SQUARE 54
TRANSPORTATION IMPACT STUDY
WASHINGTON, D.C.

Prepared for
Boston Properties, Inc ,
KSI Services, Inc ,
The George Washington University

Prepared by
Wells & Associates, LLC

May 24, 2006

WELLS & ASSOCIATES, LLC
TRAFFIC TRANSPORTATION AND PARKING CONSULTANTS

SQUARE 54
TRANSPORTATION IMPACT STUDY
WASHINGTON, D.C.

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Section 1
INTRODUCTION

This report presents the results of a transportation impact analysis of Square 54, which is located on The George Washington University Foggy Bottom campus, as shown on Figure 1-1. It is bordered by the Washington Circle and Pennsylvania Avenue on the north, Eye Street on the south, 22nd Street on the east, and 23rd Street on the west. The Foggy Bottom-GWU Metro station is located adjacent to Square 54, in the northwest quadrant of the Eye Street/23rd Street intersection.

The George Washington University Hospital was formerly located on Square 54. The old hospital building was razed and the new hospital was built on the west side of 23rd Street. Square 54 presently is vacant, ready for re-development.

Boston Properties, Inc., KSI Services, Inc, and The George Washington University propose to re-develop Square 54 with a mix of office, residential, and retail uses. The preliminary development program includes approximately 454,000 gross square feet (GSF) of office space, 333 residential units, 84,000 GSF of above and below grade retail space, including a contemplated grocery store of up to 45,000 GSF.

These proposed uses will be served by approximately 1,026 parking spaces on five underground levels. As set forth in the recently-filed Foggy Bottom Campus Plan: 2006-2025, approximately 362 additional spaces will be provided for use by The George Washington University (GWU). These spaces will replace existing spaces that will be displaced by future development on the GWU campus.

For purposes of this traffic analysis, this development was assumed to be completely built and occupied by 2010.

Tasks undertaken in this study included the following:

1. Review Boston Properties, Inc. and KSI Services, Inc.'s proposed development program, plans prepared by Pelli Clarke Pelli, and other background data.

2. A field reconnaissance of existing street and intersection geometrics, traffic controls, traffic signal phasing/timings, and speed limits.

3. Counts of existing traffic at six (6) key intersections including Washington Circle.

4. Analysis of existing levels of service at these intersections.

5. Background future traffic volumes were forecasted for project buildout.

6. Background levels of service were calculated at key intersections based on background traffic forecasts, existing traffic controls, and existing intersection geometrics.

7. The number of AM and PM peak hour vehicle-trips that would be generated by the proposed project were estimated based on: (1) Institute of Transportation Engineers (ITE) vehicle-trip generation rates, (2) the proximity of the project to the Foggy Bottom-GWU Metro station, and (3) experience with other comparable projects in Washington, D.C.

8. Total future traffic volumes were forecasted for 2010.

9. Total future levels of service were calculated at key intersections based on total future traffic forecasts, existing traffic controls, and existing intersection geometrics.

10. Operational improvements required to adequately accommodate site traffic were identified.

Sources of data for this analysis included traffic counts conducted by Wells & Associates, ITE, the Washington Metropolitan Area Transit Authority (WMATA), the District of Columbia Office of Planning, the District Department of Transportation (DDOT), The George Washington University, the U.S. Census Bureau, Pelli Clarke Pelli, Boston Properties, Inc., and KSI Services, Inc.

The conclusions of this study are as follows:

1. ***The majority of the key intersections in the study area presently operate at an overall acceptable level of service (LOS) "D" or better during the AM and PM peak hours.***

   The approved and/or proposed but unbuilt projects in the study area will generate a total of 476 AM peak hour vehicle-trips and 592 PM peak hour vehicle-trips, upon completion and full occupancy.

Square 54 will add another 396 AM peak hour vehicle-trips and 627 PM peak hour vehicle-trips, to the public street system upon project completion and full occupancy.

2. ***The eastbound right turn movement, which operates under yield control, at the Washington Circle/K Street intersection currently operates at a LOS "F" during the AM peak hour.***

   The westbound approach at the 23rd Street/Eye Street intersection currently operates at capacity at a LOS "F" during the PM peak hour due to the high volume of westbound traffic turning left onto 23rd Street.

   The westbound movement at the 22nd Street/Pennsylvania Avenue intersection presently operates at capacity at LOS "F" during the PM peak hour due to the high volume of through traffic traveling towards Washington Circle.

   Finally, the southbound approach at the 24th and K Street (westbound) intersection currently operates at a LOS "E" during the PM peak hour.

3. ***These additional background vehicle-trips would not significantly affect the existing intersection delays or levels of service described above, except at the 22nd Street/Pennsylvania Avenue and 23rd Street/Eye Street intersections, where the overall level of service would drop to a LOS "E" and at the intersection of 24th Street and K Street (westbound), where the southbound approach would operate at a LOS "F" during the PM peak hour.***

4. ***Most of the key intersections in the study area would continue to operate at overall acceptable LOS "D" or better during the AM and PM peak hours, with these additional site-generated vehicle-trips, except at the intersections discussed previously in the existing and background future levels of service sections.***

   The eastbound yield controlled right turn movement at the intersection of Washington Circle/K Street (eastbound) and the southbound movement at the intersection of 23rd Street/Eye Street will operate at a LOS "E" during the PM peak hour.

5. ***A new traffic signal and a separate eastbound left turn lane are recommended to be constructed at the intersection of 22nd and Eye Streets to accommodate the high volume of traffic turning left onto northbound 22nd Street.***

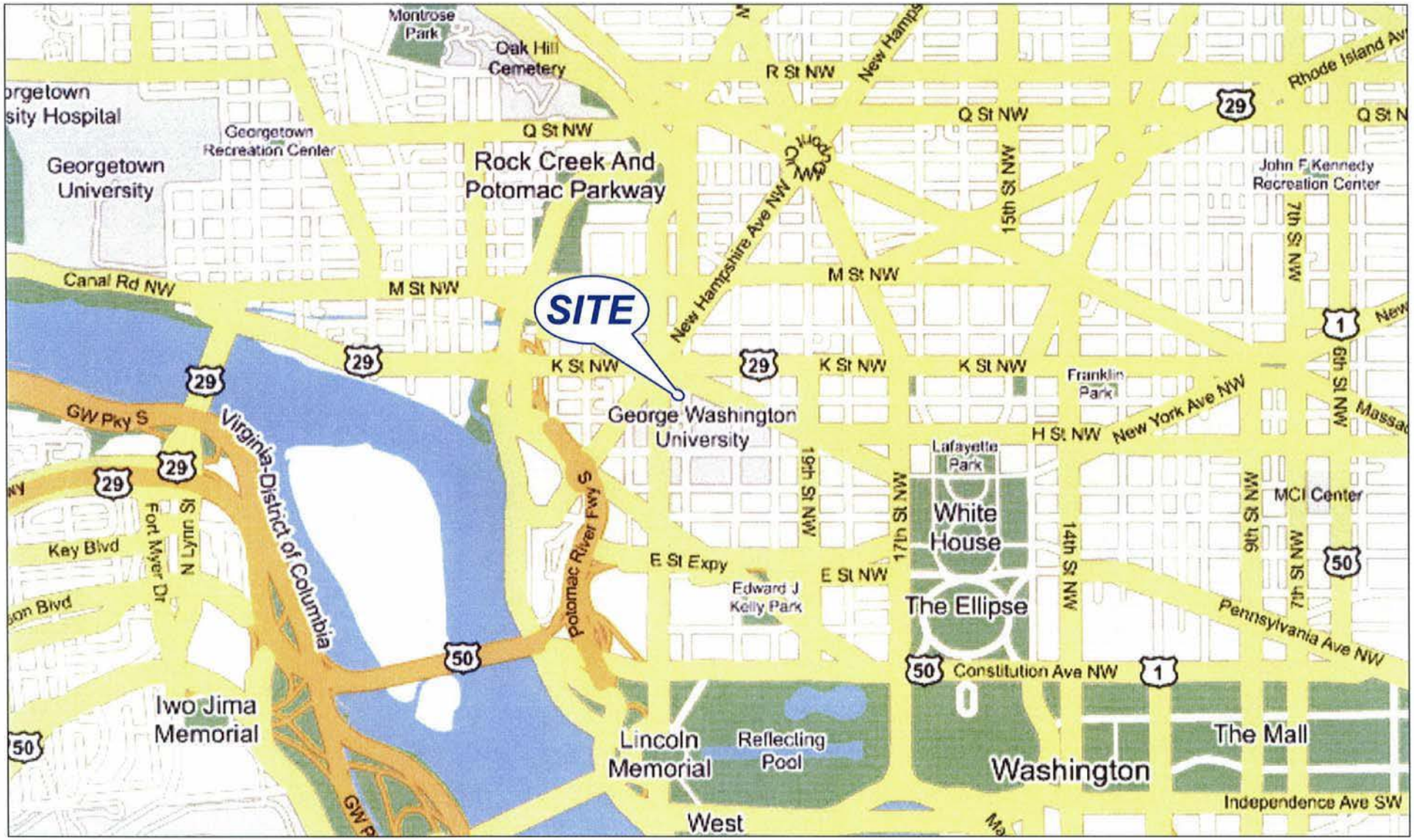

Figure 1–1
Site Location

North
Schematic

Square 54
Washington, D.C.

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Section 2
BACKGROUND DATA

Overview

This section presents background data, including the study scope, description of the public street system, description of the proposed Square 54 vehicular access concept, existing vehicular and pedestrian traffic counts, curb parking inventory, existing public transportation facilities and services, pedestrian facilities, bicycle facilities, and U.S. Census data.

Study Scope

This traffic study includes the following intersections:

1. Washington Circle:
    a. Circle/23rd Street (South),
    b. Circle/New Hampshire Avenue (Southwest),
    c. Circle/K Street Frontage Roads (West),
    d. Circle/Pennsylvania Avenue (Northwest),
    e. Circle/23rd Street (North),
    f. Circle/New Hampshire Avenue (Northeast),
    g. Circle/K Street Frontage Roads (East), and
    h. Circle/Pennsylvania Avenue (Southeast).
2. 23rd Street/Eye Street,
3. 23rd Street/Virginia Avenue/F Street,
4. 22nd Street/K Street,
5. 22nd Street/Pennsylvania Avenue,
6. 22nd Street/Eye Street, and
7. 22nd Street/Virginia Avenue.
8. 24th Street/K Street, and
9. 23rd Street/H Street.

This study also includes the following approved and proposed development projects:

1. ***IMF 2 Headquarters***. The existing PEPCO office building (420,000 S.F.) was expanded to 649,350 S.F. This development is located in the vicinity of 20th and H Streets, and was completed in fall 2005.

2. ***Columbia House Apartments I and II.*** Columbia House Apartments I and II will be developed with 142 and 213 residential units, respectively. Both residential buildings will be located on M Street, between 24th and 25th Streets.

3. ***2425 L Street, N.W.*** This building will contain 200 condominiums on the site of the former Columbia Hospital for Women, which is bounded by 24th Street on the east, 25th Street on the west, and L Street on the south.

4. ***United States Institute of Peace (USIP).*** The new USIP headquarters will be located in the northwest quadrant of the 23rd Street/Constitution Avenue intersection and will contain a total of 248,000 square feet (S.F.) (128,000 S.F. of workspace for Institute staff and research fellows (including a 250-seat auditorium), 20,000 S.F. Public Education Center, and 100,000 S.F. for a below-grade garage.)

5. ***Allstate Hotel Partnership.*** Allstate Hotel Partnership proposes to raze an existing six-story parking garage and develop a nine-story, 147-room hotel on Lot 25 in Square 122 of Northwest Washington, DC. The property, 515 20th Street, N.W., is located on the east side of 20th Street, between E and F Streets, in the northwest section of Washington, DC.

6. ***George Washington (GW) Foggy Bottom Campus Plan: 2006-2025.*** The new Campus Plan accommodates the addition of approximately 2,000,000 gross square feet (GSF) of space for university use, including classrooms, labs, residential space, offices, support space, and other University facilities.

7. ***DCPS/GW/School Without Walls PUD.*** This joint development partnership consists of two projects. The GW component is a new apartment style undergraduate residence to be located between 2125 and 2135 F Street, with access to a below grade parking garage and internal loading dock directly off F Street. The residence hall will contain approximately 474 undergraduate beds and 178 parking spaces. The second component is the addition to the existing School Without Walls structure which includes classrooms, laboratories, and a common area.

The impacts of these approved and proposed projects and the subject project were evaluated at project buildout, which is anticipated to occur in 2010.

Level of service (LOS) "D" is considered the minimum acceptable level of service in urban areas such as Washington, D.C. LOS "E" generally is considered acceptable for short periods of time in built-up areas such as downtown Washington, D.C.

Public Street Network

Square 54 is served by a connected network of arterial, collector, and local streets. Pennsylvania Avenue, Washington Circle, 23rd Street, K Street, and Eye Street are classified by DDOT as principal arterial streets. New Hampshire Avenue north of Washington Circle, Virginia Avenue and 19th and 20th Streets are classified as minor arterial streets. F, G, H, 21st, 22nd, and 24th Streets are classified as collector streets. Existing intersection lane use and traffic control at key intersections in the site vicinity are shown on Figure 2-1.

Washington Circle. K Street, 23rd Street, Pennsylvania Avenue, and New Hampshire Avenue converge at Washington Circle. The mainline of K Street passes beneath the Circle. Frontage roads on both sides of K Street intersect the Circle at grade. All streets except the K Street frontage roads intersect the Circle at signalized junctions. This is a two- to four-lane circle with a posted speed limit of 25 miles per hour (mph). No parking is permitted within the Circle. Metrobus lines 30, 32, 34, 35, 36, 38B, H1, L1, N3, and D5 provide service along Washington Circle.

23rd Street. This principal arterial is one of the most vibrant streets in Washington, D.C. Automobile, public buses, private shuttle buses, pedestrians, bicyclist, and cars parked along the curb share this five-lane street. The Foggy Bottom-GWU Metro station, The George Washington University, and the George Washington University Hospital generate large numbers of pedestrians that use the sidewalks and crosswalks on 23rd Street, particularly at Eye Street.

Three lanes are provided in the northbound direction and two lanes are provided in the southbound direction. The posted speed limit is 25 mph. The intersections of Eye and H Streets are controlled by a traffic signal. Metrobus lines H1, L1, and N3 provided service along 23rd Street to Washington Circle.

22nd Street. This is a two-lane northbound (one-way) street in the vicinity of Eye Street, and increases to a three-lane northbound (one-way) street in the vicinity of Pennsylvania Avenue. The posted speed limit is 35 mph. The 22nd Street/Eye Street intersection is controlled by all-way stop signs. The intersections of 22nd Street with Pennsylvania Avenue and K Street (eastbound and westbound) are controlled by traffic signals.

Eye Street. This is a two-lane street with a posted speed limit of 25 mph. The Eye Street/23rd Street intersection is controlled by a traffic signal and the Eye Street/22nd Street intersection is controlled by a stop sign. Eye Street, between 23rd and 24th Streets, is a pedestrian mall, closed to vehicular traffic. Metrobus lines H1, L1, and N3 provide service in the vicinity of the intersection of Eye Street and 23rd Street.

Pennsylvania Avenue. This is a four-lane street with a posted speed limit of 25 mph. Pennsylvania Avenue (northwest bound) allows two lanes to merge onto Washington Circle, and two lanes to merge back onto Pennsylvania Avenue. Pennsylvania Avenue (southeast bound) allows three lanes to merge onto Washington Circle, and two lanes to merge back onto Pennsylvania Avenue. Metrobus lines 30, 32, 34, 35, 36, and 38B provide service along Pennsylvania Avenue.

Vehicular Access Concept

Square 54 fronts on Washington Circle, Eye Street, 22nd Street, and 23rd Street. Before the old George Washington University Hospital was razed, the site was served by nine (9) driveways: three (3) on Washington Circle, three (3) on Eye Street, one (1) on 22nd Street, and two (2) on 23rd Street. All vehicular access to the proposed Square 54 underground parking garage and the loading docks would be consolidated at two adjacent driveways on 22nd Street near the center of the block. No driveways are proposed on Washington Circle, Eye Street, or 23rd Street.

Existing Traffic Counts

Intersection Vehicular Traffic Counts. Existing AM and PM peak period vehicular and pedestrian traffic counts were conducted on Wednesday, May 11, 2005, by Wells & Associates at the following intersections:

#1. Washington Circle:

- a. Circle/23rd Street (South),
- b. Circle/New Hampshire Avenue (Southwest),
- c. Circle/K Street Frontage Roads (West),
- d. Circle/Pennsylvania Avenue (Northwest),
- e. Circle/23rd Street (North),
- f. Circle/New Hampshire Avenue (Northeast),
- g. Circle/K Street Frontage Roads (East), and
- h. Circle/Pennsylvania Avenue (Southeast).

#2. 23rd Street/Eye Street,
#3. 23rd Street/Virginia Avenue,

#6. 22nd Street/Eye Street, and
#7. 22nd Street/Virginia Avenue.

Additional AM and PM peak period vehicular and pedestrian traffic counts were conducted on Tuesday, July 12, 2005, by Wells & Associates at the 23rd Street/Virginia Avenue/F Street intersection. Copies of the counts are included in Appendix A.

Additional peak hour turning movement counts were obtained from the Square 37 Traffic Impact Study[1] at the following intersections:

#4. 22nd Street/K Street,
#5. 22nd Street/Pennsylvania Avenue,
#8. 24th Street/K Street and
#9. 23rd Street/H Street.

The common peak hours for the study intersections occurred from 8:00 AM to 9:00 AM and from 5:15 PM to 6:15 PM. Existing traffic volumes from Wells & Associates' counts and the Square 37 study were adjusted to balance between study intersections with some allowance for driveways or roadways located between study intersections. Baseline peak hour traffic volumes are shown on Figure 2-2.

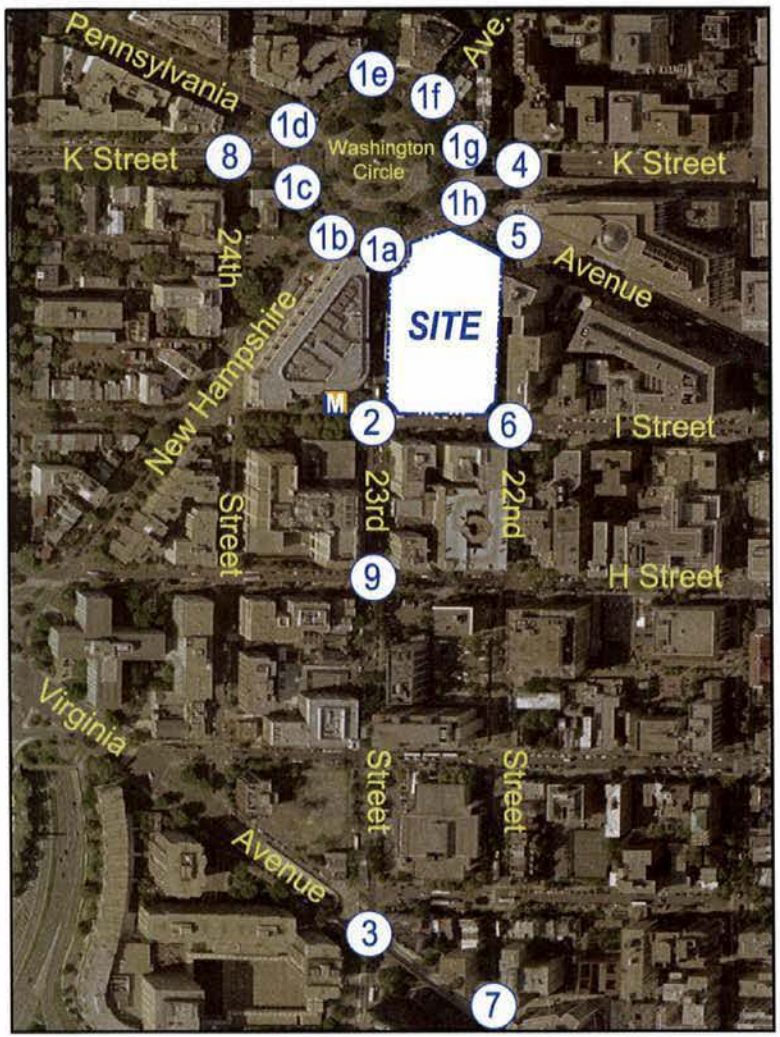
Figure 2-2 indicates that 23rd Street, south of Washington Circle, presently carries 1,096 vehicle-trips during the AM peak hour and 1,467 vehicle-trips during the PM peak hour. Approximately 55-percent of the traffic travels northbound along 23rd Street during the AM peak hour; approximately 68 percent of the traffic travels southbound along 23rd Street during the PM peak hour.

22nd Street, south of Pennsylvania Avenue, carries 639 vehicle-trips during the AM peak hour and 382 vehicle-trips during the PM peak hour.

Eye Street, between 22nd and 23rd Streets, carries 404 vehicle-trips during the AM peak hour and 382 vehicle-trips during the PM peak hour. Approximately 81 percent of the traffic travels eastbound along Eye Street during the AM peak hour; approximately 71 percent of the traffic travels westbound along Eye Street during the PM peak hour.

Link Vehicular Traffic Counts. Average daily traffic (ADT) counts for 2000 were obtained from DDOT, as shown in Table 2-1. The most heavily traveled streets in the study area are K Street, Pennsylvania Avenue, 23rd Street, and Virginia Avenue.

[1] Traffic Services Administration, District Department of Transportation, Square 37 Rezoning Traffic Impact Study, September, 2002.



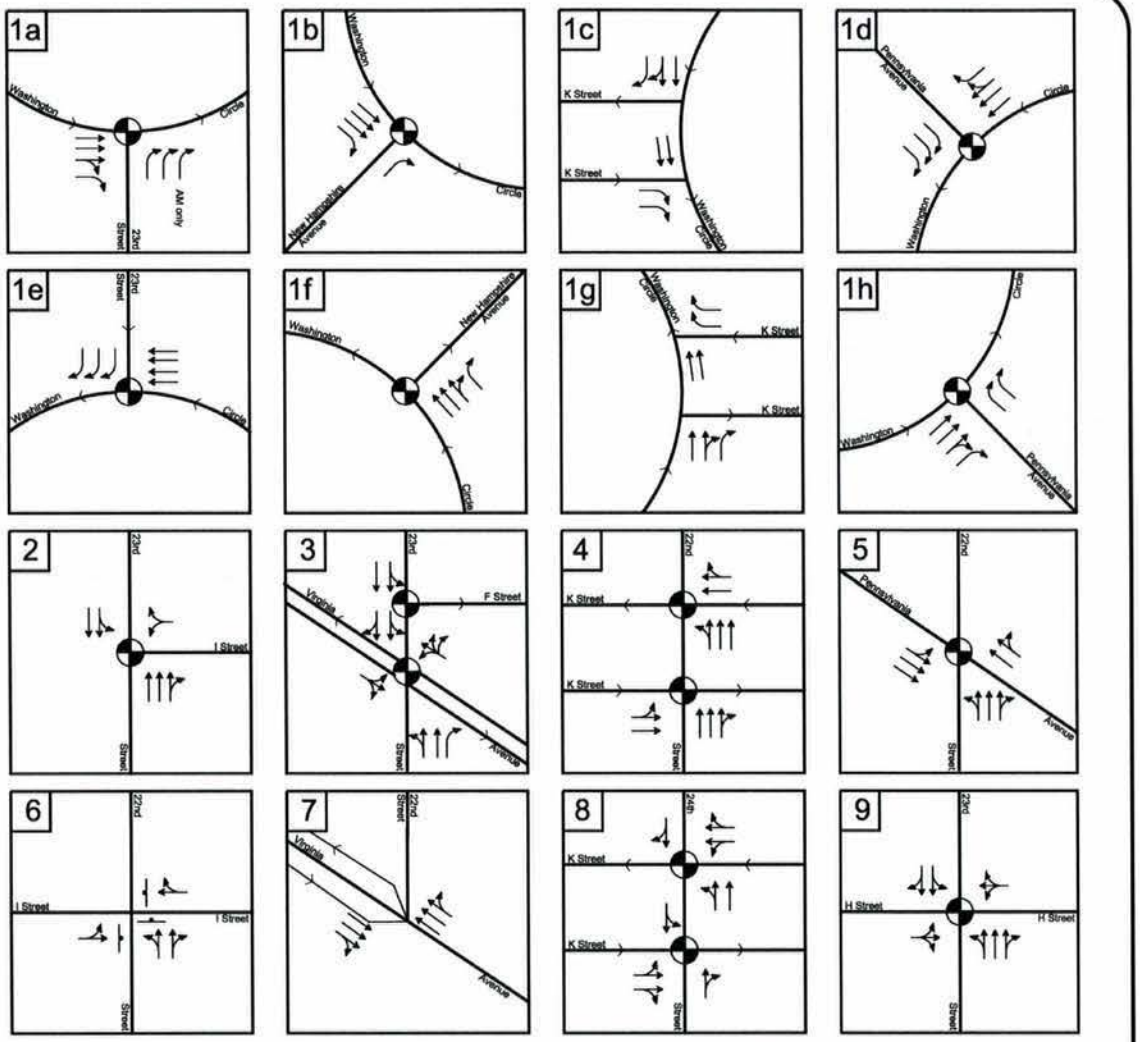


Figure 2–1
Intersection Lane Use And Traffic Control

←— Represents One Travel Lane
Signalized Intersection
— Stop Sign

North
Schematic

Square 54
Washington, D.C.

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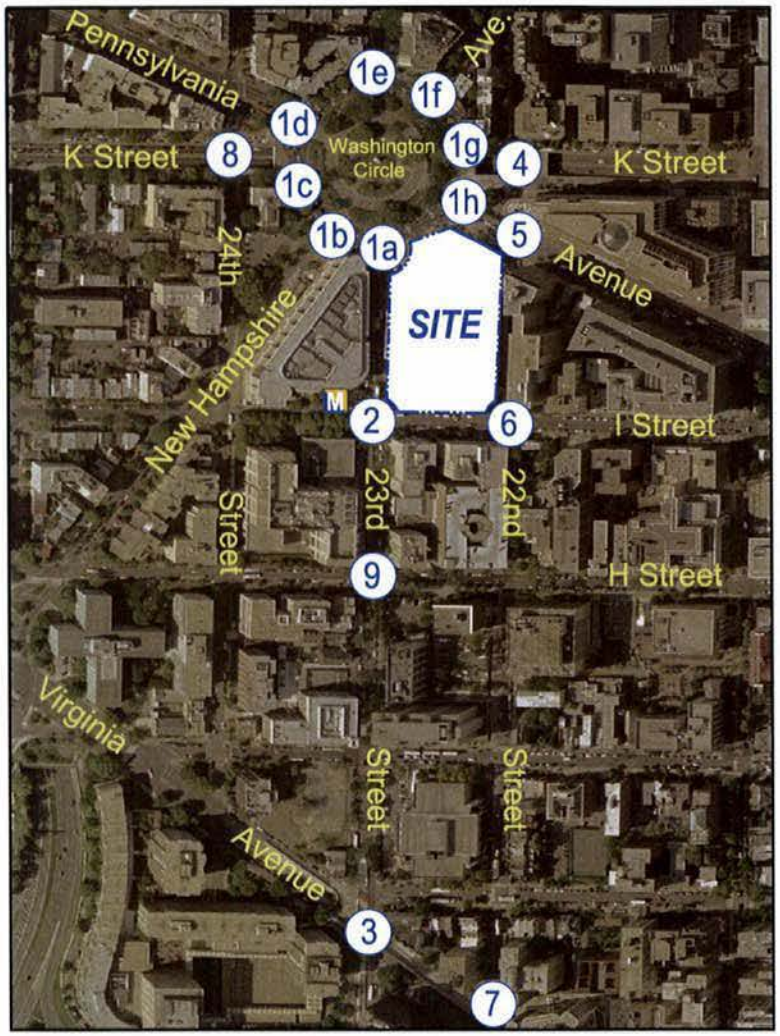

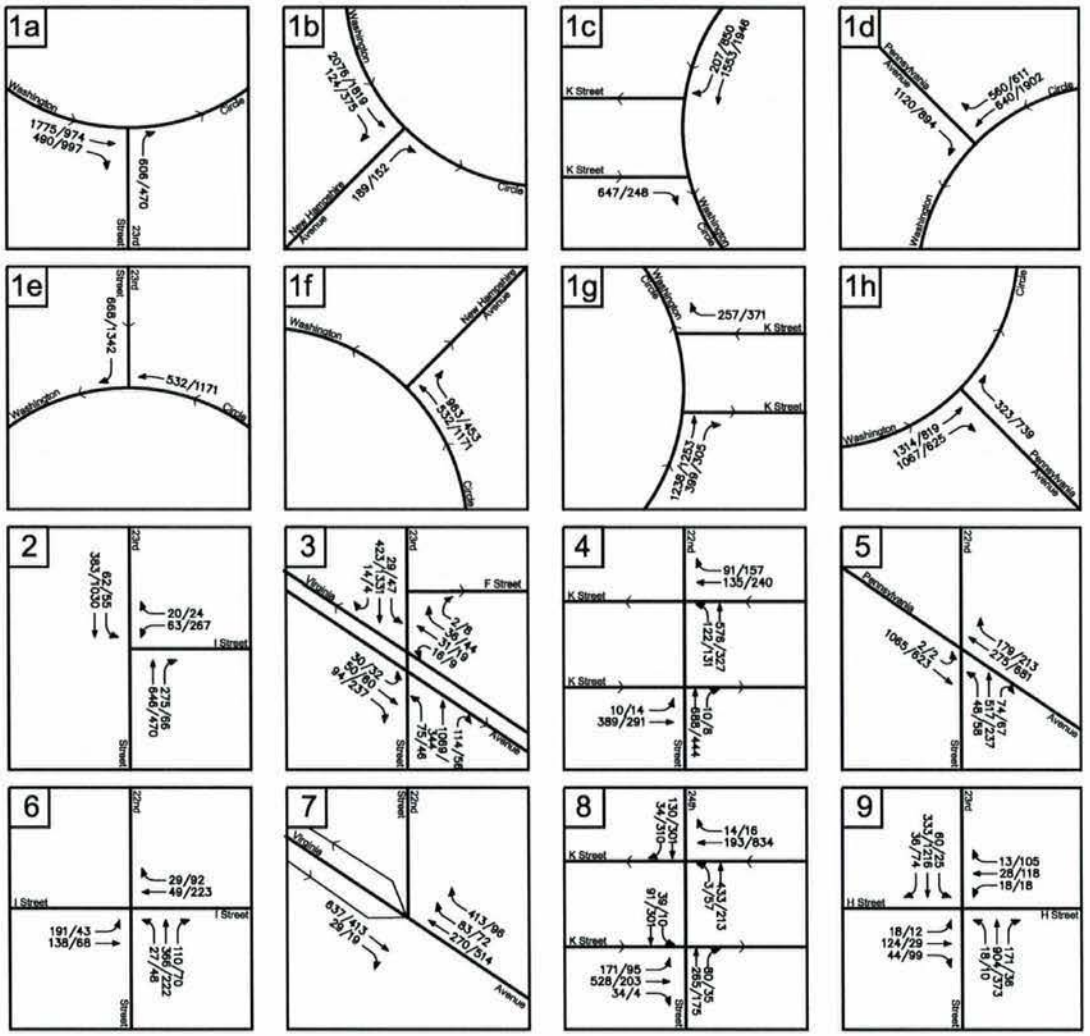

Figure 2–2
Existing Peak Hour Vehicular Traffic Counts

AM PEAK HOUR
PM PEAK HOUR
000/000

North
Schematic

Square 54
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Table 2-1
2002 Link Traffic Counts [1]

Location	At	2002 Average Daily Traffic
23rd Street (north)	Washington Circle	13,300
23rd Street (south)	Washington Circle	18,000
Pennsylvania Avenue	East of Washington Circle	23,200
Pennsylvania Avenue	West of Washington Circle	23,500
K Street (eastbound)	Washington Circle	30,000
K Street (westbound)	Washington Circle	32,000
New Hampshire Avenue	East of Washington Circle	6,000
New Hampshire Avenue	West of Washington Circle	4,900
22nd Street	K Street (eastbound) and Pennsylvania Avenue	13,500
22nd Street	I Street	5,900
23rd Street	H Street	17,600
Virginia Avenue	West of 23rd Street	12,800
Virginia Avenue	East of 22nd Street	13,400

[1] Information taken from the District Department of Transportation Traffic Volume Maps

Pedestrian Traffic Counts. Existing AM and PM peak hour pedestrian traffic counts are presented in Appendix B and summarized on Figure 2-3.

Very large numbers of pedestrians cross 23rd and Eye Streets during peak hours. Approximately 2,900 to 3,100 pedestrians cross the three legs of the 23rd Street/Eye Street intersection during the AM and PM peak commuter hours and 1,300 to 1,500 pedestrians cross the four legs of the 22nd Street/Eye Street intersection during peak hours.

Approximately 350 to 500 pedestrians cross 23rd Street south of Washington Circle, and only 85 to 125 pedestrians cross the four legs of the Pennsylvania Avenue/22nd Street intersection during peak hours.

Curb Parking

Curb parking is permitted on most streets in the study area. Daytime curb parking regulations in the immediate site vicinity is shown on Figure 2-4. A total of 32 short-term parking meters are located along the site frontage on 22nd, Eye, and 23rd Streets. (Meters were missing at two parking spaces on both 22nd and 23rd Streets at the time this data was collected). No parking is permitted in Washington Circle, except in the vicinity of 23rd Street (north) where 2-hour parking is permitted. No parking is permitted on the west side of 23rd Street, between the Circle and Eye Street; however, shuttle buses, police cars, and other official vehicles typically park here for short periods of times.

Public Transportation Facilities and Services

Overview. Square 54 is served by the Foggy Bottom-GWU Metrorail Station and six (6) Metrobus lines, as shown on Figure 2-5. The Foggy Bottom-GWU Metro station also is served by the Kennedy Center and other private shuttle bus lines.

Metrorail. The Foggy Bottom-GWU Metro Station is located across 23rd Street from Square 54, in the northwest quadrant of the 23rd Street/Eye Street intersection. This station was used by nearly 41,000 passengers on an average weekday in 2002, according to the WMATA passenger surveys that are summarized in Table 2-2. About half of all passengers using this station alight from trains in the AM peak period and board in the PM peak period.

Table 2-2
Foggy Bottom-GWU Metro Station Passenger Boardings and Alightings

Time Period	Boardings	Alightings	Total
AM Peak	2,007	9,326	11,333
AM Off Peak	4,219	5,278	9,497
PM Peak	10,725	3,440	14,165
PM Off Peak	4,906	1,021	5,927
Total	21,857	19,065	40,922

A large majority of passengers (85 to 87 percent) walk to and from the station; very few drive or are driven to the station, as shown in Table 2-3.

Table 2-3
Foggy Bottom-GWU Metro Station Passenger Ingress and Egress Modes

Mode	Ingress		Egress	
	Number	Percent	Number	Percent
Metrobus	761	3.5%	533	2.8%
Other Bus	1,271	5.8%	1,120	5.9%
Park and Ride	360	1.6%	216	1.1%
Rode with Another	19	0.1%	24	0.1%
Kiss and Ride	362	1.7%	145	0.8%
Bike	13	0.1%	5	0.0%
Walk	18,673	85.4%	16,666	87.4%
Taxi	57	0.3%	43	0.2%
Unknown	339	1.6%	313	1.6%
Total	21,855	100.0%	19,065	100.0%

About two-thirds of all passengers using the Foggy Bottom-GWU Metro station were traveling for the purpose of work or job-related business, as shown in Table 2-4. School trips accounted for less than 10 percent of all trips.

Table 2-4
Foggy Bottom-GWU Metro Station Egress Trip Purpose

Trip Purpose	Number Of Passengers	Percent
Work	11,441	60.0%
Job-Related Business	944	5.0%
Shopping or Meal	726	3.8%
School	1,870	9.8%
Personal Trip	2,541	13.3%
Sightseeing or Recreation	957	5.0%
Unknown	586	3.1%
Total	19,065	100.0%

Metrobus. Six (6) Metrobus lines operate on adjacent or nearby streets, as shown on Figure 2-5. A total of 790 bus-trips are operated on these lines on a typical weekday, 259 bus-trips on a typical Saturday, and 165 bus-trips on a typical Sunday, as shown in Table 2-5.

Table 2-5
Metrobus Service in Vicinity of Square 54

Line	Name	Daily Bus-Trips		
		Weekday	Saturday	Sunday
30, 32, 34, 35, 36	Pennsylvania Avenue	320	N/A	N/A
38B	Ballston-Farragut Square	93	73	36
D5	MacArthur Blvd-Georgetown	13	N/A	N/A
H1	Brookland-Potomac Park	15	N/A	N/A
L1, L2, L4	Connecticut Avenue	177	102	70
N2, N3, N4, N6	Massachusetts Avenue	172	84	59
Total		790	259	165

Pedestrian Facilities

Pedestrian access to Square 54 would be provided via a sidewalk system that exists on both sides of the streets in the immediate vicinity of the subject site. The sidewalks facilitate access to the site and to the Foggy Bottom-GWU Metro station, which is located adjacent to Square 54. Pedestrian signals with clearly marked crosswalks are located at all major intersection surrounding Square 54 and along Washington Circle.

Bicycle Facilities

DDOT published a draft District of Columbia Bicycle Master Plan in August 2002[2]. That document evaluates existing bicycling facilities, policies, and other bicycle-related matters. It also establishes goals, makes recommendations for achieving those goals, and presents an implementation plan.

Presently, there are no bicycle lanes, routes, or trails in the immediate vicinity of Square 54, according to the Bicycle Master Plan. Bicyclists share the public streets with motor vehicles.

The Bicycle Level of Service (BLOS) on most streets in and around the GWU campus is BLOS "D" or better, according to the Bicycle Master Plan.

The Plan recommends new bicycle lanes in the site vicinity on:

1. 22nd Street, between Virginia Avenue and Q Street,
2. 21st Street, between Constitution Avenue and R Street,
3. F Street, between Virginia Avenue and 17th Street,
4. G Street, between Virginia Avenue and 17th Street,
5. Pennsylvania Avenue, between 17th Street and M Street,
6. New Hampshire Avenue, between Virginia Avenue and Dupont Circle, and
7. Virginia Avenue, between Constitution Avenue and Rock Creek Parkway.

The Plan also recommends that the District improve bicycle access through complex intersections including, specifically, Washington Circle.

U.S. Census Data

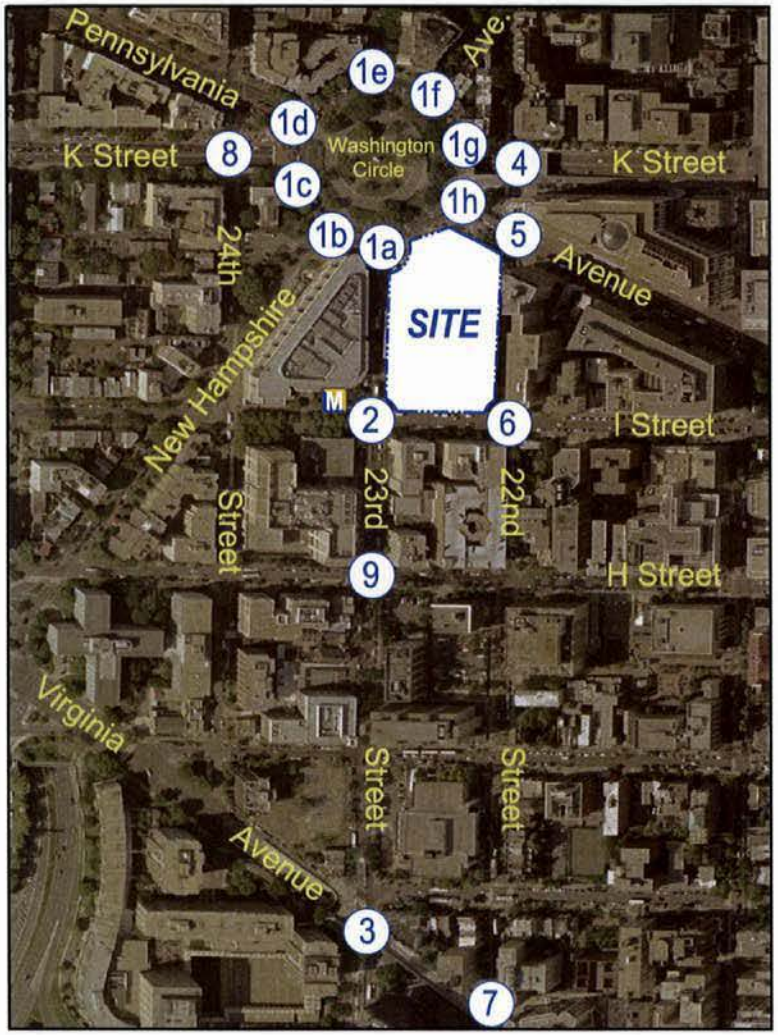
Overview. The 2000 U.S. Census reports auto availability and means of transportation to work for workers 16 years and over. Square 54 is located in Census Block 57.01. Adjacent blocks are 54.01, 55, 56, and 57.01.

Auto Availability. Home owners have an average of 0.70 available vehicles per household, as shown on Table 2-6. Nearly four out of every ten households own no vehicle and slightly more than half own one vehicle. Fewer than one out of every ten owner-occupied households have two or more available vehicles.

[2] District Department of Transportation, District of Columbia Bicycle Master Plan, August 2002.

Renters have an average of only 0.43 available vehicles per household. Nearly two out of every three renter-occupied households have no available vehicle, and less than a third own one vehicle. About one of every 20 renter-occupied households have two or more available vehicles.

Journey To Work Mode Split. Few neighborhood residents commute to work by automobile. Most walk or take Metro. Approximately 14 percent of all local residents drive or are passengers in private automobiles, as shown in Table 2-7. More than half walk and about a quarter take some form of public transportation.



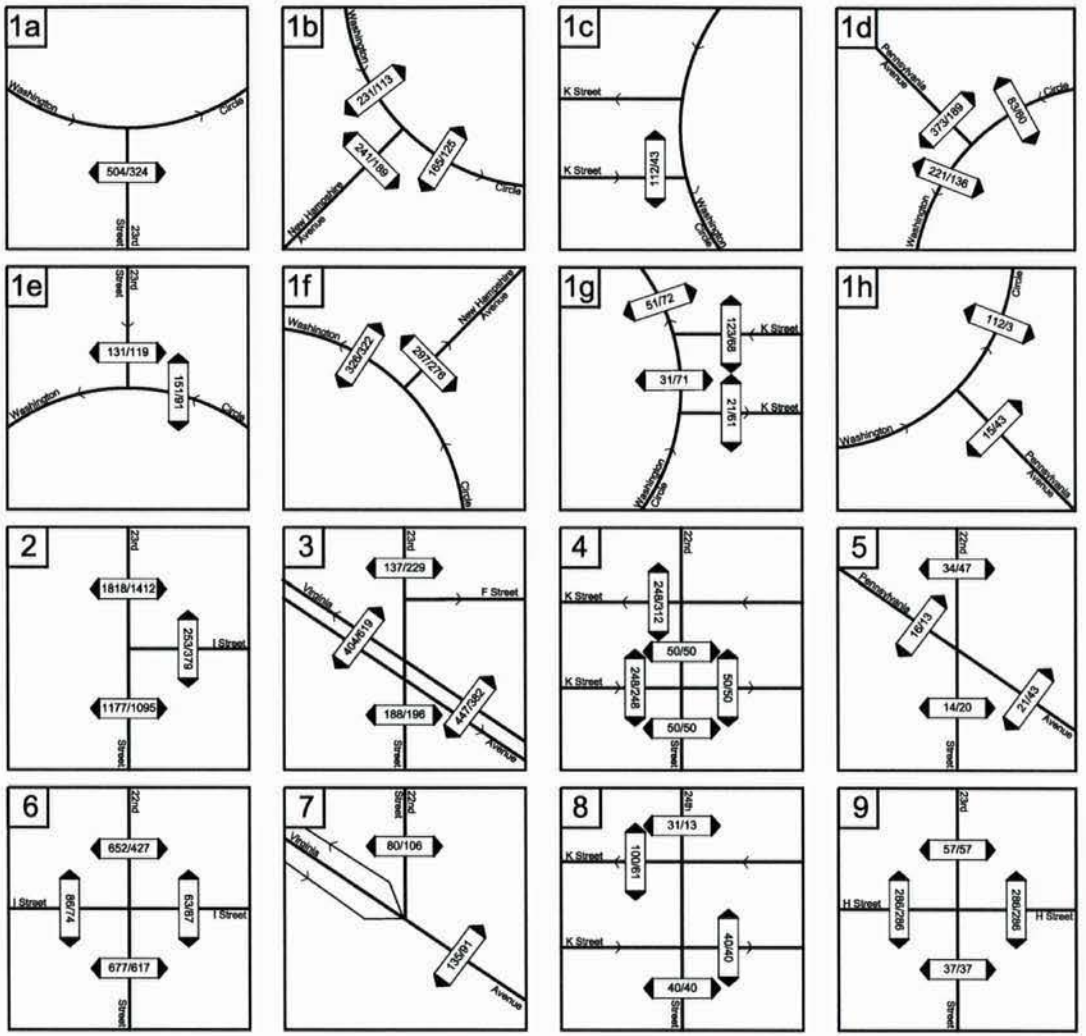


Figure 2–3
Existing Peak Hour Pedestrian Traffic Counts

AM PEAK HOUR
PM PEAK HOUR
000/000

North
Schematic

Square 54
Washington, D.C.

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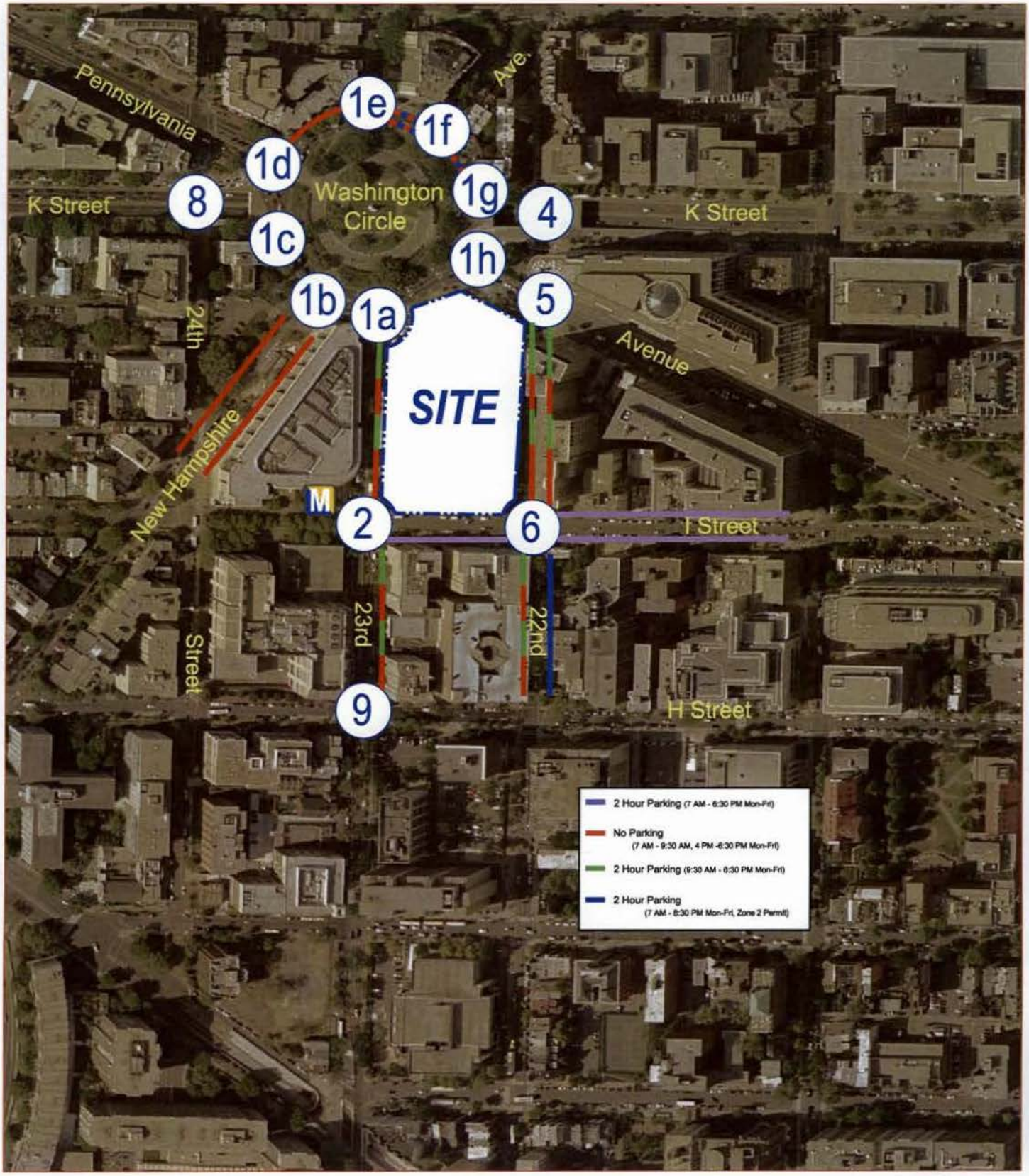

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Figure 2–4
Day Time Curb Parking Restrictions

North

Square 54
Washington, D.C.

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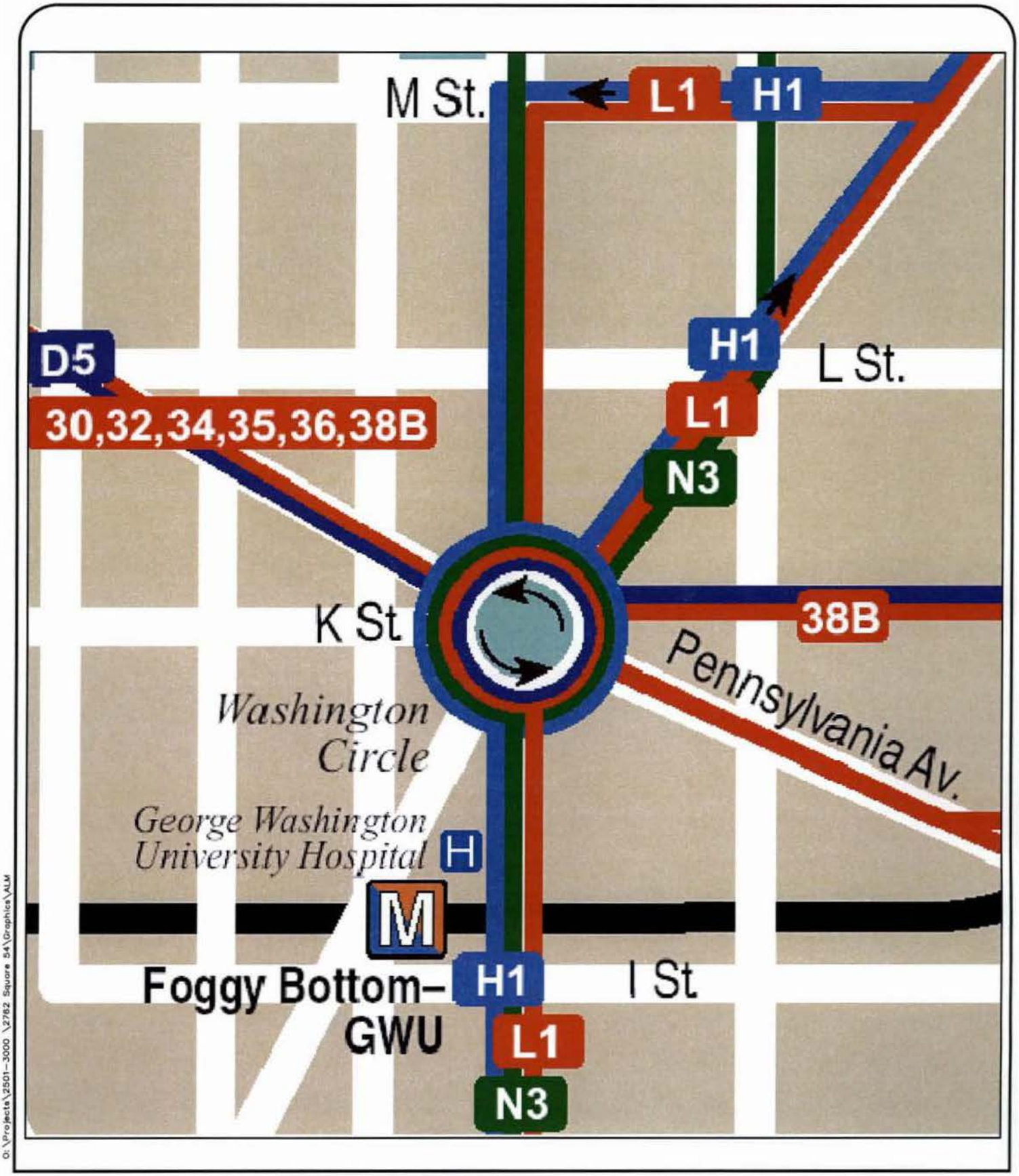

Figure 2–5
Existing Public Transportation Services

North

Square 54
Washington, D.C.

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Table 2-6

Local Resident Auto Availability

		Percent	Cumulative Percent
Total All Census Tracts Block Groups	6,816		
Owner occupied:	1,998		
No vehicle available	786	39.3%	39.3%
1 vehicle available	1,041	52.1%	91.4%
2 vehicles available	165	8.3%	99.7%
3 vehicles available	6	0.3%	100.0%
4 vehicles available	0	0.0%	100.0%
5 or more vehicles available	0	0.0%	100.0%
Average Auto Ownership	0.70	100.0%	
Renter occupied:	4,818		
No vehicle available	3,076	63.8%	63.8%
1 vehicle available	1,512	31.4%	95.2%
2 vehicles available	190	3.9%	99.2%
3 vehicles available	8	0.2%	99.3%
4 vehicles available	0	0.0%	99.3%
5 or more vehicles available	32	0.7%	100.0%
Average Auto Ownership	0.43	100.0%	
Total Average Auto Ownership	**0.51**		

Note: Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data

H44. TENURE BY VEHICLES AVAILABLE [15]

- Universe: Occupied housing units

Table 2-7

Local Resident Journey to Work Mode Split

			Percent	Cumulative Percent
Total All Census Tracts Block Groups		**6,699**		
Car, Truck or Van		961		
	Drove Alone	795	11.9%	11.9%
	Carpooled	166	2.5%	14.3%
Public Transportation		1,754		
	Bus	282	4.2%	18.6%
	Streetcar	0	0.0%	18.6%
	Subway	1,375	20.5%	39.1%
	Railroad	6	0.1%	39.2%
	Ferryboat	0	0.0%	39.2%
	Taxicab	91	1.4%	40.5%
Motorcycle		9	0.1%	40.7%
Bicycle		29	0.4%	41.1%
Walked		3,568	53.3%	94.4%
Othermeans		19	0.3%	94.6%
Stayed Home		359	5.4%	100.0%

Note: Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
P30. Means of Transportation to Work for Workers 16 years and Over [16] '- Universe: Workers 16 years and over

Section 3
ANALYSIS

Overview

This section presents analyses of existing and projected traffic conditions. It includes analysis of existing intersection levels of service, projections of future traffic volumes with and without re-development of Square 54, estimates of peak hour traffic that would be generated by Square 54, and analysis of future intersection levels of service with and without re-development of Square 54.

Existing Levels of Service

Existing peak hour levels of service were estimated at the key intersections in the study area based on the existing lane usage and traffic control shown on Figure 2-1, the existing vehicular and pedestrian traffic counts shown on Figures 2-2 and 2-3, respectively, the existing traffic signal timing plans obtained from DDOT, and the Highway Capacity Manual. The results are presented in Appendix C and summarized in Table 3-1.

Table 3-1 indicates that the majority of the key intersections in the study area presently operate at an overall acceptable level of service (LOS) "D" or better during the AM and PM peak hours.

The eastbound right turn movement, which operates under yield control, at the Washington Circle/K Street intersection currently operates at a LOS "F" during the AM peak hour.

The westbound approach at the 23rd Street/Eye Street intersection currently operates at capacity at a LOS "F" during the PM peak hour due to the high volume of westbound traffic turning left onto 23rd Street.

The westbound movement at the 22nd Street/Pennsylvania Avenue intersection presently operates at capacity at LOS "F" during the PM peak hour due to the high volume of through traffic traveling towards Washington Circle.

Finally, the southbound approach at the 24th and K Street (westbound) intersection currently operates at a LOS "E" during the PM peak hour.

Pipeline Project Vehicle-trip Generation

The number of peak hour vehicle-trips that will be generated by the seven other approved or proposed but incomplete development projects were estimated based on their respective development programs, peak hour trip generation based on the Institute of Transportation Engineers' (ITE) Trip Generation Report, 7th Edition, and non-auto mode splits observed at other comparable projects in Washington, D.C.

As shown in Appendix D, it is estimated that these projects will generate a total of 476 AM peak hour vehicle-trips and 592 PM peak hour vehicle-trips, upon completion and full occupancy.

Vehicle-trip Distribution Analysis

The distribution of peak hour vehicle-trips generated by the other approved projects was determined based on previous traffic studies. The distribution of the peak hour vehicle-trips generated by Square 54 was determined based on existing travel patterns. This distribution is described as follows:

To/From:	Retail/Office	Residential
North along 23rd Street	15%	35%
South along 23rd Street	33%	16%
East along K Street	10%	20%
West along K Street	13%	6%
Northwest along Pennsylvania Avenue	23%	19%
Southwest along New Hampshire Avenue	6%	4%
Total	100%	100%

Pipeline Project Traffic Assignments

The vehicle-trips shown in Table 3-2 were assigned to the public street network based on previous traffic studies. The results are shown on Figure 3-1.

Background Traffic Growth

Annual background traffic growth was estimated at 0.5 percent per year compounded for five (5) years for project buildout (2010). This growth rate was applied to all movements at each intersection in the study area.

Background Traffic Forecasts

Background peak hour traffic forecasts without re-development of Square 54 were estimated based on existing traffic counts, traffic generated by approved but incomplete developments, and historic background traffic growth. The background traffic forecasts for the year of project buildout (2010) are shown on Figure 3-2.

Background Future Levels of Service

Future peak hour levels of service without redevelopment of Square 54 were estimated at the key intersections in the study area for the year of project buildout (2010) based on the intersection lane usage and traffic control shown on Figure 2-1, the background traffic forecasts shown on Figure 3-2, and the Highway Capacity Manual. The results are presented in Appendix E and are summarized in Table 3-1.

Table 3-1 indicates that the pipeline developments would not affect the existing levels of service except at the 22nd Street/Pennsylvania Avenue and 23rd Street/Eye Street intersections, where the overall level of service would drop to a LOS "E" during the PM peak hour, and at the intersection of 24th Street and K Street (westbound), where the southbound approach would operate at a LOS "F" during the PM peak hour.

Site Trip Generation Analysis

The numbers of vehicle-trips that will be generated by re-development of Square 54 were estimated based on: (1) Institute of Transportation Engineers (ITE) vehicle-trip generation rates, (2) the proximity of the project to the Foggy Bottom-GWU Metro station, and (3) experience with other comparable projects in Washington, D.C.

Based on the Development Related Ridership Survey II (WMATA), it was assumed that 60 percent of all office vehicle-trips, 63 percent of all residential vehicle-trips, and 60 percent of all retail and grocery store vehicle-trips would be made on foot, by Metrorail or Metrobus, or by some means of transportation other than automobile.

The proposed re-development of Square 54 would generate a total of 396 AM peak hour vehicle-trips (287 in and 109 out) and 627 PM peak hour vehicle-trips (245 in and 382 out) at project buildout and full occupancy, as shown in Table 3-2. Approximately 37 to 63 percent of these vehicle-trips would be generated by the office component, 10 to 13 percent by the residential component, and 24 to 53 percent by the retail and grocery store component.

Site Traffic Assignments

The site-generated traffic volumes were assigned to the public street network according to the directional distribution described above. The resulting site traffic assignments are shown on Figure 3-3.

Total Future Traffic Forecasts

These site traffic assignments were added to the future background traffic volumes shown on Figure 3-2 to yield the total future traffic forecasts shown on Figure 3-4.

Total Future Levels of Service

Future peak hour levels of service with re-development of Square 54 were estimated at the key intersections in the study area based on the lane usage and traffic controls shown on Figure 2-1, the total future traffic forecasts shown on Figure 3-4, and the Highway Capacity Manual. The results are presented in Appendix F and summarized in Table 3-1.

Table 3-1 indicates that with the re-development of Square 54, the majority of the key intersections would continue to operate at overall acceptable LOS "D" or better during the AM and PM peak hours, except at the intersections discussed previously in the existing and background future levels of service sections.

The eastbound yield controlled right turn movement at the intersection of Washington Circle/K Street (eastbound) will operate at a LOS "E" with an approximately 23 percent increase in delay during the PM peak hour. The southbound movement at the intersection of 23rd Street/Eye Street will operate at a LOS "E" during the PM peak hour. A potential mitigation strategy includes the adjustment of the signal timings at this intersection. The delays for all other approaches operating at a LOS "E" or "F" under the background condition will not increase under the total future condition.

A new traffic signal and a separate eastbound left turn lane are recommended to be constructed at the intersection of 22nd and Eye Streets to accommodate the high volume of traffic turning left onto northbound 22nd Street. In accordance with the Manual on Uniform Traffic Control Devices, the peak hour traffic signal warrant at this intersection would be met under total future traffic volumes. Approximately 50 to 75 percent of this traffic is anticipated to be generated by the re-development of Square 54.

Parking Analysis

The subject site is proposed to be zoned as C-3-C. The District of Columbia zoning ordinance minimum parking requirement in zone C-3-C for apartment houses or multiple dwellings is one (1) space for every four units, for commercial space is one (1) space for each 750 S.F. in excess of 3,000 S.F. of gross floor area, and for office space is one (1) space for each 1,800 S.F. in excess of 2,000 S.F.

Per the District of Columbia zoning ordinance minimum parking requirements, the subject site would require 252 office parking spaces, 84 residential parking spaces, 56 grocery store parking spaces, and 48 retail parking spaces, for a total of 440 parking spaces.

The subject site will be served by five (5) levels of underground parking with approximately 1,026 parking spaces. The residents will be provided with 269 parking spaces or 185 more parking spaces than the minimum number of spaces required by the zoning ordinance. The office users will be provided with 315 spaces or 63 more parking spaces than the minimum number of spaces required by the zoning ordinance. The grocery store will be provided with 80 parking spaces or 24 more spaces than the minimum number of spaces required by the zoning ordinance. The retail users are anticipated to use office parking spaces during the PM peak hours as office users leave for the day. The remaining 362 spaces are anticipated to be allocated to GW for general university use as set forth in the Foggy Bottom Campus Plan: 2006-2025.

In summary, the proposed on-site parking supply would exceed the minimum zoning parking requirements.

Table 3-1
Square 54
Peak Hour Intersection Levels of Service [1]

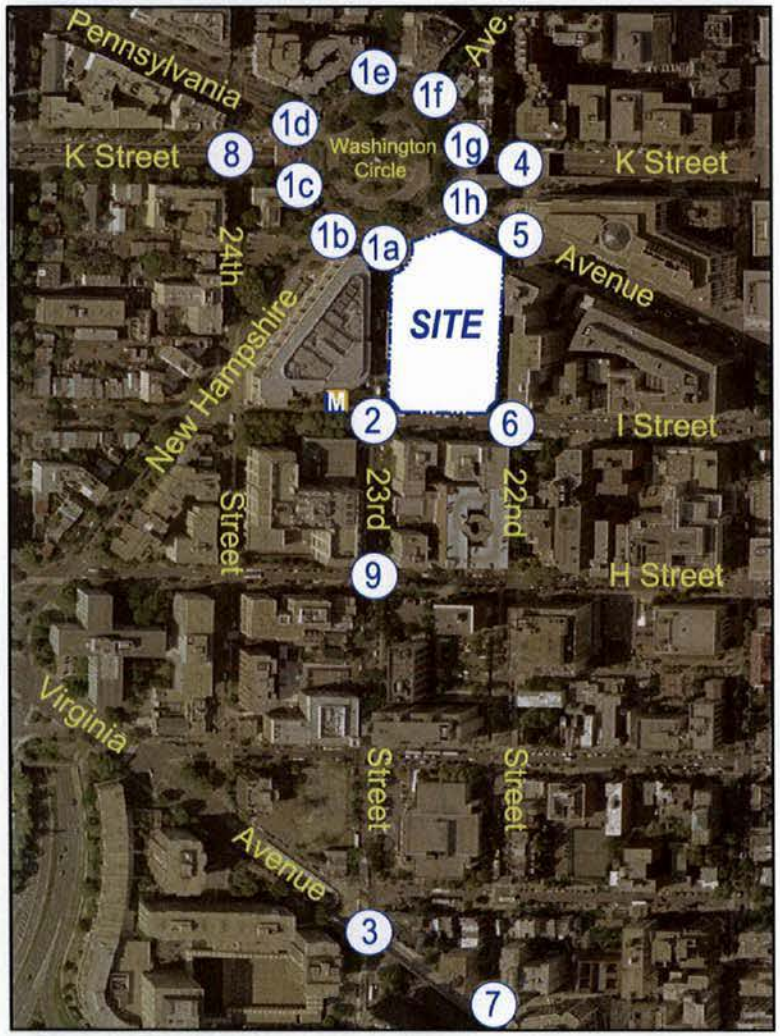
Intersection	Type of Control	2005 Existing Conditions AM	2005 Existing Conditions PM	2010 Background Conditions AM	2010 Background Conditions PM	2010 Total Future Conditions AM	2010 Total Future Conditions PM
1a Washington Circle/23rd Street (NB)	Signal						
Eastbound		A(0.4)	A(0.5)	A(0.4)	A(0.6)	A(0.4)	A(0.7)
Northbound		A(7.5)	A(3.3)	A(7.7)	A(3.0)	A(7.3)	A(2.7)
Overall		**A(1.9)**	**A(1.1)**	**A(1.9)**	**A(1.0)**	**A(1.8)**	**A(1.1)**
1b Washington Circle/New Hampshire Avenue (NB)	Signal						
Southbound		A(12.6)	A(5.9)	B(14.5)	A(6.2)	B(16.6)	A(6.7)
Northeastbound		B(18.5)	B(11.6)	B(18.8)	B(11.8)	B(19.5)	B(12.0)
Overall		**B(13.1)**	**A(6.2)**	**B(14.8)**	**A(6.6)**	**B(16.8)**	**A(7.1)**
1c Washington Circle/K Street (EB)	Yield Sign						
Eastbound R		F[235.7]	D[28.0]	F[327.0]	D[32.8]	F[412.4]	E[40.3]
1d Washington Circle/Pennsylvania Avenue (EB)	Signal						
Southwestbound		B(15.7)	B(16.2)	B(15.9)	B(16.8)	B(16.2)	B(18.1)
Southeastbound		A(0.3)	A(1.7)	A(0.8)	A(2.7)	A(1.0)	A(2.9)
Overall		**A(2.7)**	**A(8.8)**	**A(3.1)**	**A(9.5)**	**A(3.4)**	**B(10.2)**
1e Washington Circle/23rd Street (SB)	Signal						
Southbound		A(4.0)	A(4.3)	A(4.1)	A(4.6)	A(4.2)	A(4.8)
Westbound		A(0.0)	A(0.1)	A(0.0)	A(0.1)	A(0.0)	A(0.1)
Overall		**A(2.2)**	**A(2.3)**	**A(2.3)**	**A(2.5)**	**A(2.4)**	**A(2.5)**
1f Washington Circle/New Hampshire Avenue (SB)	Signal						
Westbound		A(7.1)	A(4.8)	A(7.7)	A(4.9)	A(8.0)	A(5.2)
Overall		**A(7.1)**	**A(4.8)**	**A(7.7)**	**A(4.9)**	**A(8.0)**	**A(5.2)**
1g Washington Circle/K Street (WB)	Yield Sign						
Westbound R		C[16.3]	C[16.9]	C[17.1]	C[18.0]	C[18.2]	C[23.5]
1h Washington Circle/Pennsylvania Avenue (WB)	Signal						
Northeastbound		B(13.1)	C(24.3)	B(13.9)	C(24.7)	B(14.7)	C(24.7)
Northwestbound		A(4.8)	A(1.1)	A(4.5)	A(1.1)	A(4.7)	A(1.4)
Overall		**A(9.4)**	**A(7.9)**	**A(9.8)**	**A(7.6)**	**B(10.2)**	**A(7.6)**
2 23rd Street/I Street	Signal						
Northbound		A(7.1)	A(9.5)	A(6.6)	A(9.4)	A(7.0)	B(10.1)
Southbound		A(8.6)	B(14.4)	A(9.7)	B(15.7)	B(15.1)	E(55.1)
Westbound		C(34.1)	F(283.6)	C(35.2)	F(392.9)	D(35.2)	F(392.9)
Overall		**A(9.1)**	**D(54.0)**	**A(9.3)**	**E(77.9)**	**B(11.5)**	**F(95.8)**

Notes: [1] Analysis performed using Synchro/Simtraffic Version 6.0
* An asterisk (*) indicates delays greater than 999.9 seconds.

Table 3-1 (continued)
Square 54
Peak Hour Intersection Levels of Service [1]

Intersection	Type of Control	2005 Existing Conditions AM	2005 Existing Conditions PM	2010 Background Conditions AM	2010 Background Conditions PM	2010 Total Future Conditions AM	2010 Total Future Conditions PM
3a 23rd Street/Virginia Avenue (WB)/ F Street	Signal						
Northbound		A(9.7)	A(4.6)	B(13.4)	A(5.2)	B(17.2)	A(5.3)
Southbound		A(8.6)	A(6.5)	A(9.0)	A(6.8)	A(8.0)	A(6.9)
Northwestbound		C(24.1)	C(26.7)	C(24.1)	C(26.7)	C(24.1)	C(26.7)
Overall		**B(10.1)**	**A(6.9)**	**B(12.7)**	**A(7.2)**	**B(15.1)**	**A(7.3)**
3b 23rd Street/Virginia Avenue (EB)							
Northbound		B(17.5)	B(11.0)	B(17.5)	B(11.2)	B(18.6)	B(11.6)
Southbound		A(2.5)	A(2.1)	A(2.8)	A(2.5)	A(3.2)	A(2.7)
Eastbound		C(26.2)	D(44.8)	C(26.8)	D(49.0)	C(26.8)	D(49.0)
Overall		**B(14.8)**	**B(10.6)**	**B(14.7)**	**B(11.5)**	**B(15.6)**	**B(11.7)**
4a 22nd Street/K Street (WB)	Signal						
Northbound		A(0.2)	A(0.1)	A(0.2)	A(0.1)	A(0.2)	A(0.2)
Westbound		C(34.4)	D(43.9)	C(34.5)	D(45.3)	C(34.5)	D(45.3)
Overall		**A(8.6)**	**C(20.5)**	**A(8.4)**	**C(20.6)**	**A(8.1)**	**B(18.0)**
4b 22nd Street/K Street (EB)	Signal						
Northbound		A(5.7)	A(5.6)	A(5.6)	A(4.9)	A(5.6)	A(4.7)
Eastbound		A(2.2)	A(9.2)	A(2.3)	A(9.7)	A(2.3)	A(9.8)
Overall		**A(4.4)**	**A(7.1)**	**A(4.4)**	**A(6.7)**	**A(4.4)**	**A(6.4)**
5 22nd Street/Pennsylvania Avenue	Signal						
Northbound		C(34.5)	C(21.9)	D(35.5)	C(22.5)	D(38.1)	C(25.8)
Eastbound		A(2.2)	B(11.3)	A(2.2)	B(11.5)	A(2.1)	B(11.3)
Westbound		C(27.3)	F(84.1)	C(27.8)	F(114.8)	C(27.8)	F(114.8)
Overall		**B(17.0)**	**D(48.0)**	**B(17.4)**	E(61.9)	**B(19.0)**	E(56.8)
Effect on new traffic signal at 22nd and Eye Streets							
Northbound		N/A	N/A	N/A	N/A	C(32.2)	C(23.1)
Eastbound		N/A	N/A	N/A	N/A	A(2.1)	B(10.9)
Westbound		N/A	N/A	N/A	N/A	C(27.8)	F(114.8)
Overall		**N/A**	**N/A**	**N/A**	**N/A**	**B(17.1)**	E(55.8)
6 22nd Street/I Street	Stop Sign						
Northbound LTR		B[11.9]	A[9.7]	B[13.9]	B[10.9]	C[19.6]	B[13.6]
Eastbound TL		B[14.9]	A[9.6]	C[17.3]	B[10.3]	F[73.6]	C[17.2]
Westbound TR		A[9.5]	B[12.0]	A[9.6]	B[13.0]	B[10.3]	C[15.8]
Install a new traffic signal and construct a separate eastbound left turn lane	Signal						
Eastbound		N/A	N/A	N/A	N/A	B(19.5)	A(8.3)
Westbound		N/A	N/A	N/A	N/A	B(19.4)	C(26.1)
Northbound		N/A	N/A	N/A	N/A	D(48.0)	C(31.5)
Overall		**N/A**	**N/A**	**N/A**	**N/A**	**C(33.7)**	**C(23.3)**
8a 24th Street/K Street (WB)	Signal						
Northbound		B(17.1)	B(17.7)	B(17.2)	B(19.7)	B(17.0)	B(19.6)
Southbound		A(4.9)	E(55.4)	A(6.2)	F(114.8)	A(5.9)	F(114.8)
Westbound		A(1.6)	A(6.0)	A(1.6)	A(6.2)	A(1.7)	A(6.5)
Overall		**B(10.6)**	**C(25.3)**	**B(10.9)**	**D(47.3)**	**B(10.7)**	**D(46.4)**
8b 24th Street/K Street (EB)	Signal						
Northbound		C(33.0)	C(27.3)	C(35.0)	C(29.2)	C(35.0)	C(29.2)
Southbound		A(2.3)	A(3.0)	A(2.7)	A(3.1)	A(2.7)	A(3.1)
Eastbound		C(20.1)	B(15.0)	C(21.0)	B(15.2)	C(21.6)	B(15.5)
Overall		**C(21.9)**	**B(13.6)**	**C(22.7)**	**B(14.4)**	**C(23.1)**	**B(14.5)**
9 23rd Street/H Street	Signal						
Northbound		A(0.9)	A(6.0)	A(0.9)	A(6.8)	A(0.8)	A(7.6)
Southbound		B(13.1)	A(6.4)	B(12.6)	A(7.6)	B(13.2)	A(8.8)
Eastbound		C(29.6)	C(32.2)	C(30.5)	C(34.1)	C(30.5)	C(34.1)
Westbound		C(25.3)	D(37.8)	C(24.8)	C(29.6)	C(25.0)	C(30.8)
Overall		**A(7.7)**	**B(11.6)**	**A(7.9)**	**B(10.6)**	**A(7.9)**	**B(11.7)**
10 22nd Street/Square 54 Driveway	Stop Sign						
Northbound TL		N/A	N/A	N/A	N/A	A[3.0]	A[3.4]
Eastbound L		N/A	N/A	N/A	N/A	E[35.3]	F[53.3]

Notes: [1] Analysis performed using Synchro/Simtraffic Version 6.0
* An asterisk (*) indicates delays greater than 999.9 seconds.



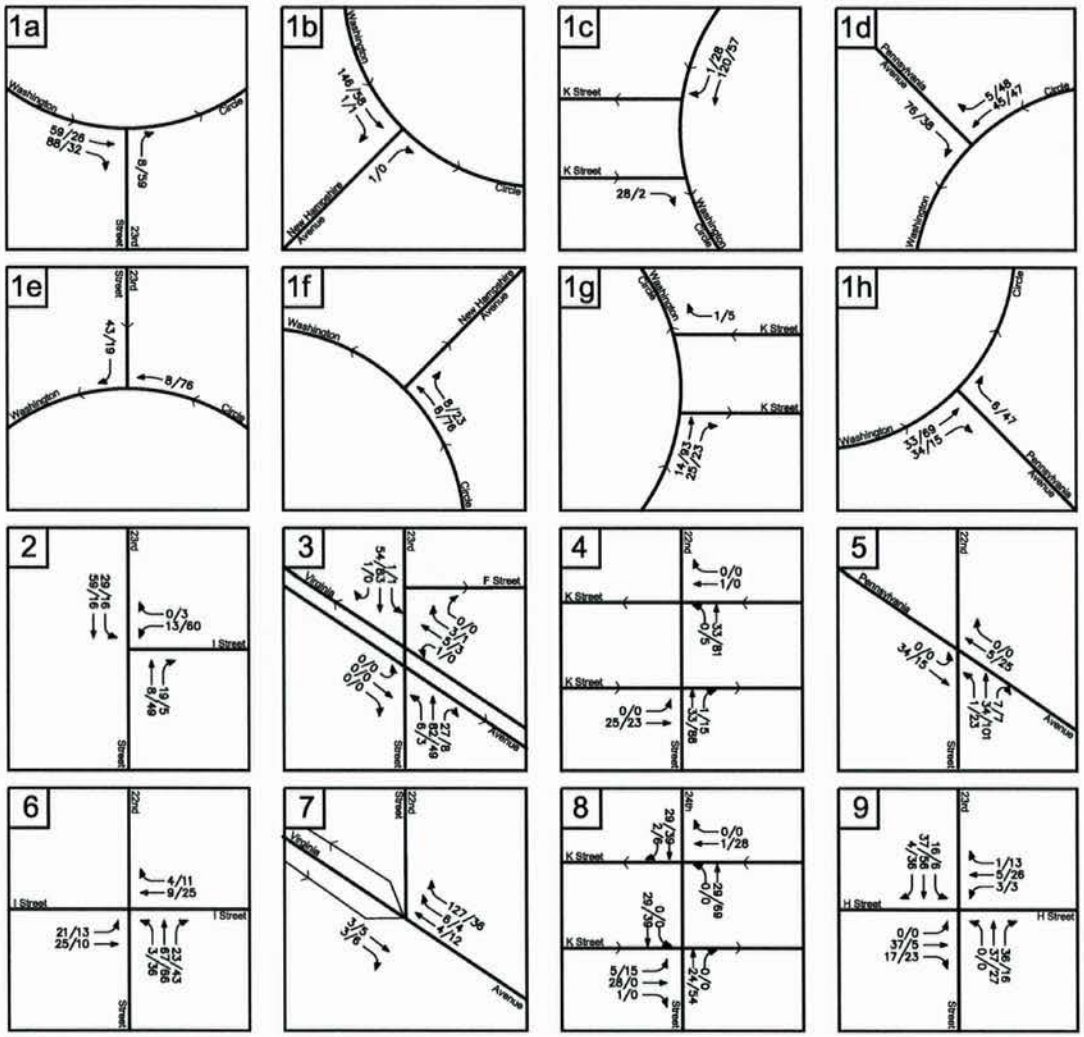


Figure 3–1
Pipeline Projects Traffic Assignments

AM PEAK HOUR
PM PEAK HOUR
000/000

North
Schematic

Square 54
Washington, D.C.

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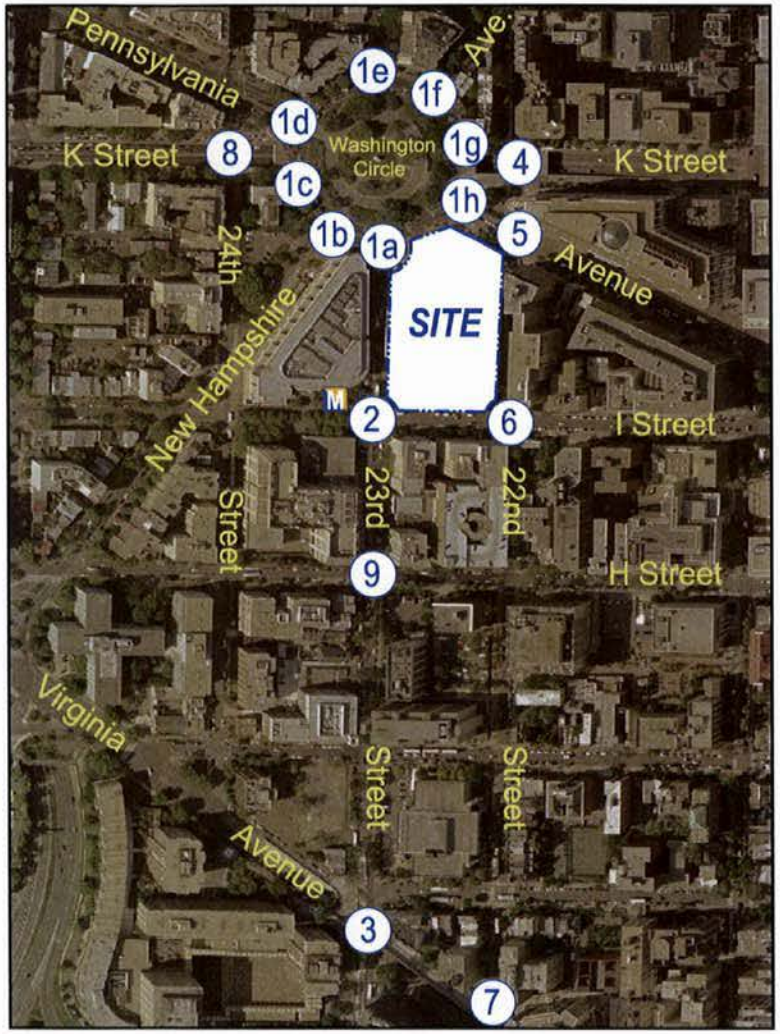

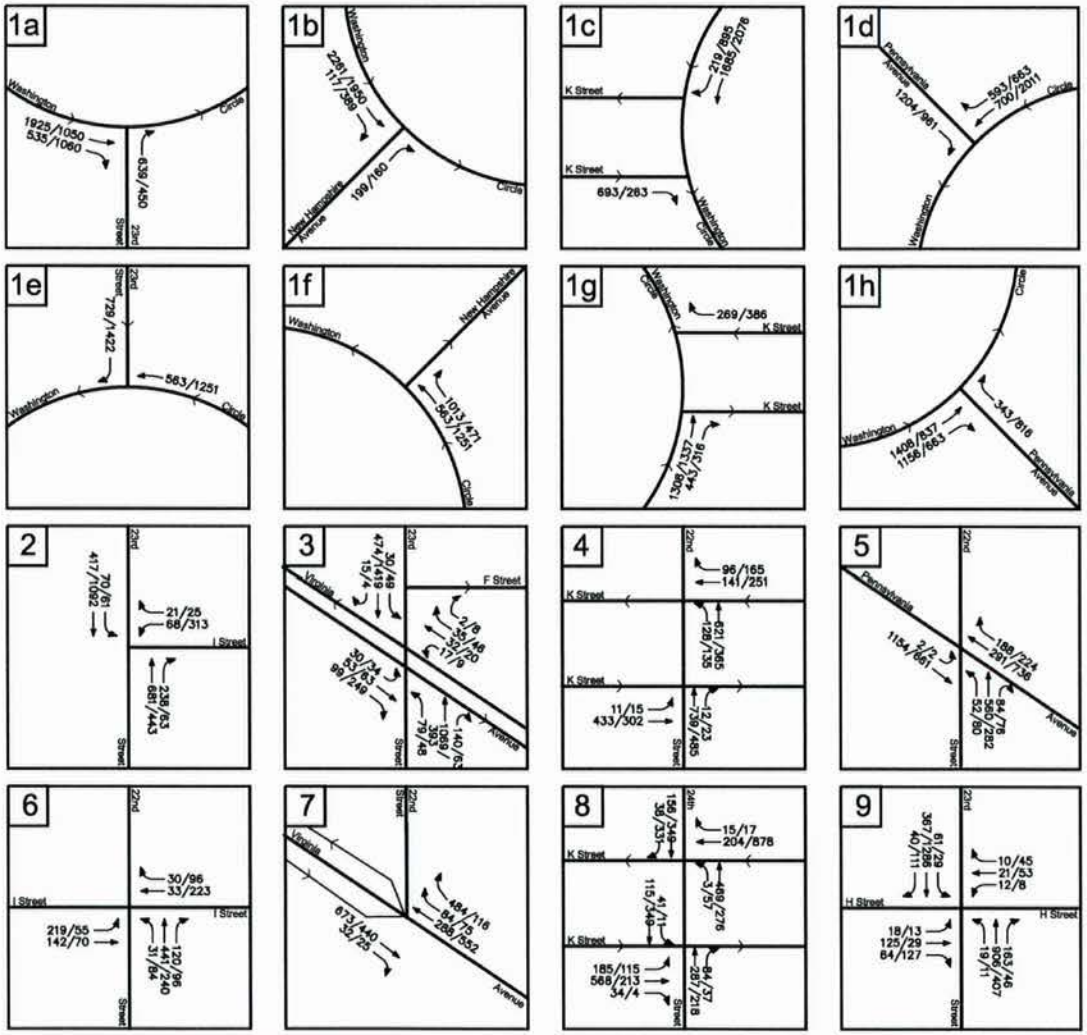

Figure 3–2
Background Future Peak Hour Traffic Forecasts

AM PEAK HOUR
PM PEAK HOUR
000/000

North
Schematic

Square 54
Washington, D.C.

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Table 3-2

Square 54

Site Trip Generation Analysis [1]

				AM Peak Hour			PM Peak Hour		
Land Use	ITE Code	Amount	Unit	In	Out	Total	In	Out	Total
Residential	230	333	D.U.	23	112	135	108	53	161
Non-Auto Reduction [2]		*63%*		*14*	*71*	*85*	*68*	*33*	*101*
Net Net Residential Trips				9	41	50	40	20	60
Office	710	454,000	S.F.	554	76	630	100	487	587
Non-Auto Reduction [2]		*60%*		*333*	*45*	*378*	*60*	*292*	*352*
New Net Office Trips				221	31	252	40	195	235
Grocery Store	850	45,000	S.F.	89	57	146	253	243	496
Non-Auto Reduction [3]		*60%*		*54*	*34*	*88*	*152*	*146*	*298*
New Net Office Trips				35	23	58	101	97	198
Retail	820	39,000	S.F.	54	35	89	161	175	336
Non-Auto Reduction [3]		*60%*		*32*	*21*	*53*	*97*	*105*	*202*
New Net Retail Trips				22	14	36	64	70	134
Total Net New Site Generated Trips				**287**	**109**	**396**	**245**	**382**	**627**

Notes:

[1] Traffic estimates based on Trip Generation, Seventh Edition, The Institute of Transportation Engineers.

[2] The non-auto reduction percentages were calculated based on information provided in the Development Related Ridership Survey II, published by the Washington Metropolitan Area Transit Authority.

[3] The non-auto reduction percentages were calculated based on information provided in the Development Related Ridership Survey II, published by the Washington Metropolitan Area Transit Authority, and on 2000 US Census population and household data.

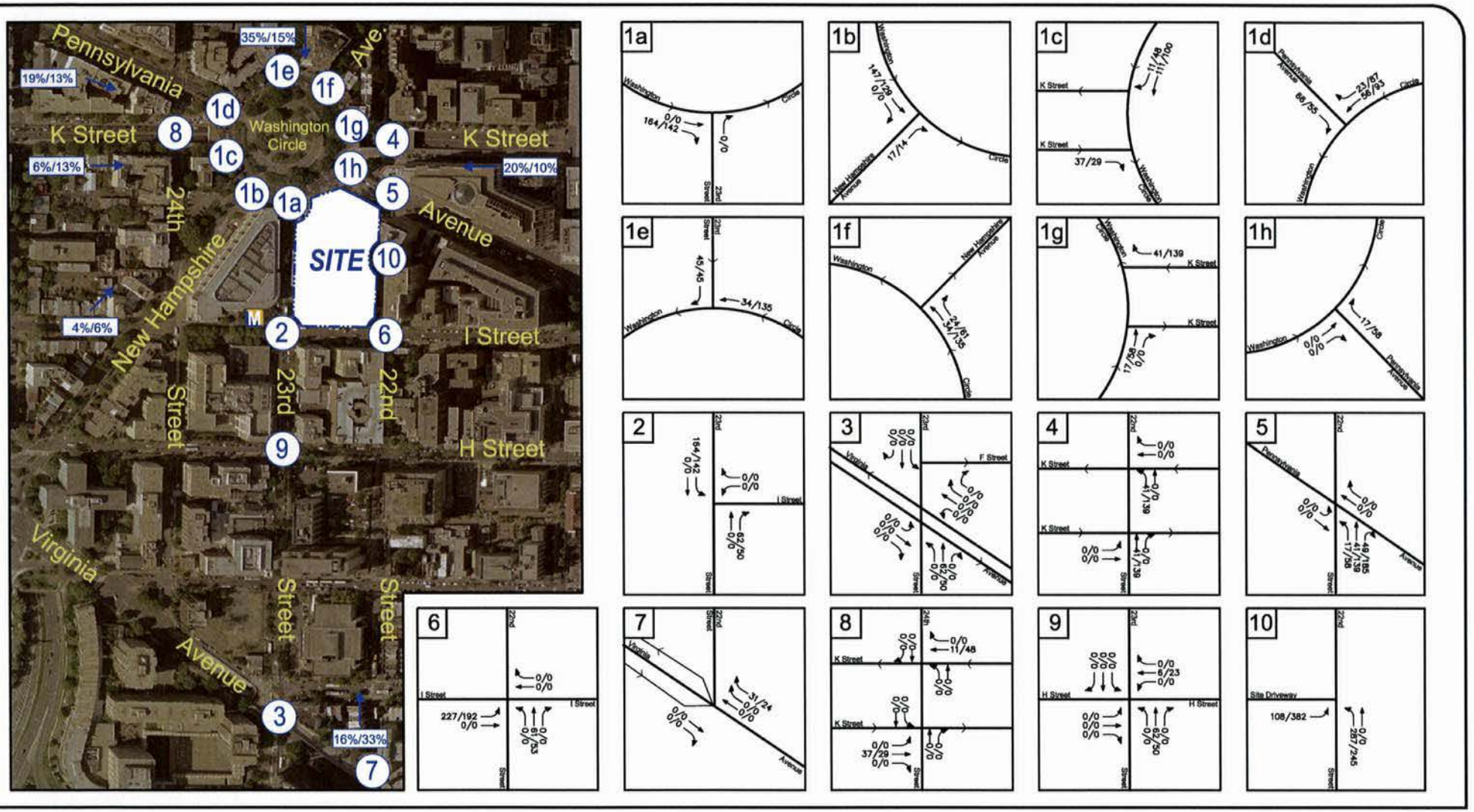

Figure 3–3
Site–Generated Traffic Assignments and Directional Distributions

AM PEAK HOUR
PM PEAK HOUR
000/000

North
Schematic

Square 54
Washington, D.C.

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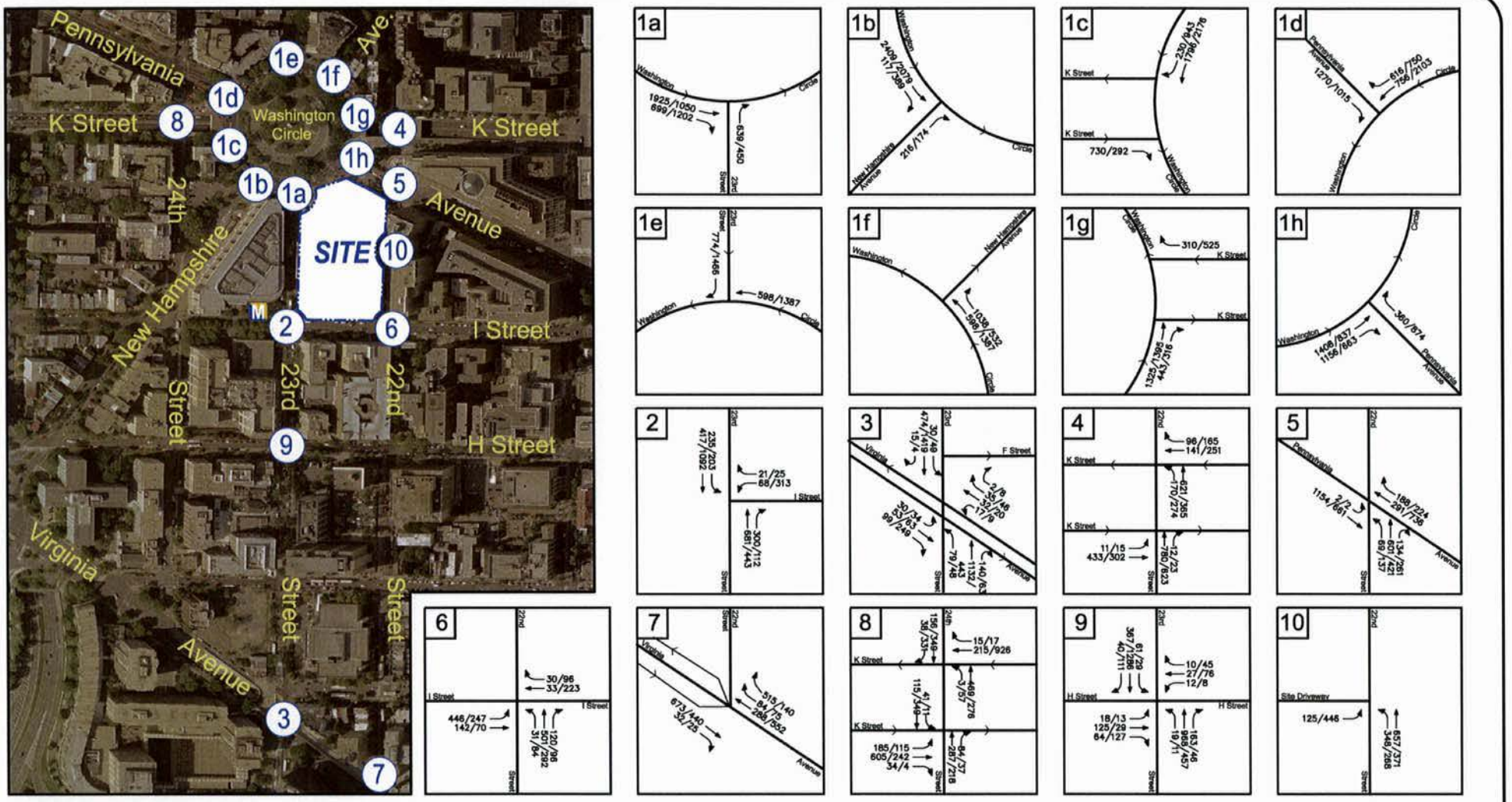

Figure 3–4
Total Future Peak Hour Traffic Forecasts

AM PEAK HOUR
000/000
PM PEAK HOUR
000/000

North
Schematic

Square 54
Washington, D.C.

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Section 4
CONCLUSIONS

The conclusions of this traffic impact study are as follows:

1. The majority of the key intersections in the study area presently operate at an overall acceptable level of service (LOS) "D" or better during the AM and PM peak hours.

   The approved and/or proposed but unbuilt projects in the study area will generate a total of 476 AM peak hour vehicle-trips and 592 PM peak hour vehicle-trips, upon completion and full occupancy.

   Square 54 will add another 396 AM peak hour vehicle-trips and 627 PM peak hour vehicle-trips, to the public street system upon project completion and full occupancy.

2. The eastbound right turn movement, which operates under yield control, at the Washington Circle/K Street intersection currently operates at a LOS "F" during the AM peak hour.

   The westbound approach at the 23rd Street/Eye Street intersection currently operates at capacity at a LOS "F" during the PM peak hour due to the high volume of westbound traffic turning left onto 23rd Street.

   The westbound movement at the 22nd Street/Pennsylvania Avenue intersection presently operates at capacity at LOS "F" during the PM peak hour due to the high volume of through traffic traveling towards Washington Circle.

   Finally, the southbound approach at the 24th and K Street (westbound) intersection currently operates at a LOS "E" during the PM peak hour.

3. These additional background vehicle-trips would not significantly affect the existing intersection delays or levels of service described above, except at the 22nd Street/Pennsylvania Avenue and 23rd Street/Eye Street intersections, where the overall level of service would drop to a LOS "E" and at the intersection of 24th Street and K Street (westbound), where the southbound approach would operate at a LOS "F" during the PM peak hour.

4. Most of the key intersections in the study area would continue to operate at overall acceptable LOS "D" or better during the AM and PM peak hours, with these additional site-generated vehicle-trips, except at the intersections discussed previously in the existing and background future levels of service sections.

   The eastbound yield controlled right turn movement at the intersection of Washington Circle/K Street (eastbound) and the southbound movement at the intersection of 23rd Street/Eye Street will operate at a LOS "E" during the PM peak hour.

5. A new traffic signal and a separate eastbound left turn lane are recommended to be constructed at the intersection of 22nd and Eye Streets to accommodate the high volume of traffic turning left onto northbound 22nd Street.