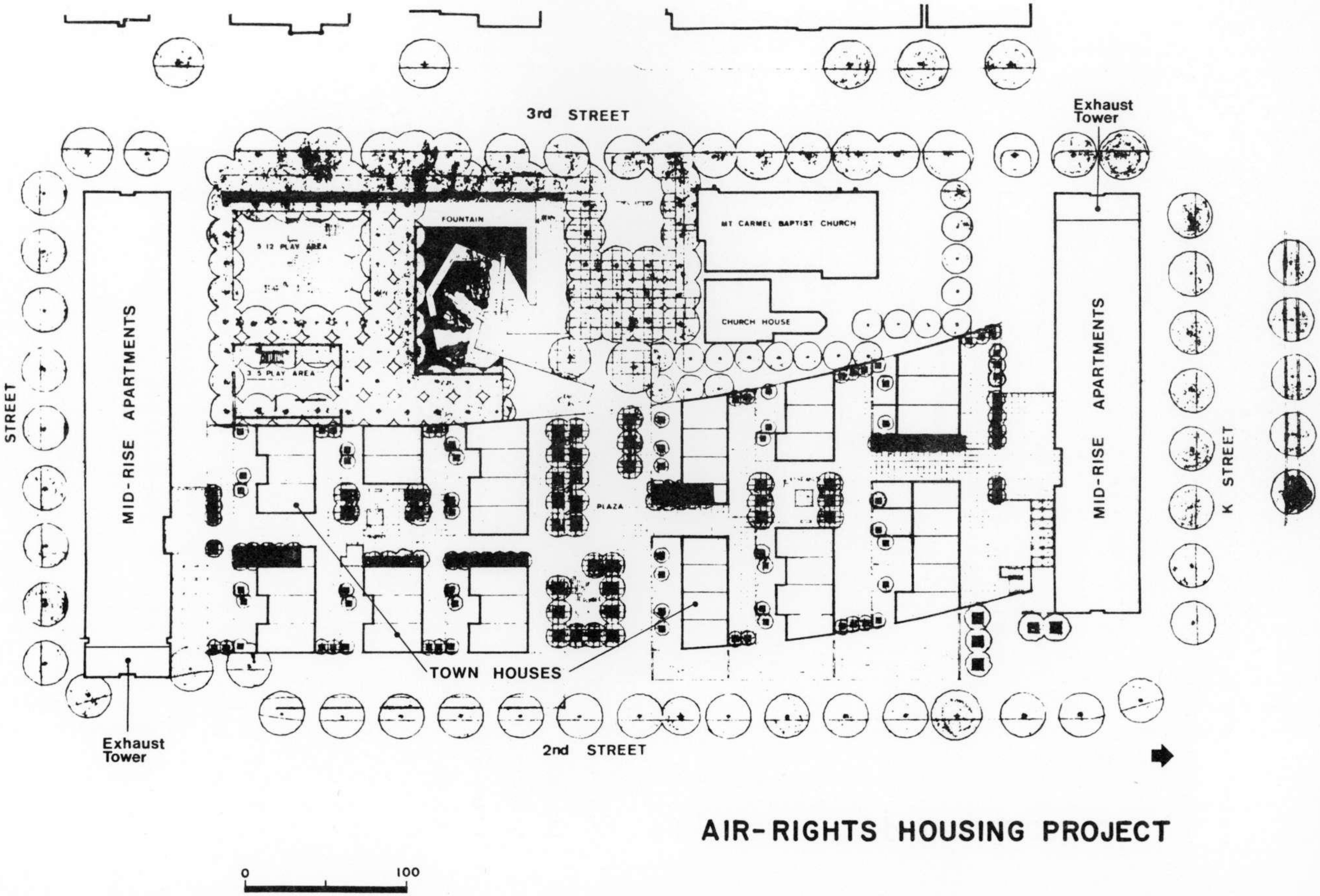
and will serve as a bridge over the freeway, reintegrating the existing neighborhoods on both sides of the freeway.

The 1,200 foot tunnel will have a mechanical ventilation system. This system is designed to limit the maximum concentration of carbon monoxide to 31 parts per 1,000,000 parts of air measured over a one hour period (i.e. 250 ppm maximum 8 hour concentration). The ventilation design is based upon this criteria and the worst possible traffic condition of all nine traffic lanes filled to maximum capacity with cars and trucks stopped with their engines running.

The exhaust ventilation ducts will be located along the outside wall of each tunnel tube and the supply ducts will be located along the roadway centerline. Thus, cross ventilation will be provided by a separate system for each tube.

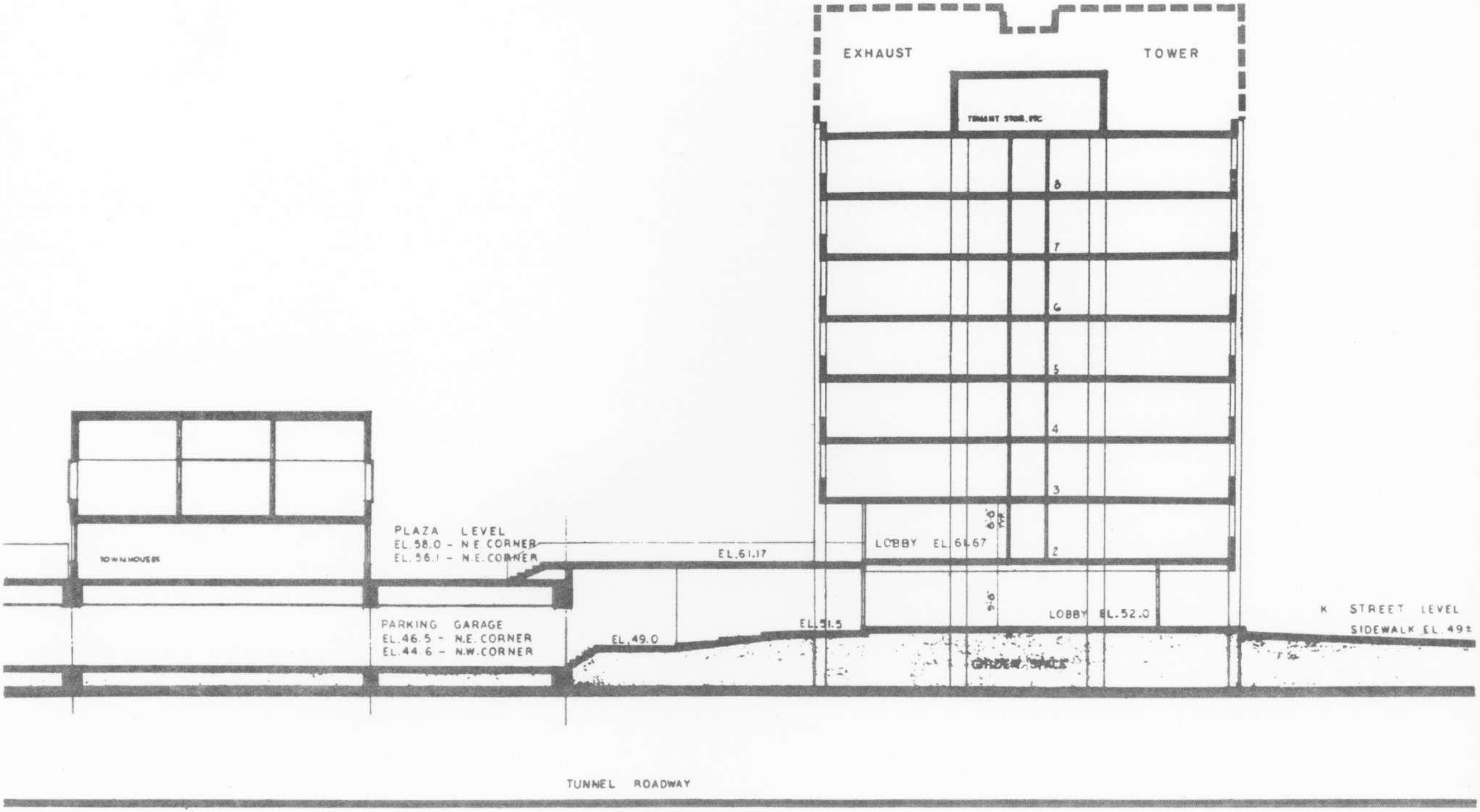
Fumes from the exhaust system will be collected and conducted through exhaust towers adjacent to the mid-rise apartment buildings located at the north and south ends of air-rights site. (See Figure 4 following this page.) The exterior of the towers will have a finish which will conform in character with that provided for the exterior architecture of these residential mid-rise buildings.

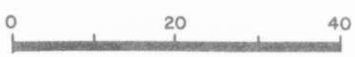
The southbound exhaust system will have an air exchange capacity of 573,000 cubic feet per minute, and the northbound exhaust system will have an air exchange capacity of 638,000 cubic feet per minute. The towers will rise to approximately 98 feet above street level (See Figure 5 following this page), which is approximately equivalent to 10 stories high. Since the mid-rise apartments of the air-rights development will rise 8 stories, the towers will be exhausting pollutants about



AIR-RIGHTS HOUSING PROJECT

Figure 4





AIR-RIGHTS HOUSING SECTION

Figure 5

20 ft., or two stories higher than the tallest building of the surrounding area.

The tunnel tubes will be lighted with a Greenens type lighting system, similar to the system used for the Mall tunnel south of this Project. Longitudinal rows of ceiling mounted fluorescent lamps will be provided over edges of the traffic lanes. Additional ceiling lighting will be provided at tunnel portals to ease daytime intensity transitions. The maintained lighting intensity, day and night, in the interior of the tunnel will be approximately 8-10 foot candles. Nighttime lighting at the portals will be the same as for the tunnel interior. Lighting intensity at the portals during daytime can be adjusted to a maximum of 40-50 foot candles. Lighting of the temporary highway connection between the north tunnel portal and New York Avenue will be located along the median and designed to an intensity of approximately 1.5 foot candles.

At the present time, the Center Leg exists in various stages of completion. The interchange of the Center Leg with the Southwest Freeway is in operation. A tunneled section of the Center Leg between C Street and Union Square under the Mall, is nearing completion, as is the segment between the end of that tunnel and D Street. The construction of the segment between D Street and H Street is complete except for an asphalt wearing surface which will be placed just before the entire Center Leg, including this Project, is opened to traffic. All bridge structures north to Massachusetts Avenue accommodating street crossings over the depressed freeway section are in operation. The K Street bridge is currently under construction.

1.03 RIGHT-OF-WAY

The right-of-way boundaries of the Project are shown on Figures 2 and 3 both following page 6. All properties within the boundaries shown on Figure 2 are now owned by the Department of Highways and Traffic.

The property acquisition which began in 1966 has involved a total of 32 businesses and 146 dwellings estimated to have had a fair market value of $4,652,349.* Most buildings have already been demolished and many of the vacant areas are currently being used for automobile parking. The roadway will be constructed under a three dimensional easement granted by the Redevelopment Land Agency to the Department of Highways and Traffic. The total land area involved in the initial phase of the Project comes to 14.5 acres.

Except for a water main and a storm sewer, there are no major utility trunk lines crossing the right-of-way. The water main is a 36" pipe along the L Street alignment that will be lowered to allow the highway crossing. The 3 x 4 foot storm sewer along K Street will be relocated to cross under the proposed highway along the alignment of L Street. This work will be coordinated with and approved by the public utility company or authority responsible for the service.

1.04 CONSTRUCTION COSTS AND DEVELOPMENT SCHEDULE

The total estimated cost of the proposed facilities is $21,600,000 including the air-rights tunnel and the temporary connection to New York Avenue but excluding the cost of $6,300,000 estimated for the proposed

*Department of Highways and Traffic

air-rights project. Construction will involve approximately 400,000 cubic yards of earth excavation, 45,000 cubic yards of portland cement concrete, 7,000 tons of asphalt concrete pavement, and 5,200 tons of structural steel. Excavated material will be disposed of by the contractor in a location and manner approved by the Department of Highways and Traffic.

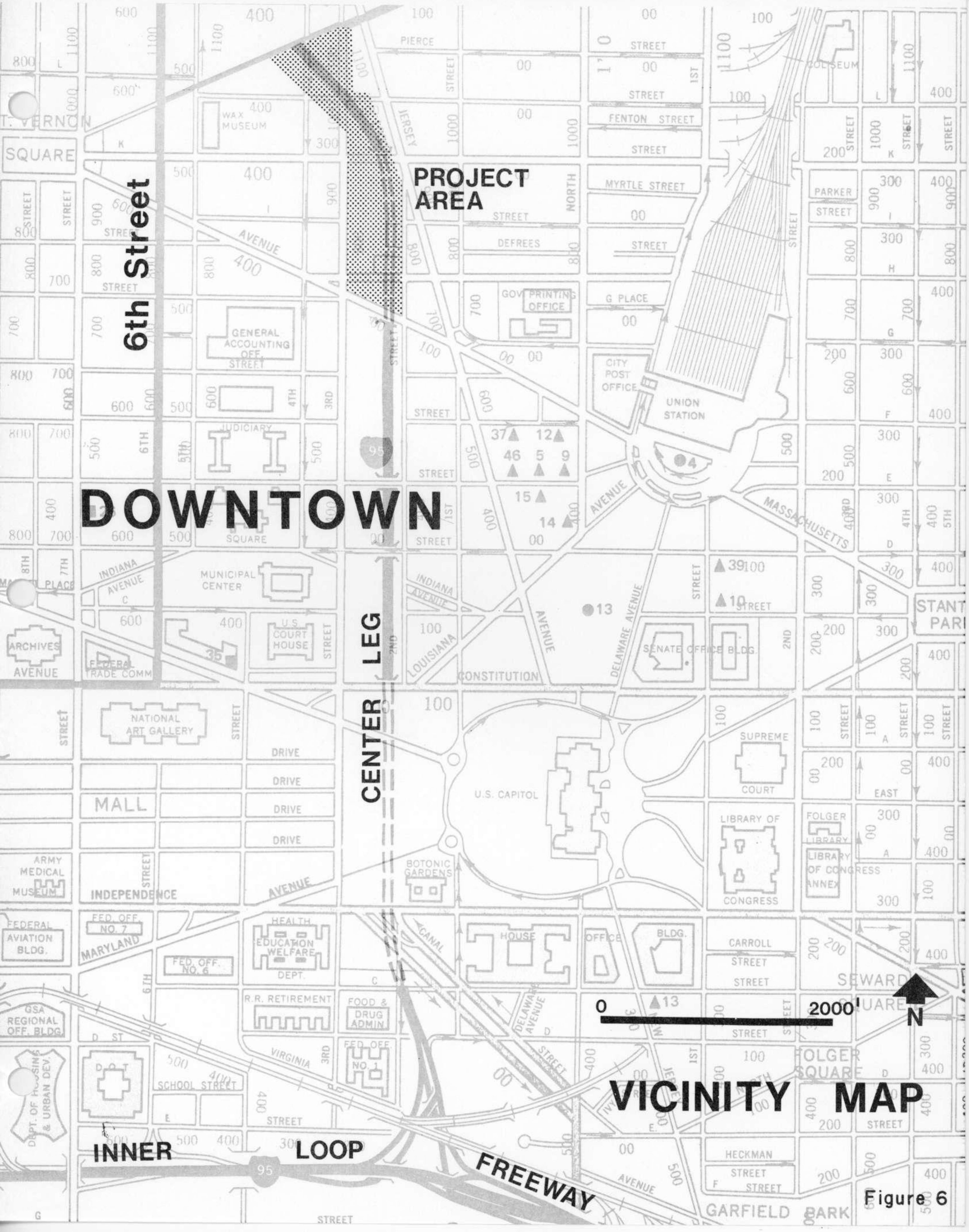
In accordance with present operating agreements, gas, electric power, and telephone utilities, affected by the Project will be relocated by the respective public utility companies. All utility work will be conducted without significant interruption of service to the surrounding communities.

A $2,012,000 contract has been awarded for the construction of the K Street bridge and construction has commenced. Construction of the major portion of the Project, however, is expected to start about January 1973, and to be completed within two years. The construction of the air-rights project will be able to proceed as soon as the tunnel and deck construction permits. Assuming a construction duration of 18 months, the housing units could be ready for occupancy by July 1976. As of this writing, the freeway segment is in the final stages of design and preparation of construction contract documents.

1.05 NEED AND BENEFITS

Sixth Street, four blocks to the west of the Center Leg, is currently designated U. S. Alternate I in downtown Washington. (See Figure 6 following this page.) As such, this street is heavily traveled and badly congested much of the time. Completion of the Center Leg, of which this Project is in the final segment, will alleviate this condition by effectively separating local traffic, particularly truck traffic serving the downtown area, and through traffic. The Center Leg will provide direct through access to the proposed industrial park north of the Project Area and New York Avenue. Recognizing this need, the U. S. Congress enacted the 1968 Federal-Aid Highway Act, a section of which called for the diligent completion of the Center Leg. The benefits intended by the transportation planners to be derived from the Center Leg cannot be realized until the Massachusetts Avenue to New York Avenue segment is constructed.

Specific social and economic benefits to be derived from the construction of the final segment of the Center Leg are discussed in the subsections under Section 3 of this Draft Statement. In general, the principal benefits anticipated are those to be derived by the improved traffic flow in the downtown central business district, the usual benefits of time and money savings and reduced accident rates to the users of the freeway and the benefits to the local community of having the presently cleared vacant site developed.



VICINITY MAP

Figure 6

2.0 DESCRIPTION OF THE PROJECT SURROUNDINGS

2.01 THE NATURAL ENVIRONMENT

2.01.1 CLIMATE

Summers in Washington are generally warm and humid. Temperatures in July, the hottest month normally range between 69° and 87° F whereas relative humidity, measured in the early morning averages 75 percent.*

Winters are generally mild, although normal temperatures in the month of January may be expected to range between 29° and 44° F. Freezing temperatures may be expected to occur between October 21 and April 16, according to records kept over the past twenty (20) years. Relative humidity averages 69 percent in January.*

Washington may expect an average of 102 days of weather classified as clear, 105 days of weather classified as partly cloudy, and 158 days classified as cloudy. In light of these figures, the population at large may expect 57 percent of their days to have some sunshine.*

Annual precipitation averages 40.8 inches, which is distributed quite evenly throughout the year. Thunderstorms frequently occur during the summer months and are often accompanied by sudden and heavy rains sometimes attended by damaging winds, hail and lightning. However, severe hailstorms, tornadoes or hurricanes are rare occurrences.

* "Local Climatological Data, Annual Summary with Comparative Data, Washington D.C. National Airport", U.S. Department of Commerce, Washington, D.C. 1971.

Snow accumulations of more than 10 inches are also relatively rare. Melt-off is usually quite rapid in Washington although snow depths of three (3") inches or more make driving conditions hazardous and results in reduced speeds or even traffic halts. Such snow accumulations may only be expected to occur an average of once or twice a year.*

Wind direction and local temperature inversions are discussed in the following subsection.

2.01.2 AIR QUALITY

This subsection is based on the results of a study undertaken by Environmental Research & Technology, Inc. (ERT) of Lexington, Massachusetts. Their full report is attached to this Draft Statement for reference as Appendix 1.

Utilizing an air quality prediction computer model, present air pollution levels, as well as the projected pollution levels in the vicinity of the Site, were evaluated by comparing the computer model results to the National Ambient Air Quality Standards developed by the Environmental Protection Agency (EPA). The EPA standards prescribe maximum average concertrations allowable to significant pollutants for various periods of the day as shown in the following table.

*"Local Climatological Data, Annual Summary with Comparative Data, Washington, D.C. National Airport U.S. Department of Commerce, Washington, D.C. 1971.

NATIONAL AMBIENT AIR QUALITY STANDARDS

(Protective of Human Health)

Pollutant	Level not to be Exceeded (PPM = Parts Per Million)
Carbon Monoxide	35 PPM (1- hour average)*
	9 PPM (8-hour average)*
Hydrocarbons	0.24 PPM (6-9 AM average)**
Oxides of Nitrogen	0.05 PPM (annual average)

* Not to be exceeded more than once each year.

** Equivalent to one-hour average of 0.29 PPM.

The standards demonstrate the various time exposure periods associated with each of the pollutants. These exposure periods were determined by related health effects. For example, for carbon monoxide there is a one-hour and an 8-hour standard whereas for oxides of nitrogen there is only an annual standard. Health effects studies have indicated that short-term exposures to high concentrations of carbon monoxide (CO) have definite physiological effects on the human body whereas similar acute short term exposures to oxides of nitrogen do not cause such effects. However, long term exposure to small concentrations of either pollutant produecs the opposite effects.

The specific time period, 6 AM to 9 AM, chosen for the hydrocarbon standard is related to the fact that the most significant adverse effect of hydrocarbons is their photochemical reaction with oxides of nitrogen. It has been found that the amount of photochemical smog produced during a day is directly related to the amount of hydrocarbons released during this early morning period, whereas emissions released during other times of the day do not have a significant effect on the production of smog and other photochemical pollutants.

For the convenience of this analysis, the concentration of pollutants has been evaluated for three atmospheric conditions: stable, neutral and unstable conditions.

The stable condition represents an atmospheric inversion, during which time vertical air motions are inhibited. During such periods, any pollutant emitted at ground level tends to stagnate and accumulate, whereas emissions occurring within or above the inversion do not reach the ground and, therefore, do not contribute significantly to ground-level concentrations. These conditions occur most frequently on clear nights with light wind speeds.

On the other hand, unstable conditions tend to enhance vertical air movements. The result is thorough mixing of the lower atmosphere. These conditions, which generally occur during the daytime and are characterized by strong solar heating and light to moderate wind speeds, cause rapid diffusion of any pollutant emitted into the atmosphere.

Neutral atmospheric conditions occur during cloudy and/or windy periods. These conditions occur quite frequently in Washington and tend to cause good mixing and the generation of mechanical turbulence due to the wind interacting with natural or man-made obstacles.

In order to evaluate pollution levels in the vicinity of the Center Leg of the Inner Loop Freeway, weather conditions representative of time periods of one hour and one year were selected for the study. For carbon monoxide and hydrocarbons (less methane), the short-term (one hour) conditions were examined. The annual average condition was calculated for oxides of nitrogen.

Preliminary analysis of the peak pollutant concentrations as a function of wind direction indicated that the west wind would yield highest short-term levels. This direction was selected for analysis, but because of its relatively infrequent occurrence (3.9%), it was decided to examine also the south-southwest wind condition (the annual prevailing wind condition). Although the latter conditions would not yield the worst condition, it is more representative of typical conditions.

For nitrogen oxides, an annual average condition was computed using the Washington National Airport stability wind rose as input to the model, since the airport is only 2-1/2 miles from the Project Area and is subject to the same weather influences. As such, the airport data provided a good estimate of conditions near the freeway on an annual basis. This information was used to compute the air quality resulting from every wind direction and speed listed for each atmospheric condition. These computed values were then added and weighted in order to obtain the annual average.

The proposed development is in an area that experiences frequent changes of air masses marked by the passage of storm systems. These changes typically occur on the order of once or twice a week. Because of these large-scale phenomena, prolonged buildup of pollution levels and large advection of background pollution levels are not frequent occurrences. There are, however, occasional periods of air mass stagnation that most often occur during the fall. Since air mass stagnation is relatively infrequent, the average microclimatic conditions are, in general, the most important elements in determining the average air quality in the vicinity of the Project.

Traffic data for every street in the downtown Washington D.C. area was obtained for the year 1970. To obtain similar data for 1972, a three percent (3%) increase per year was assumed. The vehicle mix used throughout the study was 95 percent automobiles, and five percent (5%) trucks (2% diesels).

Emission factors for automobiles, trucks and diesels were derived from EPA data and represent the best information available to date. (See Appendix 1, Section 2.2).

The ambient air quality conditions in the Project Area for the existing 1972 traffic conditions are detailed in Appendix 1. Following is a summary of findings regarding existing air quality conditions.

During current peak hour traffic conditions and a west wind, the one-hour standard for carbon monoxide is not exceeded anywhere in the vicinity of the Project Area under current unstable and neutral atmospheric conditions. However, under stable conditions the standard is presently exceeded. In this instance, the area examined extends from 1,500 to 3,000 feet in each direction from the center of the Project. The area in which the standard is generally exceeded is primarily west and southwest of the Site.

Background levels of hydrocarbons currently exceed the standard everywhere in the vicinity of the Project during peak hour traffic conditions with westerly winds for all three atmospheric stabilities examined. However, highest values normally occur during stable atmospheric conditions.

There is no hourly or daily standard at the present time for nitrogen oxides (NO_x). The National Ambient Air Quality Standard for the annual average of oxides of nitrogen is 0.05 parts per million. Current background levels exceed 0.05 ppm for approximately one-half the area studied by ERT which is generally west of the Site.

2.01.3 NOISE LEVELS

The present ambient levels were measured at the Site on April 19th and 20th, 1972, throughout the daytime and nighttime hours by L.S. Goodfriend and Associates, Consulting Engineers in Acoustics of Cedar Knolls, New Jersey. Based on these field tests, the Project Area was found to be characterized by a steady-state ambient noise. Due to the relative uniformity of the recorded ambient noise qualities, it was determined that two measurement locations and six measurement periods were sufficient to document ambient noise levels.

Characteristics of the present ambient levels recorded at the Site are given in the following table.

CHARACTERISTICS OF PRESENT AMBIENT NOISE

MEASURED AT THE SITE

Period of Day	Noise Level (dBA)
Late Morning	52
Evening Rush Hour	55-56
Late Evening	49-50
Night	44-45

The noise levels are given in A-weighted decibels because the "dBA" level is regarded as "statistically indistinguishable from the best psychological derived measures in its reliability as a predictor of human response to traffic noise".*

* Galloway, W.J., Clark, W.E., and Kerrick, J.S., "Urban Highway Noise: Measurement, Simulation and Mixed Reactions", NCHRP Report 78, 1969

The levels of highway noise fluctuate with time, requiring statistical techniques be employed. The noise level criteria which follow are presented in terms of the fifty percent level (L_{50}), or the statistical mean level. A second important point on the "statistical time distribution" curve of the noise levels is the ten percent (10%) level (L_{10}), defined as that level exceeded ten percent of the time.

The recommended design criteria for outside noise levels for residential areas are as follows:*

	L_{50}	(dBA)	L_{10}	(dBA)
	Day	Night	Day	Night
Maximum Permissible Level	50	45	56	51

It is, therefore, noted that the measured ambient noise levels in the Project Area are currently close to the maximum permissible design levels.

2.01.4 WATER RESOURCES

No surface waters, such as rivers, lakes, or streams exist within the Project Area or the near vicinity. The nearest bodies of water are the McMillan Reservoir to the northwest and the Tidal Basin to the south approximately 1-1/2 and 1-1/4 miles respectively from the Project Area. Storm drainage from the Site, however, is conducted to the Anacostia River, almost two miles to the southeast.

* Galloway, W.J., Clark W.E., and Kerrick, J.S., "Urban Highway Noise: Measurement, Simulation, and Mixed Reactions", NCHRP Report 78, 1969.

Although water bearing sand and gravel strata exist near the surface in the Project Area, no wells were found within the Site or are believed to exist in the near vicinity. There are no known plans to develop these strata as a source of potable water.

2.01.5 OTHER DEPLETABLE NATURAL RESOURCES

The only depletable natural resources known to exist within the Project Area are sand and gravel deposits. It is considered impractical and economically unfeasible to anticipate use of these on-site materials as sources of aggregate.

2.01.6 AESTHETIC CHARACTER

The Project lies along the west boundary of the Northwest One Urban Renewal Project, an area being redeveloped by the District of Columbia Redevelopment Land Agency. The proposed air-rights project is part of this urban renewal project.

Prior to demolition, the urban renewal area consisted mainly of decaying residential buildings built during the latter part of the 19th and the early part of the 20th centuries. Except for a few isolated properties, such as the Mount Carmel Baptist Church and the Bibleway Church to the north, the area was devoid of positive aesthetic character.

A new aesthetic character is emerging now because of the current redevelopment program. Just south of the Project boundaries, several rundown structures are being replaced by large new government and private office buildings. This redevelopment program is in conformity with the long standing zoning plan, to convert Massachusetts and Constitution Avenues at this point into a high-grade civic and office district*.

* TAMS, "The Joint Development of Housing and Freeways", March 21, 1967

Within the Northwest One, 588 new housing units were completed by the end of 1970, and 356 former residents had returned to its new or rehabilitated buildings. By the end of 1971 the construction of several additional housing and community facilities projects were completed with more underway. Of particular note was the Tyler house, a 9-story 60-unit, air conditioned apartment building, sponsored by the Mount Airy Church (which itself underwent renovation and expansion) and the 256-bed Nursing Home and Community Health Center of the National Medical Association Foundation. L Street, between First and North Capital Streets, was converted into a neighborhood parkbelt with a pedestrian way. Construction of the Temple Courts, a 212-unit housing project, sponsored by the Prince Hall Masons, was underway as were the Golden Rule Apartments, a 184-unit residential complex, sponsored by the Bibleway Church. In addition several other redevelopment projects are currently planned by the RLA for the Northwest One Area, including the air-rights project spanning the freeway between H and K Streets.

2.01.7 GEOLOGY

The Fall line which forms the boundary between the Piedmont Province Type and the Atlantic Coastal Plain Province, passes through Washington, D.C.*. The Project is located in the Atlantic Coastal Plain Province. Bedrock at the Site is estimated to be 120 to 150 feet below ground surface. It consists of crystalline rock, principally granite, gneiss, schist and diorite. The bedrock surface slopes generally southeastward.**

* Carr, Martha S., USGS Bulleting No. 967 "District of Columbia, Its Rocks and Their Geologic History, 1960".

** "Preliminary Design Report, Phase I Alternative Studies, Center Leg Inner Loop Freeway, D Street NW to New York Ave. N.W. Washington, D.C.," Tippetts-Abbett-McCarthy-Stratton, N.Y., N.Y., June 1965.

Several unconsolidated sedimentary formations overlie the crystalline bedrock. The oldest of these formations belong to the geologic unit known as the Potomac group and consist mainly of sand and clay mixed in varying proportions. The upper beds of the Potomac group are clays of various colors interbedded with lenses of light-colored sands. The deposits of the Potomac group are overlain by terrace deposits of Pleistocene Age and generally 15 to 40 feet thick, formed cheifly of gravel, sand and a mixture of silt, sand and gravel. Depressions or old erosion channels within these deposits have become filled with fine-grained alluvium. The northern portion of the Site lies on Quaternary river terrace deposits while the southern portion of the Site lies on alluvium.

In the air-rights tunnel section of the Project the proposed finished roadway grade levels will vary from 21 feet to 24 feet below existing ground elevations. Site boring information indicates that groundwater levels, particularly in the northerly three quarters of this section, will be above the proposed finished gradeline of the roadway. Since the base of retaining wall foundations and structures range from seven to eleven feet below that of the road gradeline, it follows that dewatering will be required during excavation for foundation installations. A relatively high groundwater level exists also in the area north of the air-rights tunnel. In this section, as with the tunnel section, a system of underdrains for permanent water pressure relief will be installed.

Over most of the Site dewatering in advance of excavation will be effected by a system of wellpoints. In the vicinity of K Street, however, where a perched groundwater condition in a sand and gravel stratum exists, it may be desirable to employ sump-pumping methods.

2.01.8 FAUNA

Few wildlife species native to the urban environment inhabit the Site. Such species are limited to occassional squirrels, rats, mice and gregarious bird species such as pigeons, sparrows, starlings and a few song birds.

Migratory birds, particularly waterfowl, using the Atlantic Flyway, mostly skirt Washington enroute to the Chesapeake Bay wintering area and are not attracted to the Site or its surrounding area.

No rare or endangered species inhabit or frequent the Site.

2.01.9 FLORA

Even prior to the clearance of the Site no stands of trees existed within the Project Area or its immediate vicinity. Remaining plant species are limited to the planted shade trees lining the streets, and the various remaining trees, shrubs, vines and weeds scattered about the Site.

2.01.10 ARCHAEOLOGICAL AND PALEONTOLOGICAL FEATURES

No relics left by ancient peoples or fossil remains of past geologic periods are suspected to lie in the Project Area. Furthermore, any such deposits were more than likely lost long ago from previous excavations and changes in the natural topography in the Project Area.

2.02 HUMAN ENVIRONMENT

2.02.1 SOCIAL CONDITIONS

Prior to the demolition of existing structures which began on November 18, 1966, the Site was occupied by a mix of generally decaying apartment houses, town houses, stores, office buildings, a 90 year old public elementary school and the Mt. Carmel Baptist Church complex. Few of these structures had been built within the last twenty-five years.

At the present time, approximately seventy (70%) percent of the Site has been cleared. Still remaining are nine buildings which are vacant, the Mt. Carmel Baptist Church and four small businesses in operation under special lease agreements. Only the Church is planned to remain.

A total of 192 families have been displaced by the Project construction between Massachusetts and New York Avenues since 1966. Of these, 73 families were considered eligible for public housing in 1967.* Approximately 97 percent of the Site's displaced inhabitants were black.** The next largest group were Chinese.

Nearly one half the displaced population was less than 18 years of age. Sex ratio differences reached a maximum between the ages of 25 and 44 years when women outnumbered men 2 to 1. Population density was a relatively low 23 families per acre. However, nearly eighty (80%) percent of the dwelling units had densities of 1.00 or more persons per room. Family sizes commonly ranged from one to six persons. Complete families outnumbered those incomplete due to either separation, divorce, or death, slightly less than 1.5 to 1.0. Approximately eighty (80%) percent of the inhabitants belonged to primary families.

School enrollment was quite high for elementary school age children. On the other hand, enrollments dropped each successive year of high school. In fact, only five out of six youngsters between the ages of 14 and 18 years were enrolled in school. Of these, seventy-five

* "The Joint Development of Housing and Freeways", Tippetts-Abbett-McCarthy-Stratton, February 1967, p.8.

** The current racial mix in the immediate vicinity is still about 87%.

(75%) percent completed four years of high school. Only one to three percent had completed any further education.

Social conditions prevailing in the Project Area, prior to demolition may also be characterized by those currently prevailing in the adjacent Downtown Urban Renewal Area to the west. According to surveys performed by the RLA in 1970, the population density in that area ranged from 60 to 120 families per acre. Housing was generally inadequate with insufficient utilities and community facilities and poor sanitary conditions. Most families were low to moderate income. Of the several hundred dwelling units within the Downtown Urban Renewal Area, ninety-four (94%) percent were occupied by tenants while only six (6%) percent by landlords and owners.

The Northwest One Area, of which the proposed air-rights project will be part, is currently being developed as a residential community for some 2,000 families of low and moderate income. Also planned to be included are new neighborhood shopping facilities, school expansion, parks, playgrounds, pedestrian ways and a large multi-use community center. The air-rights project will contribute approximately 300 new housing units, 7,500 square feet of commercial space, a day care center, a park area and community meeting rooms. Also, the air-rights project will permit a higher density of 69 families per acre. Room densities, however, will be substantially lower than those densities that prevailed prior to demolition.

2.02.2 ECONOMIC ACTIVITY

For the most part only minor economic activity exists in the entire Northwest One Area. The notable exception is the U.S. Government Printing Office which is within easy walking distance from the Site and is a major employer of both skilled and unskilled labor.

Prior to demolition, thirty-two small businesses existed in the Project Area. Of these only four still remain in operation as discussed in the previous sub section.

As previously stated, 7,600 square feet of commercial space has been planned for the ground floors of the proposed air-rights housing towers. Similar commercial space is being developed for the Golden Rule Apartments and Temple Courts complexes presently under construction in the Northwest One Area.

Directly to the west of the Project Area is Washington's central business district (CBD), the largest retail shopping center in the metropolitan region. Its 90,000 jobs are the prime source of income for many of the City's residents and taxes from that area finance a large part of the City's services. *

As of 1970, fifteen (15%) of the eligible labor force living in Northwest One was unemployed. Almost all those employed, worked for a wage with the primary exception of taxi cab owners. Most of the employed males were blue collar, non-skilled workers. Most employed females were domestic service workers, clerical workers, typists, etc. The majority of those employed worked in the CBD, Northwest One Area or the suburbs. Only one of four persons employed owned automobiles. Most walked to and from work.

2.02.3 MAJOR LAND USE PATTERNS AND RELATIONSHIPS

Prior to clearance, land use in the Project Area and the immediate vicinity was an unplanned mix of residential, commercial, industrial and institutional activities with the notable exception of the central business district. Most structures were generally under three stories

* RLA, Annual Report 1970.

high.(See Figure 7 following this page).

At this time, seventy (70%) percent of the Site is cleared. Ultimately, of the original land uses on the Site, only the Mt. Carmel Baptist Church complex will remain.

However, the former surrounding land use pattern has been undergoing radical changes over the past several years as a result of the various planned urban renewal projects. The area between the Project Area and North Capitol Street and between New York and Massachusetts Avenues (Northwest One Urban Renewal Project) is presently undergoing a transitional phase of development. Its land is predominantly vacant or under construction. Remaining, however, is a small concentration of low density residential usage along with a number of schools, churches and some community facilities. (See Figure No. 9 following page 39.)

Beyond North Captiol Street as far east as the B &O Railroad right-of-way there is a rather heavy concentration of industrial usage between K Street and New York Avenue. In addition, there is a scattering of industry occurring mostly as warehousing within predominantly residential neighborhoods outside of this area. Mixed commercial and residential usage occurs between "O" Street and H Streets from 4th Street to 6th Street, N.W. While housing is generally dispersed throughout the vicinity of the Project, the largest concentration of solid residential blocks occurs between New York Avenue and N Street from 2nd Street over the 6th Street, N.W. The corridor extending from "O" Street down to G Street along 7th Street, N.W. has the heaviest concentration of retail usage, although the entire area is characterized by spot office commercial usage.

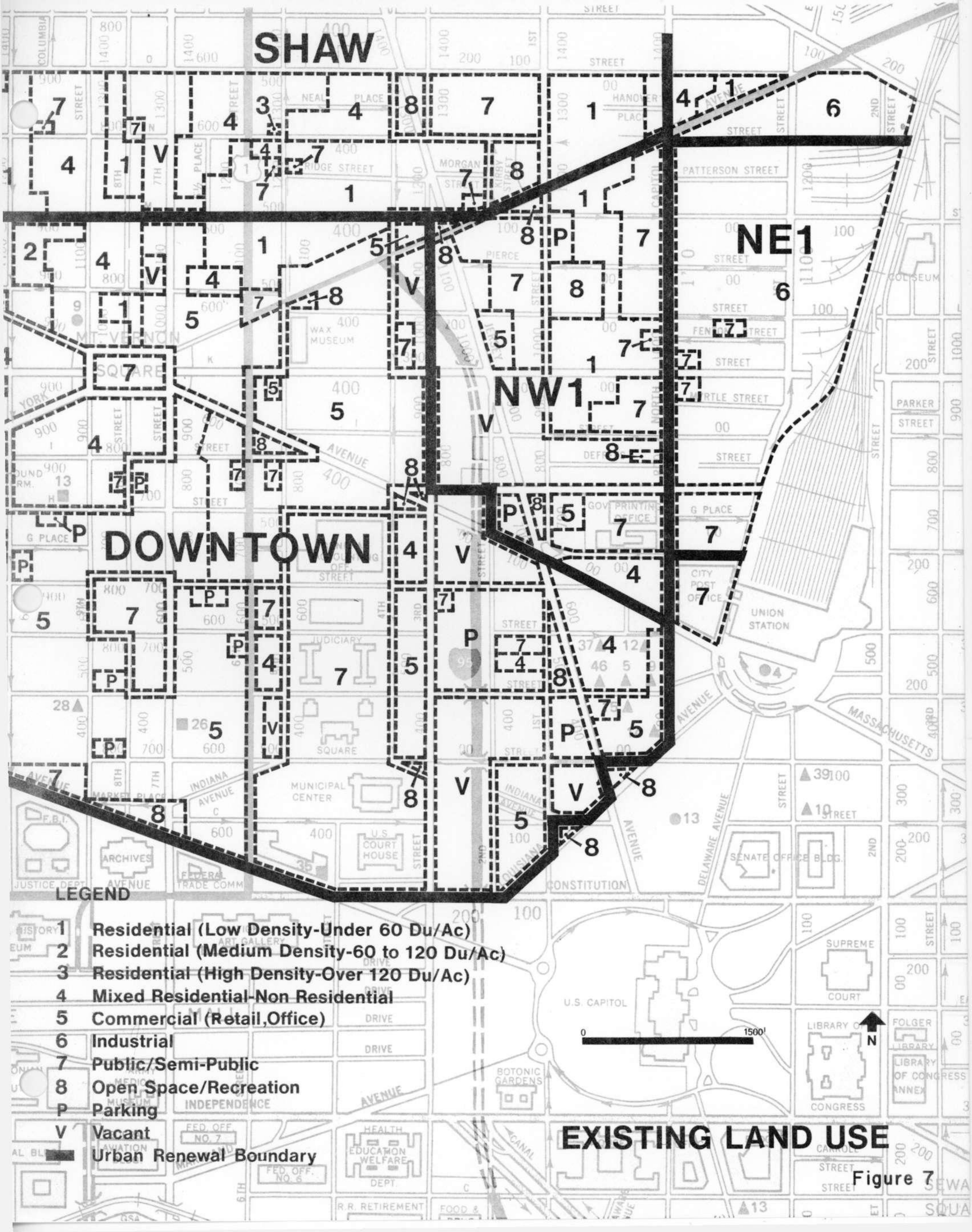

SHAW
NE1
NW1
DOWNTOWN
LEGEND
1 Residential (Low Density-Under 60 Du/Ac)
2 Residential (Medium Density-60 to 120 Du/Ac)
3 Residential (High Density-Over 120 Du/Ac)
4 Mixed Residential-Non Residential
5 Commercial (Retail,Office)
6 Industrial
7 Public/Semi-Public
8 Open Space/Recreation
P Parking
V Vacant
Urban Renewal Boundary
0
1500'
N
EXISTING LAND USE

Figure 7

A few major office buildings are located nearby. These offices include the U.S. Government Printing Office and General Accounting Office. The Printing Office is located at North Capitol and G Street and the accounting office at 4th and G Streets.

Unlike most sections of Washington, there are not abundant open space or park facilities in the immediate vicinity. It appears that the bulk of the recreational space serves the quandrant from North Capitol to New Jersey between "I" Street and "O" Street.

The area immediately surrounding the Project is presently zoned for high bulk major business, employment centers, office buildings and low rise row dwellings. The area between 2nd Street and 6th Street is zoned for office buildings and for apartment houses and hotels with a F.A.R. (floor area ratio) of 6.0 permitted by zoning ordinances. West of 3rd Street between L and H Streets and extending a little beyond 12th Street is an area zoned for high bulk major business and as an employment center. Residential use is limited to a F.A.R. of 4.5. Other areas which are similarly zoned lie south of H Street between North Capitol and 2nd Street and north of Constitution Avenue between 1st Street and 6th Street. Bounded by Florida and Rhode Island Avenues on the north and New York Avenue on the south, North Capitol on the east and 5th Street on the west is the largest singular zoned area in the vicinity of the Project Area. This area is zoned primarily for low rise dwellings with a F.A.R. of 0.9 and conversions to multiple dwellings with 900 square feet of lot per dwelling unit permitted.

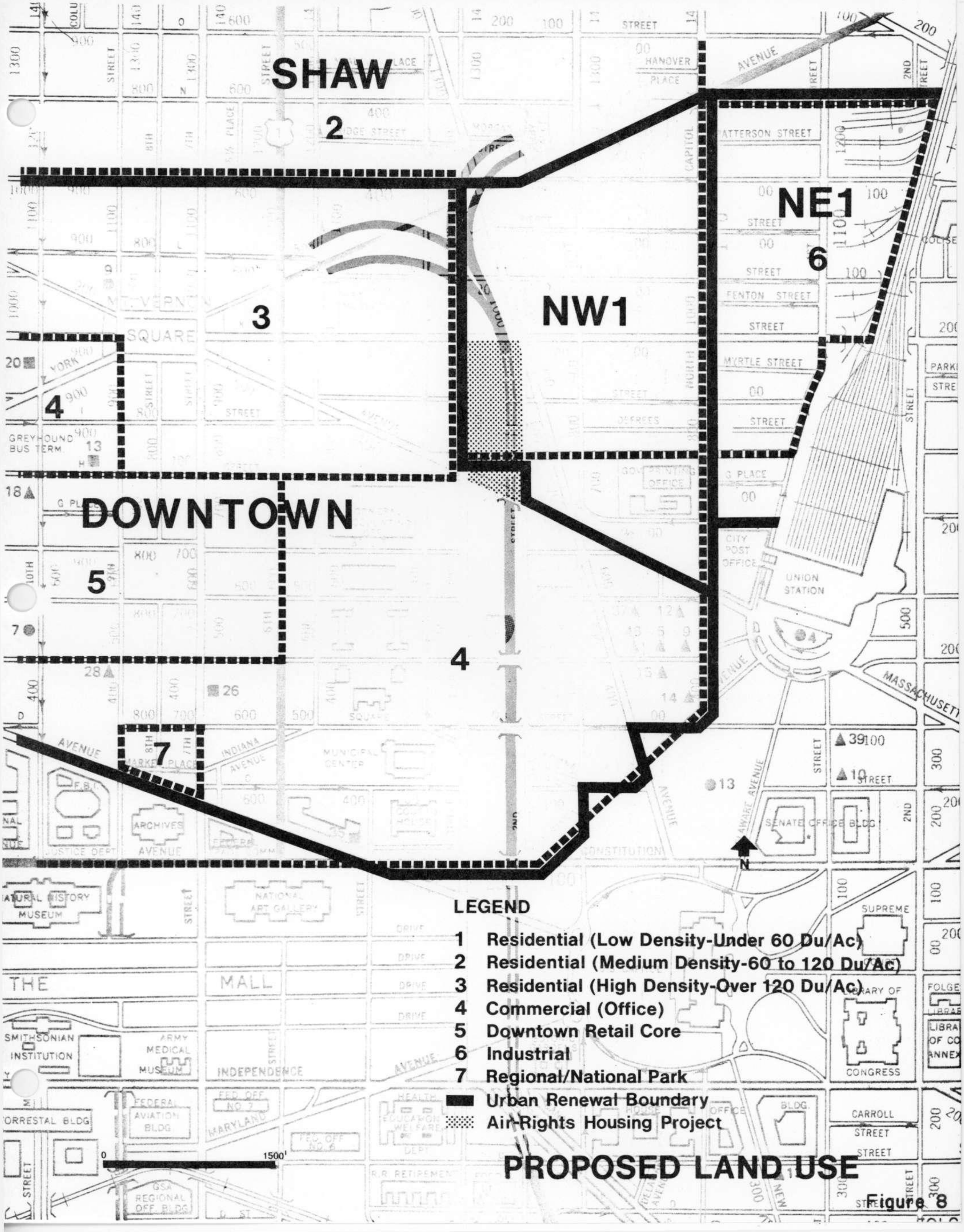
Investigation of the "Comprehensive Plan for the National Capital General Land Use Objectives -1970/1985" prepared by the National Capital Planning Commission reveals the following land use proposals involving the Project Area, and vicinity. (See Figure 8 following this page.) East of North Capitol Street from H Street to N Street is designated industrial usage. South of H Street to Constitution Avenue from North Capitol Street to Sixth Street, N. W. is a portion of the area designated as the central employment center for the City. West of Sixth Street to Fourteenth Street, N. W. and between H and E Streets is designated as the downtown retail core. South of M Street to H Street from 3rd Street to Seventh Street, N. W. is designated as high density residential.

2.02.4 OPEN SPACE AND RECREATIONAL OPPORTUNITIES

Property acquisition has not involved lands pertinent to Section 4 (f) of the 1968 Department of Transportation Act. In fact, the only recreational area that did exist on the Site prior to demolition was a school yard playground.

The bulk of the recreation and open space in the vicinity is mainly composed of urban type facilities such as neighborhood parks and playgrounds, triangles, circles, sitting areas, and indoor recreational centers. Many of these facilities are in conjunction with schools and other public buildings or monuments, while others are independently designated park areas.

Generally speaking, prior to urban renewal efforts, the immediate vicinity lacked sufficient recreational opportunities for the youthful population. However, recreational facilities are now a major feature in the urban renewal plans.



PROPOSED LAND USE

Figure 8

Recreation facilities in Washington D. C. are designated according to three types. The district center, which occupies 25 acres or more, the community center, between 10 and 15 acres and the neighborhood center which ranges from three to five acres. No district center or community center type facilities exist in the near vicinity of the Project whereas several neighborhood community centers afford a variety of athletic as well as more passive recreational activities to satisfy the needs of older people. The service area, however, seldom exceeds a one-mile radius and most residents are within walking distance of these facilities. Many of these facilities are overcrowded and considered inadequate to properly serve their existing demand.

In addition to these neighborhood centers, there are smaller sitting areas and tot lots located throughout the area, built under the auspices of the Redevelopment Land Agency and maintained by the District's Department of Recreation. Other recreational facilities forming part of public housing projects are under the jurisdiction of the National Capital Housing Authority.

A sampling of usage of nearby neighborhood center facilities where daily recreational programs are provided can be seen in the following table. The second table lists other open spaces and parks in the vicinity of the Project.*

*Comprehensive Plan for the National Capital, National Capital Planning Commission, November 5, 1970.

NEIGHBORHOOD RECREATIONAL CENTERS
(Attendance for Fiscal Year 1970 - 71)

Acreage	Recreation Center	Attendance
2.62	Bundy	35,875
.75	John F. Bundy	13,737
5.63	Dunbar	12,743
3.60	J. F. Kennedy	188,658
1.50	New York Avenue	61,675
1.7	Logan	40,607
1.13	Terrell	105,750
.38	Thomson	38,749
2.14	J. L. Young	59,856
2.80	J. O. Wilson	90,076

PARKS AND OPEN SPACES IN THE VICINITY OF THE PROJECT

NAME	LOCATION	TYPE OF FACILITY	ACREAGE
Mount Vernon Square			2.74
Franklin D. Roosevelt Memorial	9th St. & Pennsylvania Ave., N. W.	Triangle	0.41
related to Thomas Circle	Massachusetts Ave. & M St., N. W.	Street Park	0.03
Edmond Burke Memorial	11th & L Sts., N. W.	Triangle	0.37
Samuel Gompers Memorial Park	10th & L Sts., N. W.		0.41
	11th & Massachusetts Ave., N. W.	Triangle	0.02
	Massachusetts Ave. & K St., N. W.	Street Park	0.14

NAME	LOCATION	TYPE OF FACILITY	ACREAGE
	5th St., & Massachusetts Ave., N. W.	Street Park	0.31
	5th St., & Massachusetts Ave., N. W.	Triangle	0.01
	5th St., & Massachusetts Ave., N. W.	Street Park	0.23
	1st St., & Massachusetts Ave., N. W.	Triangle	0.15 0.08
	N. Capital St. & Massachusetts Ave., N.W.	Street Park	0.07
	H St. & New York Ave., N. W.	Triangle	0.09
	10th St. & New York Ave., N. W.	Triangle	0.30
	9th St. & New York Ave., N. W.	Street Park	0.12
	7th St. & New York Ave., N. W.	Street Park	0.15
	1st St. & New Jersey Ave., N. W.	Street Park	0.23 0.08
Mellon Fountain	6th St. & Pennsylvania Ave., N. W.		0.28
Logan Circle	13th & P Sts., N. W.		1.48
related to Logan Circle	12th St. & Rhode Island Ave., N. W.	Triangle	0.25
	13th St. & Vermont Ave., N. W.	Triangle	0.11
	5th St. & New York Ave., N. W.	Triangle	0.02 0.03 0.17
	3rd St. & New York Ave., N. W.	Triangle	0.11
	1st St. & New York Ave., N. W.	Triangle	0.53

NAME	LOCATION	TYPE OF FACILITY	ACREAGE
	N. Capitol St. & New York Ave., N. W.	Street Park	0.03 0.04
	Ist St. & New York Ave., N.W.	Street Park	0.05
	4th St. & New Jersey Ave., N.W.	Triangle	0.04
	4th St. & New Jersey Ave., N. W.	Street Park	0.10
	Ist St. & Florida Ave., N. W	Triangle	0.19
	6th & D St., N. W.	Triangle	0.09
General Pike Memorial	3rd & D Sts., N. W.	Triangle	0.11
	3rd St. & Massa-chusetts Ave.,N.W.	Street Park	0.09
Logan ES/ NEW Playground			3.4
Dunbar SHS			
New York Avenue Playground			
Slater-Langston ES/NEW ES			
NEW Shaw JHS/NEW SEATON ES			5
Francis JHS/Recreation Center			7
Terrell JHS/Walker-Jones ES			5.0
Cook ES/Washington SHS			2.0
Montgomery ES/Bundy ES			5.0
Kennedy Playground			2.0

2.02.5 CULTURAL AND HISTORICAL FEATURES

Washington is rich in landmarks and historic sites. Efforts have continually been made by governmental agencies and historical societies to foster the designation and preservation of landmarks. The National Historic Preservation Act of 1966, and the Demonstration Cites and Metropolitan Development Act have furthered preservation efforts, giving impetus to the City's landmark maintenance program.

The National Environmental Policy Act of 1969, in its efforts to ensure maximum compatibility of engineering projects with their physical surroundings, required that landmarks and historic sites be seriously considered when evaluating the impact of such projects. A number of these landmarks exist within the vicinity of the Project Area, however, none existed within the actual project boundaries. Following is a listing of such prominent monuments and structures found nearby.

SIGNIFICANCE	FACILITY	LOCATION
Residential	Mary Surrat House	"H" Street, off 6th Street
Religious	St. Mary's Church	5th Street, off "H" Street
Religious	Old Adas Israel Synagogue	6th and "G" Streets
Religious	Greater New Hope Baptist Church	8th and "I" Streets
Public Building	Public Library	Mt. Vernon Square
Religious	Mt. Vernon Place So. Methodist Church	9th Street at Massach-usetts Avenue
Religious	Immaculate Conception Church	7th and "N" Streets
Commercial	National Bank of Washington	7th at "O" Streets

(cont'd.)

SIGNIFICANCE	FACILITY	LOCATION
Commercial	Lansburgh's Furniture Store	9th and "F" Streets
Commercial	"O" Street Market	7th and "O" Streets
Commercial	Commercial Buildings	10th and "F" Streets
Commercial	Woodward Lothrop Building	"F" at 11th Streets
Commercial	Riggs National Bank	9th and "F" Streets
Public Building	U. S. Tariff Commission	"F" between 7th and 9th Streets
Public Building	Ford's Theatre	10th at "F" Street
Public Building	National Portrait Gallery	7th, 9 th, "F" and "G" Streets
Public Building	Pension Building	5th and "G" Streets
Religious	St. Aloysius Catholic Church	North Capitol and "L" Street
Public Building	Government Printing Office	North Capitol North Capitol - "G" and "H" Streets
Public Building	City Post Office	Massachusetts Avenue and North Capitol

2.02.6 COMMUNITY FACILITIES AND SERVICES

Formerly one elementary school built in 1881, three churches, one day care center, and one Police Boys' Club existed on the Site. All have since been removed with the notable exception of the Mr. Carmel Baptist Church, the sponsor of the proposed air-rights housing project. The role the Church has enjoyed in both religious and social affairs of the community makes the Church the dominant cultural stimulus in the immediate surrounding area.

Other community facilities exist in the surrounding area (see Figure 9 following this page) and are being planned and provided in the adjacent urban renewal areas. Within the Northwest One Area are four other churches, four schools, a nursing home, and a community facilities center. Proposed new construction includes two new community facilities centers and two parks.

The following list of activities and decentralized services are available at the existing community facilities center located in the old Notre Dame Convent Building on North Capitol Street.*

1. Department of Public Health
2. Department of Welfare
3. Metropolitan Police Boys' Club
4. Department of Corrections
5. Department of Vocational Rehabilitation
6. Citizens Information Service
7. Area C Mental Health Service
8. Homemakers Service
9. National Capital Day Care
10. U. S. Employment Service
11. Home Economics Staff Classes
12. Activities, Inc. (a residents' group that sponsors movies for adults and children and other activity programs)
13. Emergency Service Center (food, clothing)
14. Summer Recreation Program
15. Alcoholics Anonymous
16. Food Distribution Program
17. Real Estate Classes

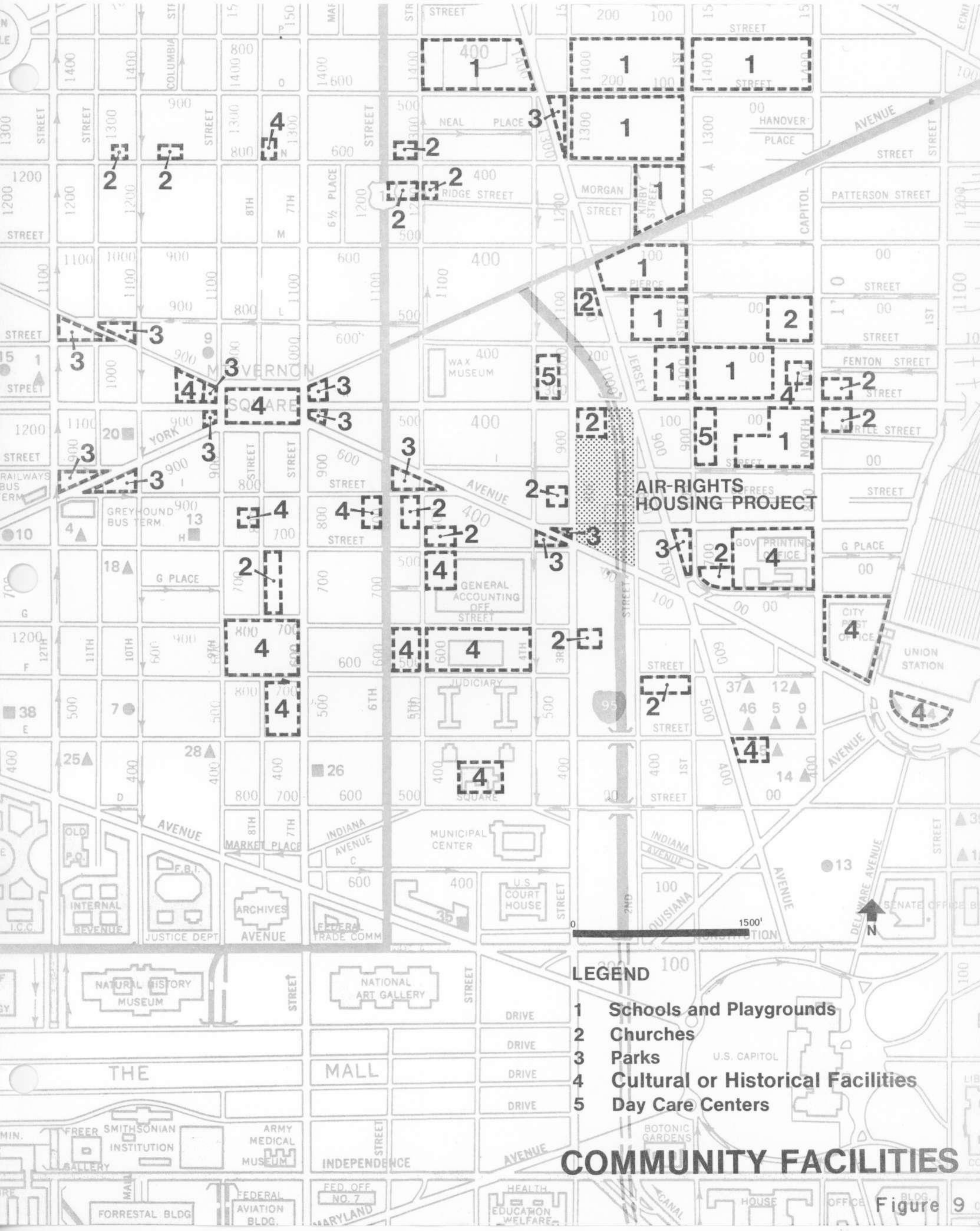
*Redevelopment Land Agency

Further community facilities being planned or developed consist of the following. A nursing home currently under construction and sponsored by the National Medical Association Foundation (NMAF), a non-profit corporation whose membership consists mainly of Negro doctors from every state and the District of Columbia, will contain 250 beds and an outpatient facility. It will later be connected with a medical cooperative scheduled for construction with the Model City Area. The Walker-Jones Elementary and Terrell Junior High School are both acquiring additional land for expansion and playground areas. Gonzaga Catholic High School is planning acquisition of land for new classroom construction and athletic facilities. A recent addition to the Mt. Airy Baptist Church has been completed providing additional classrooms and community meeting rooms.

2.02.7 TRANSPORTATION SYSTEMS

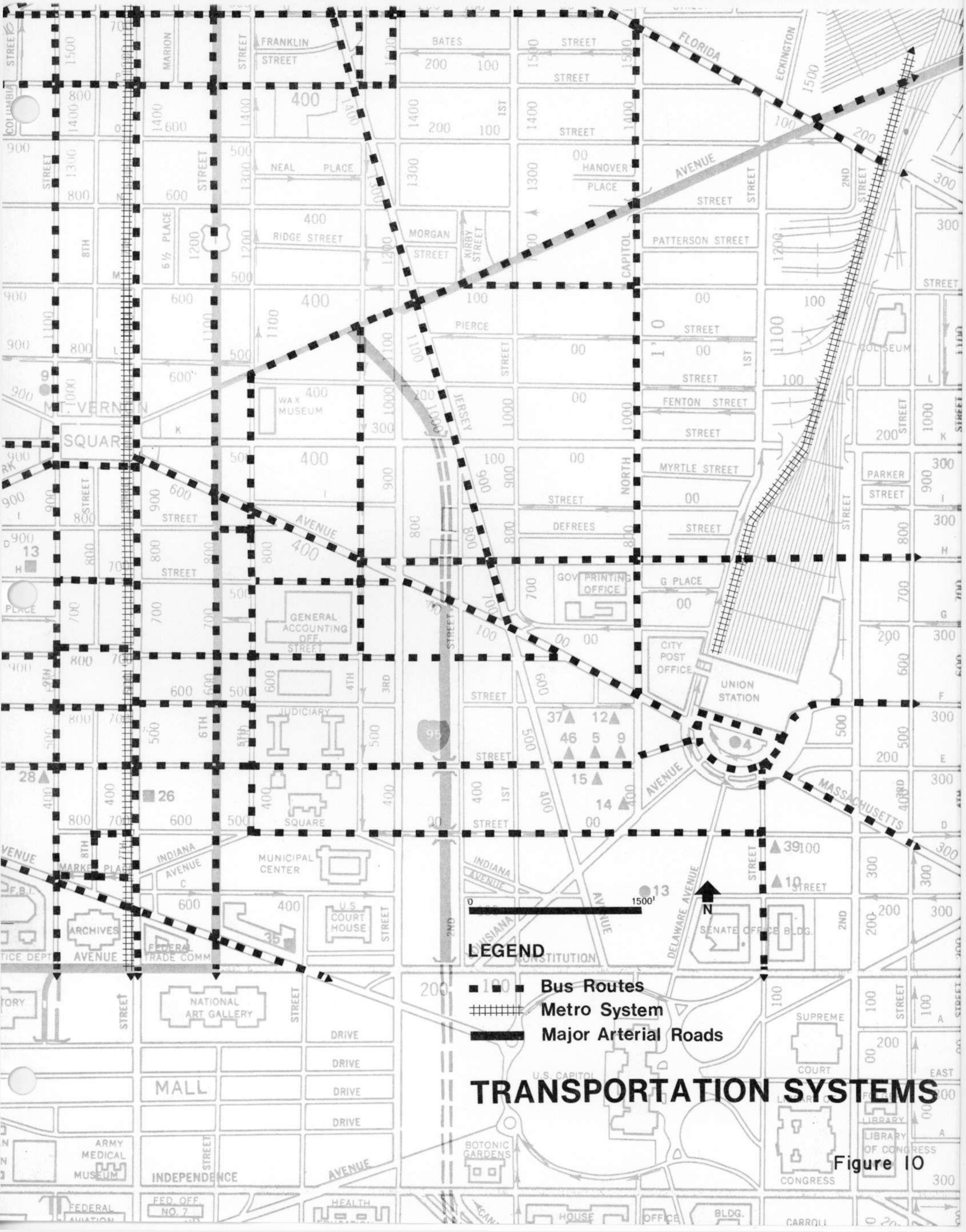
The primary transportation modes in the Washington metropolitan area are private automobile, taxi and bus. Bus routes and the future Metro (underground subway system presently under construction) alignment in the vicinity of the Project are shown on Figure 10 following this page.

The Project Area is situated close to the center of downtown Washington. Downtown Washington contains only ten (10%) percent of both the population and total land area of the District of Columbia, yet it encompasses over sixty (60%) percent of the jobs. This is particularly important since further growth of vehicular traffic will be effected more by employment than by population. To further demonstrate the current congested traffic conditions in the downtown area, it may be noted that travel through the CBD on an average 24-hour weekday in 1968, was



COMMUNITY FACILITIES

Figure 9



TRANSPORTATION SYSTEMS

Figure 10

eleven (11%) percent greater than in 1960.*

In the immediate vicinity of the Project Area, and as indicated on Figure 10, E, H and K Streets are the principal east-west arterials serving traffic in that portion of downtown Washington. Massachusetts Avenue is a major radial street serving the Bethesda, Maryland area and running in a northwest-southeast direction through the City. A channelized intersection has been constructed and is in operation for converging local streets at Massachusetts Avenue. Running in a north-south direction, 6th Street is presently designated Alternate U. S. Route 1 and functions as the major north-south distributor and truck route through the center of the City. Traffic volumes between southwest Washington and the north central area are extremely heavy. This causes a diffusion of traffic into the adjacent surface street system with resultant impairment of the efficient operation of this portion of the downtown area.

Public transit in Washington, D. C. is presently made up almost entirely of buses. Bus service operates in close proximity to the Project on surrounding streets. The closest Metro station, presently under construction, is located on 7th Street immediately north of New York Avenue.

* District of Columbia, Interstate System 1971
De Leuw, Cather Assoc., Harry Weese & Assoc., Ltd., Nov. 1971.

3.0 PROBABLE IMPACT OF THE PROPOSED PROJECT

3.01 GENERAL

This section discusses the probable positive and negative environmental impacts anticipated during and after construction of the highway and air-rights platform. Environmental conditions are analyzed for both 1975 and 1990 to determine quality trends and comparisons. (Prior to 1990, a significant number of pre-1975 vehicles are expected to be in operation. Theoretically, one of these vehicles will create ten times the amount of engine emission as a post-1975 vehicle designed specifically to meet national air quality standards.)

Of all the environmental considerations analyzed, only air quality, noise, aesthetics, geology, social conditions, economic activity, open space and recreation, community facilities and transportation systems are expected to be appreciably affected during at least one stage of development and operation. In each instance, probable effects are described both within the Project Area and outside the Project's boundaries. The remainder of the environmental factors considered were determined not to be significantly affected by the proposed development for the following reasons:

1. Local meteorological conditions, such as wind direction, sunlight, rainfall, temperature and humidity, are not anticipated to vary to any measurable extent because of construction of the Project. (It should be noted that the net difference in pavement area as a result of the proposed development will be negligible.)

2. Ground water within the vicinity of the Project has not been tapped as a source of potable water supply. As far as can be ascertained, such a future possibility is considered highly unlikely.

3. Storm drainage will be conducted to existing facilities. All storm runoff will outfall into the Anacostia River, two miles to the southeast of the Project. Water quality of this navigable stream will not be adversely affected by storm water pollution contributions from the Project Area.

4. Large amounts of sand, gravel and crushed rock will be required during the construction of the Project. Such depletable natural resources are readily available from commercial sources in the metropolitan Washington area. As contracts have not been let at this point, exact source locations cannot be determined.

On the other hand, excavation of the tunnel and open cut section of the roadway north of the tunnel will yield large quantities of spoil material suitable for fill not required by the Project. Based on recent experience in the District with disposing of such material, the spoil will in all likelihood be hauled some 15 to 20 miles for use as land fill in Maryland or Virginia.

No depletable natural resources such as coal, oil, natural gas or minerals are suspected to occur within the Site.

5. Animal and birdlife may be temporarily displaced from the Site throughout the construction phase of development. However, these typical urban species are expected to return in approximately the same number to inhabit the completely landscaped Project.

6. During the construction phase, it can be expected that some shade trees along streets within and at the periphery of the Site will be taken down. However, most of these will subsequently be replaced or compensated for, as part of the Project's overall landscaping program.

7. As discussed in Section 2 of this Draft Statement, no historical sites or structures have been affected by the clearance of the Site, and all precautions are being taken to preserve the Mt. Carmel Baptist Church. In fact, the Church's physical environment will be enhanced. Similarly, no significant cultural facilities or opportunities existed within the Site, with the exception of the Church sponsored cultural activities. As noted in previous sections of the Draft Statement, the Church and its several community and cultural functions have continued uninterrupted throughout the Project's development to date. In fact, the role of the Church as a community landmark and center of cultural affairs has been explicitly expressed in consultants' conceptual planning of the air-rights housing project. As the visual and psychological focal point of the architects' design, its future prominent role will be assured.

Outside the Project Area, no designated landmark will be visually obscured or obstructed, due to the Project's compliance with height restrictions of the District's zoning ordinances. Similarly, no landmark monuments or structures in the near vicinity of the Project (the closest of which is the old Government Printing Office Building, 1,500 feet east of the south tunnel portal) will be affected by vibrations incurred during extensive pile driving operations. It is anticipated that blasting will not be necessary.

8. As already stated in previous sections, land use in the vicinity of the Project is in transition from old two- and three-story row-dwellings mixed with commercial uses to planned urban renewal neighborhoods. In this regard, the freeway segment is not dividing or disrupting an established neighborhood or community.

9. All existing utility lines within the right-of-way of the Project have already been located and indicated on preliminary design drawings prepared by TAMS. These lines include gas, electric, telephone and combined sewer

connections. Where necessary, utilities being affected by the proposed construction will be relocated by the respective utility agency without significant disruption to the service they provide to adjacent communities. Accordingly, no significant impact is anticipated therefrom.

3.02 SIGNIFICANT NATURAL ENVIRONMENTAL EFFECTS

3.02.1 AIR QUALITY

Based on the results of the computer model air quality study, pollution levels were analyzed for two conditions: initial operation in 1975, and ultimate development in 1990 (see study report included as Appendix 1).

Concentrations of carbon monoxide, hydrocarbons, nitrogen oxides and suspended particulates were determined for the two study years. Also presented are the effects on downwind regions of emissions from the two tunnel ventilating stacks, the impact of leakage from the ends of the tunnel on the proposed air-rights buildings, and the effects of stack emissions on nearby mid-rise buildings.

This subsection summarizes the results of the above study. Figure 11 following this page outlines the study area in the vicinity of the Project and shows schematically the locations of selected points where pollutant concentrations were computed.

<u>Carbon Monoxide, 1975</u>. The one-hour maximum concentration standard for carbon monoxide is 35 ppm. According to the model, ambient concentrations would not exceed this standard in the study area. However, superimposition of the freeway segment and tunnel traffic emissions on the background will result in concentrations which exceed the maximum standard but only when a one-mile backup of stalled traffic is assumed on all four lanes.

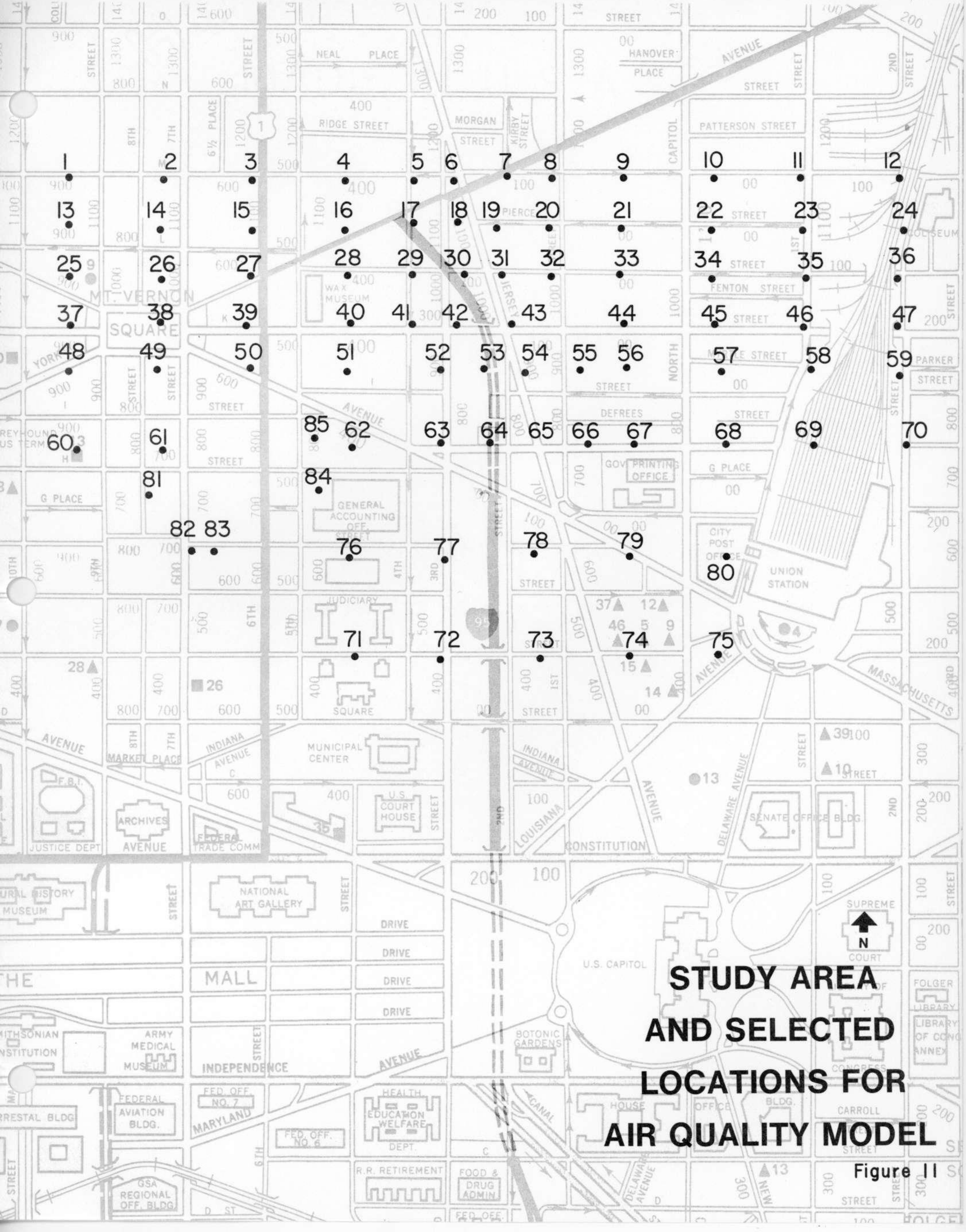
These high concentrations will occur at locations 19, 31, 73 and 78 (see Figure 11) with a west wind, and locations 19, 54, 55, 64, 65 and 78 with a south-southwest wind. In these rare instances, the air quality will affect three nearby schools, a day care center, one school and several residential blocks. For average vehicle speeds of 20 mph or greater, the standard will not be exceeded at any location in the study area.

The impact of leakage from the tunnel portals and its effect on the mid-rise apartment buildings that are proposed to be erected over the tunnel was examined for 20 mph average traffic speeds for all meteorological conditions studied. Carbon monoxide levels are estimated to be below maximum standards everywhere along the front face of the buildings.

Carbon Monoxide, 1990. In 1990, when the new Federal regulations regarding vehicular emissions will apply to all cars on the road, carbon monoxide levels are estimated to be below the maximum concentration standard throughout the area influenced by this Project for even the most adverse meteorological and worst traffic conditions combined.

Hydrocarbons, 1975. The one-hour maximum concentration standard for hydrocarbons is 0.29 ppm. The model predicted that background levels will exceed this standard over approximately 80% of the study area for two of the three meteorological conditions studied and over the entire study area for the remaining condition. Hydrocarbon concentrations including the freeway and tunnel emissions are expected to be above the standard nearly everywhere in the study area under all three meteorological conditions studied.

The two ventilation stacks that will be constructed at either end of the tunnel portion of the Project will be about 100 feet high. Normal operation of the tunnel will be such that emissions will not contain more than 125 ppm of carbon monoxide (maximum 8 hour concentration) in 1975. Based on this norm,



STUDY AREA AND SELECTED LOCATIONS FOR AIR QUALITY MODEL

Figure 11

the influence on air quality of the stack emissions alone was examined for the worst possible wind directions, that is, downwind when the plume from one stack is eventually superimposed on the plume from the second stack. For unstable atmospheric conditions coupled with slow wind speeds, the maximum standard for hydrocarbon concentrations will be exceeded at points between 600 and 2,300 feet downwind from the first stack. At the present time, such a rare occurrence will only affect two churches, as most of the land to the north and south of the stacks is vacant.

The model predicted that due to tunnel air leakage, the hydrocarbon standard will be exceeded at the first two or three stories of the north mid-rise building and the first story of the south building under the most adverse atmospheric conditions.

Hydrocarbons, 1990. Due to the vehicular emission controls which are expected to be fully in effect by 1990, the model predicts that only the stall condition (one-mile traffic backup on all nine lanes) will cause concentration levels of hydrocarbons to exceed the standard at a few locations within the study area. (See Table 10, Appendix 1.)

For traffic speeds greater than 20 mph, hydrocarbon concentrations will remain below the standard everywhere in the study area.

Only the first story of the north building is expected to rarely experience concentrations above the standard under the most adverse atmospheric conditions, due to air leakage from the tunnel portal.

Nitrogen Oxides, 1975. The standard for maximum annual average concentration of nitrogen oxides is 0.05 ppm. Model results indicate that the standard will be slightly exceeded over approximately one-half of the study area, primarily in the immediate vicinity of the open roadway.

Nitrogen Oxides, 1990. Concentration levels of nitrogen oxides will be well below the maximum annual average standard by 1990.

In summary, the air quality computer model predicted the following results:

- Hydrocarbon concentrations will exceed the 0.29 ppm hourly standard in 1975 almost everywhere in the study area, primarily due to background concentrations which are also expected to exceed the standard. In 1990, hydrocarbon concentrations will not exceed the standard except during a stalled traffic condition on all 9 lanes of the freeway segment during the most adverse meteorological conditions.

- Concentration levels of nitrogen oxides will exceed the 0.05 ppm annual standard over about one-half of the study area in 1975, again primarily due to high background concentrations. By 1990, nitrogen oxide levels will be below the maximum standard throughout the study area.

- The contribution of the roadway to suspended particulates in the air is expected to be minimal. The standard for particulates is 60 micrograms per cubic meter (m g/m^3). The model predicted annual average particulate levels to be of the order of 3-10 m g/m^3 in the study area.

3.02.2 NOISE LEVELS

The impact of noise on the area surrounding the Project was analyzed for three periods: Construction, Initial Operational Phase (1975), and Ultimate Development (1990). For the operational phases, noise emanating from both the highway and the tunnel ventilating system was considered. It is concluded that the area which will be affected by noise from the Project will be reduced by the tunnel cover to slightly more than half of what it would be if the total Project were constructed as a depressed roadway. Design criteria provide that the ventilating system will meet all applicable noise criteria and standards of a residential area.

During construction, the level of exposure and degree of impact, of noise from within the Site will depend primarily on distance from the Site. Noise generated by construction or operation of the Project will have an adverse impact only where such noise will increase the ambient level. For this to occur, the noise from the Project must be at least 5 dBA above the ambient level. It has been estimated (see Appendix 2, page 2) that 95 dBA will be the maximum average level of construction noise at 50 feet, although it is possible that pile drivers may generate slightly higher instantaneous peaks. Using this maximum average level, while assuming no barrier effect due to existing buildings, the limit of significant construction noise impact*, and the distance at which the construction noise levels equal the ambient, were determined and are presented in Figure 12 following this page. Only the Mt. Carmel Baptist Church and one day care center lie in the "great impact" zone. Several schools, churches and parks lie in the area of some impact. Accordingly, such impacts could be minimized by carefully scheduling certain construction activities not to coincide with various noise sensitive activities. The impact due to construction activity in the vicinity of the Site is given in the following table**:

* Kryter, Karl D., "The Effects of Noise on Man", Academic Press, New York, 1970.

** Bolt, Bernaek and Newman, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", NTID 300.1.

Distance from Source (feet)	Average Noise Level (dBA)	Speech Interference	Sleep Interference	Hearing Damage Risk
100	74	Severe	Severe	Slight
200	63	Severe	Moderate	None
300	60	Moderate	Moderate	None
400	57	Moderate	Moderate	None
600	54	Moderate	Moderate	None
800	51	Slight	Moderate	None

The impact of traffic noise must be assessed based on subjective human responses to noise. The parameters upon which human response directly depends are:

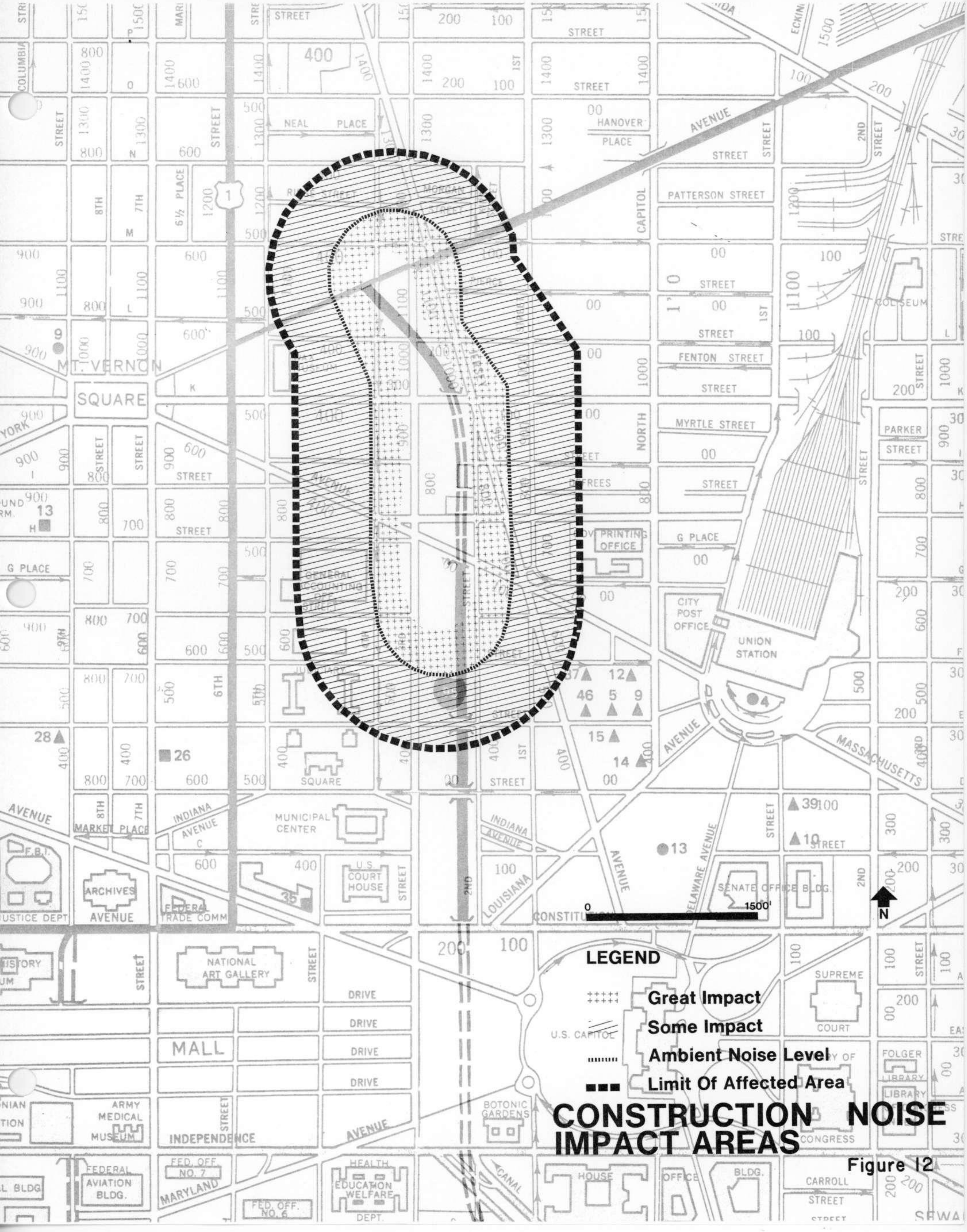
1. The relation of highway noise to the ambient noise level.
2. Interference with speech, sleep, study and other activities.
3. General annoyance.

A procedure has been developed which classifies the impact due to noise for particular land use area using these parameters. The assessment is made by classifications of the noise impact as causing:

1. No impact--Under this category, very little comment or individual reaction is expected. In an urban area, this generally holds where the predicted noise level does not exceed the criterion level. (See Section 2.01.3)

2. Some impact--Under this category, some individual comment and reaction is expected but no group action is likely. Predicted noise levels are up to five dBA greater than the criterion level.

3. Great impact--Under this category, strong individual comment and group action may be expected. Predicted noise levels are six or more dBA



CONSTRUCTION NOISE IMPACT AREAS

Figure 12

above the criterion level.

A computer model was used to predict noise levels in the vicinity of the highway for peak hour traffic volumes in 1975 and 1990. Utilizing the above classifications, the impact due to noise in the two forecast years is presented in Figures 13 and 14 following this page. Two qualifications of these contours should be emphasized.

1. The impact evaluation includes the noise contribution of projected traffic on Massachusetts Avenue and New York Avenue, where noise from the freeway is also significant.

2. No assumptions of improved technology in automotive noise control have been made.

On this basis, the predicted extent of the areas affected by noise from the Project tends to be somewhat overestimated, since it can be expected that future motor vehicles will be quieter than those on the road today.

Containing the roadway in the tunnel significantly lowers the traffic noise levels in the adjacent areas. The tunnel cover provides an acoustical barrier to a major portion of the noise generated by the freeway traffic. The dotted lines on Figures 13 and 14 indicate the extent of the traffic noise impact area if the roadway were not covered. The extended contours show that the area of significant acoustical impact between New York Avenue and Massachusetts Avenue is reduced by approximately one-half by the inclusion of the tunnel.

The noise radiated from the tunnel portal was considered as a point source equal in power to the assumed level of 80 dBA within the tunnel. (Typical noise levels in vehicular tunnels range from 70 to 80 dBA.) It was found that the effect of the noise exiting the tunnel was negligible, not significantly exceeding the noise levels generated by the open portion of the highway.

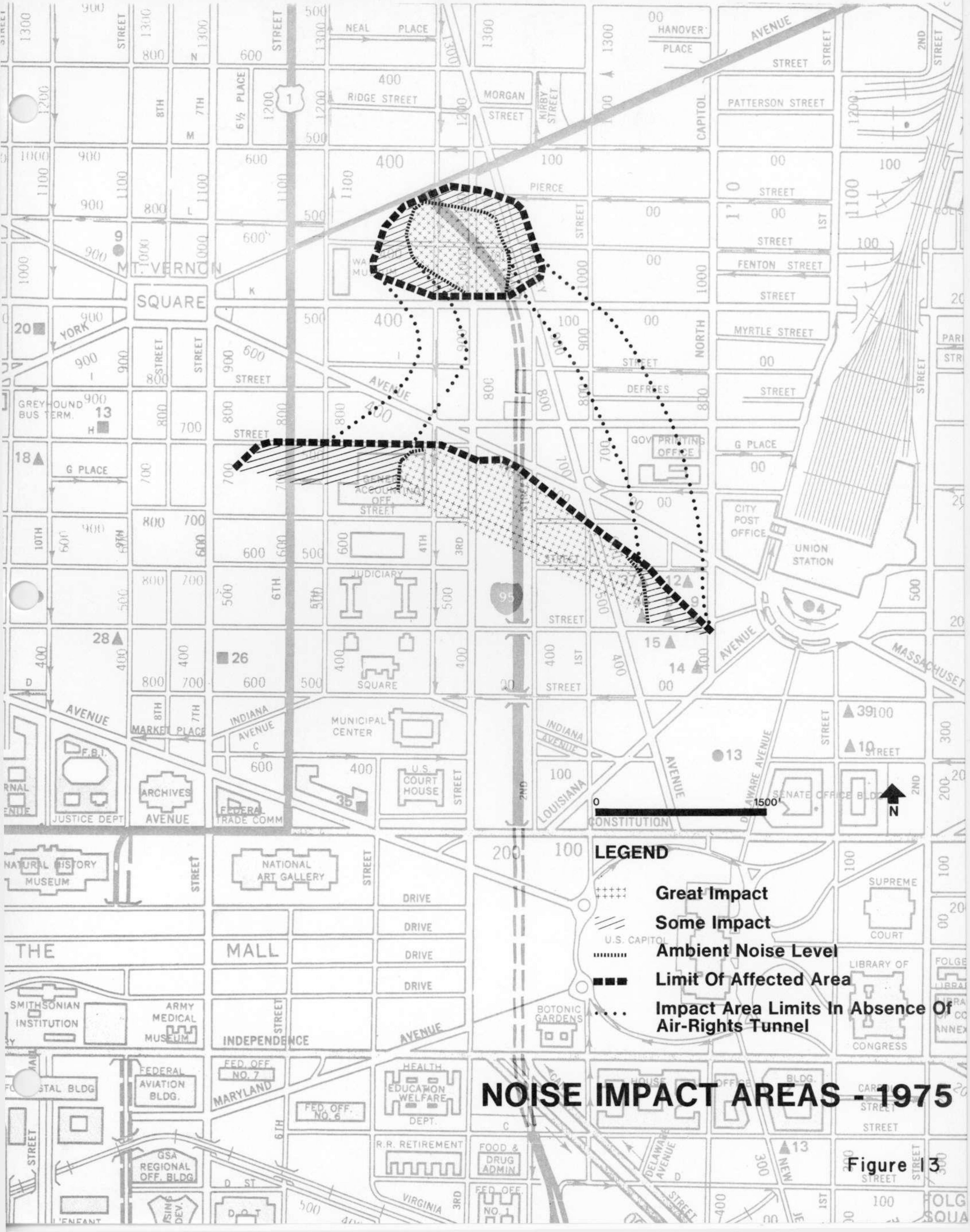
The roadway is depressed as it leaves the tunnel portal which acts to some degree as an acoustical barrier between the roadway traffic noise and the adjacent area. The degree of attenuation is approximately seven dBA in the area adjacent to the portal.

The enclosures of the mechanical equipment and the air inlets and outlets of the tunnel ventilation systems are being designed to effectively control ventilation noise levels. The criteria is to maintain exterior levels in the nearest residential or recreational areas five dBA below the ambient and thus not affect the ambient noise. The systems are also being designed to assure that interior noise levels in adjacent housing units will not exceed the criteria recommended by FHA.*

3.02.3 AESTHETIC CHARACTER

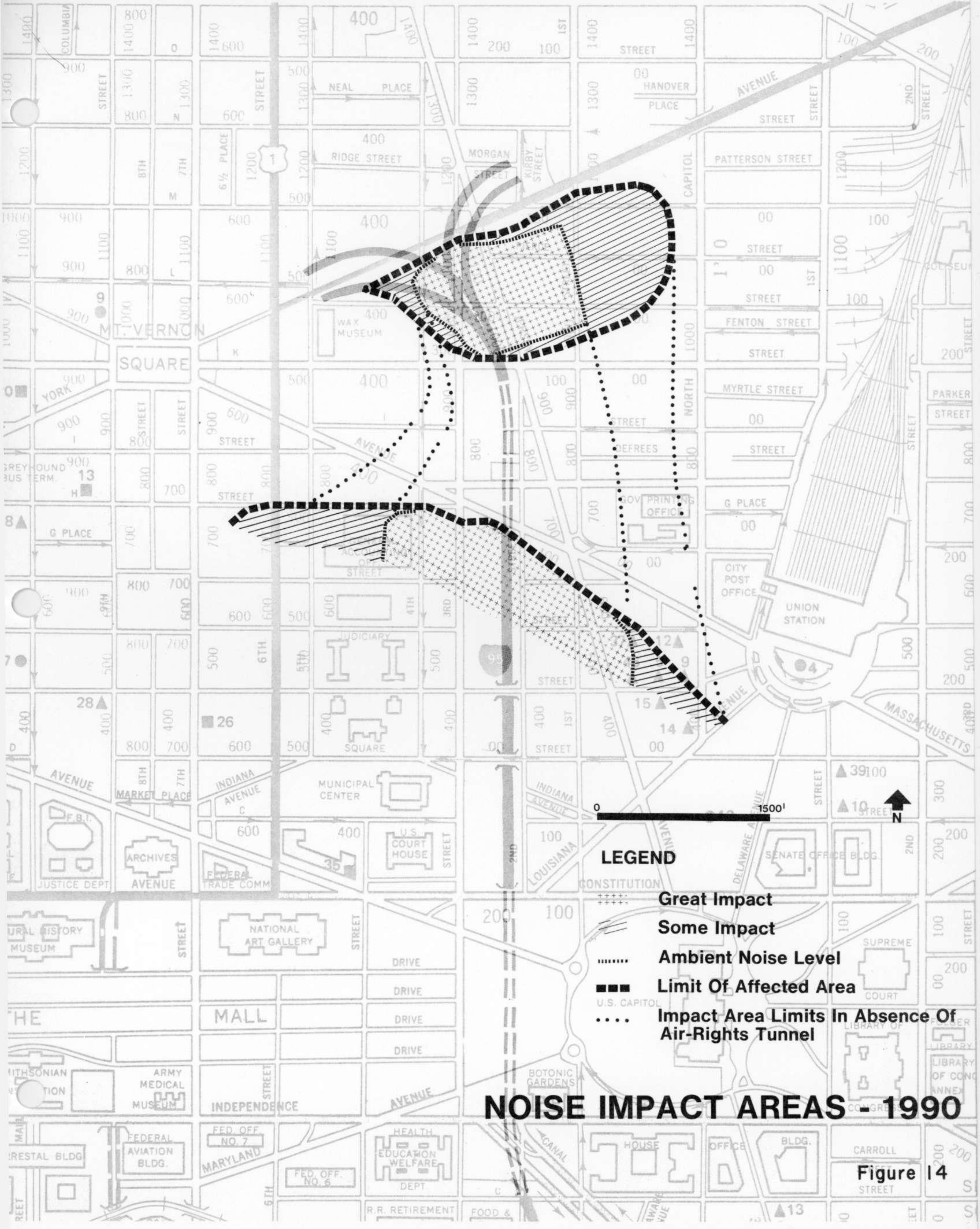
A net positive impact is expected to result from implementation of the freeway segment and proposed air-rights project. The air-rights housing over the tunneled section is expected to greatly enhance aesthetically the character of the present surroundings and to be totally compatible with the emerging architecture of the Northwest One and Downtown Urban Renewal areas. The architectural themes, the landscape improvements, and the community facilities as planned will complement the aesthetic character of the existing Mount Carmel Baptist Church Complex, and the adjacent Bibleway Church.

* Benendt, R.D., Winzer, G.E., and Burroughs, C.B., "Airborne, Impact, and Structureborne Noise--Control in Multifamily Dwellings", HUD, 1967.



NOISE IMPACT AREAS - 1975

Figure 13



NOISE IMPACT AREAS - 1990

Figure 14

3.02.4 GEOLOGY

Construction dewatering as well as permanent pressure relief will result in consolidation of foundation bearing strata in the immediate vicinity of the right-of-way. Through proper design provisions, appropriate specifications, controlled sequence of construction operations, and responsible supervision, building settlements that normally occur with this type of construction will be insignificant and undetectable.

3.03 SIGNIFICANT HUMAN ENVIRONMENTAL EFFECTS

3.03.1 SOCIAL CONDITIONS

The initial social impacts were first experienced by the 192 families, 73 of which were low income, that early implementation of the Project caused to be displaced in 1966. Since that time the cleared Site has not exerted any significant social impact on its surrounding areas.

To minimize the dividing and disrupting impacts on community life associated with most urban freeways, the following design alternatives were chosen. The freeway section will be depressed. Two of the four existing streets between Massachusetts Avenue and New York Avenue will bridge the freeway, thereby minimizing disruption of current pedestrian and vehicular traffic patterns. The proposed air-rights project with its associated housing, commercial and community facilities will provide an additional link between the Downtown Urban Renewal Area to the west of the freeway section and the Northwest One Area to the east.

With the provision for new and modern replacement housing utilizing the air-rights over the freeway and with attendant community facilities including recreational areas, the social conditions should be greatly improved by the implementation of this Project.

3.03.2 ECONOMIC ACTIVITY

Thirty-two (32) businesses, many marginal, were permanently displaced from the Site. No records are available as to the success these businesses or their employees have had in relocating. In total, however, these businesses did not constitute a major source of local employment. Four businesses remain in operation under temporary lease agreements.

No adjacent business activity was disrupted during demolition and clearance operations. Similarly, the planned converting of some local streets to one-way traffic just prior to the opening of the segment to New York Avenue, is not anticipated to decrease patronage of any of the existing enterprises. When this segment is opened for traffic, local shopping conditions should be enhanced due to a lessening of local vehicular traffic, greater parking conveniences and improved safety conditions for pedestrians. In addition, the proposed air-rights project will provide a stimulus to the local economy by an increase of 300 families and new commercial space.

The fair market value for all the properties purchased totaled $4,652,349. This temporary loss of tax ratables to the District does not represent a significant decrease in its tax base. In fact, increased property values of adjacent land due to the clearance of a slum condition, have probably offset the loss of taxes collected from the Site over the past several years.

In addition, the freeway segment is expected to provide the following economic benefits for its users. Increased operating speeds will result in time savings and operating costs savings. Through traffic on the local streets will be reduced resulting in less noise, air pollution and fewer accidents.

3.03.3 OPEN SPACE AND RECREATIONAL OPPORTUNITIES

Property acquisition for the Project did not involve the destruction or disruption of any existing recreational or open space facilities or any Section 4 (f) lands. The freeway (outside of the air-rights project) will provide a visual sense of open space to the residents of the area. The freeway itself will provide no additional recreational facilities but included in the proposed air-rights housing project is a park and playground area.*

The park is designed as a separate physical element, and is located to provide functional usage, a sense of space for the user and to be a center for wholesome year-round activity. It is to have a water fountain and wading pool complete with spouts, water slide, and suitable embodied sculptural forms which will serve as an important neighborhood focal point during the summer for all ages. Also to be included are basketball courts, slides, swings, pyramidal climbing and jumping masses for younger children and an ice skating area.

The Day Care Center faces onto the park and it is anticipated that classes will use the park for organized group games. Benches will be located in the park and along the promenades on the plaza deck.

3.03.4 COMMUNITY FACILITIES AND SERVICES

The freeway has been planned to minimize disruption of the services provided by the Bibleway Church and the Mt. Carmel Baptist Church. Construction operations in the immediate area of the churches will be controlled to minimize noise, vibrations and other disruptive influences on church activities.

* Northwest Urban Renewal Area, Project No. 1, "Multiple Use Site" Joint Venture, November 1, 1970.

Following construction and after the opening of this segment to traffic, neighboring community facilities and their service activities will be improved. This will result from decreasing congestion on local streets, thereby facilitating ease of access and traffic circulation in the vicinity of the proposed Project, including service by fire, police, ambulance and other official vehicles.

In conclusion, in order to minimize any adverse effect on the community, sensitive community facilities and services, such as the two religious institutions, have been taken into consideration in planning and subsequent design stages of the Project. Most other displaced facilities will be replaced by new such facilities as part of the urban redevelopment programs in the area.

3.03.5 TRANSPORTATION SYSTEMS

This section presents the anticipated positive and negative impacts of the Project on existing and future transportation systems both within and adjacent to the Project Area. The periods analyzed are: construction, initial and ultimate operational phases.

In accordance with Section 1.04 of this Draft Statement, construction will be staged to minimize disruption to local cross street traffic. H and K Streets are the principal east-west arterials serving traffic in the portion of downtown Washington between the White House and Union Station and including the Project Area. The K Street bridge is presently under construction. A special detour has been constructed just north of existing K Street to handle its traffic during construction.

During the final stages of construction 3rd Street will be closed permanently to traffic between K Street and New York Avenue. Outside of this closed section and because the major part of the Site does not encroach upon existing north-south streets, the disruption of traffic in this direction due to actual construction operations will be minimal.

In the initial operational phase and prior to the completion of the air-rights project, the Center Leg of the Inner Loop Freeway will be opened to traffic in both north and southbound directions. It is expected that during this phase there will be extremely heavy traffic in the vicinity of the Project and especially in that area bounded by New Jersey Avenue and 4th Street and from New York Avenue to G Street. In order to minimize the congestion from these heavy volumes, a system of one-way traffic routing is planned (See Figure 15 following this page). It is assumed in this Draft Statement that by the ultimate phase of operations in 1990, the proposed New York Avenue - Industrial Freeway will also be operational.*

In conclusion, the Project will have some slight negative impact upon the local street traffic patterns during the first phase of its operations. But this impact is not only temporary but unavoidable. The temporary detours and connectors are necessary elements to the construction phase of the Project. In the second and ultimate operational phases the freeway will have very positive impacts upon the Project Area. It will alleviate congestion on local streets and arterials with results, to adjacent communities, of welcome reductions in air and noise pollution and increased safety. It will provide more efficient access to major activity centers and industrial areas for commercial vehicles. And, lastly, by complementing the planned Metro System, it will result in improved mobility between residential areas and centers of employment, education and recreation.

* Elements of the Comprehensive Plan for the National Capital, National Capital Planning Commission, September 30, 1969.

4.0 PROBABLE UNAVOIDABLE ADVERSE EFFECTS

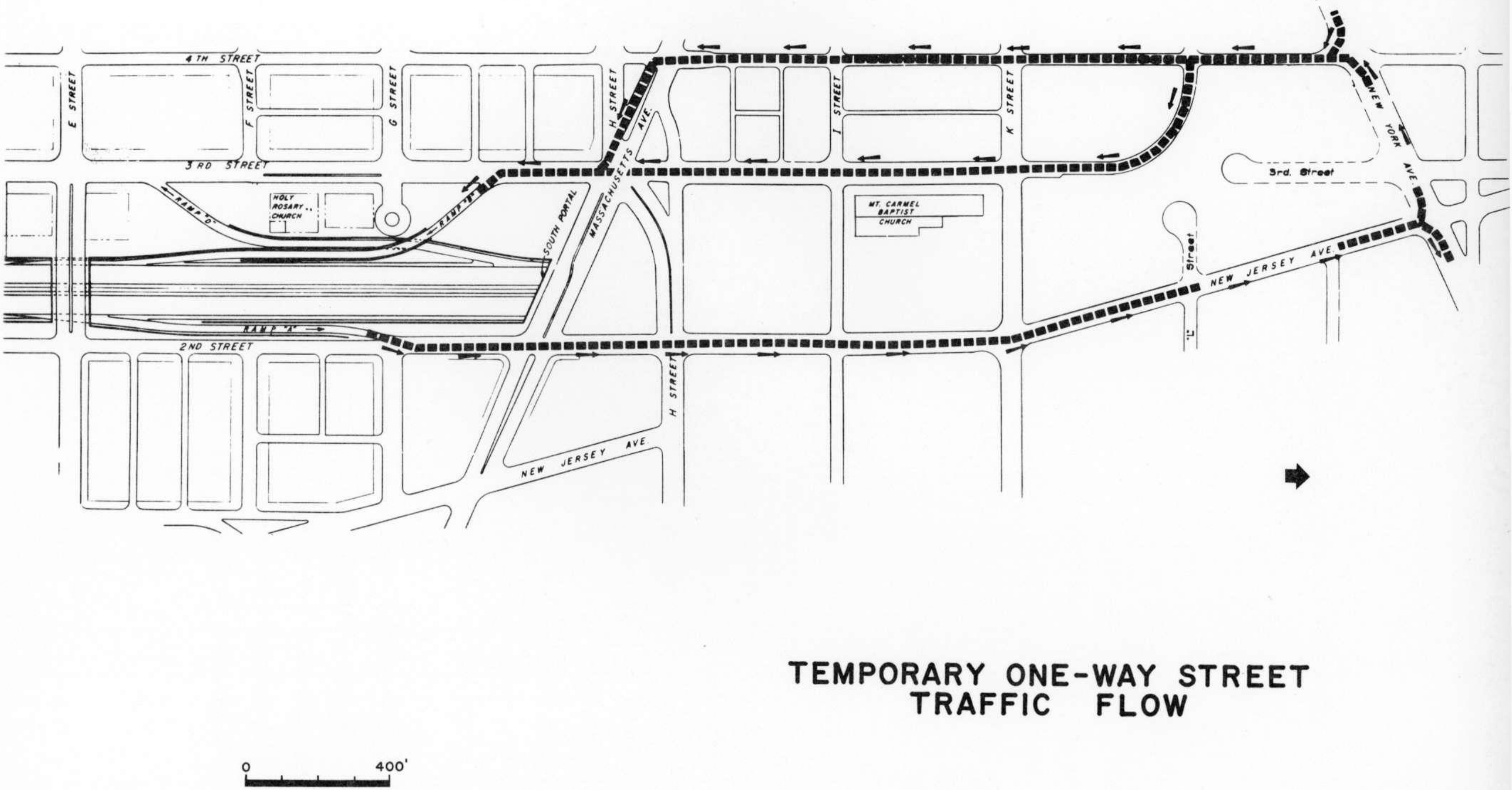
4.01 GENERAL

This section concerns itself with those elements previously investigated in Section 3.0 in which it was anticipated that, upon implementation of the Project, certain probable and unavoidable adverse environmental impacts would result. In addition, steps are recommended to minimize these harmful environmental effects.

4.02 AIR POLLUTION

According to computer model studies performed for this Draft Statement, hydrocarbon concentrations in 1975 are expected to exceed the maximum concentration standard of 0.24 ppm (maximum 6 AM - 9 AM concentration) during worst traffic conditions (stalled traffic backed up one mile in each direction from the tunnel on all four lanes). This will occur under certain meteorological conditions only, and will be due primarily to the already high concentrations of hydrocarbons in the background ambiance. It must be emphasized, moreover, that these predictions are not meant to describe normal concentrations, but rather worst case conditions that occur only very infrequently.

Levels of nitrogen oxides will exceed the annual standard over about one-half of the study area west of the tunnel in 1975, due in large part to high background concentrations. But by 1990, however, levels of carbon monoxide, hydrocarbons and nitrogen oxides will normally be below the maximum standards.



TEMPORARY ONE-WAY STREET TRAFFIC FLOW

Figure 15

The tunnel ventilation system is designed so that in 1975 the level of carbon monoxide in the tunnel will never exceed 125 ppm over an eight-hour period. The ventilation of 57 percent of total project length with venting through two stacks 100 feet high will represent a positive feature of the proposed Project as compared to an uncovered and unventilated roadway configuration.

Model studies show that emissions from the ventilating stacks will not adversely affect occupants of nearby tall buildings. Downwind concentrations of the three major pollutants studied are not expected to exceed maximum standards under worst traffic and meteorological conditions. The only exception will be hydrocarbon concentrations in the presence of slow winds and unstable atmospheric conditions when some downwind locations may experience higher than standard concentrations. The wind directions and speeds required to cause high hydrocarbon concentrations downwind of the stacks can be expected to occur only 0.7 percent of the time based on the annual frequency distribution of wind speeds and atmospheric conditions presented in Tables 3 to 8 of Appendix 1.

The design of the ventilating system for the tunnel section, as well as the system's proposed normal operational levels, will remove much of the pollution generated on the roadway and disperse it through stacks to avoid high ground concentrations near the Project. To protect motorists in case of ventilating system breakdown or higher than design concentrations, an automatic monitoring system will be in effect to keep additional vehicles from entering the tunnel and to advise those already there to shut off engines and evacuate the tunnel or follow other necessary emergency procedures.

4.03 INCREASED NOISE LEVELS

Adverse effects due to noise in the Project Area were summarized graphically in Figures 13 and 14 which show the areas in the immediate vicinity of the Project that are expected to experience certain impacts. The definition of these areas is based on standards and methods set forth in National Cooperative Highway Research Program Report 117 as defined in Appendix 2.

Any possible adverse noise effects due to the tunnel ventilating system have been attenuated by careful acoustical design provisions and the long-term impact from this source will be negligible.

Although some areas will fall under the classification of "major impact", the dotted lines in Figures 13 and 14 indicate that the total area adversely affected will be much smaller than what would be expected without the tunnel configuration.

4.04 DISPLACED PERSONS

The displacement of the 192 families, 73 of which were considered low income, was an unavoidable adverse effect. In recognition of this fact, 28 large housing units in the Fairmount Apartments on the Site facing New York Avenue were renovated by the Department of Highways and Traffic. In January, 1967 this renovation was completed and the accommodations were made available to displaced families applying for replacement housing.

4.05 DISPLACED ECONOMIC ACTIVITY

As discussed in Section 3.03.2, 32 businesses were permanently displaced. Four others were allowed temporarily to continue to operate under special lease agreements.

The impact due to displaced economic activity is temporary. The entire area is undergoing urban renewal which will include planned commercial sites. The air-rights development over the freeway will include 7,600 square feet of commercial space.

5.0 ALTERNATIVES

5.01 GENERAL

The discussion of alternatives to the proposed action, covered by this section, is specifically required by the National Environmental Policy Act of 1969 [Section 102 (2) (C) (iii)]. The purpose of the discussion is to describe the range of alternatives considered from which this scheme was selected as the optimum solution.

As stated in the project description of this Draft Statement, the scope of the proposed action covers the northernmost segment of the Center Leg of the Inner Loop Freeway. The range of alternatives discussed does not include location alternatives for the following reasons:

1. Plans for the Center Leg date back to 1950.
2. Existing Center Leg alignment was established in 1959.
3. The Center Leg is included in the National Capitol Planning Commission's "Elements of the Comprehensive Plan for the National Capitol" dated 1970.
4. The only required public hearing concerning the alignment of the Center Leg was held September 3, 1963.
5. Construction of the first segment of the Center Leg began January 5, 1966 with the D Street bridge.
6. Construction of the Mall Tunnel began November 23, 1966.
7. Demolition between Massachusetts and New York Avenues began November 13, 1966.
8. At this time 70 percent of the Site has been cleared.

The alternatives presented in this section are discussed under one of the following headings:

1. Alternatives of Action
2. Alternatives of Scope
3. Alternatives of Design

5.02 ALTERNATIVES OF ACTION

There are two basic alternatives to the proposed construction and development of the Project: the alternative of no-action, and the alternative of delayed action. These alternatives are discussed with due consideration to the facts: that all sections of the Center Leg south of the Project Area are nearing construction completion, and that basic decisions for the urban redevelopment of the Northwest One Area are somewhat dependent upon the action taken on this Project.

An alternative of no-action would drastically reduce the public benefits expected from the Center Leg Freeway, and would be harmful to the environmental character of the area. The ramp connections to Second and Third Streets would become the northern end of the Center Leg. All construction north of these ramps, including suppressed pavements to H Street and the combined Massachusetts Avenue - H Street bridge structure, would become wasted investments. These depressed and covered spaces would have to be studied for the most appropriate alternative use. Otherwise, the area would become an eyesore of litter and abandon, and a serious hazard to all aspects of the surrounding community life.

A no-action alternative would have a grave adverse impact upon the character of social improvements that are envisioned as part of the

Northwest One Urban Renewal Area. Without the proposed connection, the traffic between the abridged freeway and New York Avenue would congest Second and Third Streets, and would result in social and physical adverse effects to adjacent properties and inhabitants.

The alternative of delayed action would have results similar to those of no-action for the duration of the delay. In addition to delaying the planned urban developments, there would be added costs resulting from escalation when the Project is ultimately constructed.

5.03 ALTERNATIVES OF SCOPE

Since this Project combines joint use development of the air-rights for much needed replacement housing with the final link of a beneficial freeway, there are no other feasible alternatives of scope.

5.04 ALTERNATIVES OF DESIGN

Many design alternatives have been studied in the course of developing preliminary designs and criteria for the proposed Project. Throughout the work these alternatives were evaluated and compared on the basis of technical, economic, sociological and environmental considerations.* The Project as planned will realize the maximum in public benefits with minimum adverse environmental impact.

*See "Preliminary Design Report" prepared by Tippetts-Abbett-McCarthy-Stratton, New York, June 1965.

6.0 RELATIONSHIPS BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

6.01 GENERAL

This chapter discusses the relationships between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, as it pertains to the implementation of this Project. As explained in the current guidelines of the Council on Environmental Quality*, this provision requires, in essence, that the Project be assessed for cumulative, long-term effects from the perspective that each generation is trustee of the environment for succeeding generations.

In accordance with the National Environmental Policy Act of 1969, the encouragement of the productive and enjoyable harmony between man and his environment is stated as one of the basic purposes. Relating to the Project, the environment involved is an artificial urban habitat developed by man in pursuit of his social needs; an environment created through ages of evolution which have developed man into a social being that can function, prosper, and survive only as long as he associates with other human beings.**

For this analysis, all references to "man's environment" are considered to include the socioeconomic and natural resources that will

*Sec. 102 (2) (c) (iv) Environmental Quality, Council on Environmental Quality, August 1971

**Rene Dubos, "So Human an Animal", 1969, Charles Scribner's Sons, New York, N.Y.

be affected by the proposed action, and the expected benefits that may result from this use in terms of social and economic values. "Short-term" considers the foreseeable future equivalent to the Project's useful life. "Long-term" is that period beyond the Project's useful life.

The analysis presented by this chapter is subdivided into three subsections. The first section considers the short-term use of the environment. The second section discusses the long-term productivity. And the third section is a concluding statement of both the relative short- and long-term effects.

6.02 SHORT-TERM USES

Within its scope limitations, the short-term use of this Project will be to provide an extension of the Center Leg facilities under construction that will, initially, provide traffic connections with New York Avenue and, ultimately, tie to a northwest corridor freeway system above New York Avenue. The proposed action will open to traffic a vitally needed link that will absorb most of the traffic that presently uses Alternate U.S. Route One, causing congestion in the downtown portion of the City.

In contrast to the disconcerting impact that many freeways through urban areas cause to residential settings, the 1,200 feet of tunneled section being proposed is planned to accommodate urban redevelopment to spread over its right-of-way. Air pollutants from cars using the roadway will be collected and discharged above the tallest structure in the vicinity. Vehicular noises will not exceed acceptable standards for an urban site.

In its ultimate use, the Project will relieve congestion of the city center, provide easier access to those who seek its services and recreations, and create additional sites for competitive business.

In summary, the Project will benefit all metropolitan residents and will be conducive to economic growth. Its cumulative benefits will be compatible with the short-term objectives of urban redevelopment.

6.03 LONG-TERM PRODUCTIVITY

Conjectures as to possible future transportation modes or urban shapes, and the suitability of the elements of the Project to accommodate them are beyond the scope of this discussion. As an inheritance to future generations, the Project can be analyzed only for what is known now or what it might be worth.

There is no doubt that man will continue to be a social being who will require an appropriate urban environment for the progressive development of his cultural evolution. In this respect, the kind of environment which would be most satisfactory would be one that could be shaped to fit man's needs. By concept and by definition, it is impossible to find an urban setting with physical landscapes unaltered by human intervention. In this respect, combined with the proposed urban redevelopment effects, the Project will contribute to a desirable land use change that will impose order on the urban elements in compatible relation to the important human needs for peace, quiet, privacy and open space.

The Project's contributions to economic growth during its short-term use represent assurance for continued availability of financial and other human resources required to promote future improvements to the urban environment compatible with needs of future generations. When the Project becomes obsolete for distant future uses and needs, its cumulative effect in economic progress will have more than offset the investments being proposed by this action.

6.04 CONCLUSIONS

Based upon our cultural experience, it can be stated that the relation being created by the Project between the short-term use of local environment and its long-term potential in productivity are in accordance with the national policy for creating a perpetual harmony between man and his environment.

7.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

7.01 GENERAL

This section considers the various human and natural resources that may be committed to the construction of this portion of the Center Leg - Inner Loop Freeway, to the extent that such resources cannot be reclaimed or retrieved at some later date.

Consideration is given to the following resources:

- Air Quality
- Water Quality
- Land Area
- Other Depletable Natural Resources
- Human Resources
- Economic Resources

In consideration of air quality (as explained in Section 4.02 of this Draft Statement), there will be an unavoidable short-term deterioration in air quality in the area contiguous to the new highway due to increased traffic volumes. However, in the long-term view based on expected advances in automotive emission control technology coupled with stringent new Federal regulations, this situation will be reversed in the 1980's. Thus, this short-term impact will not constitute an irreversible or irretrievable commitment of air resources.

There will be no irreversible or irretrievable loss of water quality. There are no surface waters in or near the Project Area. The lowering of groundwater levels will have insignificant impact since groundwater does not, in this case, constitute a future source of potable water supply.

The irreversible or irretrievable commitment of land area to highway usage will be largely obviated by the provision for development of housing on the tunnel deck.

With respect to other depletable natural resources, investigations have indicated that possible retrieval of sand and gravel from excavations within the Project boundaries would be uneconomical. This material may be disposed of in the Washington area as land fill, for which there is a demand.

Implementation of the Project will not result in an irretrievable or irreversible commitment of human resources. Suitable housing in adjacent communities has been found for persons displaced as a result of the highway construction. It is not considered that the occupational, educational, or particular life styles of adjacent populations will be adversely affected by the Project. The social disruption during the actual construction period is temporary and is not considered of significant, long-term impact.

Only with regard to economic resources is it possible to identify, to any significant degree, a range of beneficial future uses that would be curtailed upon implementation of the Project. An analysis of the irreversible and irretrievable commitment of economic resources is contained in the following subsection.

7.02 ECONOMIC RESOURCES

The capital resources committed to this Project by the various government agencies involved are outlined in the project description sections of this Draft Statement.

The economic feasibility and desirability of the Project, with regard to the affected community and in the context of the overall regional transportation systems, have also been discussed in earlier sections of this Statement.. The question remains whether a commitment of a similar amount of capital to other public-oriented projects would have more justification at this time.

Since a condition of chronic traffic congestion has become a major problem in this portion of Washington, D.C., and since the currently proposed mass transit system in the capital has independent public financing, it is felt that this Project should have priority status. Although the finances committed to this Project must be considered irreversible commitments for the next several decades, these capital expenditures cannot be regarded as irretrievable commitments of resources. As described in Section 3.03.2 of this Statement, capital expenditures will be recovered through financial benefits to highway users on a regional wide basis.

Economic activity on the Site that predated development of this Project was limited to a few low-value businesses. Any reduction in the tax base as a result of the loss of these businesses is not considered significant to the local neighborhood or regional economy.

7.03 CONCLUSIONS

As explained in the guidelines issued by the Environmental Protection Agency*, the purpose of investigating the irreversible and

*Environmental Quality - 2nd Annual Report of the Council on Environmental Quality, August 1971 irretrievable commitments of resources related with the proposed action is to identify the extent to which the action curtails the range of beneficial uses of the environment. In this respect, and with the exception of economic resources, there are no significant irreversible or irretrievable commitments of human or natural resources resulting from the proposed action. Although the capital investment is irreversible, it is not irretrievable since the construction of the Project is justified in terms of the socioeconomic benefits that will be derived from it.

APPENDIX I

STUDY OF THE EFFECTS ON AIR
QUALITY OF BUILDING THE CENTER LEG AND TUNNEL
OF THE INNER LOOP FREEWAY IN WASHINGTON, D.C.

ERT Project P-402

MAY 1972

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1. INTRODUCTION

This report describes a study by Environmental Research and Technology, Inc. (ERT) on the impact of air quality of building a tunnel in the District of Columbia that extends from H Street, NW in a south to north direction between 2nd and 3rd Streets, for a length of about 500 meters to K Street. The tunnel will be part of the center leg of the Inner Loop Freeway in Washington, D.C. From the north portal, there will be about 300 meters of depressed freeway that exits onto New York Avenue. South of the south portal will be 500 meters of depressed roadway that extends to D Street and into another tunnel that continues to about one-half mile south of Independence Avenue.

Our specific objectives in this study were to determine levels of carbon monoxide, hydrocarbons (less methane), nitrogen oxides and particulates that are likely to be present under a variety of meteorological and traffic flow conditions for the years 1972, 1975 and 1990. Traffic flow for 1972 corresponds to the existing conditions prior to the building of the tunnel, in 1975, the proposed tunnel will be open to four lanes of traffic (2 in each direction) and for the year 1990, the tunnel is expected to have 9 lanes of traffic, but by that time the new federal regulations on vehicular emissions will apply to nearly all the vehicles in the tunnel.

To determine the expected levels of pollution in the vicinity of the proposed tunnel we have used our sophisticated air quality prediction model in combination with detailed model input information from the

Environmental Protection Agency (EPA) and the D.C. Department of Highways and Traffic. The ERT model is a version of the Martin-Tikvart gaussian plume model highly modified and extended to increase the flexibility and accuracy when applied to linear sources of air contaminants, and particularly to roads. EPA has provided the emissions information for the mix of vehicles expected in the tunnel. The D.C. Department of Highways and Traffic has supplied very detailed accurate traffic counts and rates of speed for the present time and has projected traffic data for the years 1975 and 1990.

The remainder of the main body of this report focuses on the details of the study approach and the results obtained.

The Appendix A of this report contains a thorough description of diffusion meteorology, the ERT Highway Impact Model, the National Ambient Air Quality Standards and the National Vehicular Emission Standards.

Appendix B describes the effects of automotive pollutants on specific receptors.

2. STUDY APPROACH

2.1 Cases Selected for Study

Three cases were chosen for analysis in this study:

1. Present traffic conditions in the area where the center leg of the Inner Loop Freeway is to be constructed, including traffic volumes, mixes of vehicles (autos, trucks, diesels) and emission factors. This will provide background concentrations of the various pollutants <u>before</u> the center leg, including the tunnel of the freeway, is built.
2. Expected traffic conditions in 1975 using volumes, mixes of vehicles and emission factors for that year when the center leg of the freeway will be open to four lanes of traffic and have a temporary connector to New York Avenue.
3. Expanded configuration (nine lanes) of the center leg of the freeway, and tunnel, using 1990 traffic volumes, mixes of vehicles and emission factors.

Comparison of results between 1972 and 1975 allows a determination to be made of the impact of the roadway and tunnel on air quality in the area when the freeway has four lanes of traffic. The 1990 conditions are analyzed to specify the predicted full effect of the automotive emission standards, since it is estimated that by 1990 all cars without emission controls will be effectively out of service. In all cases, selected for study, the contribution of the center leg and tunnel of the Inner Loop Freeway and all other D.C. roadways (background) are examined relative to applicable ambient air quality standards.

2.2 Derivation of Emission Factors

The emission factors used for 1972, 1975 and 1990 for automotive travel were developed according to the following three-step criteria:

1. Use of published EPA data where available (Ref. 1)
2. Use of the latest unpublished data available from EPA through September 1971 (Ref. 3)
3. Use of engineering judgement to interpret data from 1. and 2. only, where necessary.

The categories of emissions and emission factors reflect the current breakdown available from EPA. In general, for each pollutant and each time period, separate emission factors are set forth for: (1) cars, including light duty trucks (less than 6000 lbs); (2) heavy duty trucks, often subdivided into three categories; and (3) diesel vehicles, including both trucks and buses. Further, a distinction is made between idling and moving vehicles, and for CO and HC for 1975 and 1990 gasoline-powered vehicles. An additional distinction is made according to the speed of moving vehicles.

The emission factors are discussed in five sections, as follows:

1. 1972, 1975, and 1990 automobile factors
2. 1972, 1975, and 1990 heavy duty truck factors
3. 1972, 1975, and 1990 diesel factors
4. 1975 and 1990 idling factors, for all vehicles
5. 1990 factors for all vehicles

2.2.1 1972 and 1975 Automobile Factors

The 1972 and 1975 auto emission factors were derived separately for (1) CO and HC, which exhibit speed-emission relationships; (2) NO_X, for which recent tests had shown changes in the factors; and (3) particulates. The data were largely derived from three EPA references: one published report and two private communications (Refs. 1, 3 and 4).

Carbon Monoxide and Hydrocarbon

The base data came from EPA's 1971 published emission factors book (see Table 14 of Ref. 1). The information used is representative of urban conditions (with an average speed of 25 mph) and an assumed national mix of model years presently on the road. CO and HC figures were published for 1965, 1970, 1972, 1974, and 1975; the hydrocarbon figures include evaporation, crankcase, and exhaust emissions.

Urban Travel Adjustment Factors for CO and HC (see Figures 1 and 2)* were used to derive an emission curve for each pollutant and year, for speeds from 10 to 35 mph. These were the basic curves that were used; they depend only upon EPA's published factors.

It was necessary to extend the speed emission curves for 1970, 1972, and 1974 from 35 to 60 mph. This was done using the Rural Travel Adjustment Factors (see Figures 1 and 2 of Ref. 1). The figures for the speeds in Table 1 were taken directly from these curves.

Nitrous Oxides

The 1972 and 1975 values for NO_X were obtained from EPA (Ref. 3). According to EPA's latest tests, no variation with speed should be used. The figures in Table 2 are those supplied by Sigworth (Ref. 3).

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*Figures 1 and 2 contain information derived from Figures 1 and 2 of Ref. 1.

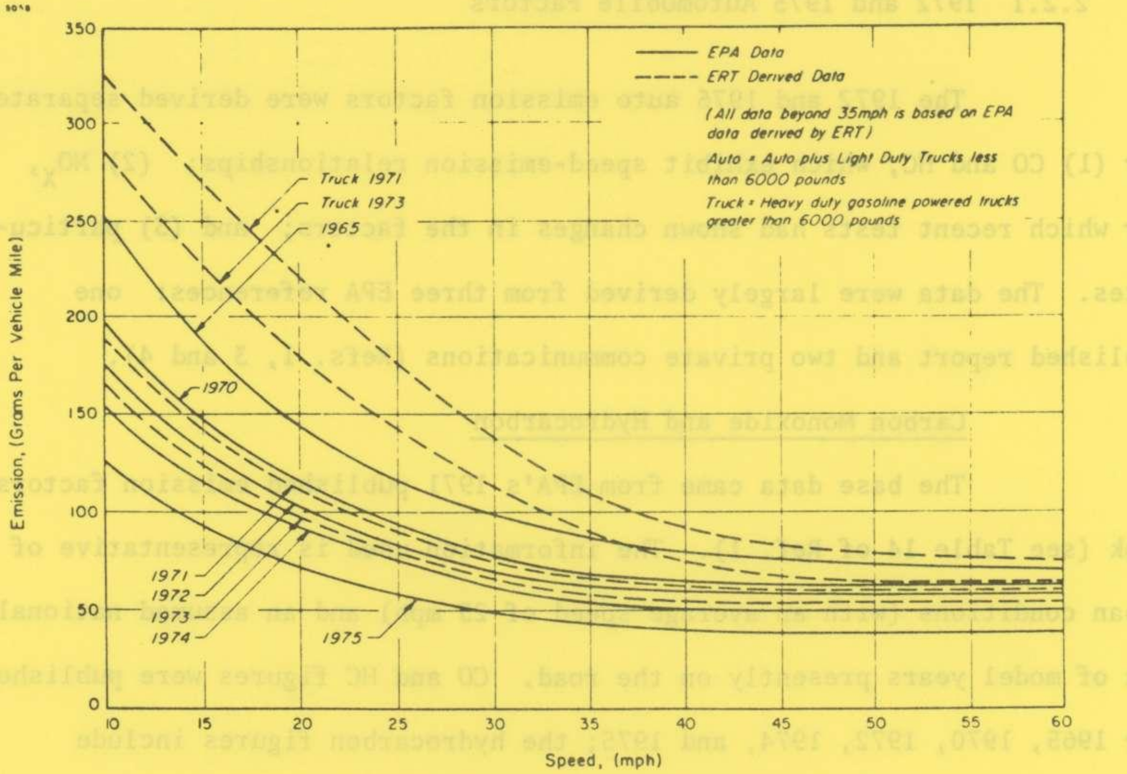

Figure 1 Variation of carbon monoxide emission factors with speed

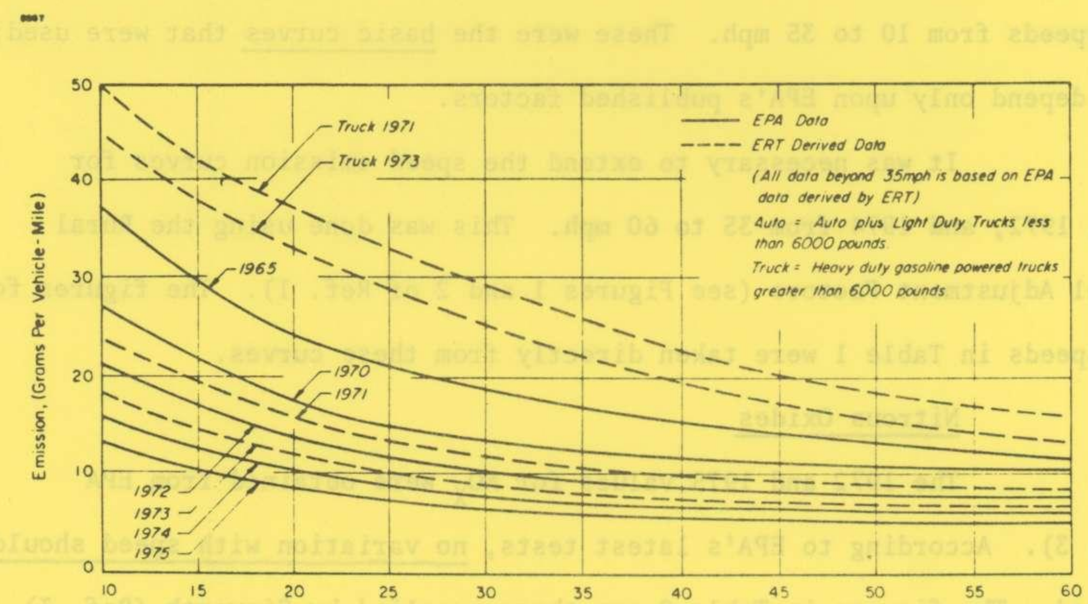

Figure 2 Variation of hydrocarbons emission factors with speed

TABLE 1

EMISSION FACTORS FOR EACH CLASS, SPEED

(Non-idle emission factors are given in g/veh-mi;
idle emission factors are given in g/veh-sec.)

Speed (MPH)	Type Vehicle	Hydrocarbons Less Methane	Carbon Monoxide	Nitrogen Oxides	Particulates
1972					
10	C	21.0	175.0	6.3	0.30
	T	47.0	293.0	8.8	0.45
	D	3,4	19.7	38.9	1.20
15	C	18.0	115.0	6.3	0.30
	T	38.0	188.0	8.8	0.45
	D	3.4	19.7	38.9	1.20
25	C	12.0	75.0	6.3	0.30
	T	32.5	125.0	8.8	0.45
	D	3,4	19.7	38.9	1.20

C = Cars

T = Trucks

D = Diesels

TABLE 1 (cont'd)

EMISSION FACTORS FOR EACH CLASS, SPEED

(Non-idle emission factors are given in g/veh-mi; idle emission factors are given in g/veh-sec.)

Speed (MPH)	Type Vehicle	Hydrocarbons Less Methane	Carbon Monoxide	Nitrogen Oxides	Particulates
			1975		
Idle	C	0.0023	0.0132	0.0090	0.00120
	T	0.0039	0.0164	0.0136	0.00083
	D	0.0092	0.0620	1.1000	0.00500
10	C	12.5	125.0	5.0	0.30
	T	28.2	208.0	7.0	0.45
	D	2.0	14.0	30.7	1.20
15	C	10.0	9.0	5.0	0.30
	T	21.0	14.7	7.0	0.45
	D	2.0	14.0	30.7	1.20
20	C	9.0	72.0	5.0	0.30
	T	18.5	110.0	7.0	0.45
	D	2.0	14.0	30.7	1.20
25	C	8.0	55.0	5.0	0.30
	T	15.6	91.2	7.0	0.45
	D	2.0	14.0	30.7	1.20
40	C	7.1	44.0	5.0	0.30
	T	14.2	65.0	7.0	0.45
	D	2.0	14.0	30.7	1.20

C = Cars
T = Trucks
D = Diesels

TABLE 1 (cont'd)

EMISSION FACTORS FOR EACH CLASS, SPEED

(Non-idle emission factors are given in g/veh-mi; idle emission factors are given in g/veh-sec.)

Speed (MPH)	Type Vehicle	Hydrocarbons Less Methane	Carbon Monoxide	Nitrogen Oxides	Particulates
1990					
Idle					
	C	0.00023	0.00132	0.0009	0.000120
	T	0.00039	0.00164	0.00136	0.00008
	D	0.00092	0.00620	0.0100	0.00050
All Speeds					
	C	0.454	5.0	0.688	0.316
	T	0.907	6.7	0.998	0.316
	D	0.399	3.62	0.770	1.140

C = Cars

T = Trucks

D = Diesels

TABLE 2

DEFINITIONS OF STABILITY AND WIND SPEED CLASSES

Stability Class	Definition
1	Very unstable
2	Unstable
3	Slightly unstable
4	Neutral
5	Stable

Wind Speed Class	Definition (Speed in Knots)
1	0 - 3
2	4 - 6
3	7 - 10
4	11 - 16
5	17 - 21
6	>21

2.2.2 1972 and 1975 Heavy Duty Truck Factors

Revised estimates of total (national) heavy duty urban and rural emissions for 1969 were obtained from EPA (Ref. 3) in three vehicle class categories (HDT-2, HDT-3, and HDT-4) for CO, HC and NO_X. These were divided by the total (national) 1969 heavy duty truck vehicle miles (by urban and rural), and by the three vehicle class categories) shown on EPA's computer printout provided earlier (see Ref. 4). This yielded an emission factor for each of the above categories, pollutants, and speeds (urban vs. rural). The weighted average of the total national 1969 vehicle miles for each of the three categories was used to generate one emission factor for each pollutant for urban and rural conditions. The derived urban and rural NO_X values, as expected, were nearly the same.

Following the suggestion of Sigworth (Ref. 3), these derived data were used as a base for 1972. Adjustment factors for each pollutant (also provided by Sigworth) were used to derive the 1975 values for urban and rural conditions.

The values for 1972 and 1975 for CO and HC for urban (25 mph) and rural (45 mph) speeds were plotted on the same graphs as the auto speed emission curves; 1972 and 1975 heavy duty truck speed emission curves were drawn through the two known points (25 and 45 mph) with the same general curvature as the auto curves. This approach had been suggested to us by people in EPA previously. The emission values in Table 2 for CO and HC were taken directly from these curves (see Ref. 2). The NO_X values as derived above were used directly.

2.2.3 1972 and 1975 Diesel Factors

All relevant information was obtained by personal communication (Ref. 3). The values supersede those previously published (See Table 15 of Ref. 1). There is no variation with speed and no variation from 1972 to 1975. EPA assumes that a diesel vehicle averages 5 miles per gallon.

2.2.4 1972 and 1975 Idling Factors for All Vehicles

All relevant information was obtained by personal communication (Ref. 3). Slightly different procedures were used for gasoline vs. diesel vehicles, as described below.

<u>1975, 1990 Auto and Heavy Duty Truck Idling</u>

Emission factors in the form of "parts per million" for CO, HC, and NO_X, together with assumptions as to average car weight, speed, amount of gasoline consumer per hour, etc., were also provided by EPA (Ref. 3). Emission factors in "grams/hour" were calculated. For particulates, emission factors in grams/hour were provided directly; the EPA assumptions take into account the fact that exhaust volume has been correlated with car weight.

For heavy duty trucks, Sigworth suggested adjustment factors as follows: For 1.3 x autos and for concentration - 1.15 x autos (a combined adjustment factor of 1.5 x auto factors). To convert to g/m sec, each vehicle is assumed to occupy 6.9 meters of a line source.

<u>1975, 1990 Diesel Idling</u>

Emission factors in the form of "lbs per thousand gallons" for all pollutants were provided, together with assumptions as to amount of gasoline consumed per hour. From these, emission factors in grams/hour were calculated.

1975 Idling, All Vehicles

Sigworth (Ref. 3) suggested that the same proportionate increase or decrease in idling factors as was found in the average of the urban and rural factors be used for 1975; any errors in the approach would tend to be toward the conservative side.

1990 Factors for All Vehicles

All of the emission factors used for 1990 were provided to us by EPA for use in another study (Ref. 4). Sigworth (Ref. 3) verified these figures as still being applicable. No variation with speed for any pollutant is assumed for 1990. These figures were the best available when our analyses were conducted in April 1972.

2.2.5 Emissions from Stacks Above Center Leg Freeway Tunnel

Emissions from each of the 2 stacks used to exhaust air from the tunnel were specified for peak hour and average hour conditions for 1975 and 1990. The values for each effluent as a function of traffic condition are given below:

1975	HC	CO	NO_X	Particulates
Peak hour	3.86	24.0	1.2	0.0072
Avg. hour	1.62	10.0	0.5	0.0030
1990				
Peak hour	0.86	5.4	0.27	0.0016
Avg. hour	0.31	1.92	0.096	0.00058

2.2.6 Leakage from Tunnel Portals

The traffic exiting from the tunnel will drag some of the air out of the tunnel. This is defined as leakage.

For the idle case for both 1975 and 1990 no leakage will be observed since there will be no traffic movement. For 20 mph, the leakage area will be the width of the roadway and extend from each portal to 60 ft. from each portal; for 40 mph, 80 ft. from each portal. The emissions of each effluent for each traffic condition and year are given below.

1975 - Veh.Speed	HC	CO	NO_X	Particulates
20 mph	0.36	2.36	0.118	0.0040
40 mph	0.32	2.20	0.106	0.0036

1990 - Veh. Speed	HC	CO	NO_X	Particulates
20 mph	0.130	0.858	0.042	0.0014
40 mph	0.121	0.849	0.034	0.0012

2.3 The Meteorological Conditions Used in the Models

As discussed in Appendix A, the National Ambient Air Quality Standards for each of the vehicular pollutants of interest correspond to various time-averaging periods. In order to evaluate pollution levels in the vicinity of the Center Leg of the Inner Loop Freeway, weather conditions representative of time periods of one hour and one year were selected for study. For carbon monoxide and hydrocarbons less methane, the short-term (one hour) conditions are examined. The annual average condition is calculated for oxides of nitrogen.

A preliminary analysis of the peak pollutant concentrations as a function of wind direction indicated that the West (W) wind would yield highest short-term levels. This direction was selected for analysis, but because of its relatively infrequent occurrence (3.9%), it was decided to also examine the South Southwest wind condition (the annual prevailing wind condition). The latter condition would not yield the worst conditions but would be representative of more typical conditions.

The nitrogen oxides, an annual average condition is computed using the Washington National Airport stability wind rose as input to the model because the airport is only 2-1/2 miles from the Center Leg of the Inner Loop Freeway and weather conditions at the airport are very representative of the area being studied. The airport data thus provides a good estimate of conditions near the freeway on an annual basis. This information is used to compute the air quality resulting from every wind direction and speed listed for each stability class (atmospheric condition) and then these values are summed and weighted for the annual average.

Tabulated wind roses for each of the stability classes (using the Washington, D.C. airport data) are presented in Tables 3 through 7. The wind speed and stability class definitions are presented in Table 2. Table 8 illustrates the wind speed and direction distribution for all stabilities; i.e., the numbers in the table indicate the approximate number of hours per year that the given wind speed, wind direction occur simultaneously.

TABLE 3

TABULATED ANNUAL WIND ROSE FOR WASHINGTON NATIONAL AIRPORT, WASHINGTON, D.C.

STABILITY CLASS 1-EXTREMELY UNSTABLE

(1-YEAR AVERAGE IN HOURS)

	WIND SPEED CLASS						
DIRECTION	1	2	3	4	5	6	AVG SPD
N	5	20	0	0	0	0	4.4
NNE	1	10	0	0	0	0	4.3
NE	4	17	0	0	0	0	4.1
ENE	5	18	0	0	0	0	4.0
E	4	12	0	0	0	0	3.9
ESE	2	21	0	0	0	0	4.3
SE	4	18	0	0	0	0	4.3
SSE	1	13	0	0	0	0	4.4
S	5	19	0	0	0	0	4.0
SSW	0	8	0	0	0	0	4.6
SW	1	5	0	0	0	0	4.3
WSW	3	3	0	0	0	0	3.7
W	1	12	0	0	0	0	4.5
WNW	5	9	0	0	0	0	4.1
NW	3	11	0	0	0	0	4.4
NNW	5	11	0	0	0	0	4.0
AVG	2.6	4.6	0.0	0.0	0.0	0.0	3.5
TOTAL	49	207	0	0	0	0	

TABLE 4

TABULATED ANNUAL WIND ROSE FOR WASHINGTON NATIONAL AIRPORT, WASHINGTON, D.C.

STABILITY CLASS 2-UNSTABLE

(1-YEAR AVERAGE IN HOURS)

	WIND SPEED CLASS					
DIRECTION	1	2	3	4	5	6
N	30	83	45	0	0	0
NNE	34	68	42	0	0	0
NE	43	85	47	0	0	0
ENE	53	78	34	0	0	0
E	38	77	16	0	0	0
ESE	52	68	13	0	0	0
SE	37	66	28	0	0	0
SSE	42	115	64	0	0	0
S	71	231	226	0	0	0
SSW	25	45	28	0	0	0
SW	34	35	15	0	0	0
WSW	24	48	30	0	0	0
W	19	40	43	0	0	0
WNW	19	40	46	0	0	0
NW	20	54	61	0	0	0
NNW	15	56	51	0	0	0
AVG	2.8	5.2	7.5	0.0	0.0	0.0
TOTAL	556	1189	789	0	0	0

TABLE 5

TABULATED ANNUAL WIND ROSE FOR WASHINGTON NATIONAL AIRPORT, WASHINGTON, D.C.

STABILITY CLASS 3-SLIGHTLY UNSTABLE

(1-YEAR AVERAGE IN HOURS)

	WIND SPEED CLASS					
DIRECTION	1	2	3	4	5	6
N	16	112	242	45	1	0
NNE	16	62	111	11	0	0
NE	14	104	81	3	1	0
ENE	28	87	71	15	0	0
E	18	62	53	7	0	0
ESE	8	55	52	6	0	0
SE	24	36	49	3	0	0
SSE	8	104	132	11	0	0
S	47	313	711	112	2	0
SSW	20	125	192	49	3	0
SW	25	78	123	16	2	0
WSW	27	61	118	26	0	0
W	10	60	118	34	4	0
WNW	6	54	208	47	5	0
NW	9	72	267	94	13	1
NNW	12	79	257	57	3	1
AVG	2.6	5.1	3.1	12.0	17.9	23.5
TOTAL	238	1464	2785	536	34	2

TABLE 6

TABULATED ANNUAL WIND ROSE FOR WASHINGTON NATIONAL AIRPORT, WASHINGTON, D.C.

STABILITY CLASS 4-NEUTRAL

(1-YEAR AVERAGE IN HOURS)

	WIND SPEED CLASS					
DIRECTION	1	2	3	4	5	6
N	76	234	568	795	111	7
NNE	42	189	426	381	34	3
NE	54	296	544	418	40	4
ENE	76	361	564	345	36	17
E	67	233	225	93	10	2
ESE	65	166	177	69	16	2
SE	65	188	215	78	5	1
SSE	34	194	273	106	19	5
S	97	658	1458	834	51	3
SSW	43	279	717	630	89	7
SW	47	194	326	287	41	12
WSW	45	168	199	125	15	7
W	38	112	162	217	64	11
WNW	27	136	329	872	268	78
NW	28	135	487	1346	393	98
NNW	22	129	520	970	205	33
AVG	2.6	5.0	3.5	12.9	18.3	34.6
TOTAL	826	3672	7190	7567	1397	290

TABLE 7

TABULATED ANNUAL WIND ROSE FOR WASHINGTON NATIONAL AIRPORT, WASHINGTON, D.C.

STABILITY CLASS 5-STABLE

(1-YEAR AVERAGE IN HOURS)

	WIND SPEED CLASS					
DIRECTION	1	2	3	4	5	6
N	185	617	325	0	0	0
NNE	80	241	115	0	0	0
NE	90	287	112	0	0	0
ENE	107	270	110	0	0	0
E	61	142	38	0	0	0
ESE	67	134	56	0	0	0
SE	88	238	61	0	0	0
SSE	60	226	92	0	0	0
S	350	1108	537	0	0	0
SSW	188	934	402	0	0	0
SW	343	866	159	0	0	0
WSW	426	783	84	0	0	0
W	198	360	128	0	0	0
WNW	120	382	365	0	0	0
NW	64	440	522	0	0	0
NNW	98	416	487	0	0	0
AVG	2.6	5.0	8.3	0.0	0.0	0.0
TOTAL	2525	7444	3593	0	0	0

TABLE 8

TABULATED ANNUAL WIND ROSE FOR WASHINGTON NATIONAL AIRPORT, WASHINGTON, D.C.

ALL STABILITIES

(1-YEAR AVERAGE IN HOURS)

	WIND SPEED CLASS					
DIRECTION	1	2	3	4	5	6
N	312	1066	1180	840	112	7
NNE	173	570	694	392	34	3
NE	205	789	784	421	41	4
ENE	269	814	779	360	36	17
E	188	526	332	100	10	2
ESE	194	444	298	75	16	2
SE	218	546	353	81	5	1
SSE	145	652	561	117	19	5
S	570	2329	2932	946	53	3
SSW	276	1391	1339	679	92	7
SW	450	1178	623	303	43	12
WSW	525	1063	431	151	15	7
W	266	584	451	251	68	11
WNW	177	621	948	920	273	78
NW	124	712	1337	1440	406	99
NNW	152	691	1315	1027	208	34
AVG	2.6	5.0	8.4	12.9	18.3	24.6
TOTAL	4244	13796	14357	8103	1431	292

It should be noted that the occurrence of low wind speed and high stability (which contribute to lower air quality) do not necessarily occur during congested or high volume traffic conditions. Therefore, to demonstrate representative conditions and reduce computer requirements, three stability conditions with a selected wind speed (chosen to be generally similar to the mean of the wind speed categories of Pasquill, Ref. 6) were selected for examination with each wind direction. These three cases were:

1. Unstable - 5 mph
2. Neutral - 10 mph
3. Stable - 5 mph

2.4 The Traffic Data

Traffic data for every street in the downtown Washington, D.C. area was available for the year 1970. To obtain data for 1972, 1975, and 1990, the D.C. Department of Highways suggested using a figure of 3% increase per year. In addition, projected traffic data for the proposed Inner-Loop for 1975 and 1990 were used as model input.

The model also requires as input the mix of automobiles, trucks and diesels. The mix used throughout the study was 95% automobiles, 3% trucks, and 2% diesels.

2.5 Description of the ERT Highway Impact Model

In order to examine the air pollution impact of a highway, an atmospheric diffusion model is used to predict ambient pollutant concentrations for representative meteorological conditions. The ERT multiple source diffusion model MARTIK was used throughout this study. This computer program represents the state of the art in diffusion modeling. Its validity has been accepted by many state control agencies and the EPA. This model can simulate atmospheric transport and diffusion processes for either steady state (short term) or varying meteorological conditions (long term).

The ERT highway impact model program (MARTIK) provides the means for study of air pollution in the complex environment of an urban area. The program is based upon a diffusion model developed by Martin and Tikvart (Ref. 5). Basic input to the program consists of a description of the emission sources located within the region of interest, together with meteorological data appropriate to the region. The program computes mean pollutant concentrations as a function of position within the region at any set of specified points. Up to six pollutants may be considered in a single calculation. Single-wind cases may be calculated in addition to or instead of long-term averages, e.g., to examine worst-case conditions. The influence of individual sources upon selected receptors may also be displayed for sensitivity analyses. A number of optional program modes enable the application of backgrounds and calibration factors at each receptor site for each pollutant, to use previously created data banks, and to pass the results on to other programs.

To properly evaluate the air pollution impact of a highway, many factors affecting the resulting air pollution must be considered. The meteorological parameters required include the wind speed, the wind direction, and a measure of the vertical mixing or stability of the atmosphere. The amount of pollutants released into the atmosphere is directly related to the number of vehicles using a roadway. In addition, the speed of the traffic must be considered because the emission rates of some pollutants are a function of speed. And the mix of vehicles will influence the exact quantities of pollutants emitted. The MARTIK program requires an input of all pertinent traffic and road information. It then converts this information into a spatial distribution of emissions, applies the meteorological inputs to the emission distribution, and finally computes the steady state of distribution of the pollutants over any downwind region.

The wind speed is important because the faster the wind the more air which is available to dilute the emissions from any source or source region. Low wind speeds do not ventilate a region well and therefore ground-level pollutant concentrations tend to be higher. Vertical mixing provides more volume in which a given amount of pollutant can be distributed and therefore will reduce ground-level concentration. For a complete analysis of a region background pollution levels from non-road sources must be added in.

All mathematical models should be calibrated and validated for a given geographic area. This is usually done by comparing concentrations predicted by the model with concentrations actually measured. The model values presented in this report have not been calibrated because the measured values at the one site at which measurements were available were for a period that differed from the meteorological data. Thus, reliability of the calibration based on the available data was not high enough to warrant calibration of the model.

It should be noted, however, that the same model has recently been used and calibrated by ERT personnel in a similar road study for Interstate 90 near Seattle. Computed values for carbon monoxide were found to be low by 8%, for hydrocarbons high by 18.5% and for nitrogen oxides high by 70%.

3. RESULTS

3.1 Air Quality in Vicinity of Center Leg of Inner Loop Freeway - 1972

1. Carbon Monoxide

For the peak traffic hour and for west wind conditions, the 1 hour standard for carbon monoxide (CO) of 35 ppm is not exceeded anywhere in the vicinity of the center leg of the Inner Loop Freeway for Atmospheric Stabilities 2 (unstable) and 4 (neutral). (Figures 3 and 4). It is, however, exceeded for stability 5 (stable) over nearly one-quarter of the area examined in the vicinity of the center leg freeway tunnel). (See Figure 5.) The area where the standard is presently exceeded is generally west and southwest of the proposed tunnel.

2. Hydrocarbons (Less Methane)

Background levels of hydrocarbons exceed the 3 hour standard (.24 ppm) everywhere in the vicinity of the center leg of the inner loop freeway for peak hour traffic conditions with west winds for all stabilities examined (2, 4, and 5) (see Figures 6 - 8). Highest values occur with stability 5 (stable).

There is no one-hour standard but the effective one-hour standard is estimated at about .29 ppm.

3. Nitrogen Oxides

There is no hourly or daily standard at the present time for Nitrogen Oxides (NO_X). The national ambient air quality standard for an annual average of NO_X is .05 ppm. Background levels exceed .05 ppm for approximately one-half the area to the west of the proposed center leg roadway and tunnel (Figure 9).

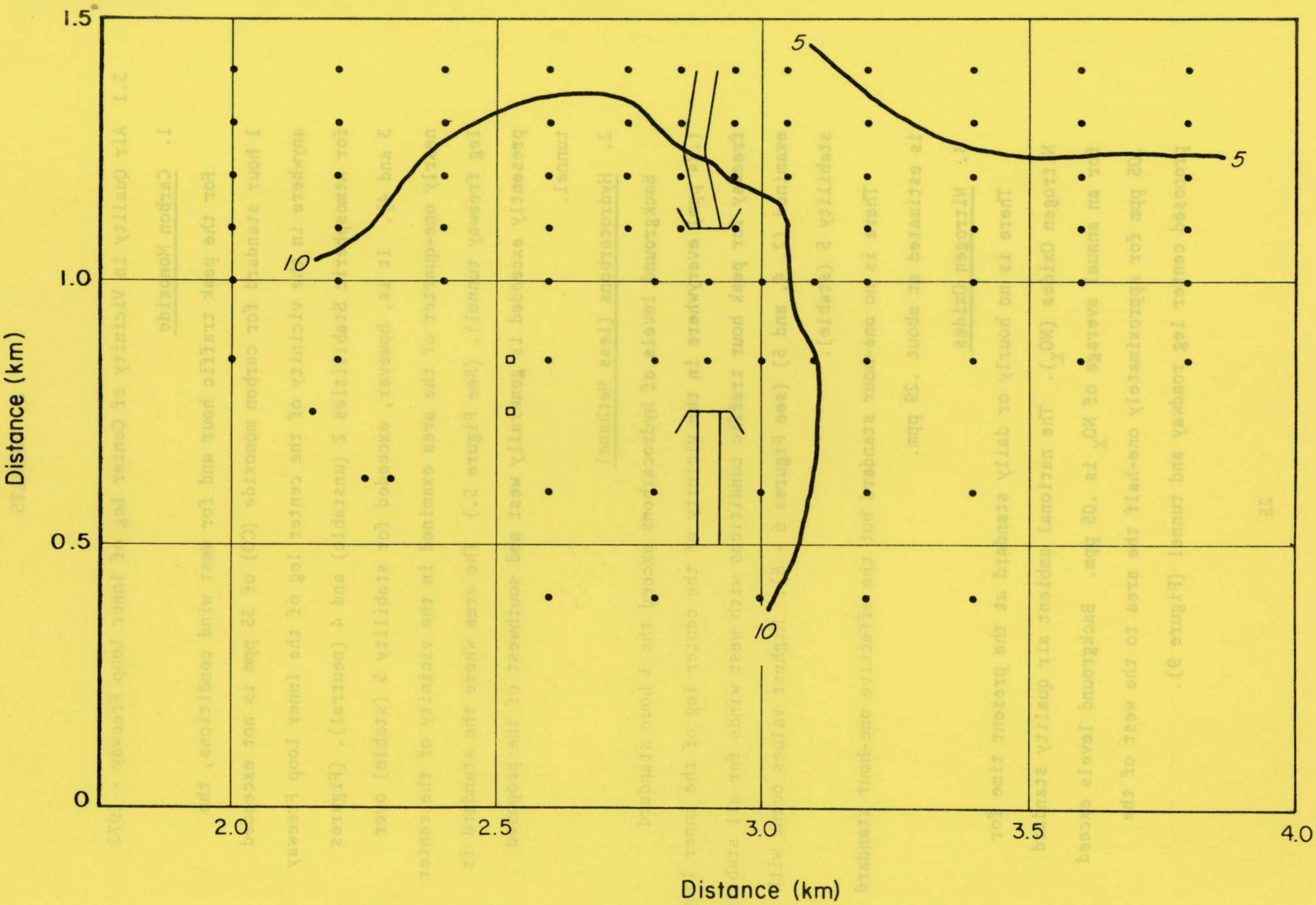

Figure 3 Background levels of CO in vicinity of proposed center leg of Inner Loop freeway, Washington, D.C. 1972, for west wind, Stability 2

5189

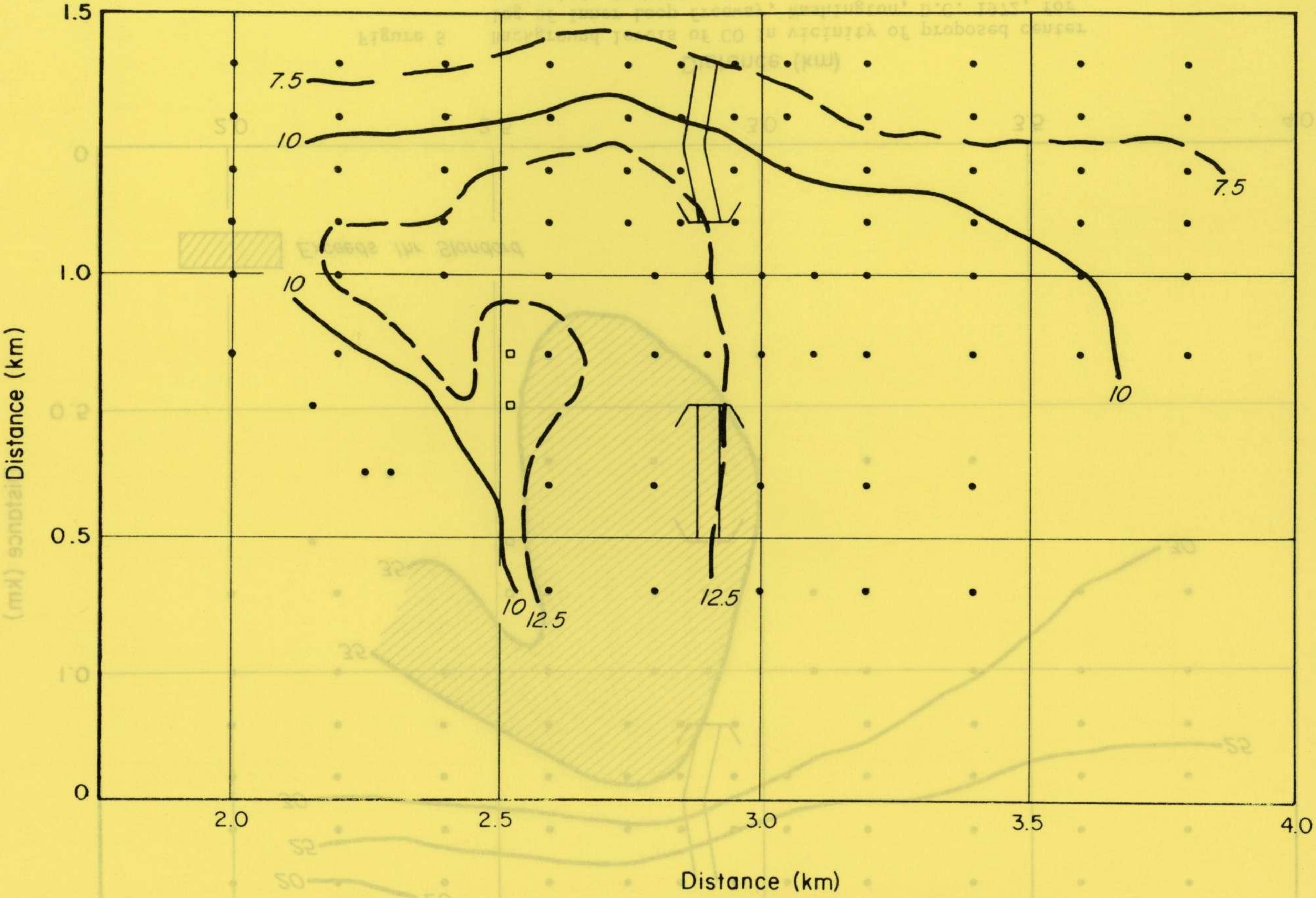

Figure 4 Background levels of CO in vicinity of proposed center leg of Inner Loop freeway, Washington, D.C. 1972, for west wind, Stability 4

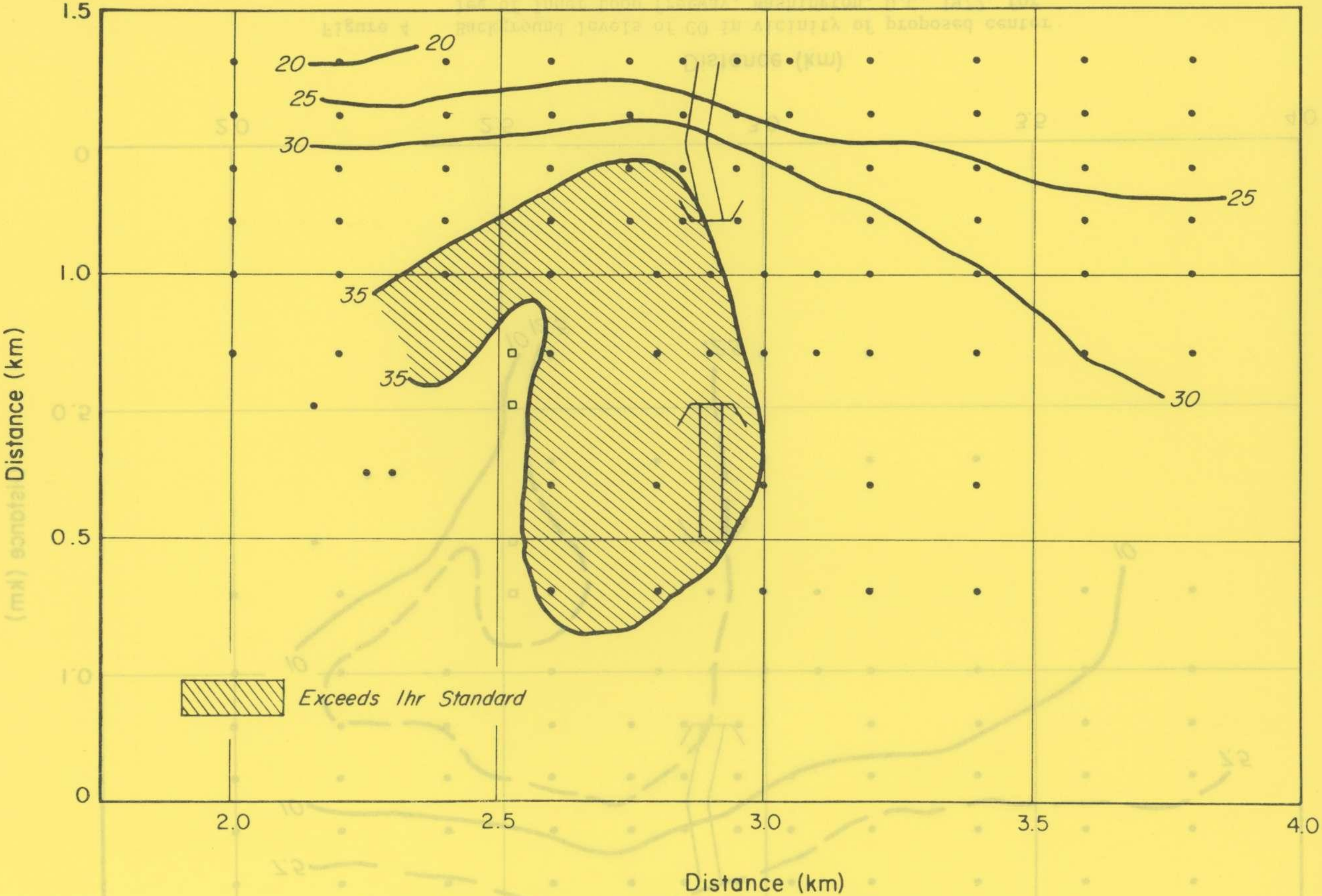

Figure 5 Background levels of CO in vicinity of proposed center leg of Inner Loop freeway, Washington, D.C. 1972, for west wind, Stability 5

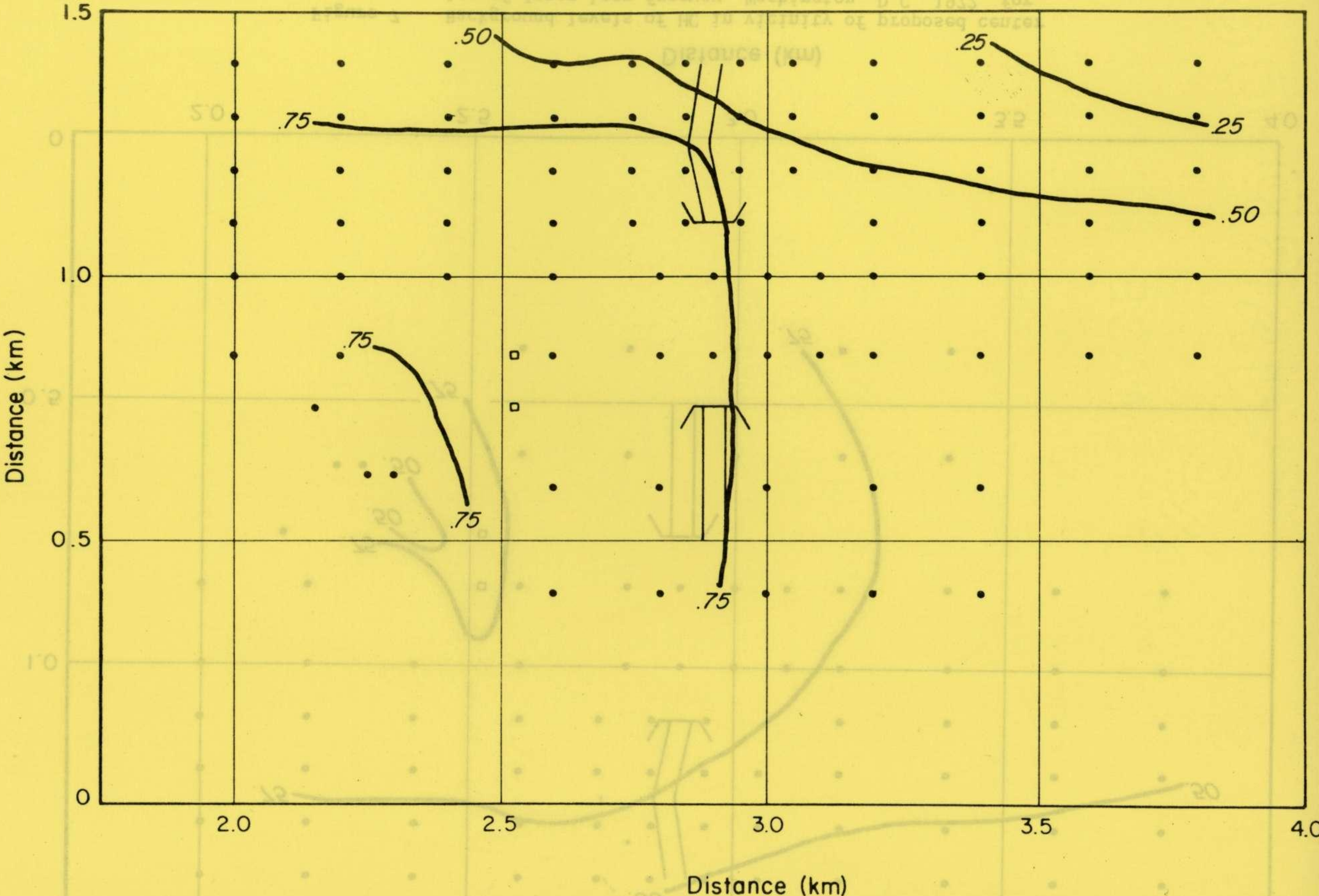

Figure 6 Background levels of HC in vicinity of proposed center leg of Inner Loop freeway, Washington, D.C. 1972, for west wind, Stability 2

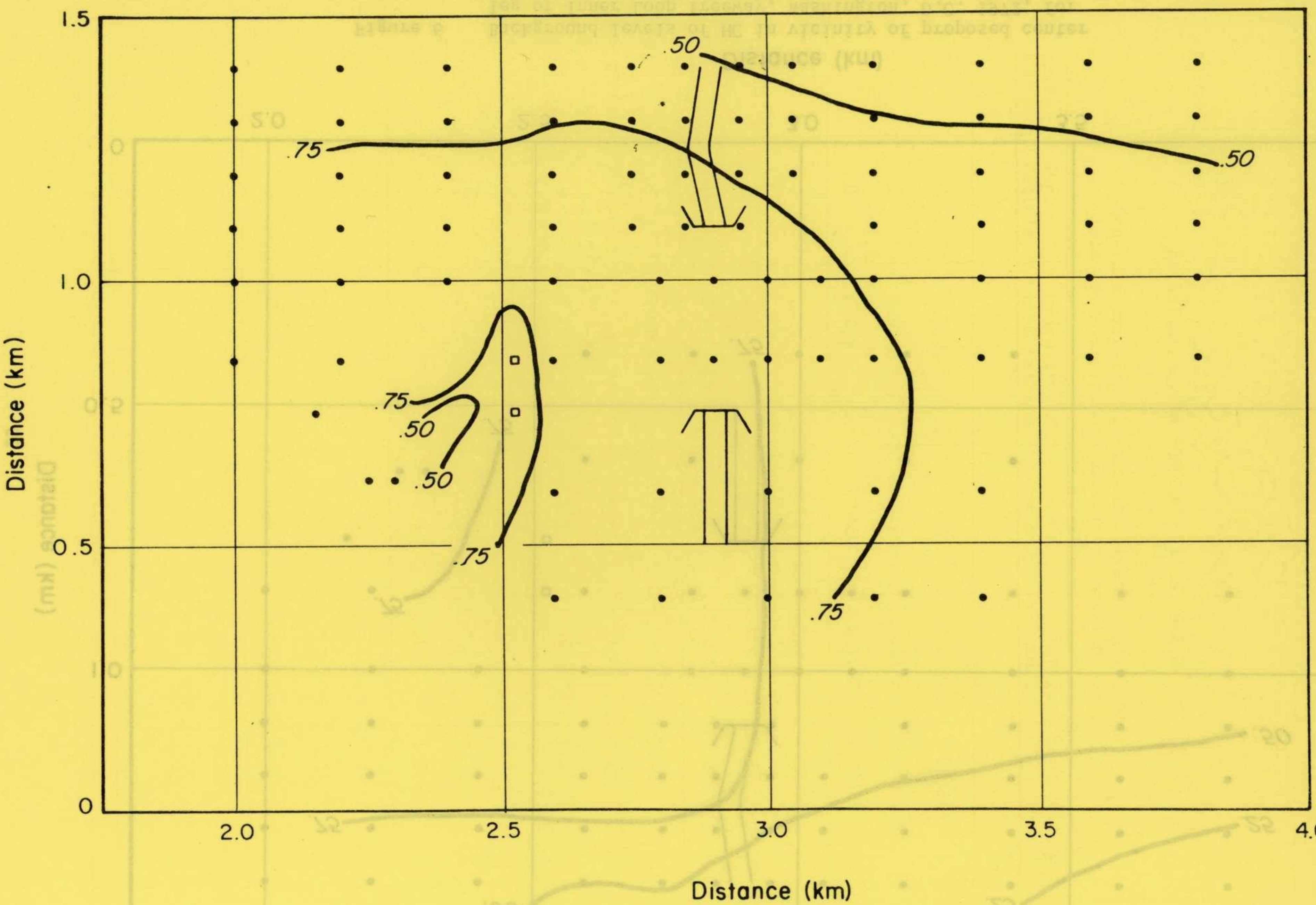

Figure 7 Background levels of HC in vicinity of proposed center leg of Inner Loop freeway, Washington, D.C. 1972, for west wind, Stability 4

5185

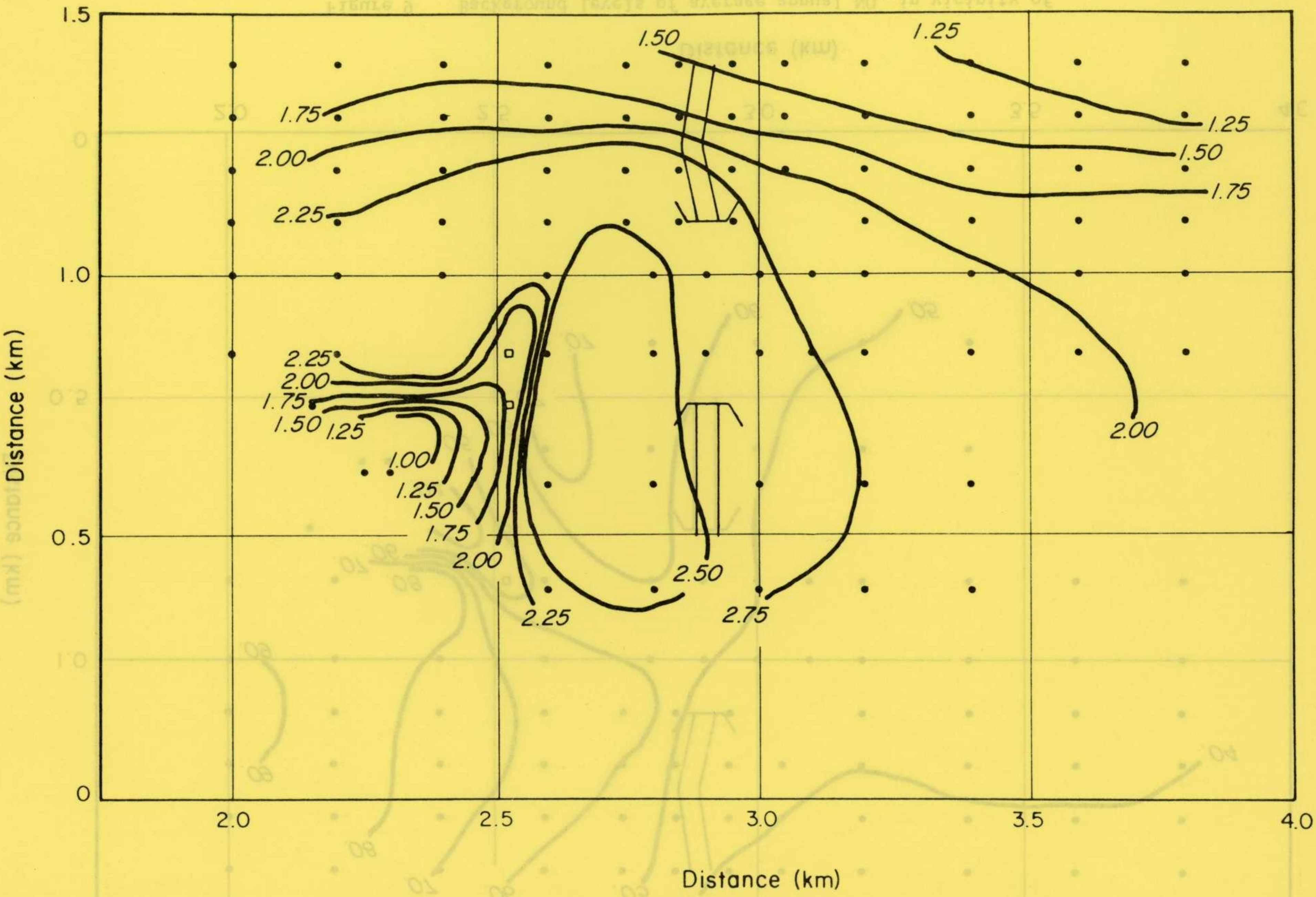

Figure 8 Background levels of HC in vicinity of proposed center leg of Inner Loop freeway, Washington, D.C. 1972, for west wind, Stability 5

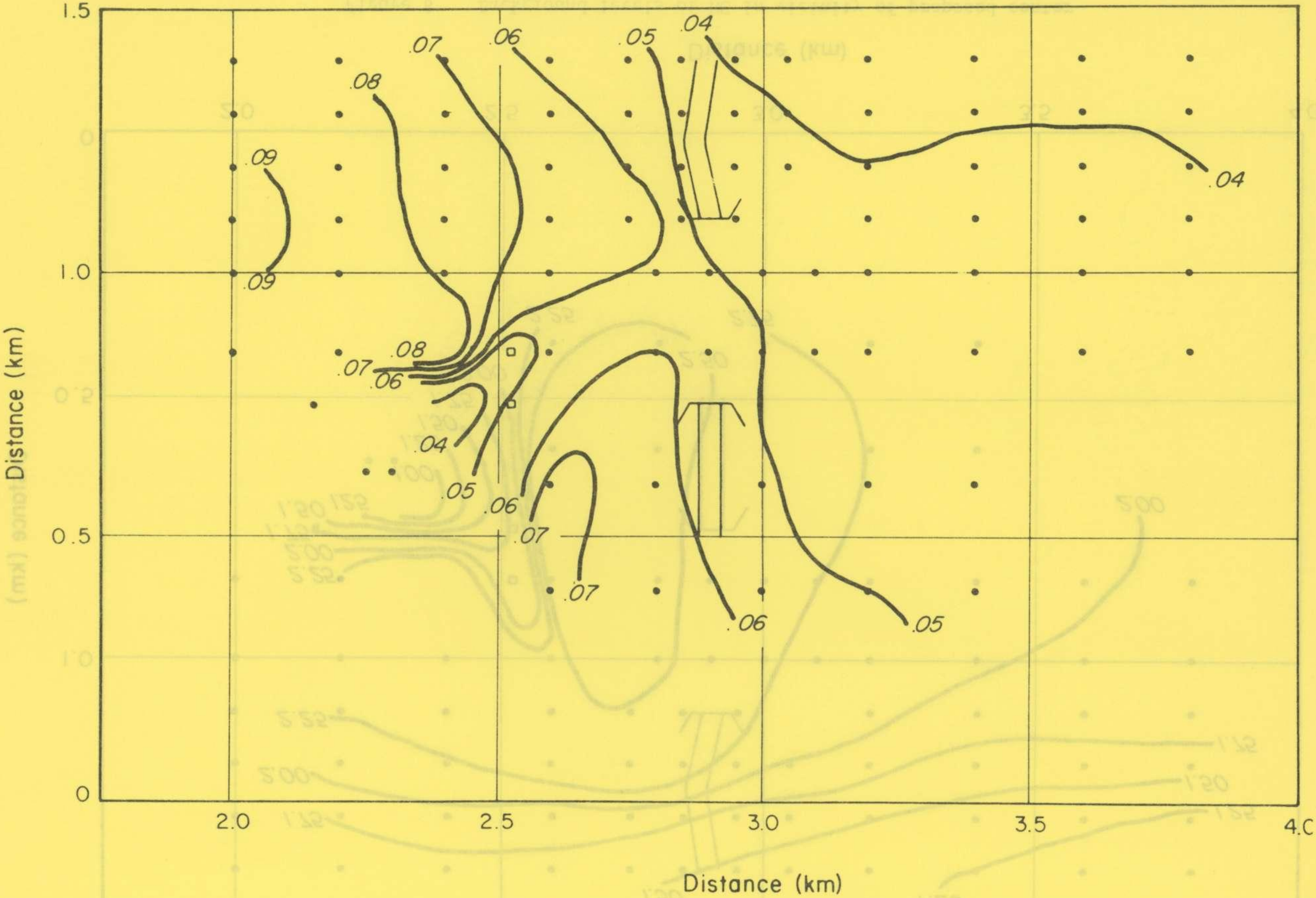

Figure 9 Background levels of average annual NO_X in vicinity of proposed center leg of Inner Loop freeway, 1972

3.2 Air Quality in Vicinity of Center Leg of Inner Loop Freeway - 1975

1. Carbon Monoxides and Hydrocarbons Background

Concentrations of CO for 1975 peak hour traffic conditions (when 4 lanes of the proposed freeway and tunnel are expected to be open to traffic) indicate that the one hour standard of 35 ppm is not exceeded anywhere in the vicinity for all stabilities examined.

For Hydrocarbons (Less Methane), the picture is quite different. Background levels of HC exceed the 3-hour standard of .24 ppm over approximately 4/5 of the area (area is that shown in Figures 3 - 9) with only the extreme northeast corner of the area below the standard for stabilities 2 and 4. The standard is exceeded everywhere for stability 5.

When the proposed freeway and tunnel traffic for 1975 is added, the model calculations for concentrations of CO and HC indicate that the speed of the traffic during the peak traffic hour strongly influences the concentrations. Table 9 is a summary of maximum values. For CO, a stalled traffic condition with a one mile backup of traffic in each direction from the center leg of the freeway (almost the absolute worst condition imaginable) causes the 1 hour standard to be exceeded at 5 locations for west wind, stability 2; zero locations for west wind stability 4; and 6 locations for west wind stability 5. When average hourly traffic volume remains the same, but the speed of traffic flow increases to 20 mph, only one location exceeds the standard for each stability and these locations are very close to the roadway. See Figure 10 for receptor locator information.

TABLE 9

MAXIMUM VALUES FOR CO AND HC (1975) AND

LOCATIONS OF MAXIMUM VALUES (WEST WIND, STABILITIES 2,4, & 5)

(ALL VALUES WHERE STANDARDS ARE EXCEEDED ARE LISTED)

CO 1 Hr. Standard = 35 PPM   HC 3 Hr. Standard = .24 PPM

1 Hr. Standard = .29 PPM

			CARBON MONOXIDE						HYDROCARBONS					
ATM STAB	WIND DIR	WIND SPEED	V.S. 0	LOC	V.S. 20	LOC	V.S. 40	LOC	V.S. 0	LOC	V.S. 20	LOC	V.S. 40	LOC
2	W	5	66	73	7(B)	43	6(B)	43	12.8	19	1.6	43	1.3	43
			40	7					Standard exceeded almost everywhere within 2 km, mainly due to background					
			37	31										
			48	19										
			63	78										
4	W	10	2(B)	19	5(B)	43	5(B)	78	5.7	19	1.0	43	0.9	43
5	W	5	77	73	14(B)	78	13(B)	78	13.4	19	2.6	43	2.3	43
			37	7					Standard exceeded almost everywhere within 2 km, mainly due to background					
			45	31										
			45	32										
			52	19										
			74	78										
2	SSW	5	49	65	9(B)	31	8(B)	31	12.8	65	1.7	31	1.6	31
			46	78										
4	SSW	10	35	65	6(B)	31	6(B)	31	7.9	78	1.2	31	1.1	31
5	SSW	5	89	65	16(B)	31	15(B)	31	23.1	65	2.9	31	2.8	31
			51	19										
			50	54					Standard exceeded almost everywhere within 2 km, mainly due to background					
			47	55										
			35	64										
			76	78										

VS = Vehicle Speed
LOC = Receptor Location See Fig. 10
(B) = Maximum Value is Below Standard

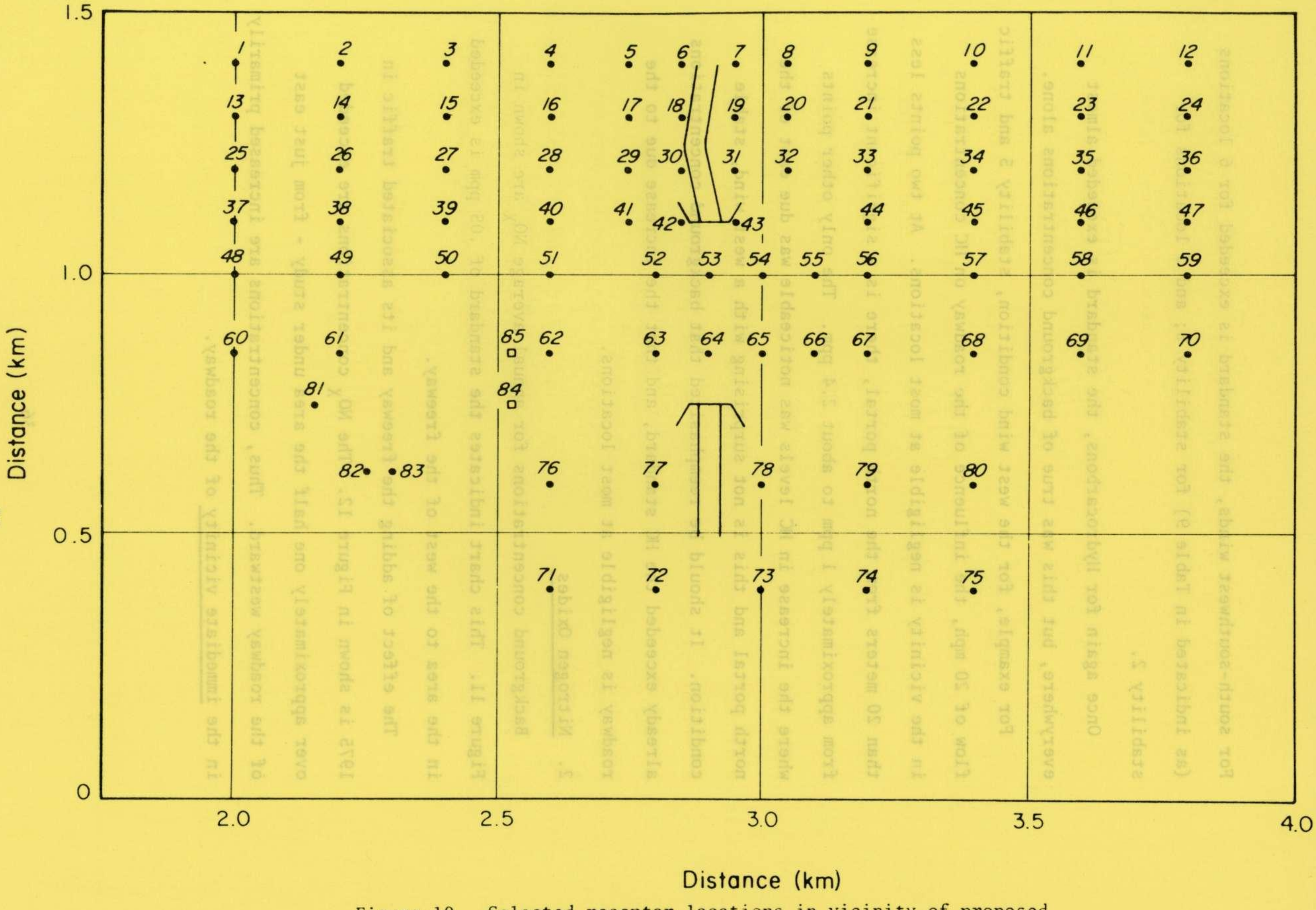

Figure 10 Selected receptor locations in vicinity of proposed center leg of Inner Loop freeway, Washington, D.C.

For south-southwest winds, the standard is exceeded for 6 locations (as indicated in Table 9) for stability 5; and 2 locations for stability 2.

Once again for Hydrocarbons, the standard is exceeded almost everywhere, but this was true of background concentrations alone.

For example, for the west wind condition, stability 5 and traffic flow of 20 mph, the influence of the roadway on HC concentrations in the vicinity is negligible at most locations. At two points less than 20 meters from the north portal, there is a significant increase from approximately 1 ppm to about 2.4 ppm. The only other points where the increase in HC levels was noticeable was due east of the north portal and this is not surprising with a west wind, stable condition. It should be reemphasized that background concentrations already exceeded the HC standard, and that the increase due to the roadway is negligible at most locations.

2. Nitrogen Oxides

Background concentrations for annual average NO_X are shown in Figure 11. This chart indicates the standard of .05 ppm is exceeded in the area to the west of the freeway.

The effect of adding the freeway and its associated traffic in 1975 is shown in Figure 12. The NO_X concentrations are exceeded over approximately one half the area under study - from just east of the roadway westward. Thus, concentrations are increased primarily in the immediate vicinity of the roadway.

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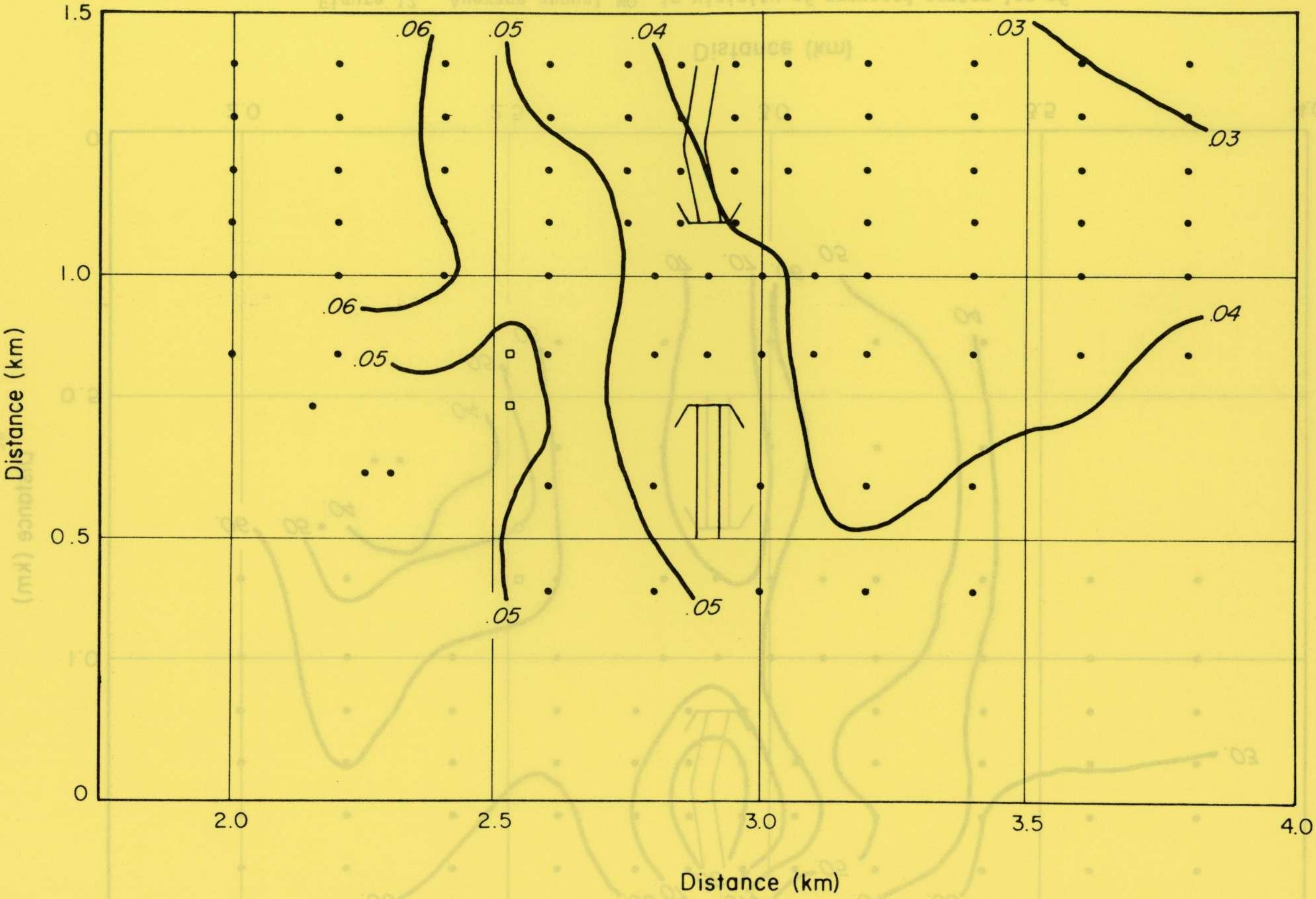

Figure 11 Background levels of average annual NO_X in vicinity of proposed center leg of Inner Loop freeway, 1975

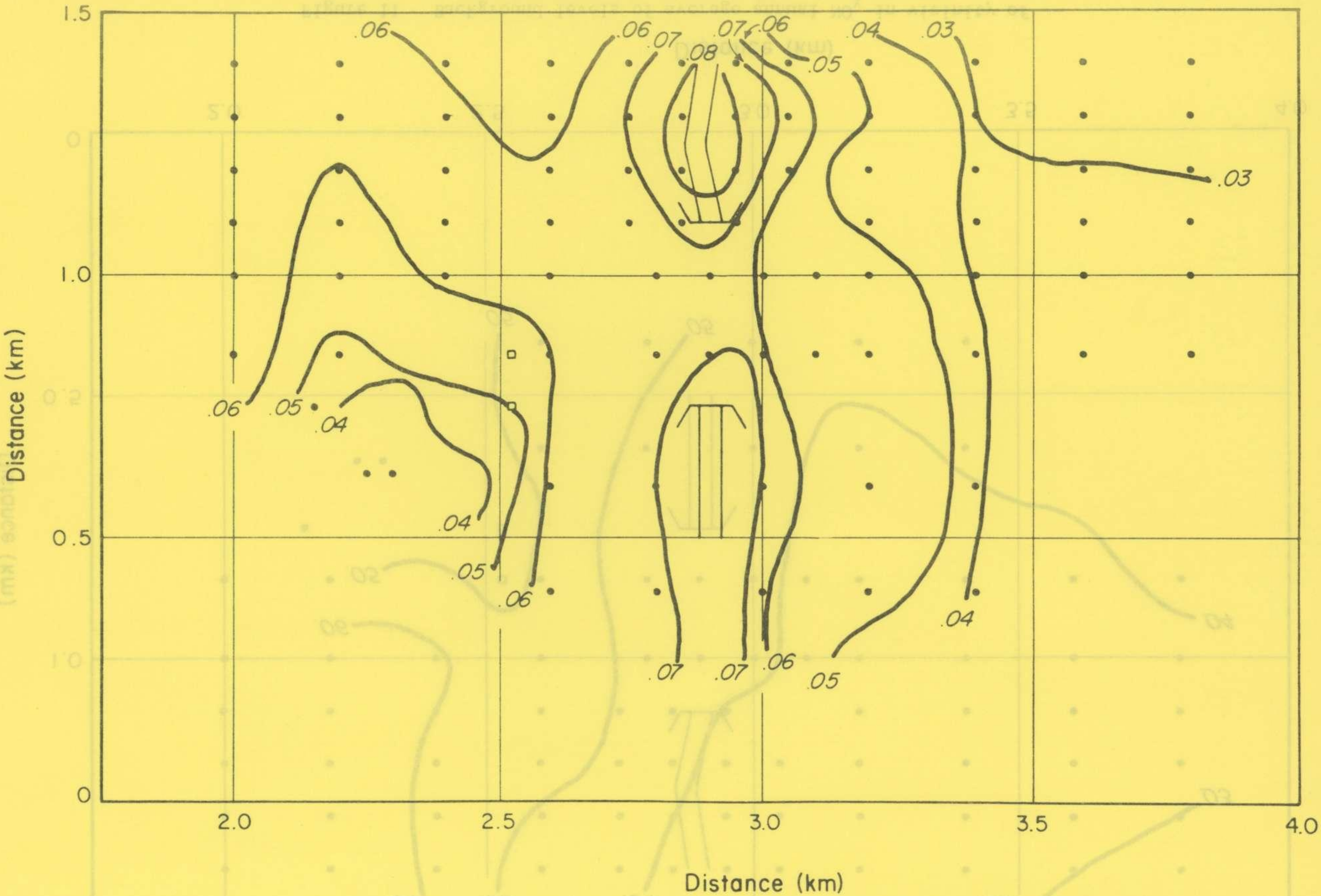

Figure 12 Average annual NO_x in vicinity of proposed center leg of Inner Loop freeway projected freeway traffic included, 1975

3. Particulates

The primary and secondary annual National Ambient Air Quality Standards for particulates are 75- and 60- micrograms per cubic meter (mg/m^3). Computations with the ERT highway diffusion model indicate average annual particulate values due to the roadway to be of the order of 3 - 10 mg/m^3. Thus, the contribution of the roadway to particulates in the air is expected to be minimal.

3.3 Air Quality in Vicinity of Center Leg of Inner Loop Freeway - 1990

1. Carbon Monoxide and Hydrocarbons

In 1990, when the new federal regulations regarding vehicular emissions will apply to essentially all cars on the road, carbon monoxide levels are expected to be below the standard for both the worst meteorological and worst traffic conditions combined. (See Table 10). Of course, background levels are also well below standards.

For Hydrocarbons, only the stall condition (one mile traffic backup, all 9 lanes) creates values above the standard at the receptor locations indicated in Table 10.

For traffic speeds greater than or equal to 20 MPH, ambient concentrations, including background are expected to be below standards everywhere.

2. Nitrogen Oxides

NO_X will not be a problem in 1990 as shown in Figure 13. Annual average concentrations are well below the annual standard over all the area, except in the immediate vicinity of the roadway, where values, although somewhat higher (.04 ppm) are still below the standard of .05 ppm.

Background levels of NO_X are approximately .01 ppm everywhere.

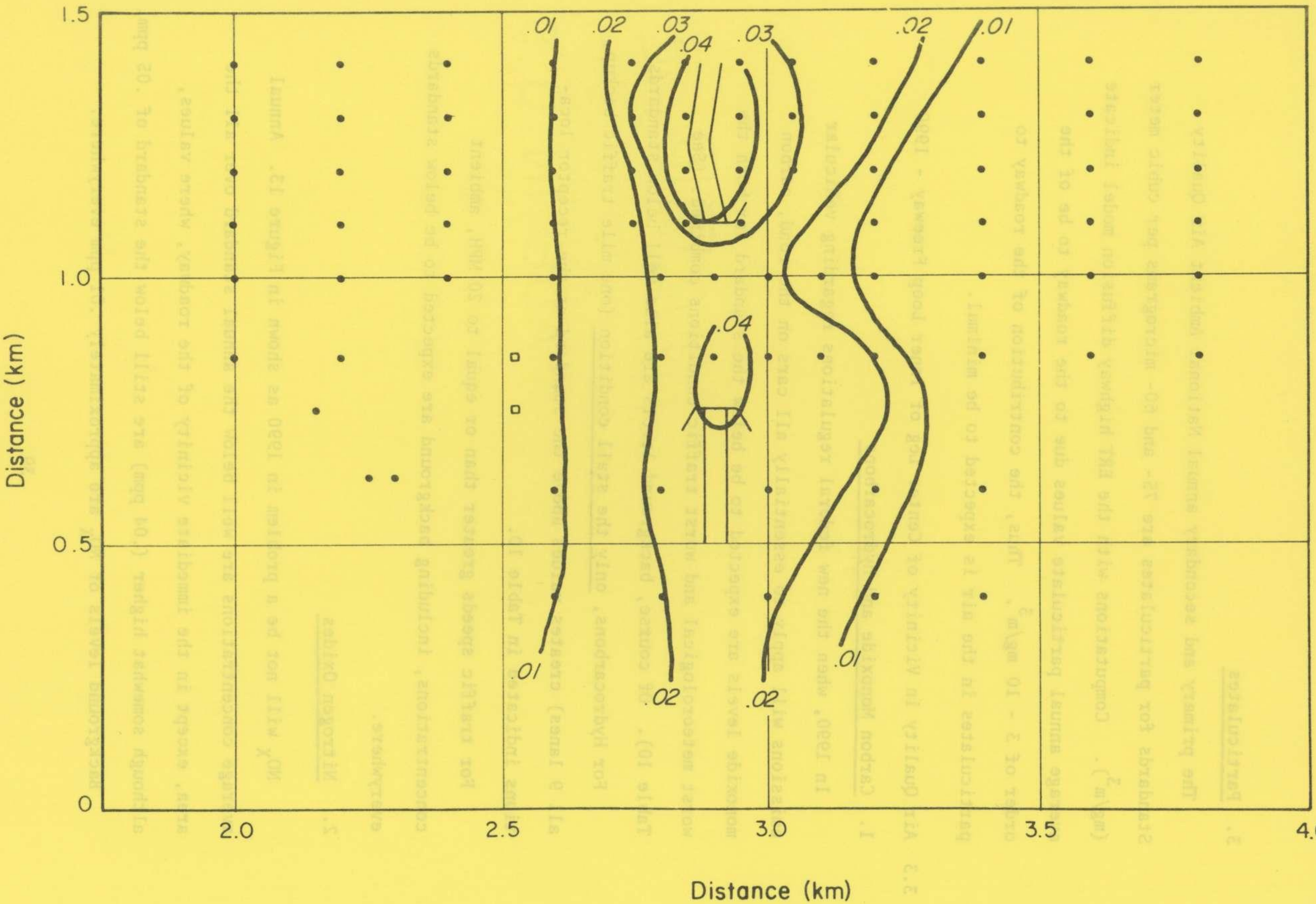

Figure 13 Average annual NO_X in vicinity of proposed center leg of Inner Loop freeway projected freeway traffic included, 1990

3.4 Special Cases

3.4.1 Impact of Leakage on Tunnel Buildings

Of interest is the impact of leakage from the tunnel portals on the high rise apartment buildings that are to be erected above the tunnel. We examined this aspect for 20 mph traffic speeds for all stabilities, for downwind wind directions (north for north building, and south for south building) for both 1990. Figures 14-16 illustrate the concentrations of CO and HC, respectively, for the north building and HC for the south building, respectively. They indicate that CO levels are below standards everywhere up along the wall of the building. However, the hydrocarbon standard is exceeded for the lowest 7 meters of the north building under the worst stability conditions and for the lowest 3 meters under the worst stabilities for the south building.

In 1990, carbon monoxide levels due to tunnel leakage are not a factor for concern for the north or south buildings. Hydrocarbon levels decrease to below standards for the south building but are somewhat above the standard along the lowest 3 meters of the north building (see Figures 17-19).

3.4.2 Effect of Stack Emissions on Downwind Regions

The two stacks that will be constructed at either end of the tunnel portion of the center leg of the inner loop freeway will be about 100 feet high. Fans in the tunnel will keep the stack emissions from exceeding some preset limits. Emission information given to us by TAMS is that the stacks will be controlled to emit no higher than 125 ppm in 1975, and 28 ppm in 1990, when vehicle emissions are much lower due to control devices.

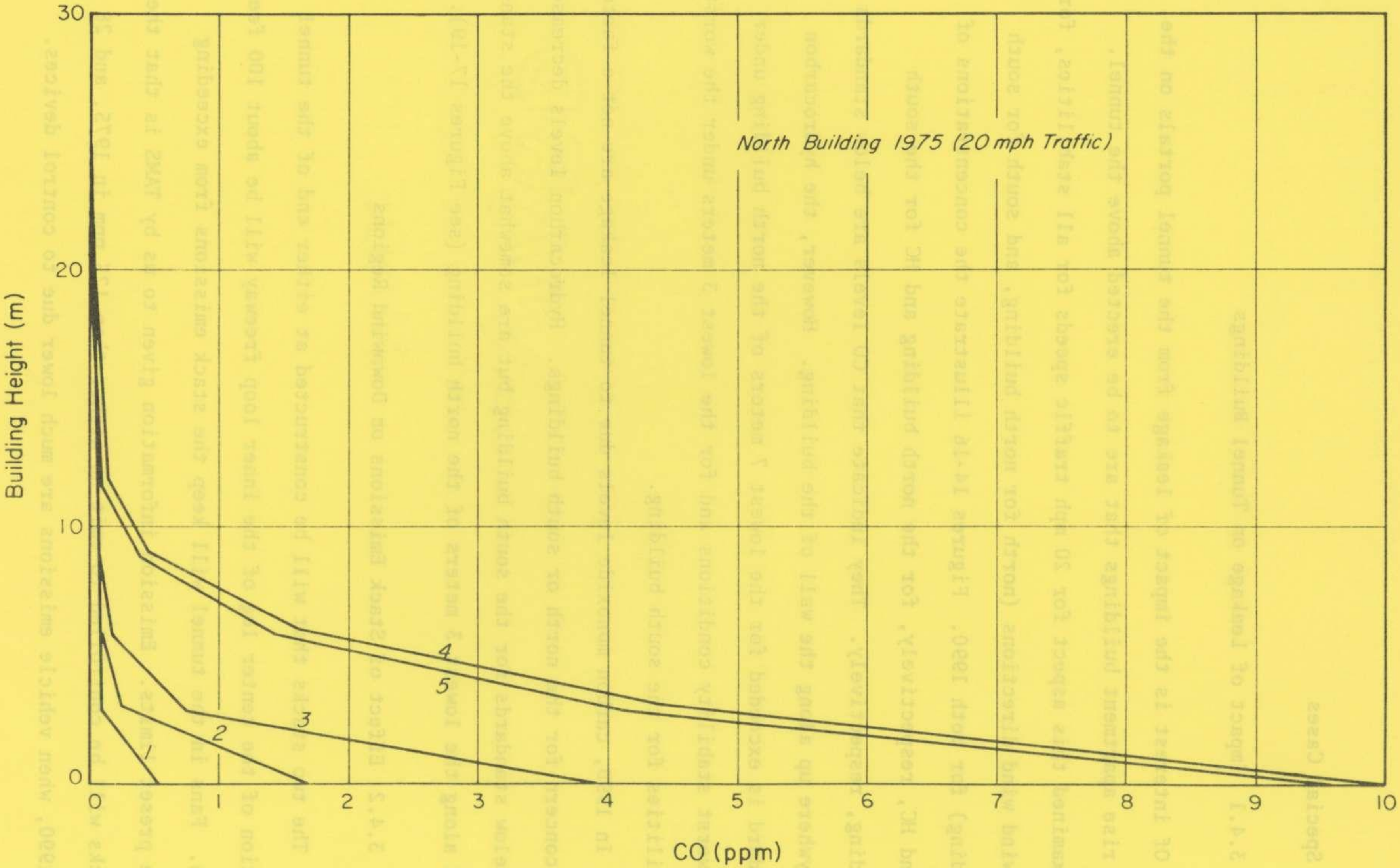

Figure 14 CO concentrations on North Tunnel building due to tunnel leakage, 20 mph traffic, 1975

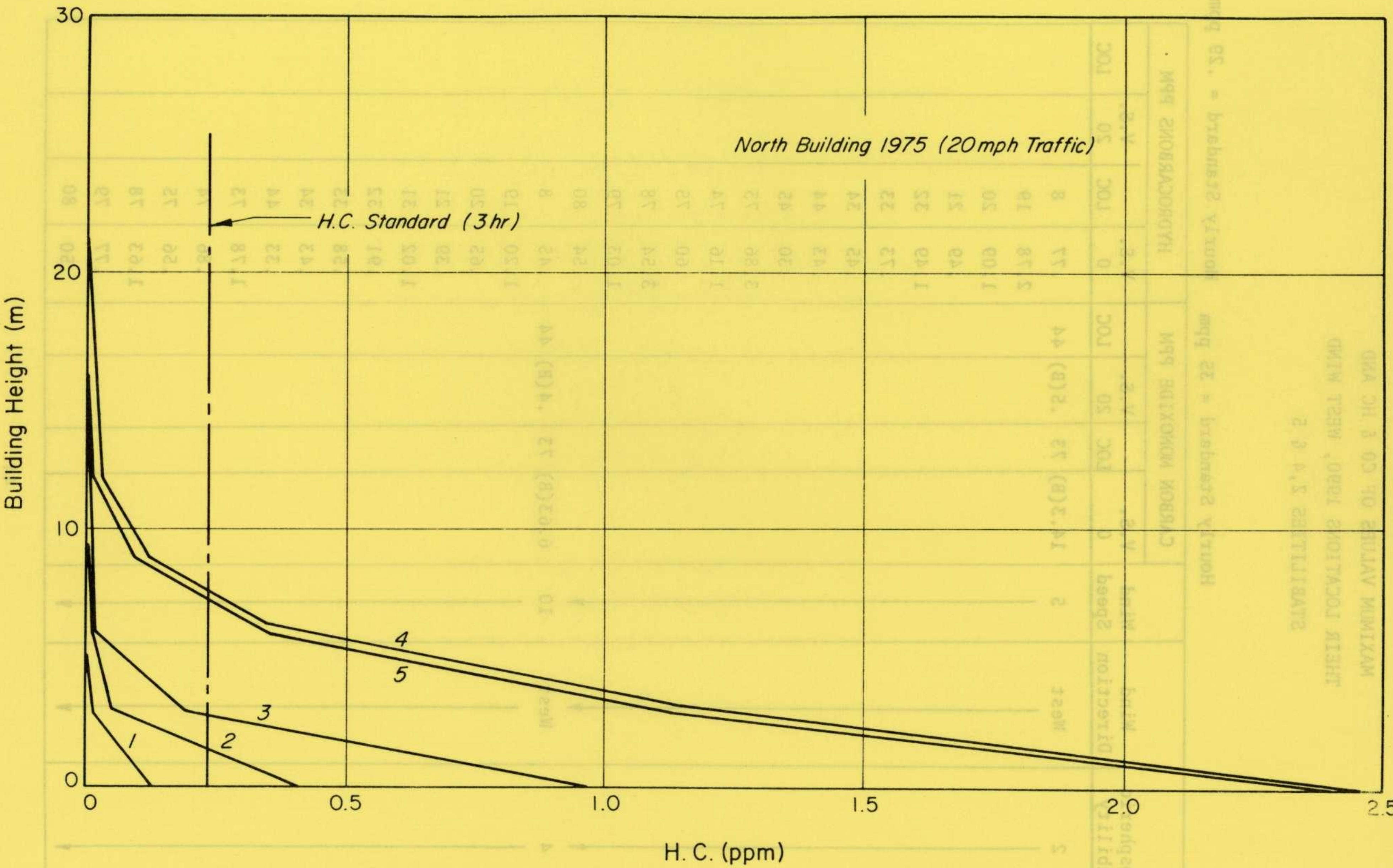

Figure 15 HC concentrations on North Tunnel building due to tunnel leakage, 20 mph traffic, 1975

TABLE 10

MAXIMUM VALUES OF CO & HC AND

THEIR LOCATIONS 1990, WEST WIND

STABILITIES 2,4 & 5

Hourly Standard = 35 ppm (Carbon Monoxide)   Hourly Standard = .29 ppm (Hydrocarbons)

Atmospheric Stability	Wind Direction	Wind Speed	CARBON MONOXIDE PPM V.S. 0	LOC	V.S. 20	LOC	HYDROCARBONS PPM V.S. 0	LOC	V.S. 20	LOC
2	West	5	14.3(B)	73	.5(B)	44	.77	8		
							2.78	19		
							1.09	20		
							.49	21		
							1.49	32		
							.73	33		
							.45	34		
							.43	44		
							.30	45		
							3.86	73		
							1.16	74		
							.60	75		
							3.54	78		
							1.03	79		
							.54	80		
4	West	10	6.63(B)	73	.4(B)	44	.45	8		
							1.20	19		
							.65	20		
							.39	21		
							1.02	31		
							.91	32		
							.58	33		
							.43	34		
							.33	44		
							1.78	73		
							.86	74		
							.56	75		
							1.63	78		
							.77	79		
							.50	80		

TABLE 10 (Contd.)

Atmospheric Stability	Wind Direction	Wind Speed	CARBON MONOXIDE PPM (Hourly Standard = 35 ppm) V.S. 0	LOC	V.S. 20	LOC	HYDROCARBONS PPM (Hourly Standard = .29 ppm) V.S. 0	LOC	V.S. 20	LOC
5	West	5	15.5(B)	73	.84(B)	44	1.09	8		
							.73	9		
							.45	10		
							.37	11		
							2.76 to .48	19-24		
							2.38 to .68	31-36		
							0.81 to 0.57	44-47		
							.32	58		
							.38	59		
							0.43 to 0.36	68-70		
							4.14	73		
							2.23	74		
							1.52	75		
							3.80	78		
							2.00	79		
							1.36	80		
2	SSW	5	9.97(B)	65	.86(B)	32	2.67	65	.20	32
							1.13	54		
							1.00	55		
							2.59	78		
							1.04	66		
							.40	67		
							.69	73		

TABLE 10 (Contd.)

			Hourly Standard = 35 ppm				Hourly Standard = .29 ppm			
			CARBON MONOXIDE PPM				HYDROCARBONS PPM			
Atmospheric Stability	Wind Direction	Wind Speed	V.S. 0	LOC	V.S. 20	LOC	V.S. 0	LOC	V.S. 20	LOC
4	SSW	10	6.94(B)	65	.53(B)	32	.53	8	.12	32
							.41	9		
							.48	21		
							.79-.51	31-33		
							.40	43		
							.59	44		
							.94	54		
							.92	55		
							.55	56		
							1.86	65		
							.90	66		
							.38	67		
							.39	73		
							1.67	78		
5	SSW	5	17.78(B)	65	.98(B)	64	1.39 to .39	8-11	.19	64
							2.50 to 0.78	19-22		
							1.93 to 0.19	31-35		
							1.64	44		
							.53	45		
							2.45 to 0.36	54-57		
							4.77 to 1.04	65-67		
							.94	73		
							4.19	78		

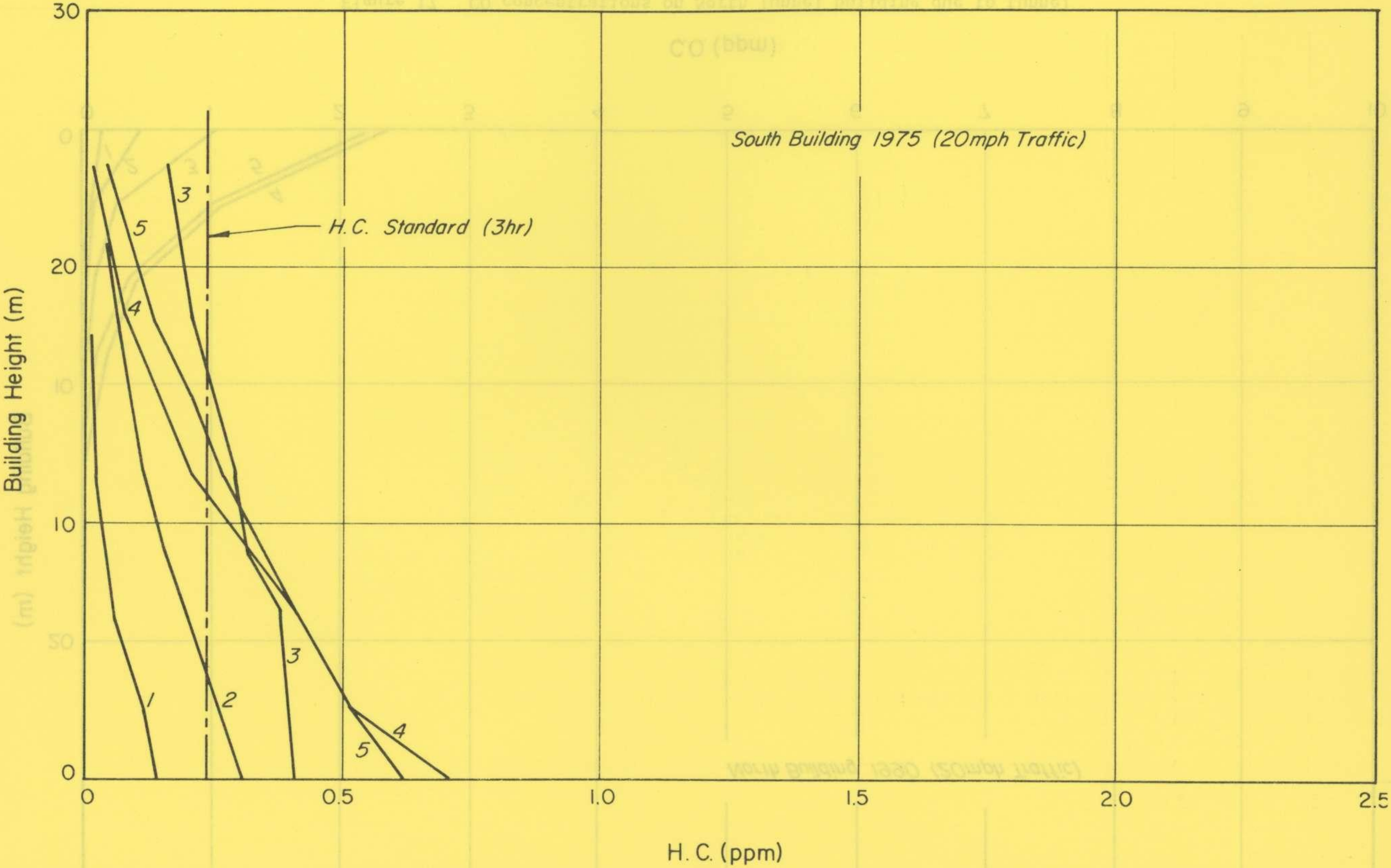

Figure 16 HC concentrations on South Tunnel building due to tunnel leakage, 20 mph traffic, 1975

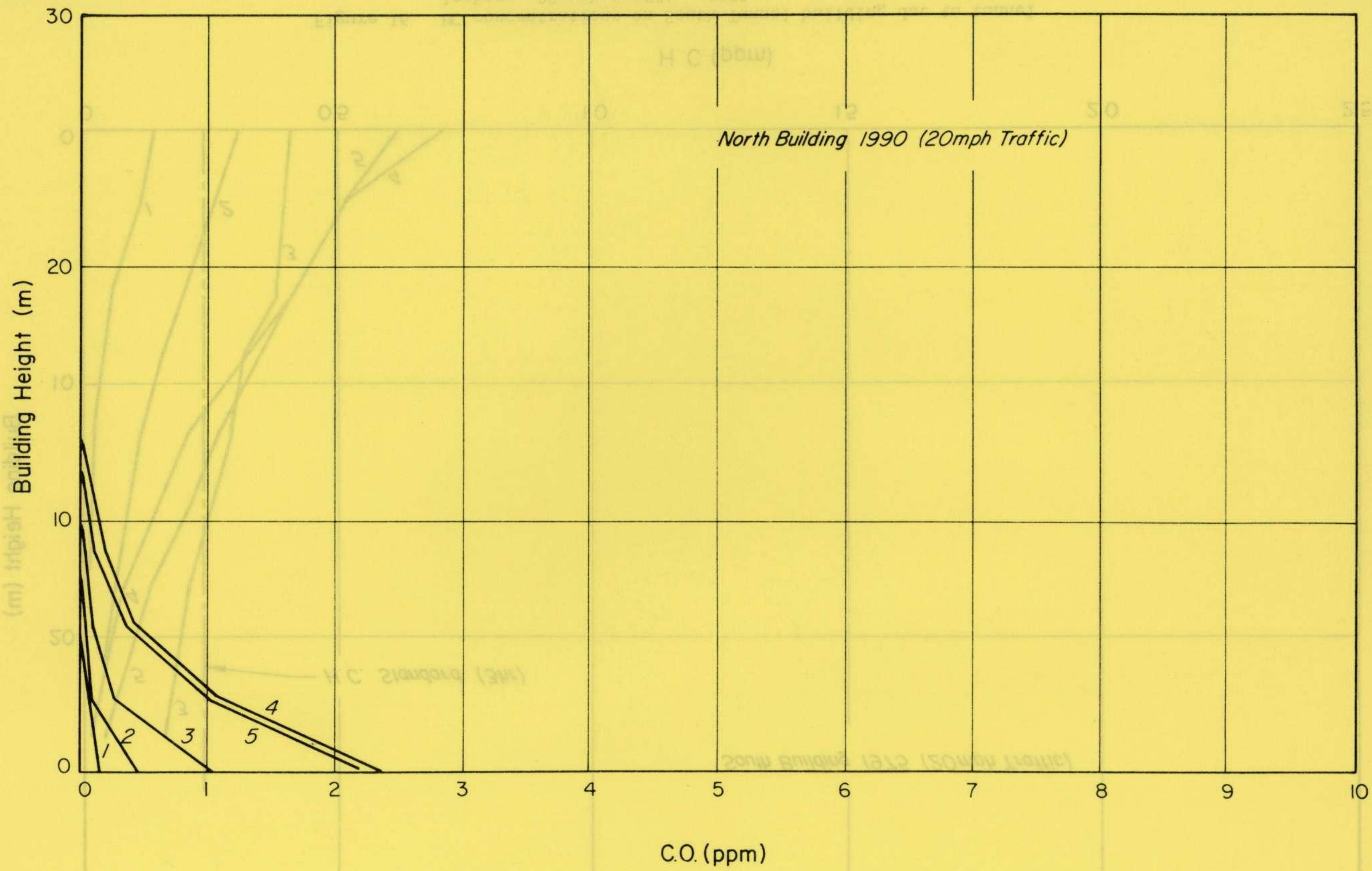

Figure 17 CO concentrations on North Tunnel building due to tunnel leakage, 20 mph traffic, 1990

5194

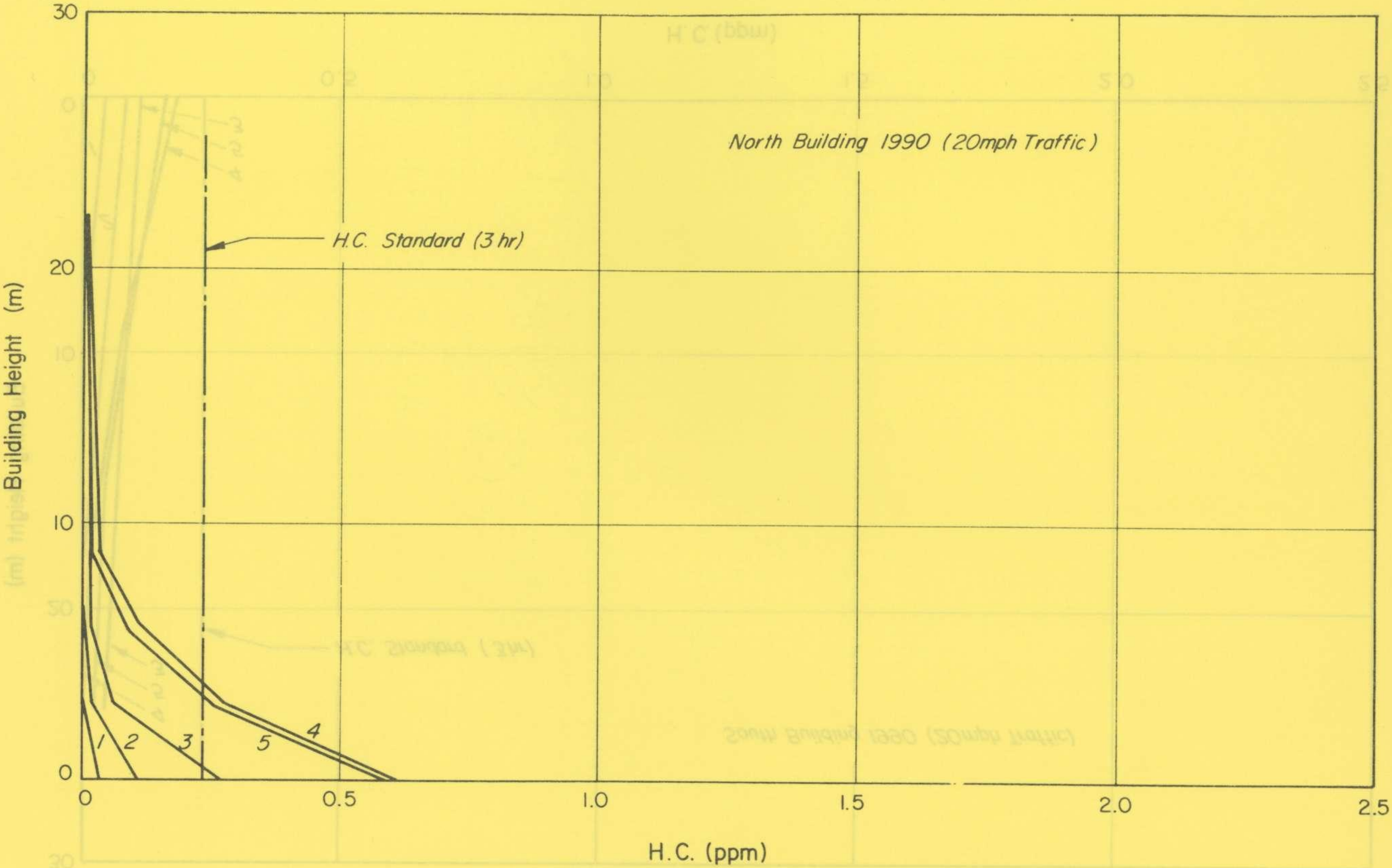

Figure 18 HC concentrations on North Tunnel building due to tunnel leakage, 20 mph traffic, 1990

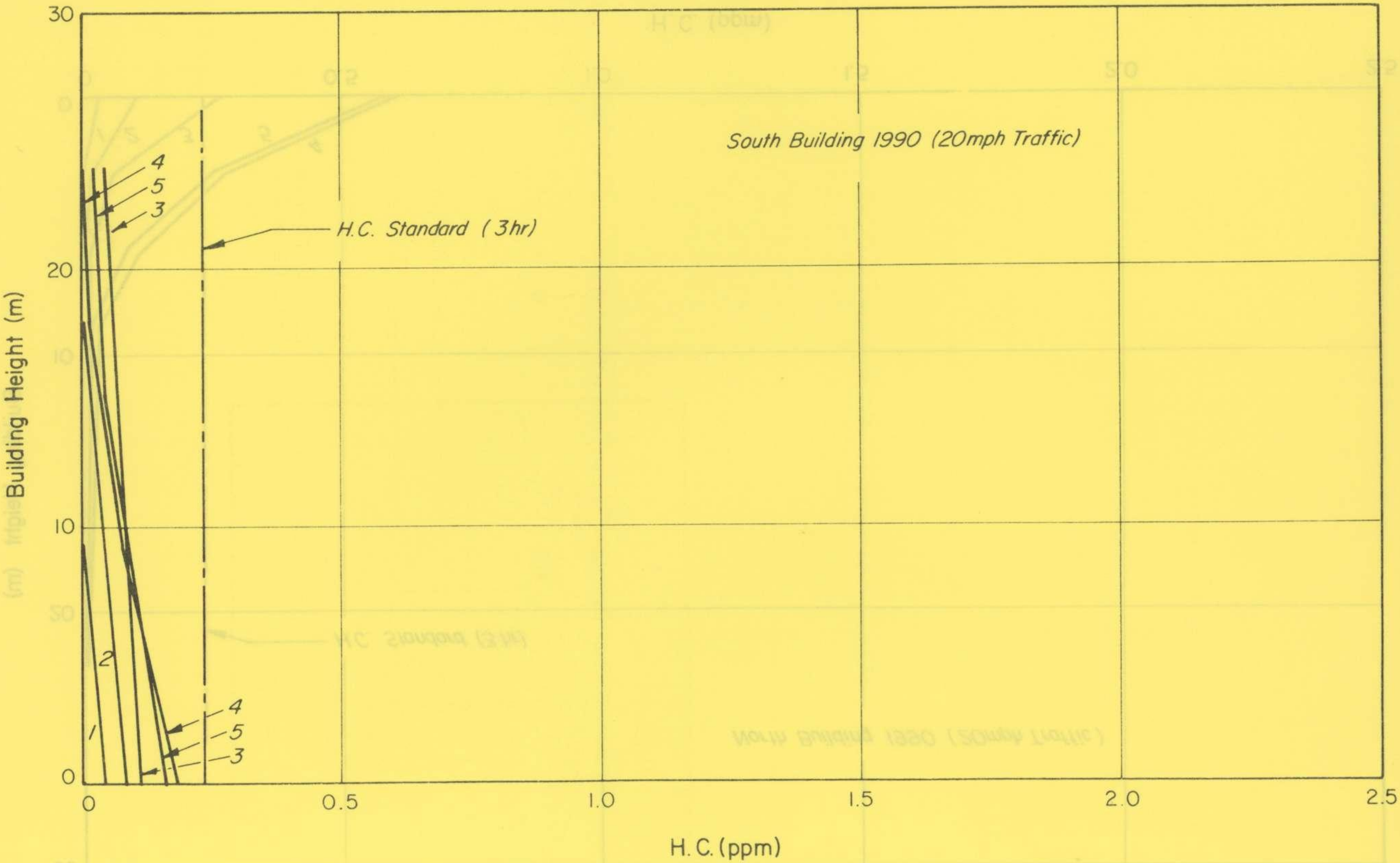

Figure 19 HC concentrations on South Tunnel building due to tunnel leakage, 20 mph traffic, 1990

The influence on air quality due to the stack emissions alone was examined for the worst possible wind directions, i.e., downwind, when the plume from one stack is eventually superimposed on the plume from the second stack, resulting in increased concentrations of pollutants. Downwind concentrations of CO, and HC, were computed for all atmospheric stabilities and various wind speed classes. Results are shown in Figures 20-24 for carbon monoxide, and in Figures 25-29 for hydrocarbons. The scale on the left is for 1975 concentrations and that on the right for 1990 concentrations. Levels of CO at any distance downwind from the stack remain well below the one-hour standard for both 1975 and 1990. Concentrations of HC do not exceed the 1-hour or 3-hour standards for stability classes 3, 4 and 5.

For stability 1 (very unstable) and wind speeds of 2 mph, the effective 1-hour HC standard is exceeded for 1975 at points approximately 0.3 km and 0.6 km downwind from the first stack. For wind speeds of 6 mph for stability 1 standards are barely exceeded in 1975 at distances of 0.2 km and 0.5 km. For stability 2 (unstable), and wind speeds of 2 mph, the 1975 concentration above equals the effective 1-hour standard (0.29 ppm) but is lower than the 3-hour standard, 0.24 ppm) at a point 0.7 km downwind from the stack.

3.4.3 Impact of Stack Emissions on Buildings in Vicinity of Center Leg of Inner Loop Freeway

There are several buildings in the vicinity of the freeway that extend to heights of 80 to 130 feet. Most of those buildings are to the west of the stacks that will be constructed above the tunnel. A specialized run of the diffusion model was run to determine the impact of the stacks at heights along the sides of the buildings for east and east-northeast winds (downwind from the stacks). In no case did the stack emissions cause CO or HC levels to exceed the standards on receptors "placed" on the buildings.

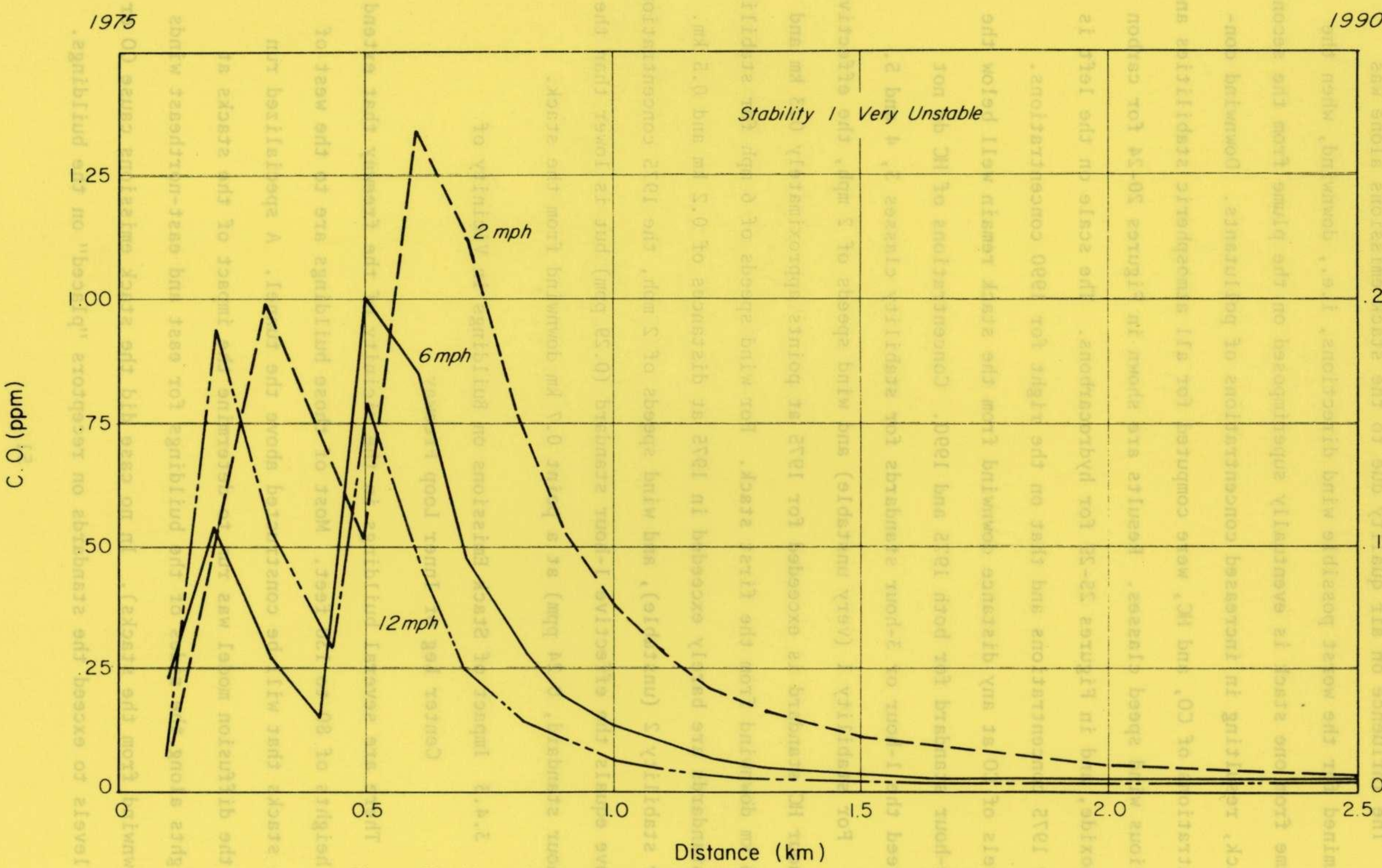

Figure 20 Downwind concentrations of CO (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 1 - very unstable

5197

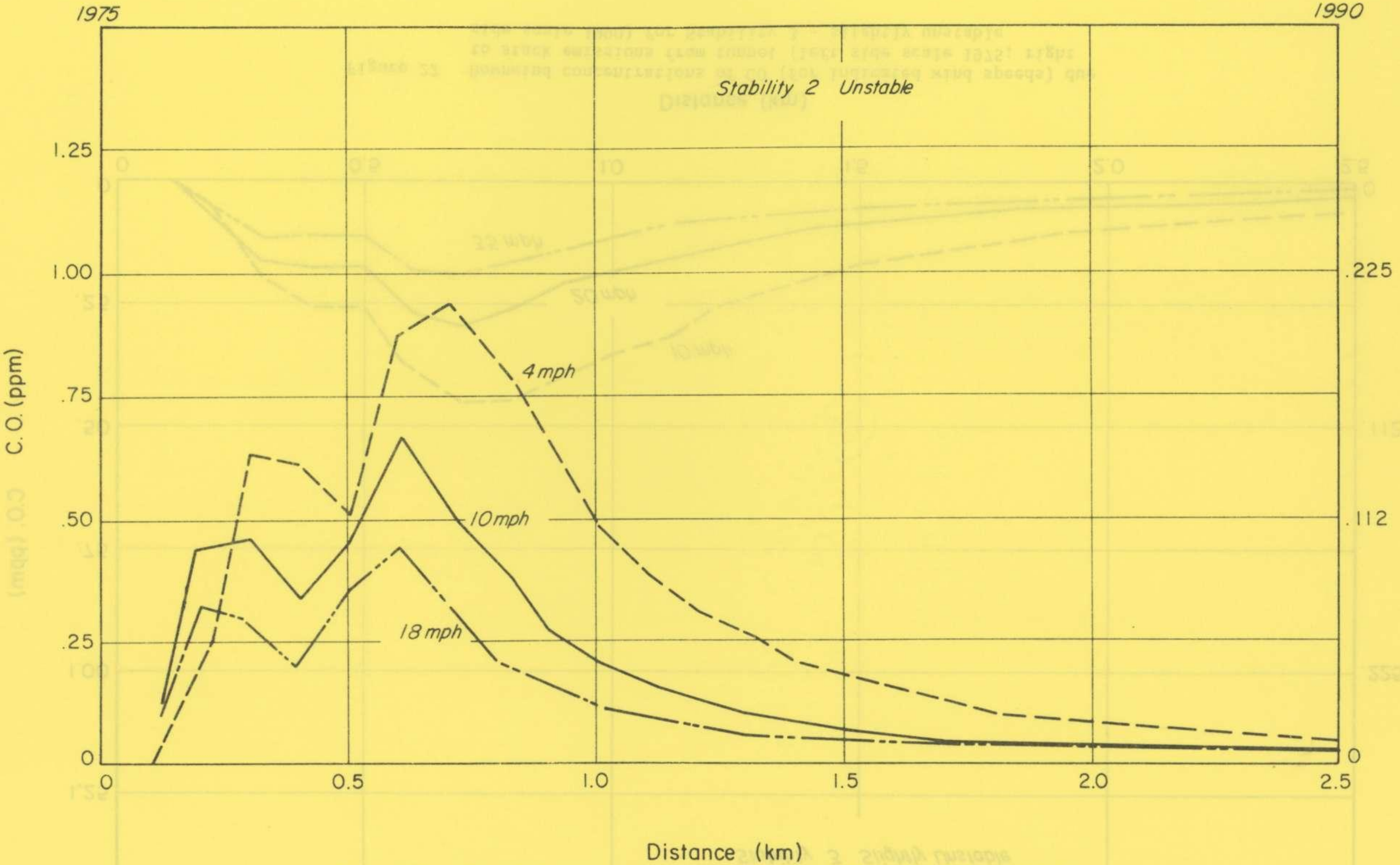

Figure 21 Downwind concentrations of CO (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 2 - Unstable

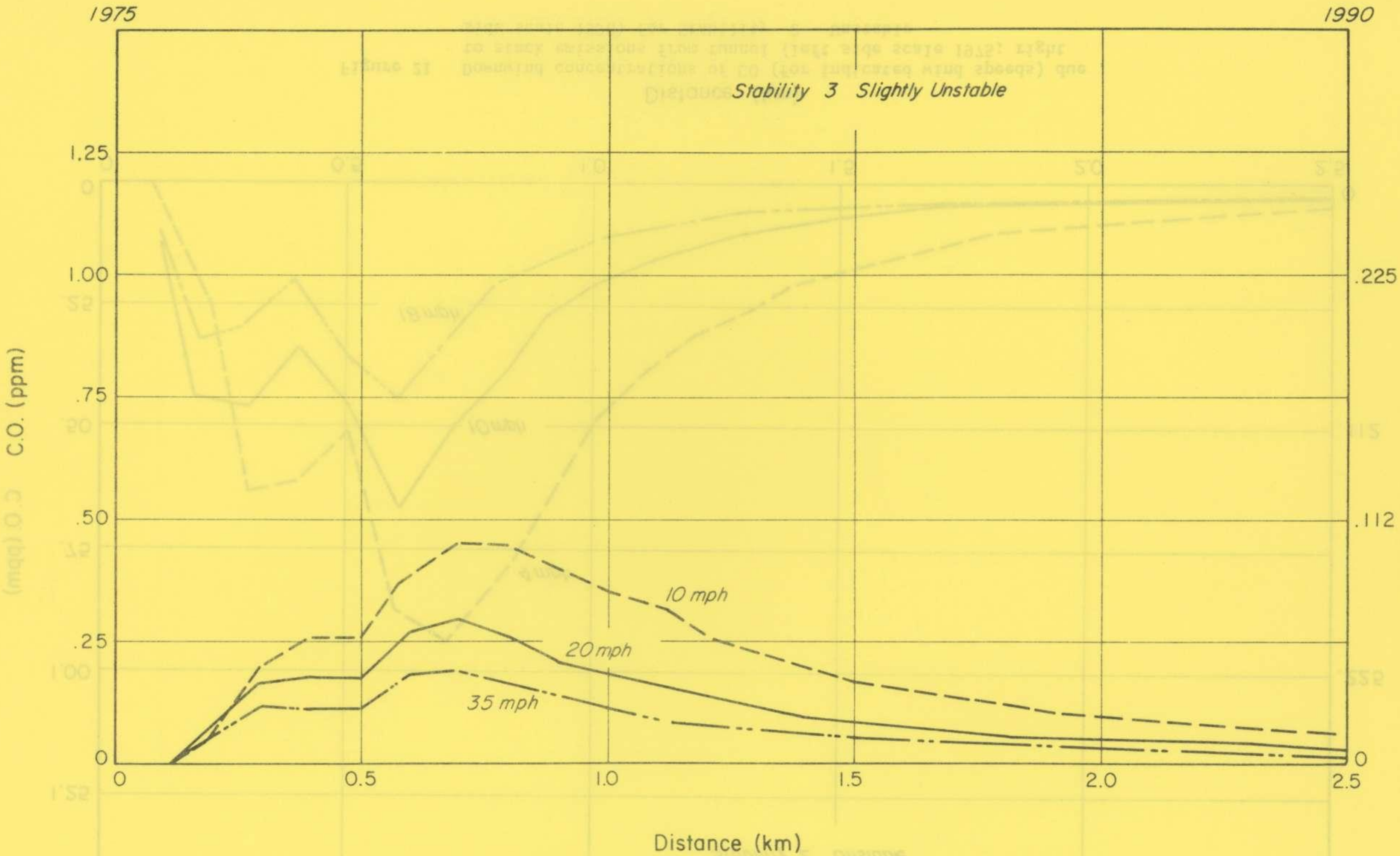

Figure 22 Downwind concentrations of CO (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 3 - slightly unstable

5199

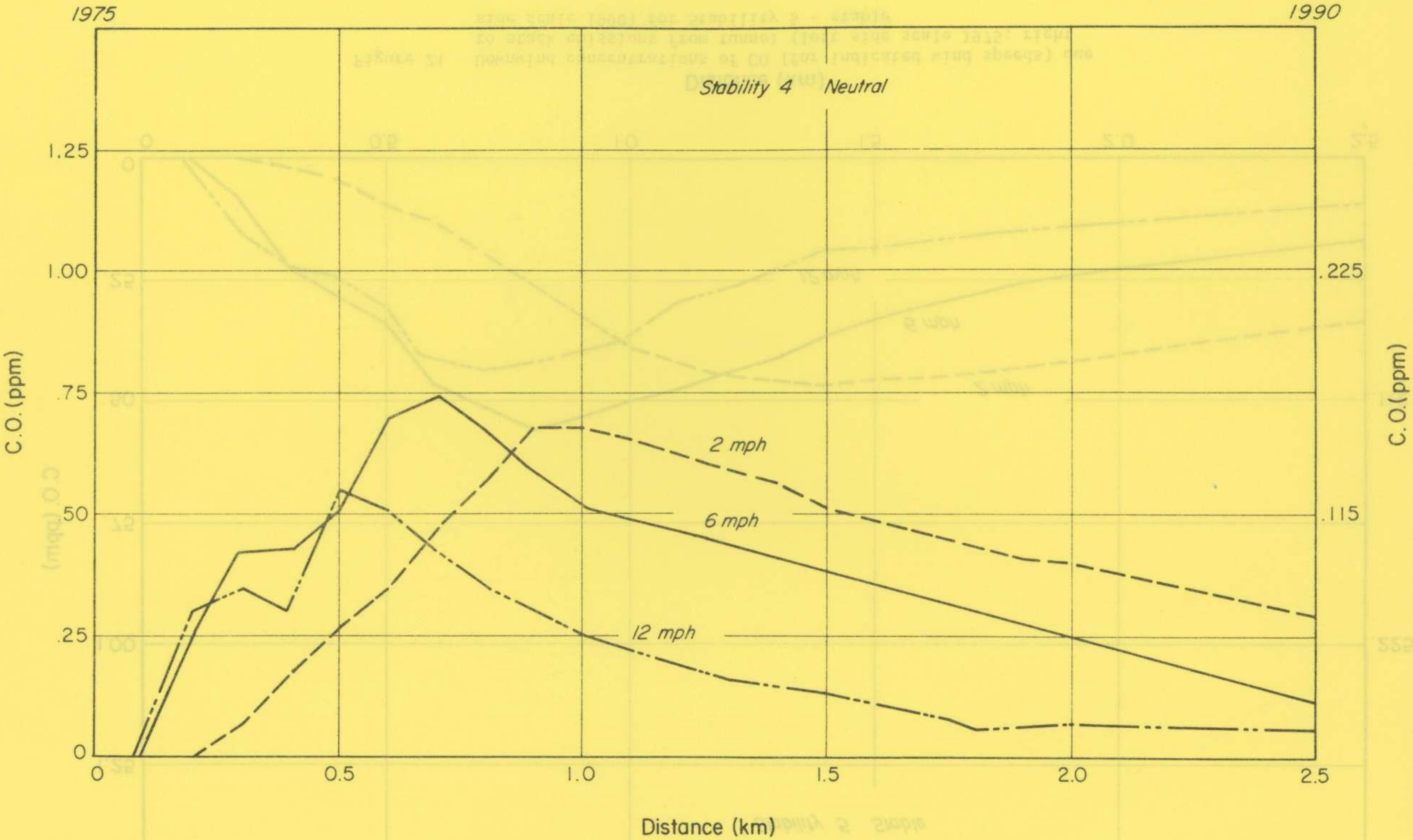

Figure 23 Downwind concentrations of CO (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 4 - neutral

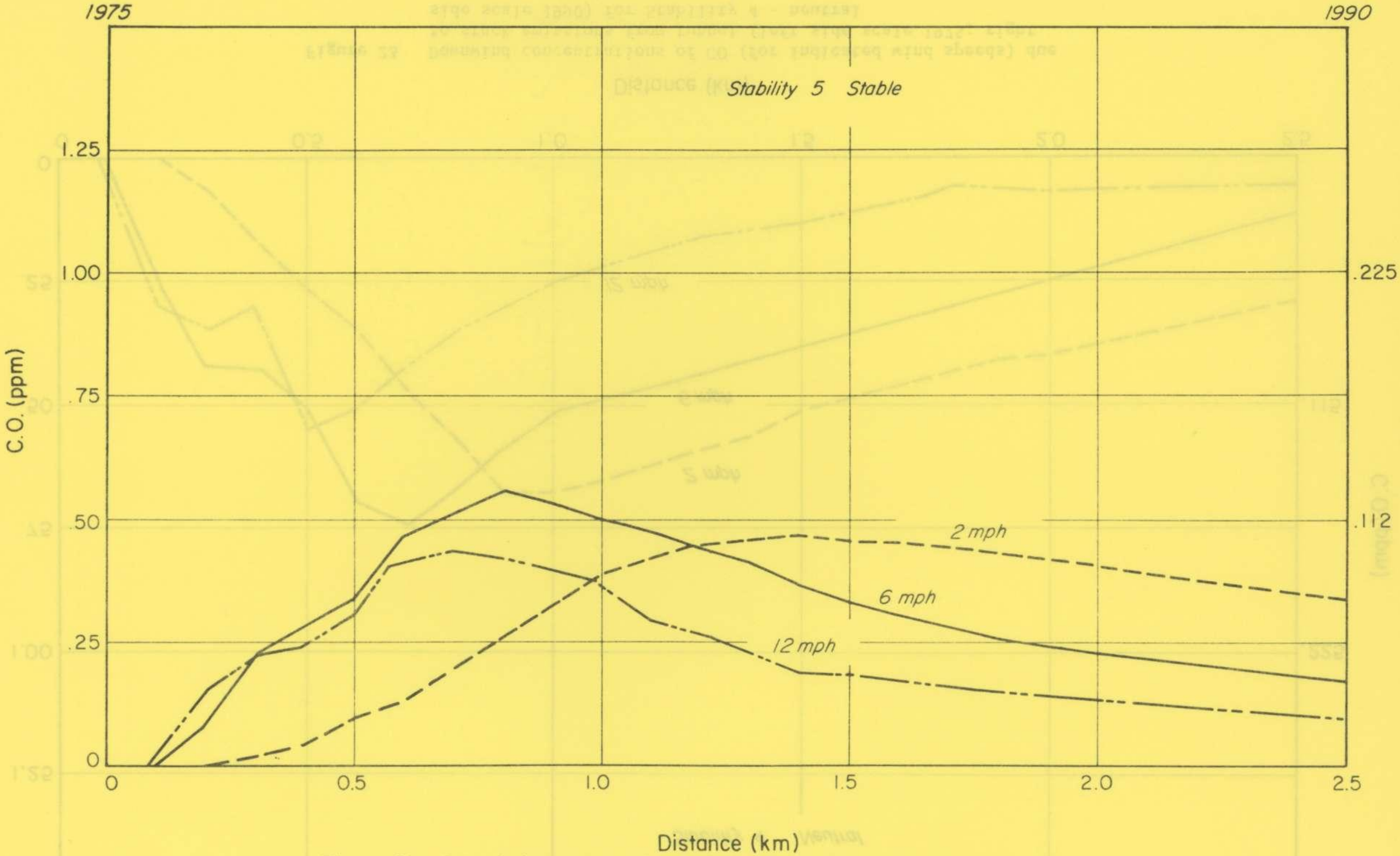

Figure 24 Downwind concentrations of CO (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 5 - stable

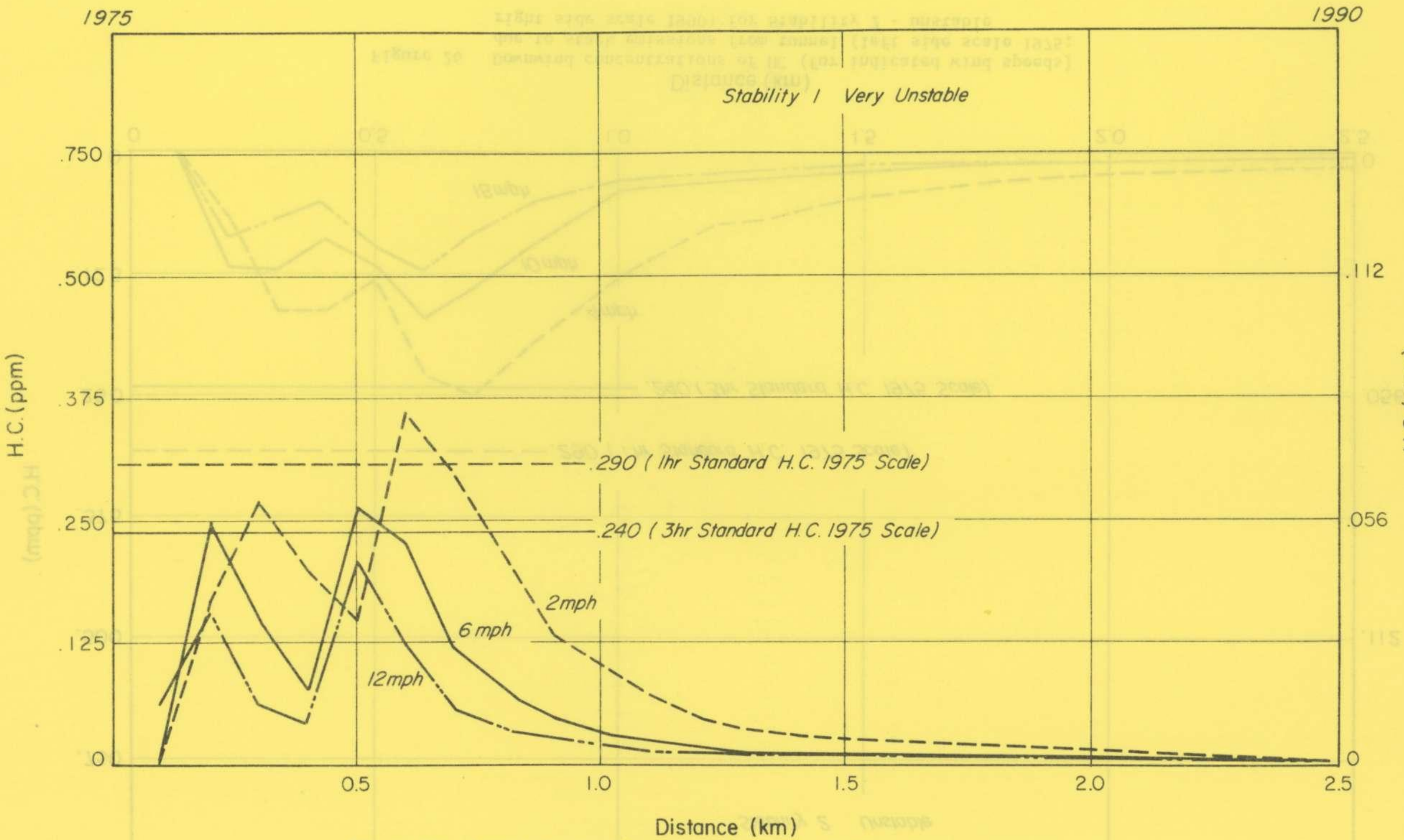

Figure 25 Downwind concentrations of HC (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 1 - very unstable

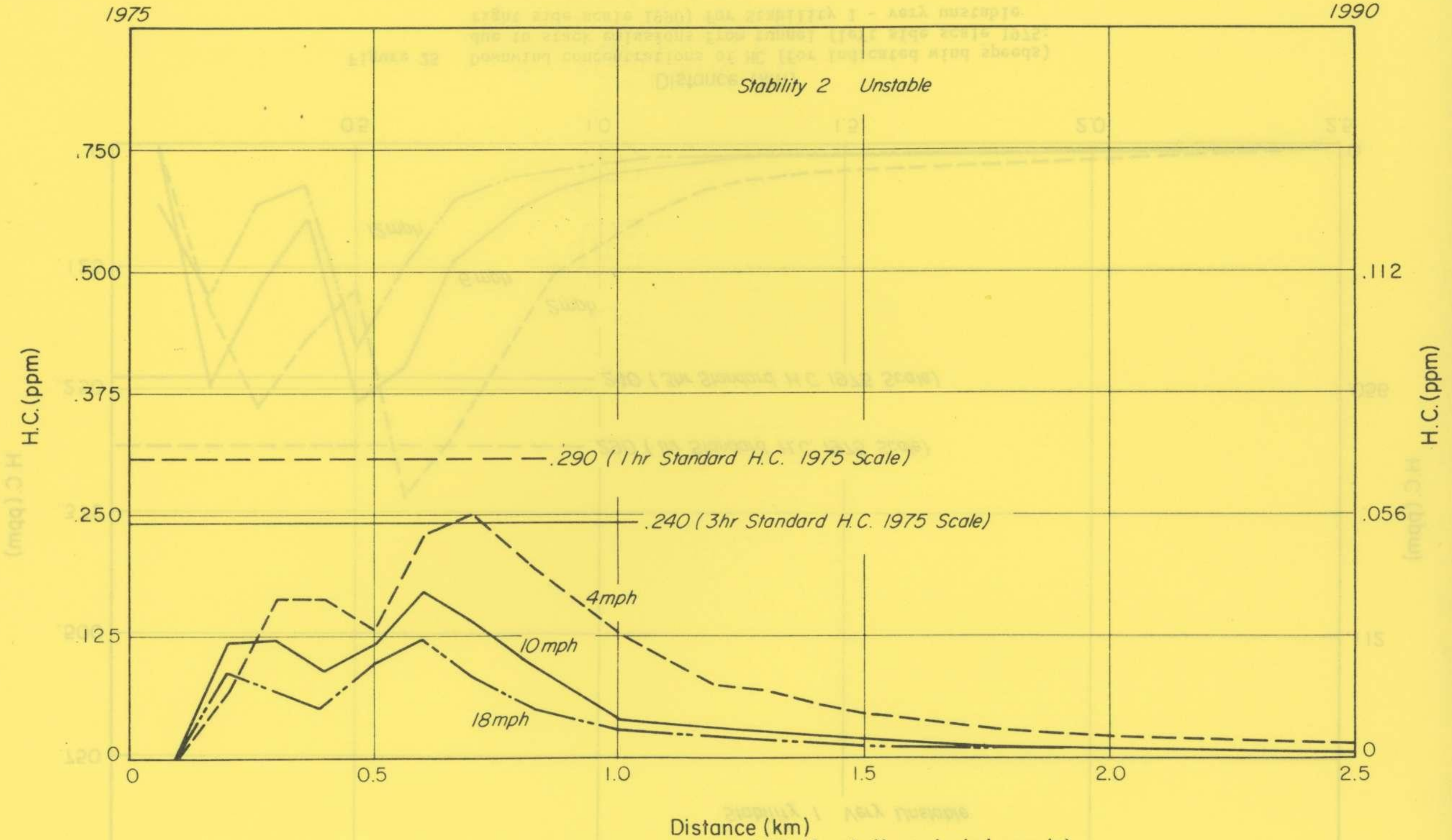

Figure 26 Downwind concentrations of HC (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 2 - unstable

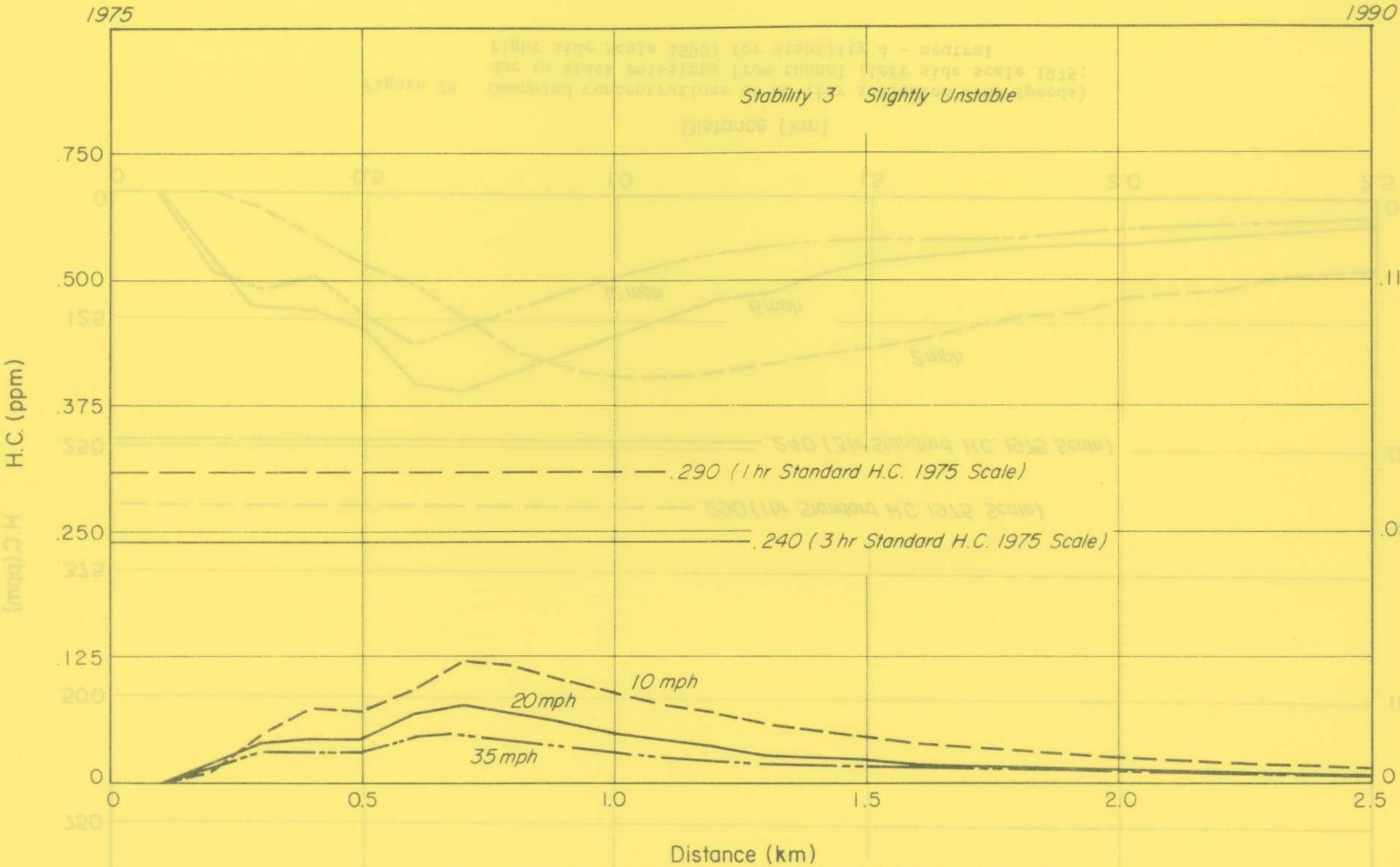

Figure 27 Downwind concentrations of HC (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 3 - slightly unstable

5204

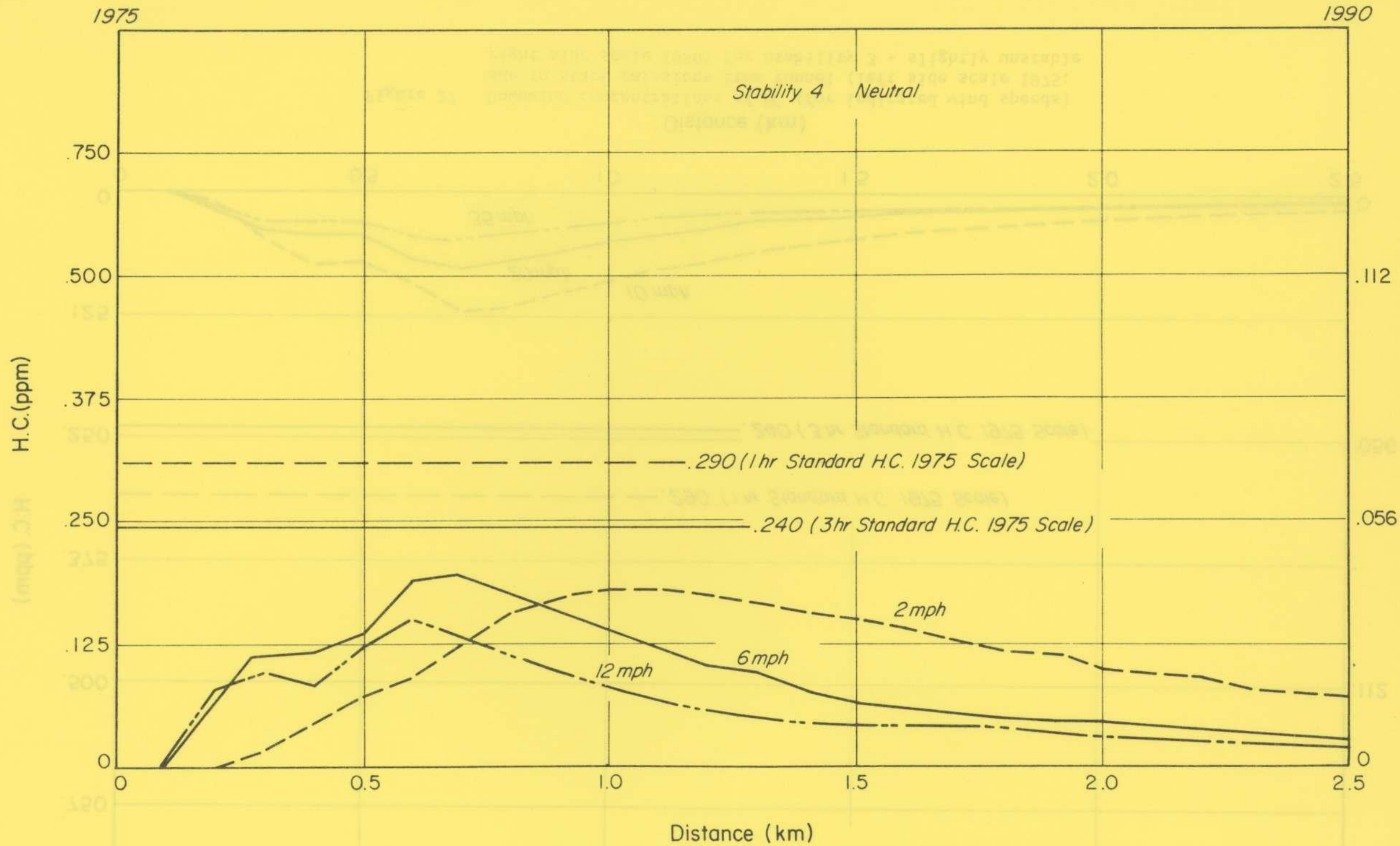

Figure 28 Downwind concentrations of HC (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 4 - neutral

5205

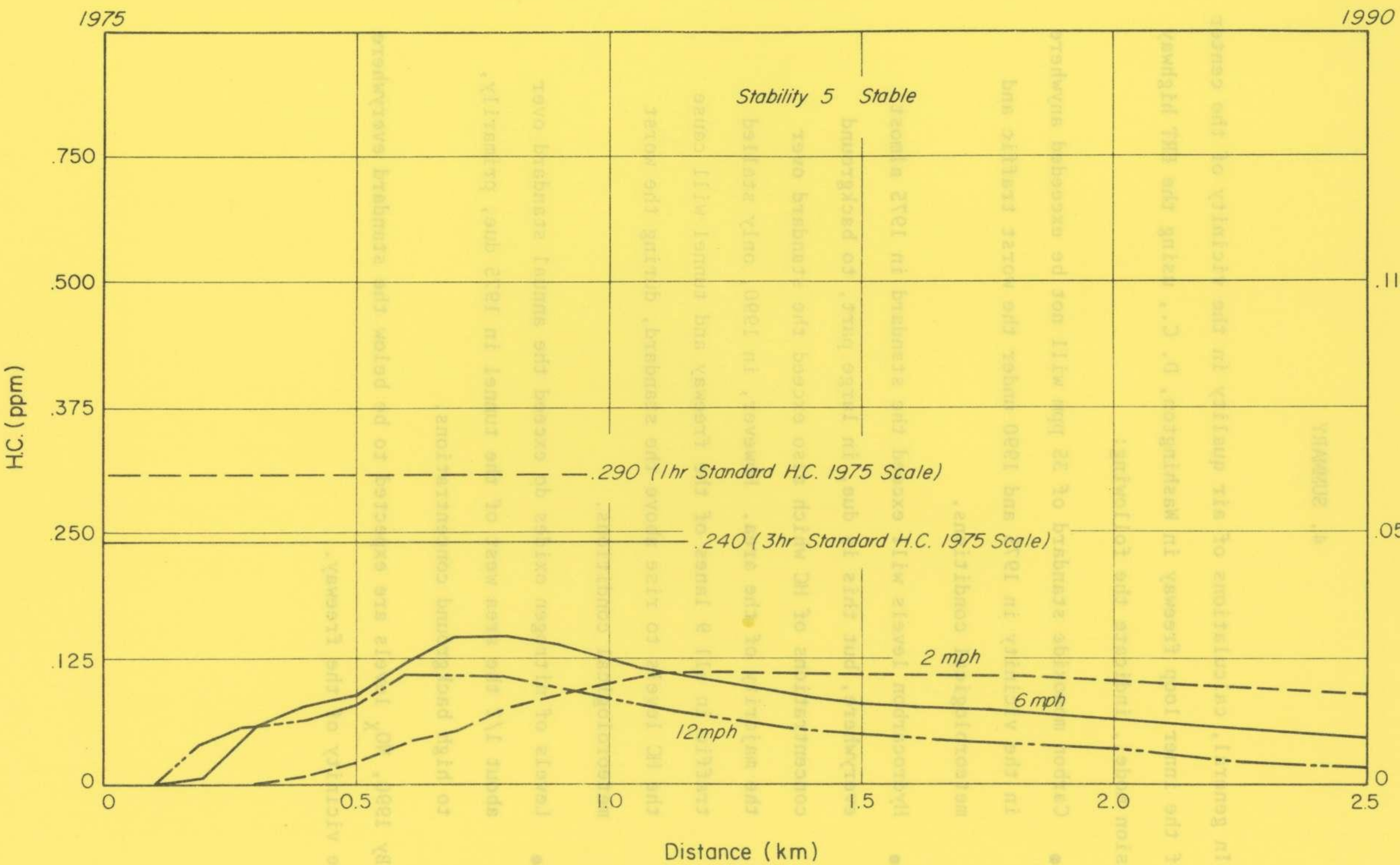

Figure 29 Downwind concentrations of HC (for indicated wind speeds) due to stack emissions from tunnel (left side scale 1975; right side scale 1990) for Stability 5 - stable

4. SUMMARY

In general, calculations of air quality in the vicinity of the center leg of the inner loop freeway in Washington, D. C., using the ERT highway diffusion model, indicate the following:

- Carbon monoxide standard of 35 ppm will not be exceeded anywhere in the vicinity in 1975 and 1990 under the worst traffic and meteorological conditions.
- Hydrocarbon levels will exceed the standard in 1975 almost everywhere, but this is due, in large part, to background concentrations of HC which also exceed the standard over the majority of the area. However, in 1990, only stalled traffic in all 9 lanes of the freeway and tunnel will cause the HC levels to rise above the standard, during the worst meteorological conditions.
- Levels of nitrogen oxides do exceed the annual standard over about 1/2 the area west of the tunnel in 1975 due, primarily, to high background concentrations.

By 1990, NO_X levels are expected to be below the standard everywhere in the vicinity of the freeway.

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APPENDIX A

DIFFUSION METEOROLOGY, NATIONAL AIR QUALITY STANDARDS

A.1 Diffusion Meteorology and Stability Statistics

The transport and diffusion of pollutants emitted into the ambient air from a given source are governed primarily by the dynamic and thermal structure of the atmospheric layer adjacent to the ground. The intensity of local turbulence and the general horizontal wind flow are responsible for dispersing the pollutants originating from a pollutant source region such as a road. Studies of the spatial and temporal distributions of pollutants must therefore take into account the statistics of several meteorological elements including wind speed, wind direction and the stability of the lower atmosphere (an indirect measure of turbulence).

For convenience, the stability of the lower atmosphere may be divided into three categories: unstable, neutral and stable.

Past field measurements and diffusion studies have shown that under stable (inversion) conditions, vertical motions are inhibited. Any pollutant emitted at the ground tends to stagnate and accumulate while effluents emitted within or above the inversion do not reach the ground and, therefore, do not contribute significantly to ground-level concentrations. These conditions occur primarily during clear nights with light wind speeds.

At the opposite end of the spectrum, unstable conditions tend to enhance vertical motions. The result is thorough mixing of the lower atmosphere and the enhancement of turbulence. These conditions cause rapid diffusion of any pollutant emitted into the atmosphere. They occur during the day and are characterized by strong solar heating and light to moderate wind speeds.

A third stability category called neutral, occurs during cloudy and/or windy conditions. These conditions are noted frequently and tend to cause good mixing and the generation of mechanical turbulence due to the wind interacting with tropographical features.

A.2 Effects of Large-Scale Meteorological Phenomena

The effects of large-scale atmospheric motions on pollutant concentrations in the vicinity of roadways are important to the micrometeorological effects described above. The intensity and direction of the wind field near the source region will be closely related to the intensity and direction of the general wind field as described on weather charts covering the general area. The stability of the atmosphere will be related to the stability of the air covering the entire region in which the road or other source of pollutants is located.

The Washington D.C. area is an area that is under the influence of prevailing westerly wind flow at midtropospheric levels. This results in translation of weather systems from west to east across the area. Under normal conditions there are relatively frequent changes of air masses brought about by the passage of storms and their associated cold frontal and warm frontal systems. These changes typically occur on the order of one to three times per week. Because of these large-scale phenomena, prolonged buildup of pollution levels is usually an infrequent occurrence. There are, however, occasional periods of air mass stagnation that occur most frequently during the fall that are usually associated with regional episodes. Because of the relatively infrequent occurrence of these episodes, the mean micrometeorological conditions are, in general, the most important elements in determining the average air quality in the vicinity of a roadway.

A.3 The National Ambient Air Quality Standards

The National Ambient Air Quality Standards for automotive-related pollutants are given in Table A-1. This table clearly illustrates that there are various time exposure periods associated with each of the pollutants. These exposure periods were determined by related health effects. For example, for carbon monoxide there are 1-hour and 8-hour standards whereas for oxides of nitrogen there is only an annual standard. Health effects studies have indicated that short-term exposures to high concentrations of CO have definite effects on the human body while similar acute exposure to oxides of nitrogen do not. The converse is apparently true for long-term exposure.

The specific time period, 6 to 9 AM., chosen for the hydrocarbon standard is related to the fact that the most important effects of hydrocarbons are their photochemical reaction with oxides of nitrogen. It has been found that the amount of photochemical smog produced during a day is directly related to the amount of hydrocarbons released during this period,

TABLE A-1

NATIONAL AMBIENT AIR QUALITY STANDARDS

(Protective of Human Health)

Pollutant	Level not to be exceeded
Carbon Monoxide	35 ppm (1-hour average)* 9 ppm (8-hour average)*
Hydrocarbons	0.24 ppm (6-9 AM average)**
Oxides of Nitrogen	0.05 ppm (annual average)

*Not to be exceeded more than once each year.

**Equivalent to one-hour average of 0.29 ppm.

and emissions released during other times of the day have no significant effect on the production of smog and other photochemical pollutants.

The adoption of these standards has been accompanied by an ongoing controversy concerning their applicability and validity. They have been largely criticized by the automotive and oil industries as being too stringent while environmental groups have countered that they are too lenient and are not based on sufficient health effects studies. It is not the intent of this study to question the validity of these standards. They have been adopted by the Environmental Protection Agency and are currently accepted as law. They are used in this study as guidelines to compare pollution levels predicted for the various road configurations.

A.4 The National Vehicular Emission Standards

Automobile exhaust has been known for some years to be a very large contributor to poor air quality on and near roads. In order to improve this situation, the federal government has promulgated emissions standards to reduce automobile emissions. All 1975 model automobiles sold in the United States are to be equipped with emission control devices to limit exhaust emissions of CO and hydrocarbons. Oxides of nitrogen emissions will be controlled in 1976 model vehicles.

Figures 1 and 2 in Section 2 of this report give some idea of the effect of the new standards on automobile emissions. Figure 1 illustrates the change in emissions expected from uncontrolled to controlled automobiles for carbon monoxide. If the standards are met, CO emissions will be reduced approximately by a factor of from 7 to 10 from the average pre-1968 model emissions to the post-1975 models at all speeds. Similarly, as shown in Figure 2, total hydrocarbons less methane will be reduced by a similar factor from the pre-1968 automobiles to the fully controlled vehicle after 1975. Nitrogen oxides, not shown graphically, are expected to be reduced by more than a factor of 10 for automobiles between the uncontrolled and controlled conditions.

Another interesting feature of these figures is the relationship between speed and emissions. For both carbon monoxide and hydrocarbons, and for both the pre-1968 and post-1975 emission curves, lower emission values per vehicle mile are measured at higher speeds than at lower speeds. In each case, differences by factors of two or three are indicated between emissions at 10 and 50 mph. For nitrogen oxides it is believed that the speed-emissions curve does not exhibit this variability but remains nearly constant over this speed range.

The emissions are expected to decrease as the effect of the interim and final emission standards for automotive vehicles takes effect. The 1968 standards have already begun to reduce emissions per vehicle on the average. Improvement will continue until all vehicles have controls. The improvement will not be complete until approximately 1990. Therefore, for any given year, one needs a set of emission factors for cars, trucks and diesels which represent the mix of controlled and uncontrolled automobiles on the highway.

APPENDIX B

EFFECTS OF AUTOMOTIVE POLLUTANTS ON SPECIFIC RECEPTORS

The pollutants of primary concern associated with the automobile, consist of carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO_X), and oxidants. In general, we are concerned with the effects of these pollutants on human health, vegetation, materials, weather modification, visibility and aesthetic considerations. However, each of these categories of receptors has different (and frequently non-determinable) susceptibility and sensitivity to the different pollutants.

B.1 Carbon Monoxide

The only effect of CO is on human health; concentrations of 115 mg/m^3 (100 ppm) cause practically no effects on higher forms of plant life. Its primary effect is the formation of carboxyhemoglobin (COHb) which reduces the capacity of the blood to transport oxygen from the lungs to the tissues of the body. A 2% COHb level can result in the impairment of time interval discrimination in normal persons. This level is achieved in a sedentary person through exposure over an 8-hour period to 12 mg/m^3 (milligrams per cubic meter) or 10 ppm (parts per million). At a 5% COHb level, a normal person experiences impaired performance on psychomotor tests and visual discrimination. This level is achieved in non-smokers upon exposures to 35 mg/m^3 for 8-12 hours. By comparison, cigarette smokers may have carboxyhemoglobin levels as high as 8%. At concentrations of slightly more than 1000 ppm, CO kills quickly. Most people experience dizziness, headache, lassitude, and other symptoms at approximately 100 ppm, a level which is generally considered the upper limit of safety in industry for healthy persons when exposure may continue for an 8-hour period.

In addition, highly active persons, young persons, elderly persons, and persons with preexisting illnesses are considered to be much more highly susceptible to the effects of exposures to pollutants and may be classed as high risk or critical receptors. A summary of the more significant effects of carbon monoxide is given in Table B-1.

B.2 Hydrocarbons

No direct effect on human health is attributable to hydrocarbons at usual ambient atmospheric concentrations. Hydrocarbons are, however, directly hazardous to vegetation. Of the constituents of gaseous hydrocarbons, ethylene represents one of the greatest hazards to vegetation since it is phytotoxic and contributes to the formation of photochemical air pollution. At low concentrations, the principal effect of ethylene is to inhibit the growth of plants. However, injury to sensitive plants has been reported after exposure to ethylene concentrations of 1.15 to 575 micrograms per cubic meter (.001 to 0.5 ppm) for an 8 to 24 hour time period. Studies of the effects of ambient air concentrations of gaseous hydrocarbons have not demonstrated direct adverse effects on human health. However, it has been demonstrated that ambient levels of photochemical oxidants (which do have adverse effects on health as well as vegetation) are a direct function of gaseous hydrocarbon concentrations. Consequently, the ambient air quality standard for hydrocarbons is primarily based on inhibiting the formation of such oxidants.

B.3 Nitrogen Oxides

Nitrogen oxides are major participants in photochemical reactions. The most significant of these is nitrogen dioxide (NO_2). Nitrogen dioxide is a yellow-brown gas which significantly reduces visibility in high concentrations and is also known to be toxic to man at high concentrations. Nitrogen dioxide also adversely affects vegetation when exposed at high concentrations. However, the main concern for NO_2 is its participation with hydrocarbons to produce photochemical oxidants, primarily peroxyacetyl nitrate (PAN) and ozone (O_3) both of which are highly phytotoxic to vegetation. In addition, ozone and other oxidants are known to have highly damaging effects on materials such as rubber, textiles, and dyes.

TABLE B-1

EFFECTS OF CARBON MONOXIDE

Environmental conditions	Effect	Comment	Reference
35 mg/m^3 (30 ppm) for up to 12 hours	Equilibrium value of 5 percent blood COHb is reached in 8 to 12 hours; 80 percent of this equilibrium value, (4 percent COHb) is reached within 4 hours.	Experimental exposure of nonsmokers. Theoretical calculations suggest exposure to 23 (20 ppm) and 12 mg/m^3 (10 ppm) would result in COHb levels of about 3.7 and 2 percent, respectively, if exposure was continuous for 8 or more hours.	Smith
58 mg/m^3 (50 ppm) for 90 minutes	Impairment of time-interval discrimination in nonsmokers.	Blood COHb levels not available, but anticipated to be about 2.5 percent. Similar blood COHb levels expected from exposure to 10 to 17 mg/m^3 (10 to 15 ppm) for 8 or more hours.	Beard and Wertheim
115 mg/m^3 (100 ppm) intermittently through a facial mask	Impairment in performance of some psychomotor tests at a COHb level of 5 percent.	Similar results may have been observed at lower COHb levels, but blood measurements were not accurate.	Schulte
High concentrations of CO were administered for 30 to 120 seconds, and then 10 minutes was allowed for washout of alveolar CO before blood COHb was measured.	Exposure sufficient to produce blood COHb levels above 5 percent has been shown to place a physiologic stress on patients with heart disease.	Data rely on COHb levels produced rapidly after short exposure to high levels of CO; this is not necessarily comparable to exposure over a longer time period or under equilibrium conditions.	Ayres et al.

Reference: Air Quality Criteria for Carbon Monoxide, NAPCA Publication No. AP-62

APPENDIX II

L. S. GOODFRIEND & ASSOCIATES
Consulting Engineers in Acoustics

Project No. 2303B

NOISE POLLUTION SECTIONS

WASHINGTON AIR RIGHTS TUNNEL

ENVIRONMENTAL IMPACT STATEMENT

Prepared for:

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New York, New York 10022

24 May 1972

1.00 Description of the Project and Surroundings

1.20 Ambient Noise Levels

The existing ambient noise levels were measured at the proposed site on 19 and 20 April 1972, throughout the daytime and nighttime hours. The areas proposed for construction were characterized by a steady-state ambient noise environment. Due to the relative uniformity of the ambient sound, it was determined that two measurement locations and six measurement periods were sufficient to document ambient noise levels.

Approximately half of the proposed site had been torn down at the time of the measurements, as had much of the adjacent area. Massachusetts Avenue and Third Street were both heavily traveled.

The ambient noise levels which are characteristic of the area bounded by "H," "I," and 2nd and 3rd Streets, are:

Period of Day	Noise Level (dBA)
Late Morning	52
Evening Rush Hour	55-56
Late Evening	49-50
Night	44-45

The measurement locations and a composite of the octave band ambient noise levels are shown in Figures 1 and 2, respectively.

2.00 The Probable Impact of the Project Related to the Construction and Efforts to Minimize Effects

2.08 Ambient Noise Levels

In figure 3, various types of roadway construction equipment are categorized and presented with characteristic noise levels at a distance of 50 feet[1].

The minimum decrease in sound intensity is proportional to the inverse square of the distance from the noise source or six decibels for each doubling of distance. Shielding from buildings around the site would further decrease the sound intensity. From Figure 3, it can be seen, that excluding conventional pile drivers, 95 dBA at 50 feet would be an estimate of maximum construction noise. Pile driver noise is of an impulsive nature and cannot be evaluated in the same manner as other construction equipment noise. Using the levels given in Figure 3, while assuming no barrier effect due to existing buildings, the bounds of significant construction noise impact[2], and the distance at which the construction noise levels equal the ambient, were determined and are presented in Figure 4.

The level of exposure and degree of impact, due to noise from the construction site, depend upon the distance of a listener from the site. The impact due to construction activity for the residences in the vicinity of the site, is given in the following table[1].

Distance from Source (feet)	Average Noise Level (dBA)	Speech Interference	Sleep Interference	Hearing Damage Risk
100	74	Severe	Severe	Slight
200	63	Severe	Moderate	None
300	60	Moderate	Moderate	None
400	57	Moderate	Moderate	None
600	54	Moderate	Moderate	None
800	51	Slight	Moderate	None

It is assumed that any pile driving at night, would involve the use of relatively quiet, ultrasonic drivers, If conventional pile drivers are used during the daytime, the noise they produce should have an insignificant impact on speech interference at the distances given in the table.

3.00 The Probable Impact of the Project Related to the Use of the Highway Sections and Efforts to Minimize Effects

3.11 Ambient Noise Levels

A. Traffic Noise

A technique for the prediction of noise levels due to highways, has been presented in the National Cooperative Highway Research Program[1]. This method was adapted to a computer program by the Michigan Department of State Highways. The effect of all parameters significant to highway noise, including traffic flow, speed, mix, roadway elevation type, grade, etc., are accounted for in the program. This computer technique was utilized for the noise level estimates which follow.

The noise level estimates are given in A-weighted decibels because the "dBA" level is regarded as "statistically indistinguishable from the best psychological derived measures in its reliability as a predictor of human response to traffic noise[4]." The levels of highway noise fluctuate with time, requiring that statistical techniques be employed. The noise level predictions which follow are present in terms of the 50 percent level (L_{50}), or the statistical mean level. A second important point on the "statistical time distribution" curve of the noise levels is the 10 percent level (L_{10}), defined as that level exceeded 10 percent of the time. For highway noise L_{10} level ranges from three to five decibels above the L_{50} level.

The expected L_{50} noise levels, due to traffic flow at a predicted average daily traffic (ADT) of 31,000, the 1975 condition, for rush hour conditions (10 percent of ADT) are shown in Figures 5 and 6. The figures present two contours where the expected highway noise levels are equal to, and are five decibels below, the ambient conditions. The ambient noise levels will be raised three decibels where the highway noise equals the ambient, and will not be raised when the highway noise levels are five decibels below the normal ambient. Inside the outer contour, contours of equal noise level are presented in three decibel increments. The L_{10} contours may be obtained by adding four decibels to the presented L_{50} contours. The presented contour for the expected 1975 rush hour conditions: 10 percent ADT, 0 to five percent truck traffic, can be extended to other times of day, variations in the ADT, or various truck traffic by using the contour adjustments of Tables I through III. The shape of the contours will remain the same. The predicted level for the new conditions is obtained by adding the appropriate adjustment to the contour of Figures 5 and 6.

The A-weighted noise level contours shown, do not account for the shielding due to the presence of buildings or structures between the roadway and the observer. A value of three to five dBA per row of houses may be used as typical of this shield. This attenuation should not exceed a maximum of 10 dBA, and should be applied only in cases where no direct line-of-sight exists between observer and source.

The tunnel-depressed roadway significantly lowers the traffic noise levels of the adjacent areas. By covering a major portion of the roadway, the tunnel provides an acoustical barrier to a major portion of the noise generated by the expressway traffic. The dotted lines on Figures 5 and 6, indicate the extent of the traffic noise contours if the roadway were not covered. The extended contours show that the area of significant acoustical impact between New York Avenue and Pennsylvania Avenue is reduced by approximately one-half by the inclusion of the tunnel.

The noise radiated from the tunnel portal was predicted by analyzing the tunnel noise as being radiated by a point source equal in power to the total sound power at the portal of an assumed 80 dBA level within the tunnel. (Tunnel levels of 70 to 80 dBA are typical.) It was found that the effect of the noise exiting the tunnel was small, not exceeding the noise levels generated by the open portion of the highway by one decibel at any position.

The roadway is depressed from ground level as it leaves the tunnel portal. This type of structure acts to some degree, as an acoustical barrier between the roadway traffic noise and the adjacent area. The degree of attenuation is approximately seven dBA in the area adjacent to the exit. It is beyond practicality to achieve further noise reduction by extending the depressed area, as this would necessarily increase the roadway grade. Above ground level barriers would be both structurally and aesthetically impractical. The only method seen as providing additional reduction in the noise levels of the traffic radiating into the adjacent area, would be the extension of the tunnel north to New York Avenue and south to the mall tunnel covering the entire roadway area.

B. Tunnel Ventilation Noise

The enclosures and air inlets and outlets of the tunnel ventilation systems are being designed to effectively control ventilation noise levels. The criteria call for exterior levels in the nearest recreational areas to be five dBA below the ambient. Such levels will not raise the ambient. The systems are also being designed to assure interior levels in adjacent housing units that do not exceed NC-35. This meets recommended FHA criteria[5].

4.00 Probable Adverse Environmental Effects Which Cannot Be Avoided Should the Proposed Project Be Implemented

4.02 Noise Pollution

An assessment of traffic noise impact must use a criterion based on subjective human responses to noise. The parameters upon which this response directly depend are:

1. The relation of highway noise to the ambient.
2. Task interference as associated with speech, sleep, learning, and other activites.
3. General annoyance.

A procedure has been developed[3] which, using these parameters, evaluates the impact due to noise for particular land use area. The assessment is made by classification of the noise impact as being of:

1. no impact
2. some impact
3. great impact

This technique was found to be within reasonable agreement of other published methods[2].

The recommended design criteria for outside noise levels for residential areas are[3]:

	L_{50} (dBA) Day	L_{50} (dBA) Night	L_{10} (dBA) Day	L_{10} (dBA) Night
Maximum Permissible Level	50	45	56	51

Utilizing the technique of reference 3, and this criterion, the impact due to noise are shown by areas in Figures 7 and 8, for the 1975 condition. Two points should be emphasized:

1. The impact evaluation includes the noise contribution of Massachusetts Avenue and New York Avenue, where the Expressway noise is also significant.
2. The impact evaluation, based on the contours of Section 3.11, does not include shielding effected of other buildings between the Expressway and the receiver. This is seen to result in a highly "conservative" estimate.

The conditions shown are for daytime L_{50} levels. These conditions control the impact boundary over nighttime or L_{10} conditions.

6.00 The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity

6.08 Foreseen Long-term Changes in Ambient Noise Levels

A. Traffic Noise

Long-range predictions were made of projected Expressway noise levels for 1990 traffic conditions, based on a City Council plan. The computer technique used for prediction of traffic noise levels was presented in Section 3.11.

In Figures 9 and 10, the contours of A-weighted noise levels due to Expressway traffic in 1990, are presented for rush hour conditions: 10 percent, one to five percent truck mix. The contours can be corrected for time of day, change in truck mix and change in ADT, by use of Tables I, II, and IV, respectively. The L_{10} levels are found by adding four dBA to the L_{50} contours.

The criterion for assessment of noise impact was presented in Section 4.02.1. Using this criterion for residential land use, the areas of no, some, and great impact for 1990 conditions, are presented in Figures 10 and 11.

B. Tunnel Ventilation Noise

With proper maintenance, the noise levels produced by the tunnel ventilation equipment should not significantly increase with time. Likewise, the means used to attenuate the ventilation noise should remain effective for an extended period beyond 1990. With the ambient due to other sources increasing, the long-range acoustical impact of the ventilation equipment should be negligible.

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TABLE I

CONTOUR ADJUSTMENT FOR EXPECTED TIME OF DAY FLOW CONDITIONS

Time of Day	Expected Percent Weekly ADT	Contour Adjustment (dBA)
12 a.m. - 1 p.m.	4.5	-5.5
1 - 2	4.6	-5.5
2 - 3	5.1	-5.0
3 - 4	6.8	-3.0
4 - 5	8.5	-1.5
5 - 6	7.5	-2.5
6 - 7	5.3	-5.0
7 - 8	4.2	-6.0
8 - 9	3.1	-7.0
9 - 10	2.9	-7.0
10 - 11	3.0	-7.0
11 - 12	2.6	-8.0
12 p.m. - 1 a.m.	1.5	-11.5
1 - 2	0.8	-15
2 - 3	0.4	-21
3 - 4	0.3	-23
4 - 5	0.4	-21
5 - 6	1.5	-11.5
6 - 7	6.1	-4.0
7 - 8	10.1	0
8 - 9	8.2	-2
9 - 10	5.3	-5.0
10 - 11	4.1	-6.0
11 - 12	4.4	-5.5

TABLE II

CHANGE DUE TO TRUCK MIX
REFERENCE MIX ONE PERCENT

Mix	Change in dBA re One Percent Mix
0 to 5%	0 dBA
15%	+3 dBA
25%	+6 dBA

TABLE III

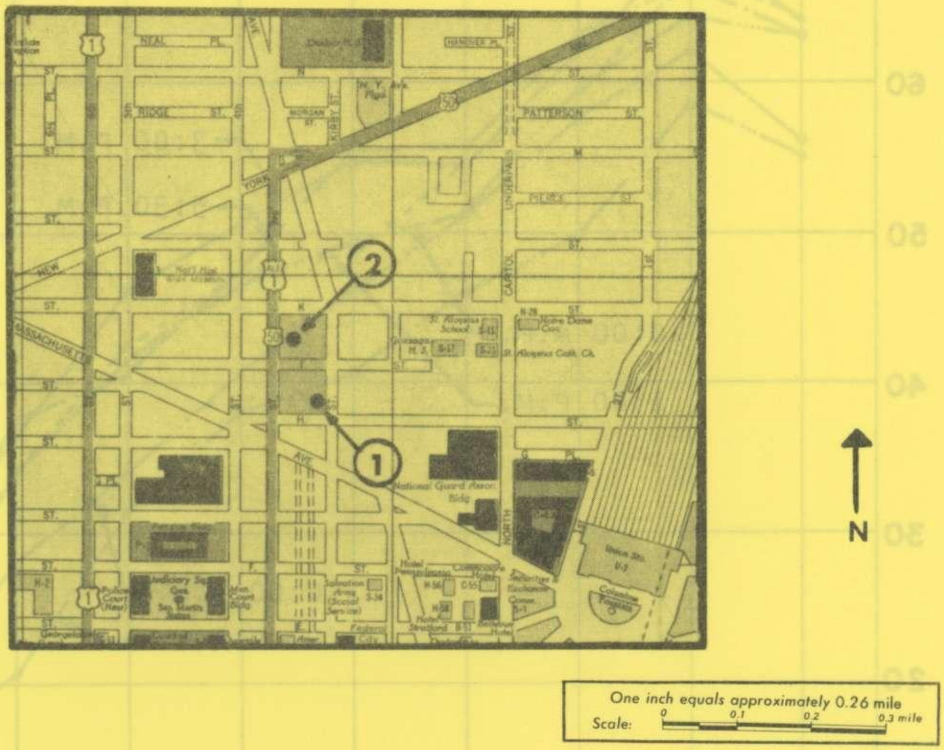
IF, FROM THE PREDICTED 31,000 FOR 1975 THERE IS A CHANGE IN THE ADT, THE PREDICTED NOISE LEVEL MAY BE FOUND

New ADT	Change in L_{50}
140,000	+11
100,000	+9
75,000	+7
55,000	+5
35,000	+1
25,000	-1
10,000	-5

TABLE IV

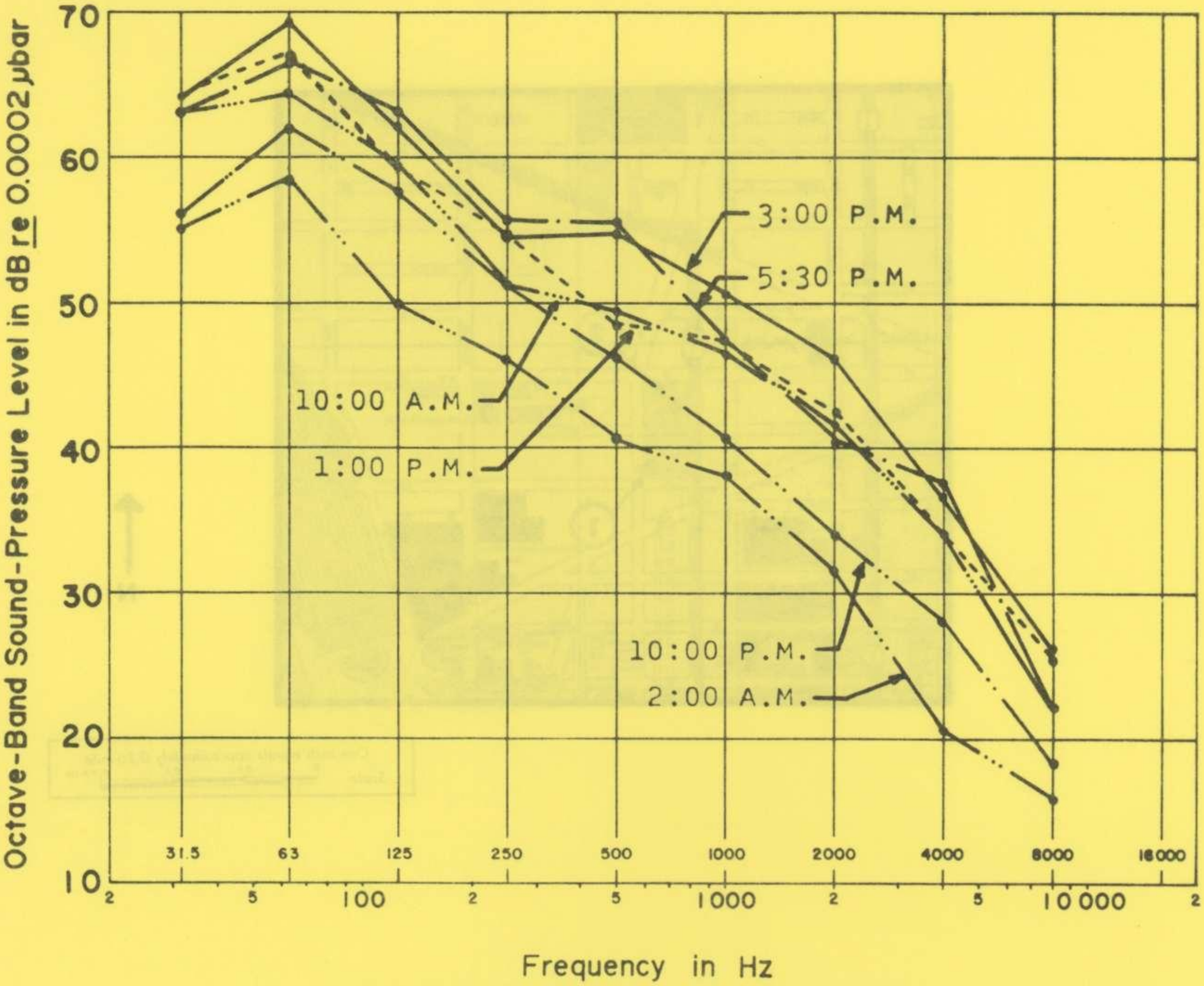
IF, FROM THE PREDICTED 45,000 FOR 1990 THERE IS A CHANGE IN THE ADT, THE PREDICTED NOISE LEVEL MAY BE FOUND

New ADT	Change in L_{50}
140,000	+8
100,000	+6
75,000	+4
55,000	+2
35,000	-2
25,000	-4
10,000	-8



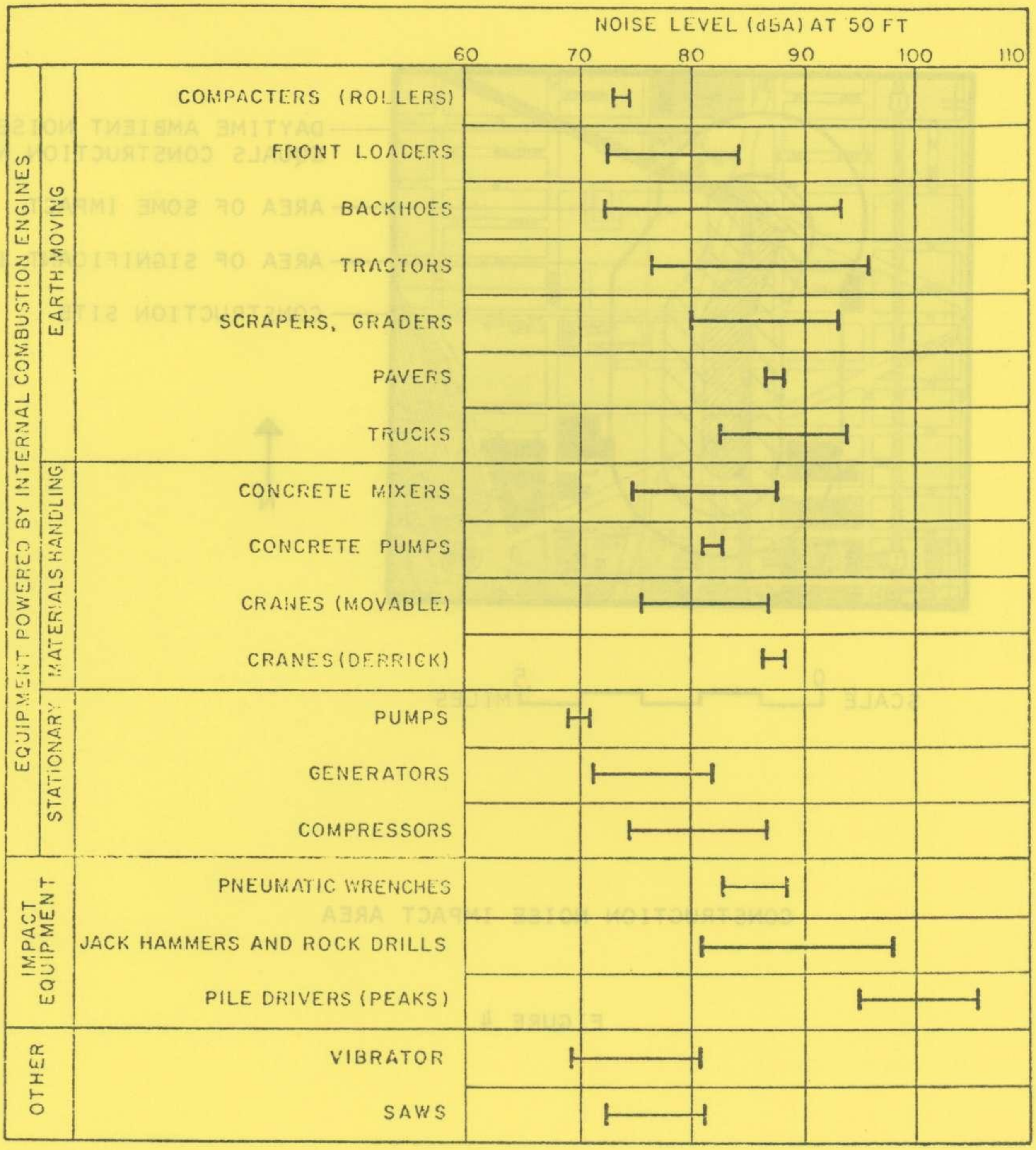
MEASUREMENT LOCATIONS 1 AND 2 FOR AMBIENT NOISE MEASUREMENTS OF 29-30 APRIL 1971, IN WASHINGTON, D.C. AT THE SITE OF THE PROPOSED AIR RIGHTS BUILDINGS.

FIGURE 1



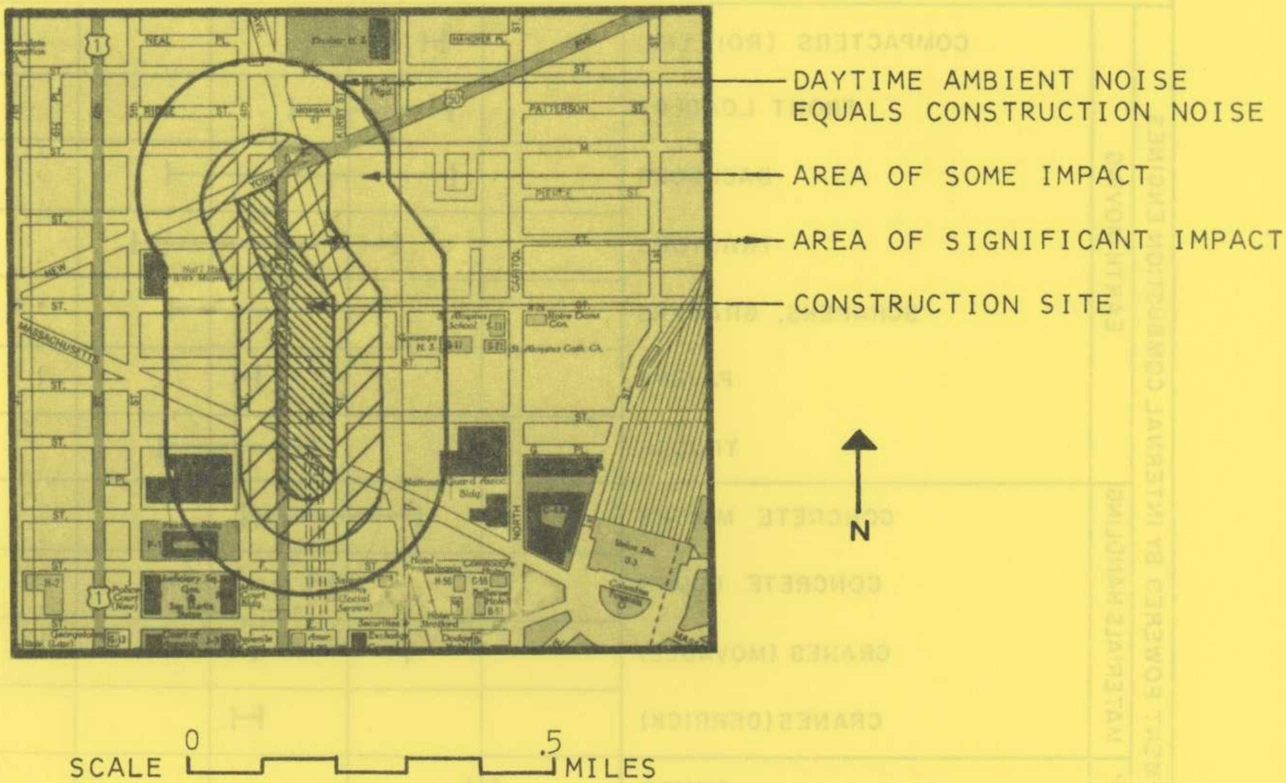
COMPOSITE OF AMBIENT NOISE LEVELS AT THE SITE OF THE PROPOSED AIR RIGHTS BUILDINGS IN WASHINGTON, D. C., MEASURED 29-30 APRIL 1971.

FIGURE 2



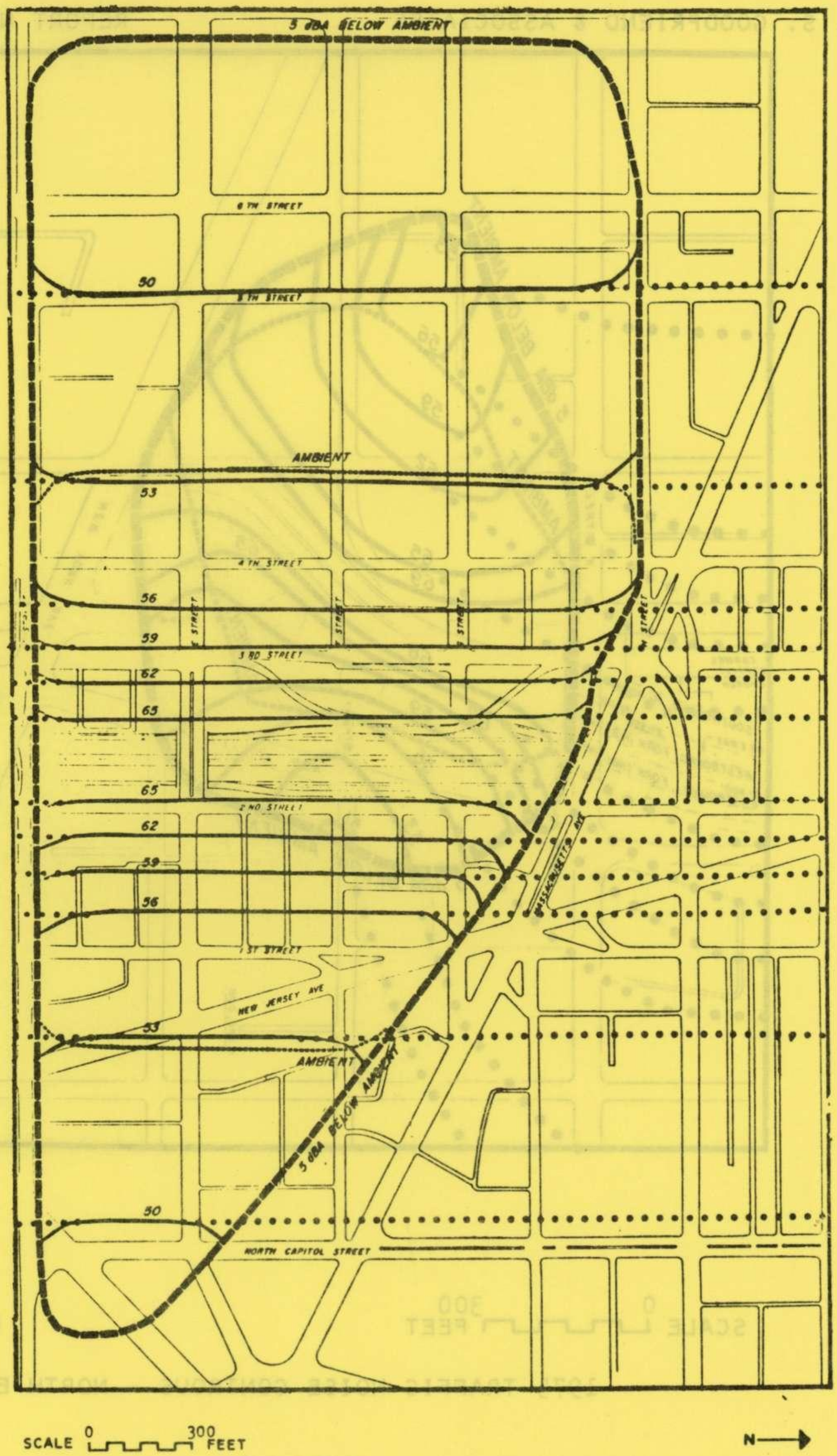
CONSTRUCTION EQUIPMENT NOISE LEVEL RANGES AT 50 FEET[1].

FIGURE 3



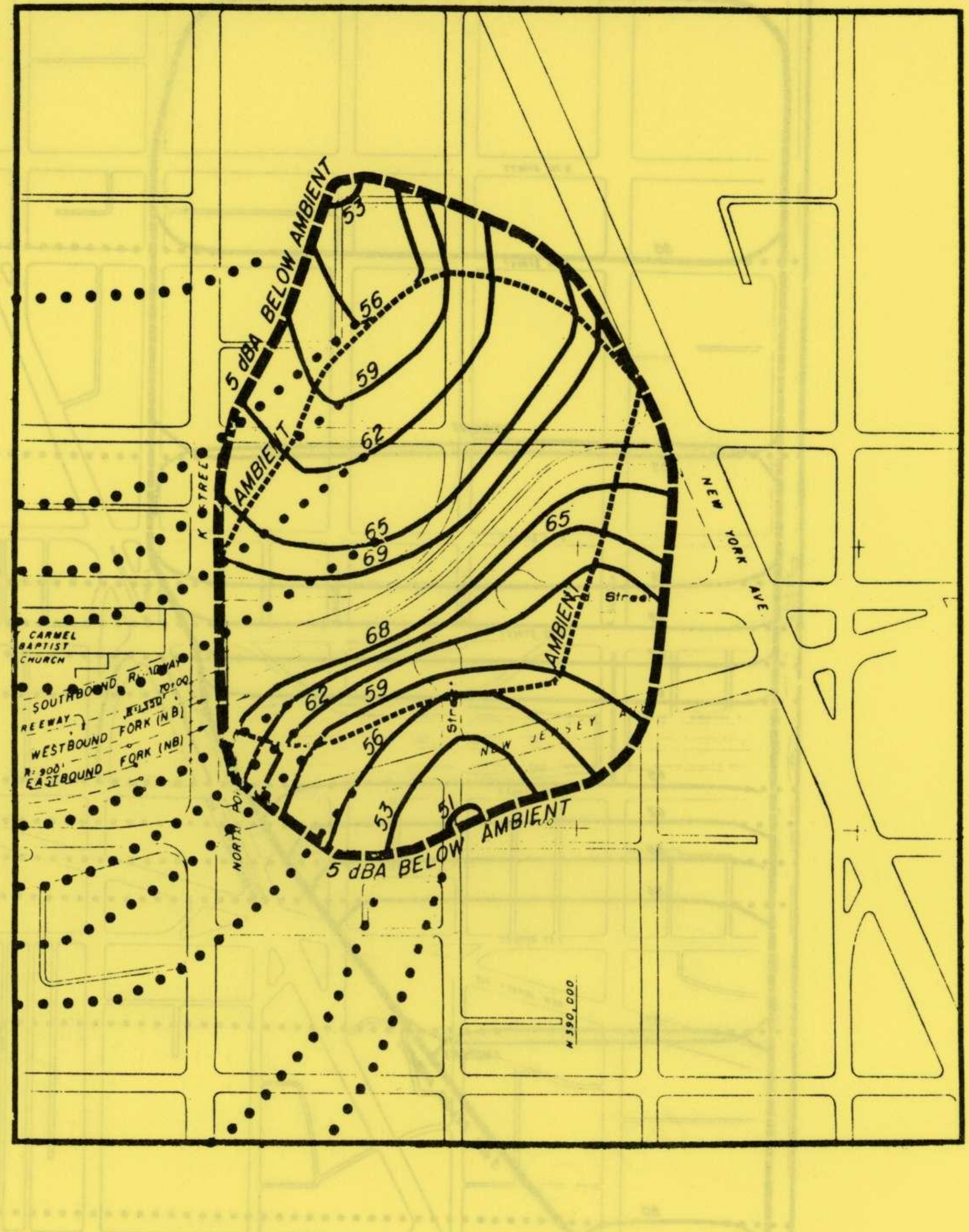
CONSTRUCTION NOISE IMPACT AREA

FIGURE 4



1975 TRAFFIC NOISE CONTOURS - SOUTH END

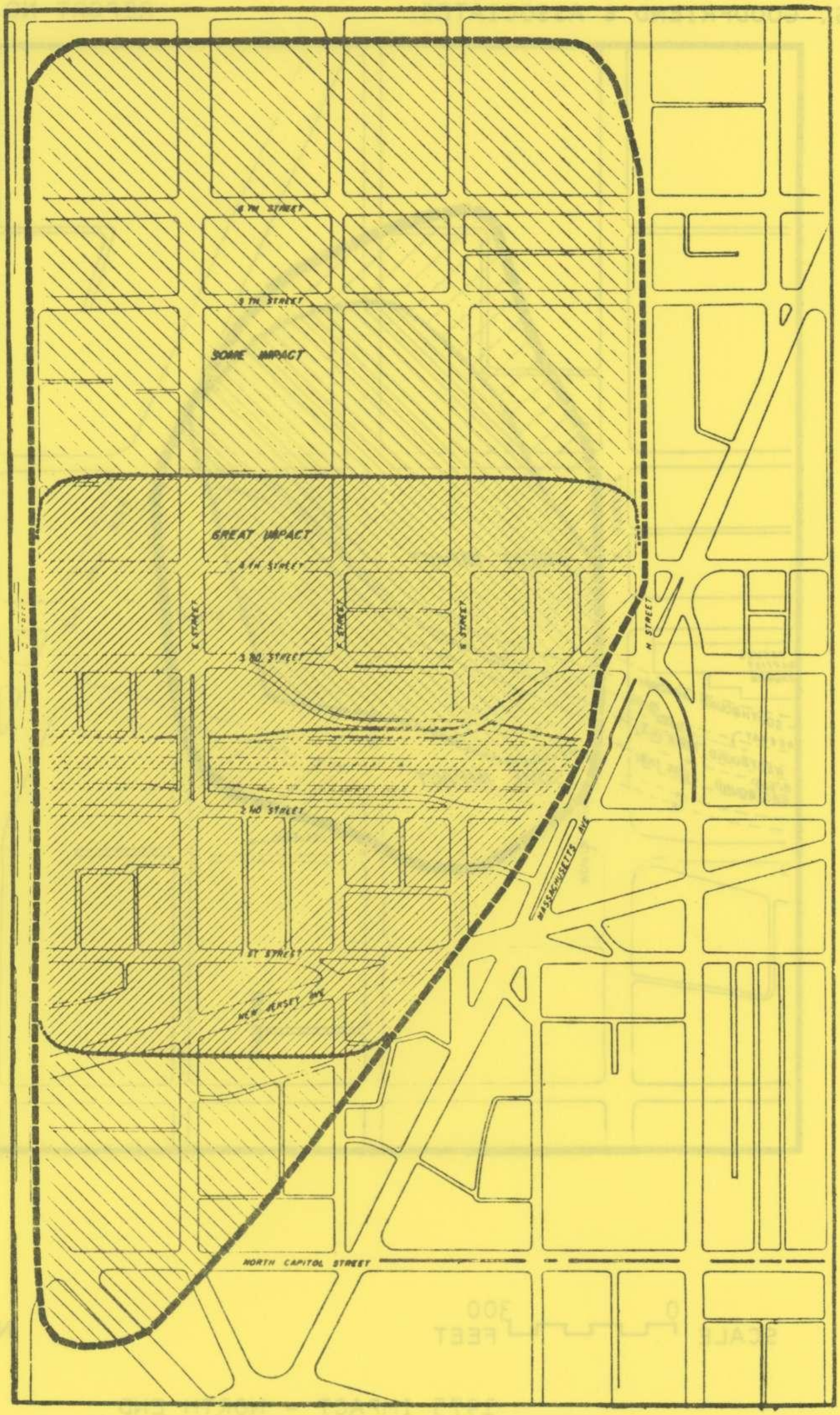
FIGURE 5



SCALE 0 300 FEET N→

1975 TRAFFIC NOISE CONTROUS - NORTH END

FIGURE 6

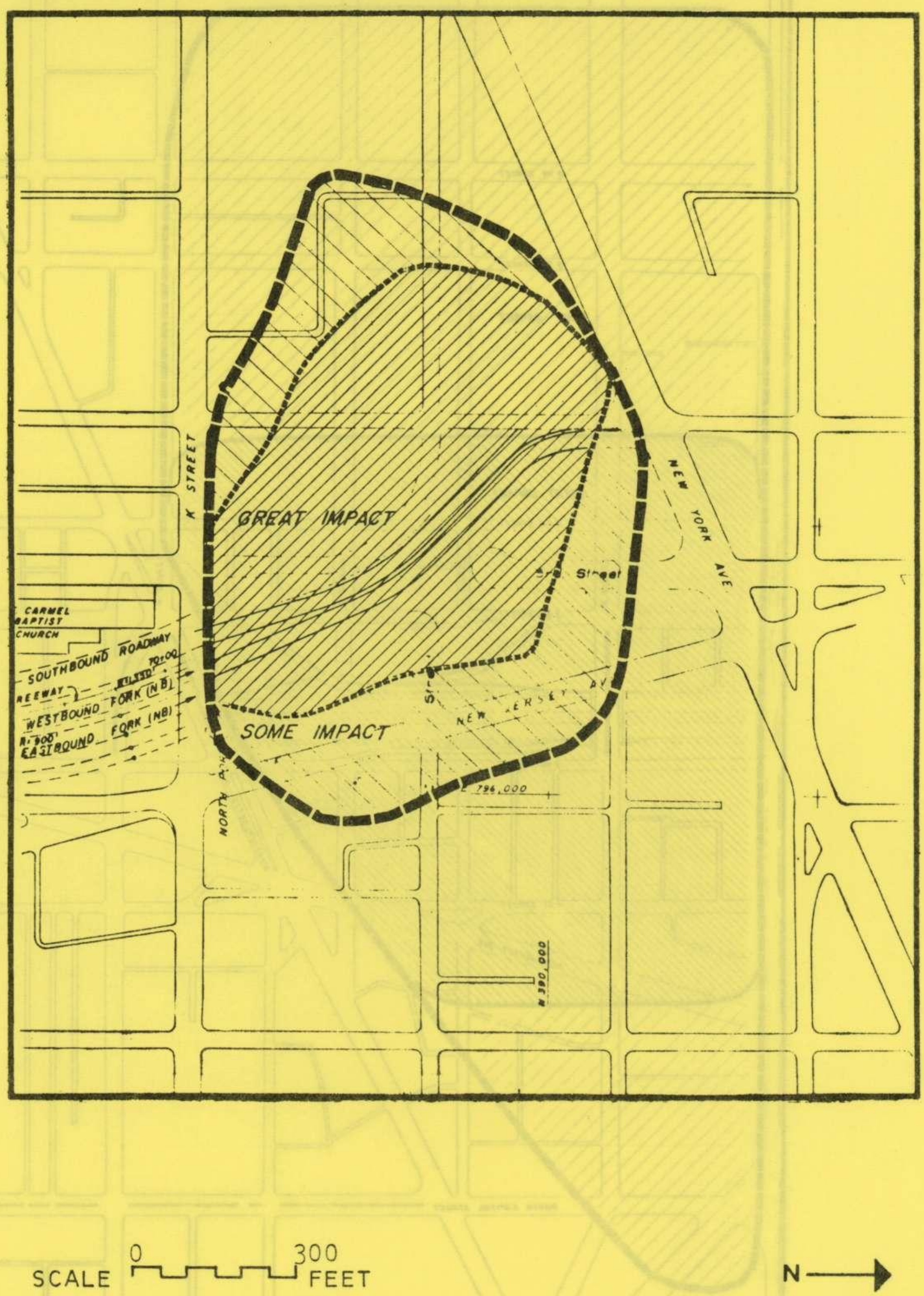


SCALE 0 300 FEET

N→

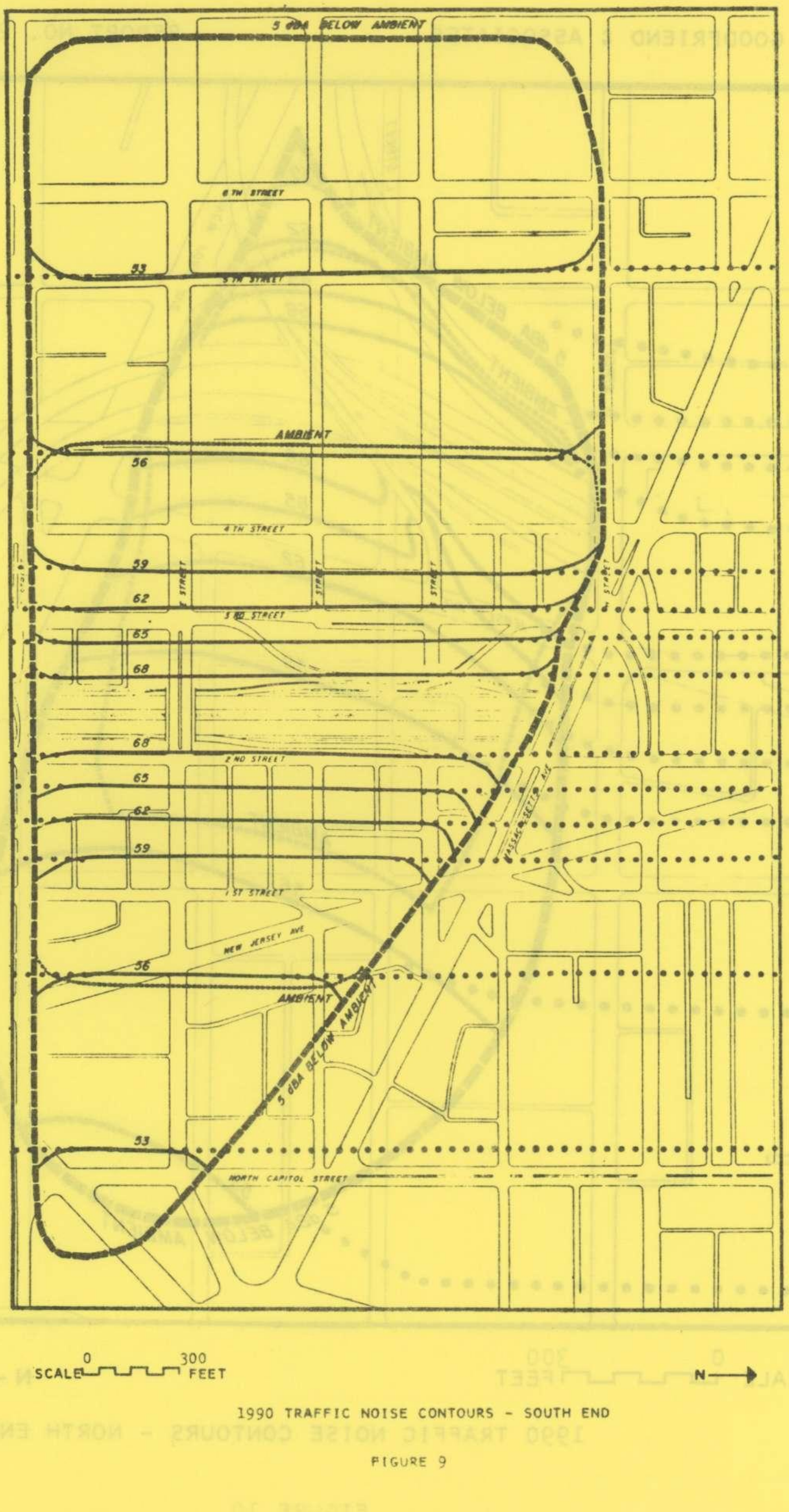
1975 IMPACT - SOUTH END

FIGURE 7



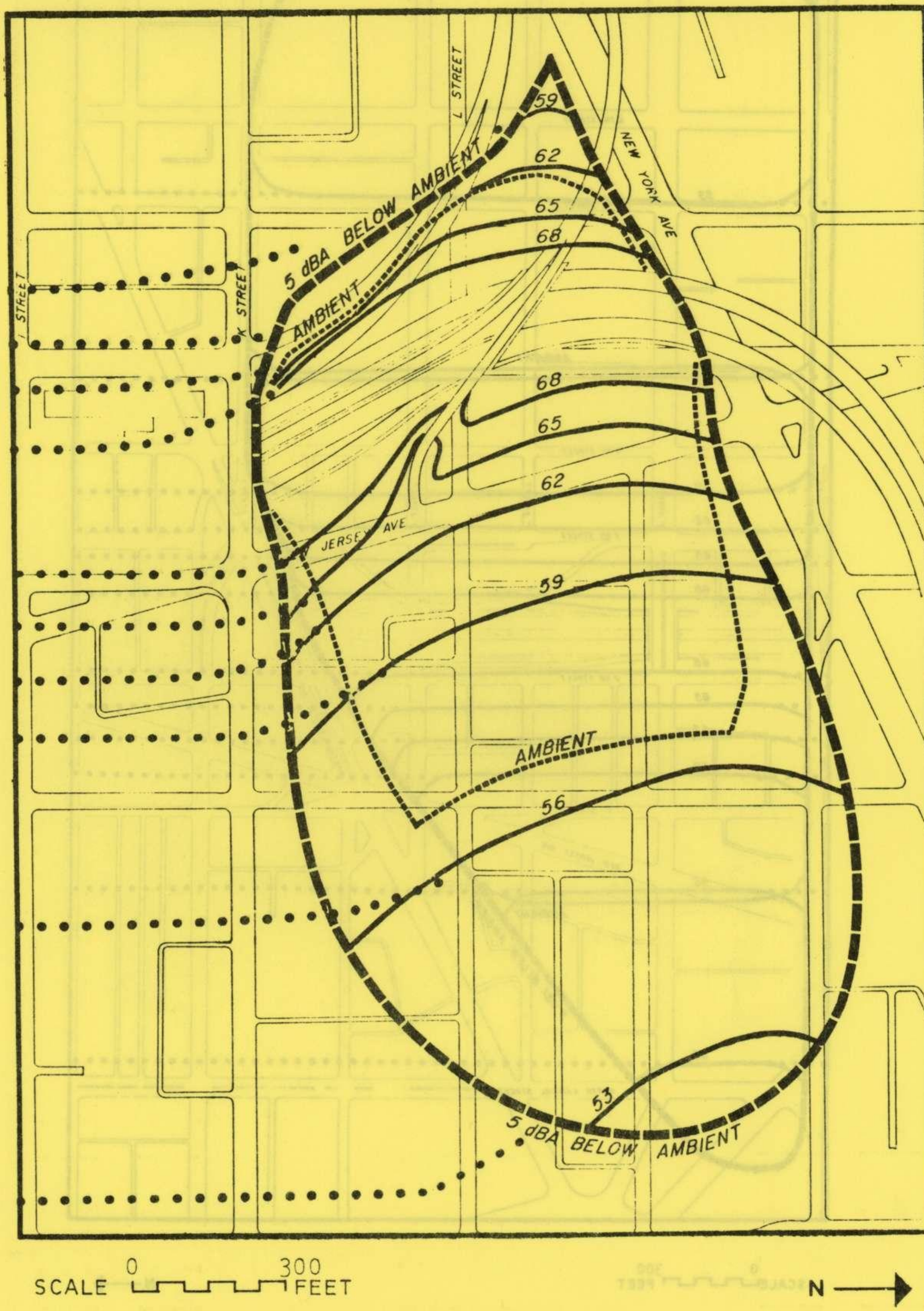
1975 IMPACT - NORTH END

FIGURE 8



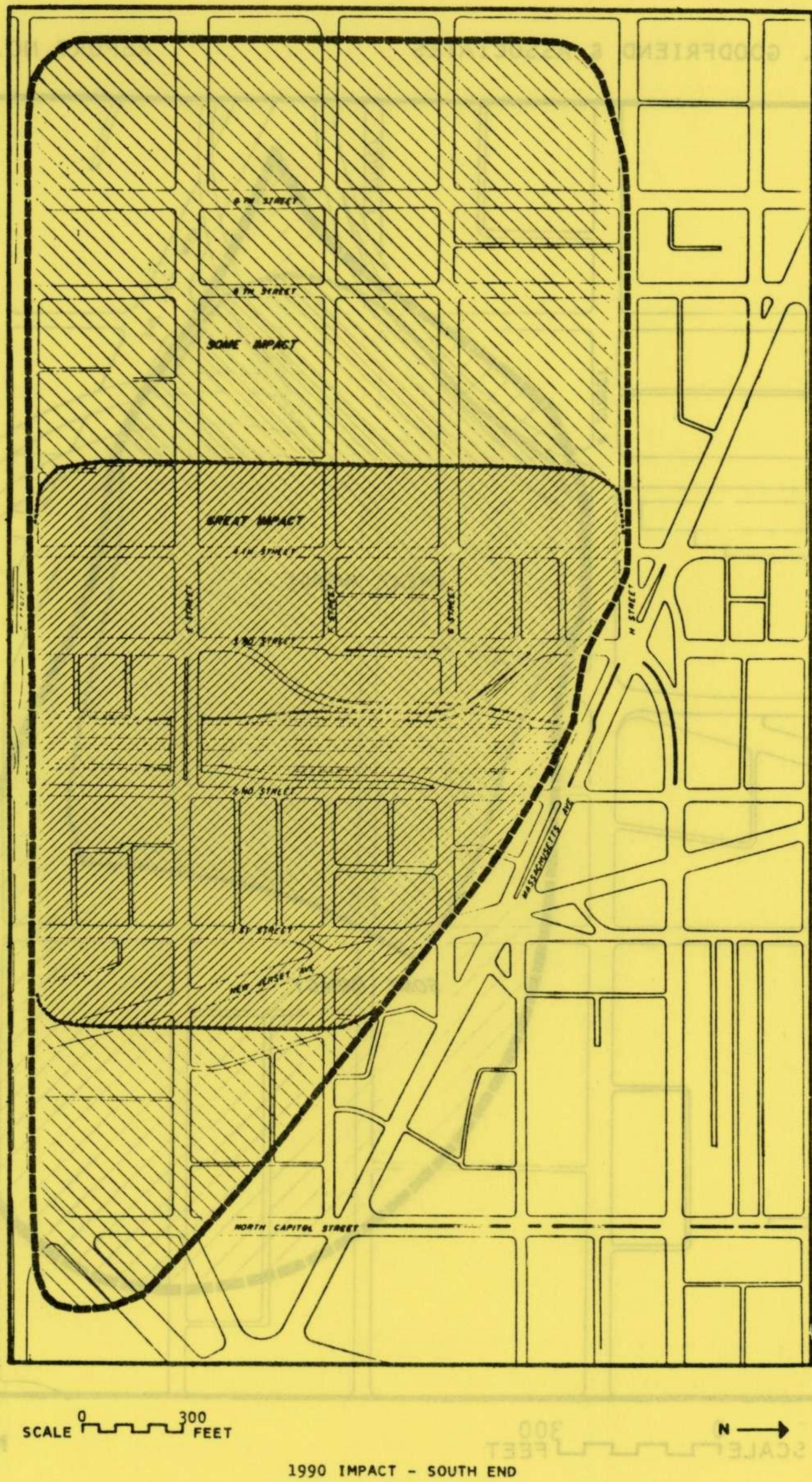
1990 TRAFFIC NOISE CONTOURS - SOUTH END

FIGURE 9



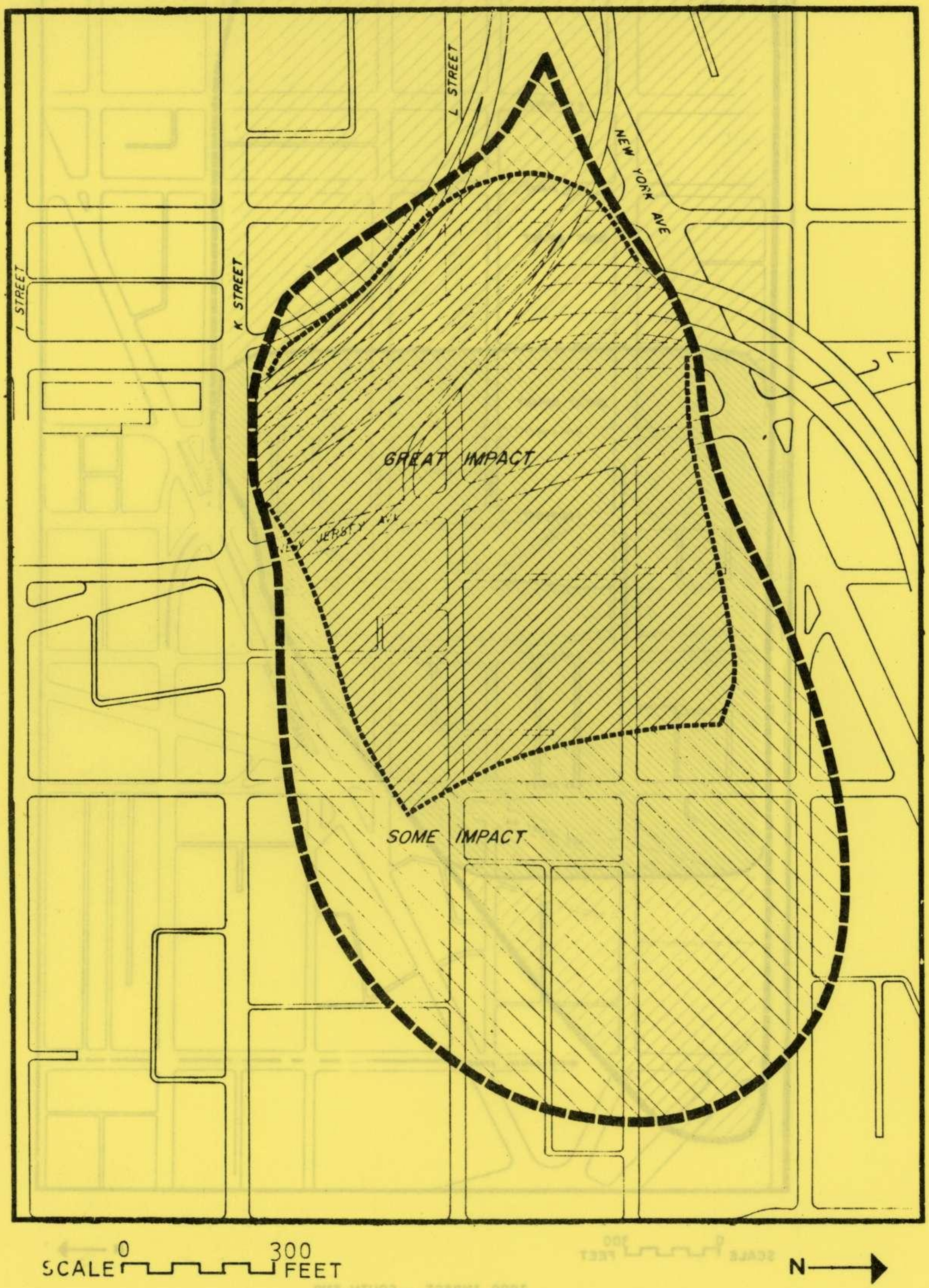
1990 TRAFFIC NOISE CONTOURS - NORTH END

FIGURE 10



1990 IMPACT - SOUTH END

FIGURE 11



1990 IMPACT - NORTH END

FIGURE 12