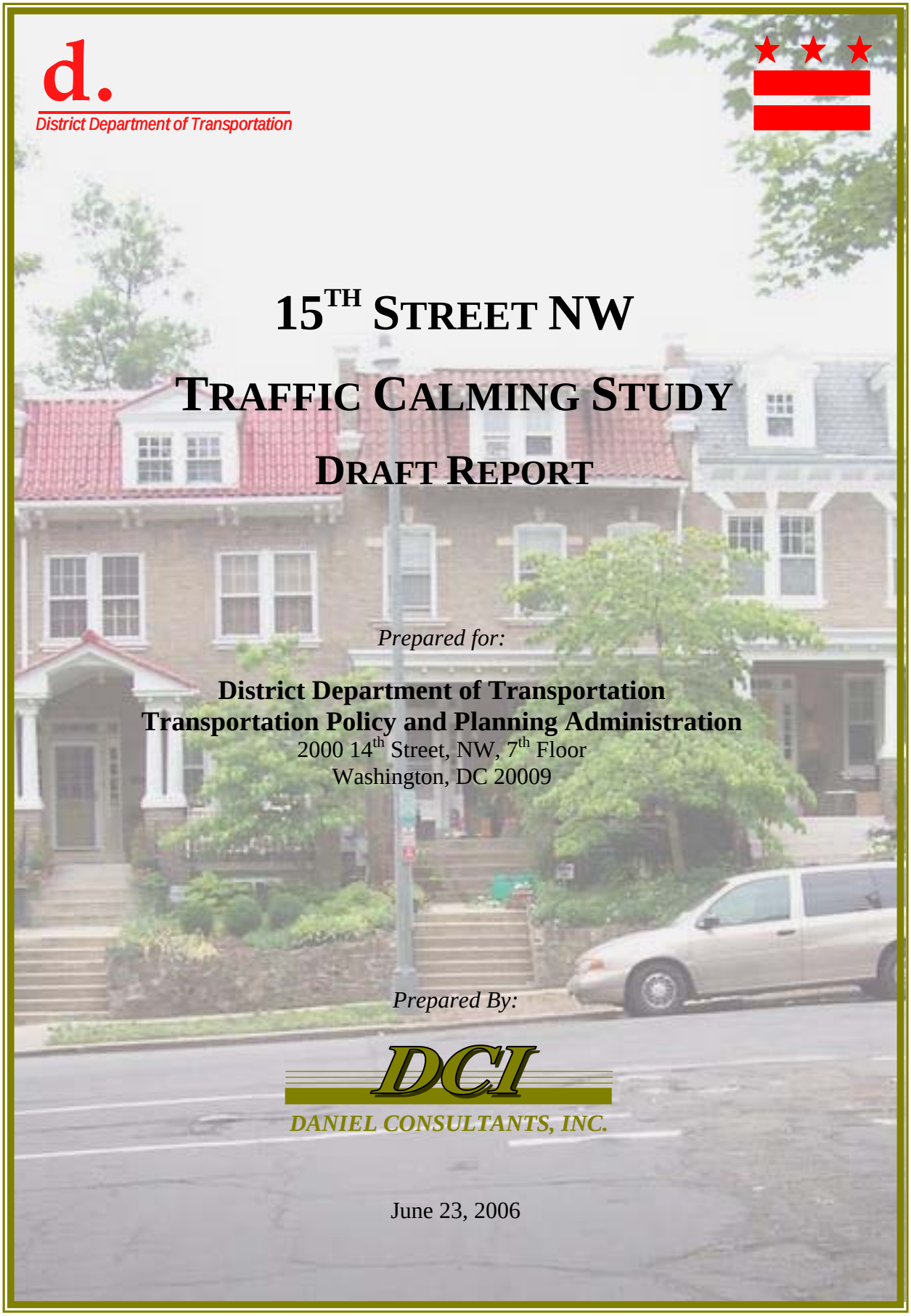

District Department of Transportation

15TH STREET NW

TRAFFIC CALMING STUDY

DRAFT REPORT

Prepared for:

District Department of Transportation
Transportation Policy and Planning Administration
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June 23, 2006

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1. INTRODUCTION

The District Department of Transportation (DDOT) initiated this project to conduct an audit of the existing transportation system in 15th Street Area of Northwest Washington, D.C. This effort was undertaken in response to citizens' petition to conduct a traffic calming study to address concerns regarding speeding, cut-through traffic, non-uniformity of traffic control devices, among other issues.

The purpose of the study was to examine the existing traffic/transportation conditions in the study area, and to determine whether any necessary traffic calming mitigation measures are needed. The study is conducted using structured guidelines.

Figure 1 presents the study area and include the following demarcations:

1. North: Decatur Street
2. East: 14th Street
3. West: 16th Street
4. South: Varnum Street

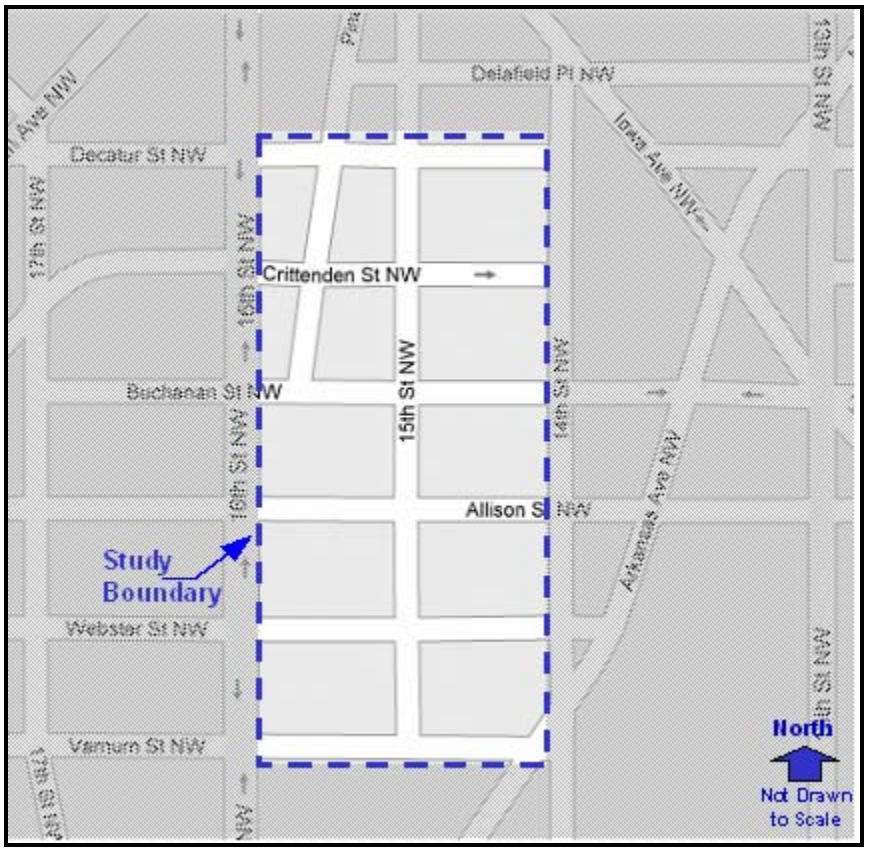

Figure 1. Map of the Study Area

This document contains the findings from the study and the associated traffic calming measures and recommendations. It includes three other chapters in addition to this introduction (Chapter 1). Chapter 2 describes the existing conditions. Chapter 3 presents the analysis and findings. Finally, Chapter 4 discusses the summary of all recommendations.

2. EXISTING CONDITIONS

A rigorous data collection and subsequent analysis of the traffic data were performed to assess the existing conditions of the transportation system within the 15th Street Study Area. The data include roadway information (such as number of lanes, lane width, etc) and traffic information (such as traffic volume, class, speed, cut-through traffic percentages, etc.), as well as other pertinent information. The types of data collected and data collection methods are as follows:

1. Existing Data (land use, street classification and maps)
2. Existing Transportation System Reconnaissance (walk-through)
3. Weekday Intersection Turning Movement Data (manual collection)
4. Weekday Pedestrian and Bicycle Movements (manual collection)
5. Traffic Data -volume, class and speed (machine collection)
6. Percent of Cut-through traffic (origin-destination survey)
7. Planned Future Developments (No data was available)

The data were used as input to a number of analytical tools, such as the Synchro traffic simulation model to determine the traffic level of service, analyzing the warrants for traffic control devices, and determining other safety considerations. The following sections discuss the data collection and the resulting analysis.

2.1 EXISTING LAND USE AND TRANSPORTATION SYSTEM INVENTORY

2.1.1 EXISTING LAND USE

The study area represents a residential development. Figure 2 shows the zoning configuration of the area.

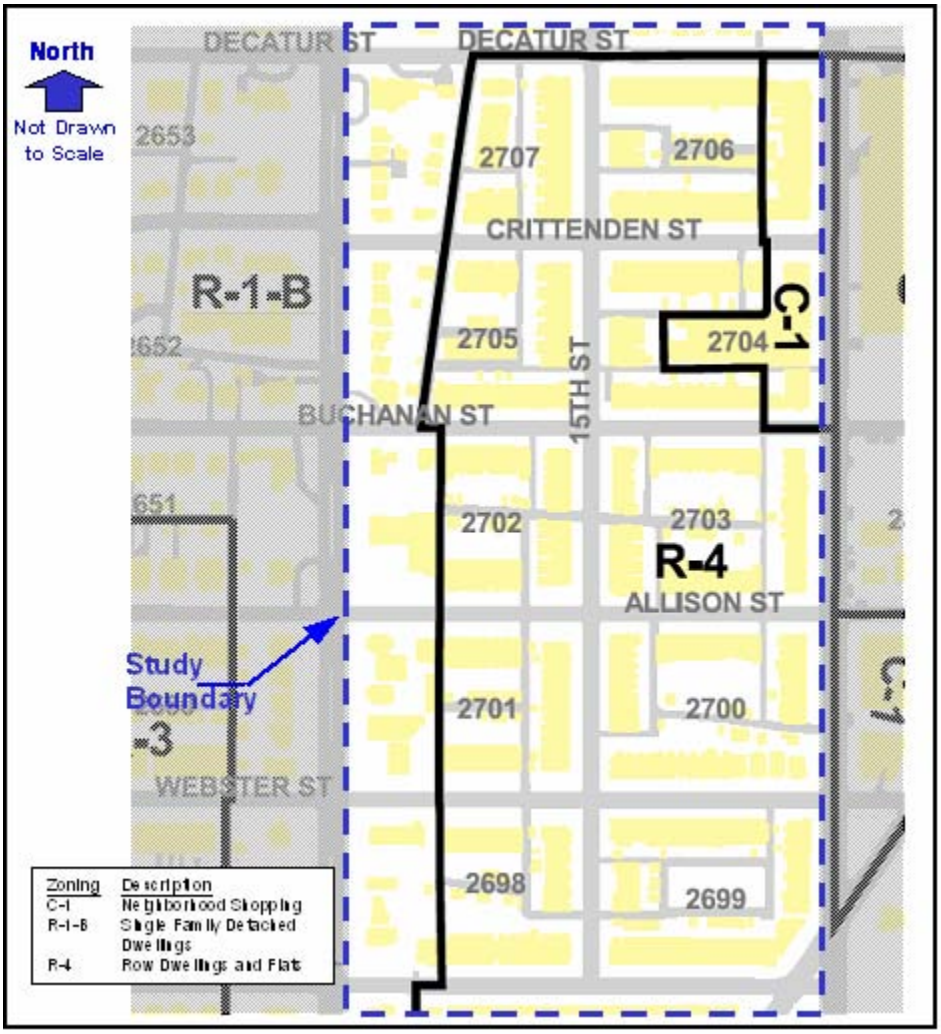

Figure 2. Zoning Map of the Study Area
(Source: District of Columbia Office of Zoning Website)

2.1.2 ROAD NETWORK CHARACTERISTICS

15th Street runs in the north-south direction and is stop-controlled at all intersections with the study side streets. Five of the six east-west streets (e.g., Decatur Street, Crittenden Street, Buchanan Street, Webster St and Varnum Street) have uninterrupted flow at 15th Street, with the exception of Allison Street, that has a 4-way stop control at the intersection. Figure 3 illustrates the functional classification map of the road network within the study area based on the DC roadway functional classification system. The functional classifications for the roads inside the study area include:

a. *Collector* (depicted in yellow)– This includes Decatur Street

b. *Local* (depicted in grey) – This covers all other streets (e.g., 15th Street, Crittenden Street, Buchanan Street, Allison Street, Webster St and Varnum Street).

Regarding the study area boundaries, the following road classifications exist:

a. *Principal Arterial* (depicted in green) – This includes 16th Street.
b. *Minor Arterial* (depicted in blue) – This includes 14th Street.

The classification information provides an overall guidance on the type of improvements that can be considered for a particular road.

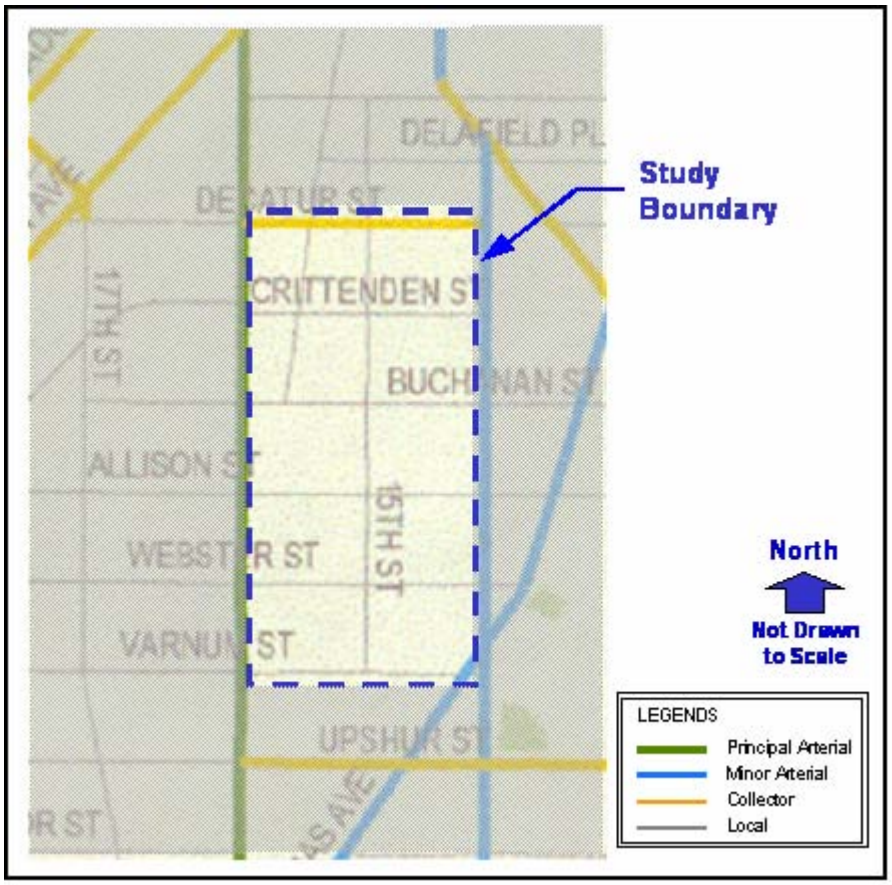

Figure 3. Functional Classification of 15th Street Study Area Road Network

2.1.3 INFRASTRUCTURE INVENTORY

An inventory of the existing roadway facilities information were collected. This information provided a basis for analysis as well as developing recommendations. The summary of the roadway inventory is shown in Appendix A.

2.2 TRAFFIC CHARACTERISTICS

A comprehensive manual and machine traffic counts were conducted within the study area. The data provided a basis for quantitative traffic analysis of the area. An analysis of the collected traffic data is described in the next sections.

2.2.1 INTERSECTION TURNING MOVEMENT DATA

Turning movement data were collected at 6 intersections in 15 minutes intervals for 13 hours during the typical weekdays. The turning movement data included basic classification (i.e., cars, bus, trucks, bicycles, and pedestrians). Figure 4 shows the locations of the counts.

Figure 4. Locations of Manual Intersection Turning Movement Counts

Table 1 shows the data collection schedules for the turning movement counts. The 13-hour counts are presented in the Appendix B.

Table 1. Turning Movement Count Locations

No.	Location	Schedule
1	15th Street and Decatur Street, NW	Tuesday 5/16/2006
2	15th Street and Crittenden Street, NW	Tuesday 5/16/2006
3	15th Street and Buchanan Street, NW	Tuesday 5/16/2006
4	15th Street and Allison Street, NW	Wednesday 5/17/2006
5	15th Street and Webster Street, NW	Wednesday 5/17/2006
6	15th Street and Varnum Street, NW	Wednesday 5/17/2006

Figure 5 through Figure 7 shows the typical weekday peak hour traffic data summaries at the 6 intersections.

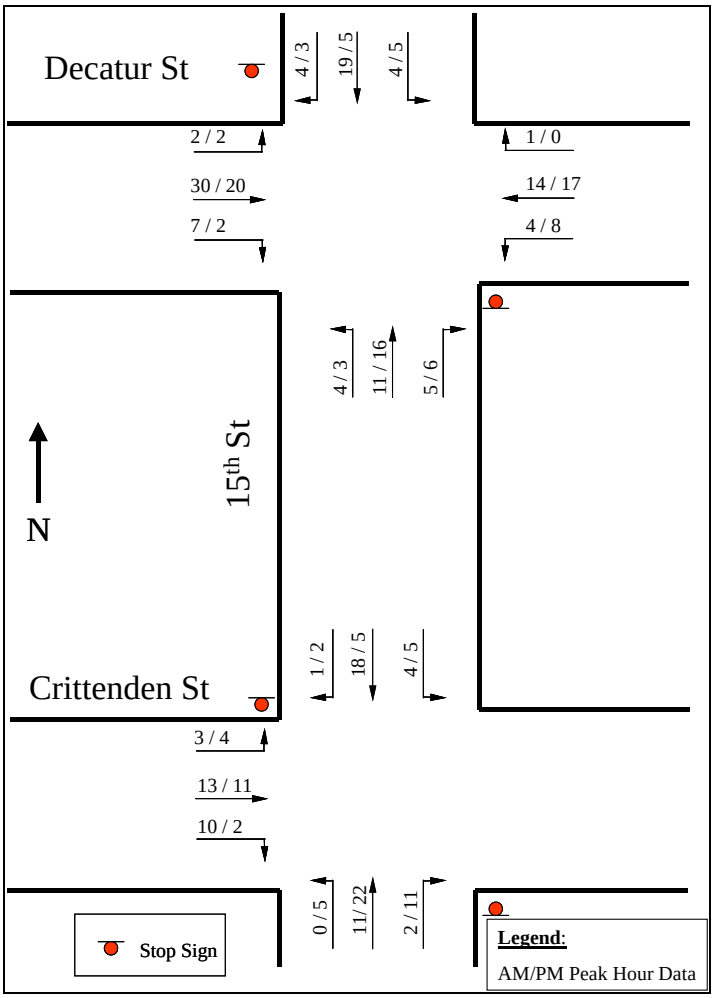

Figure 5. Weekday Peak Hour Traffic Data

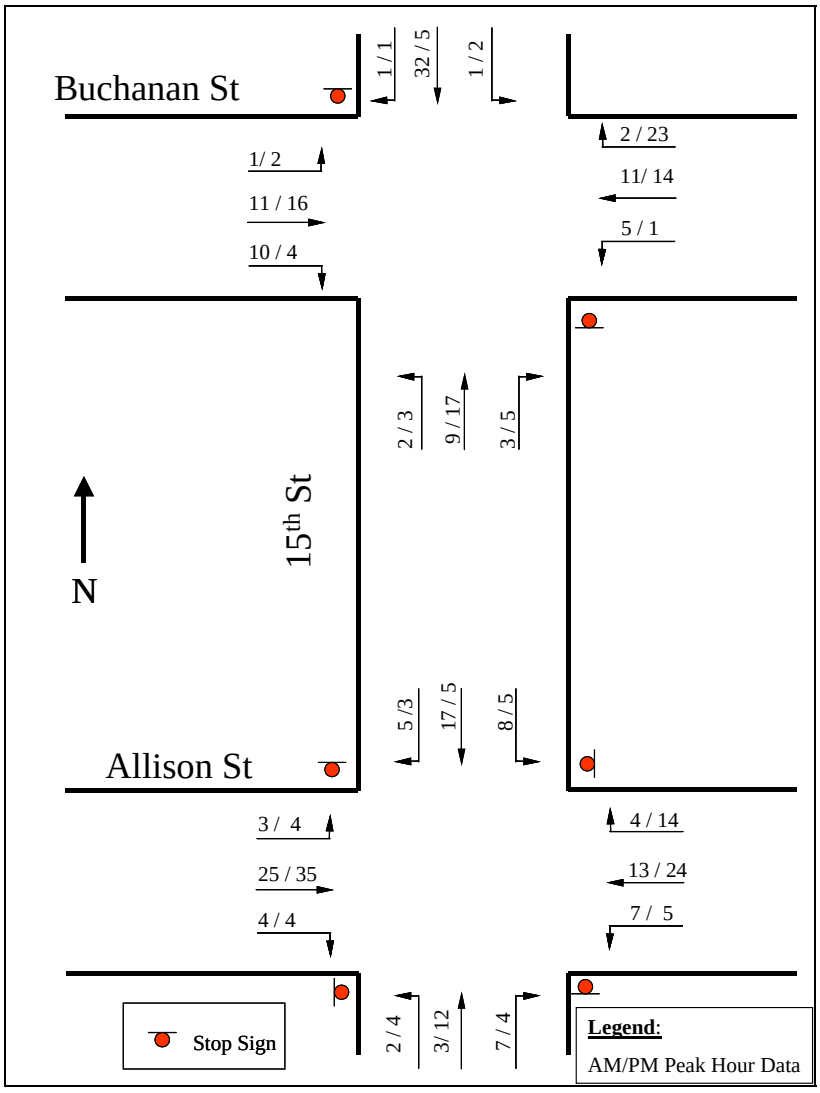

Figure 6. Weekday Peak Hour Traffic Data (Cont'd)

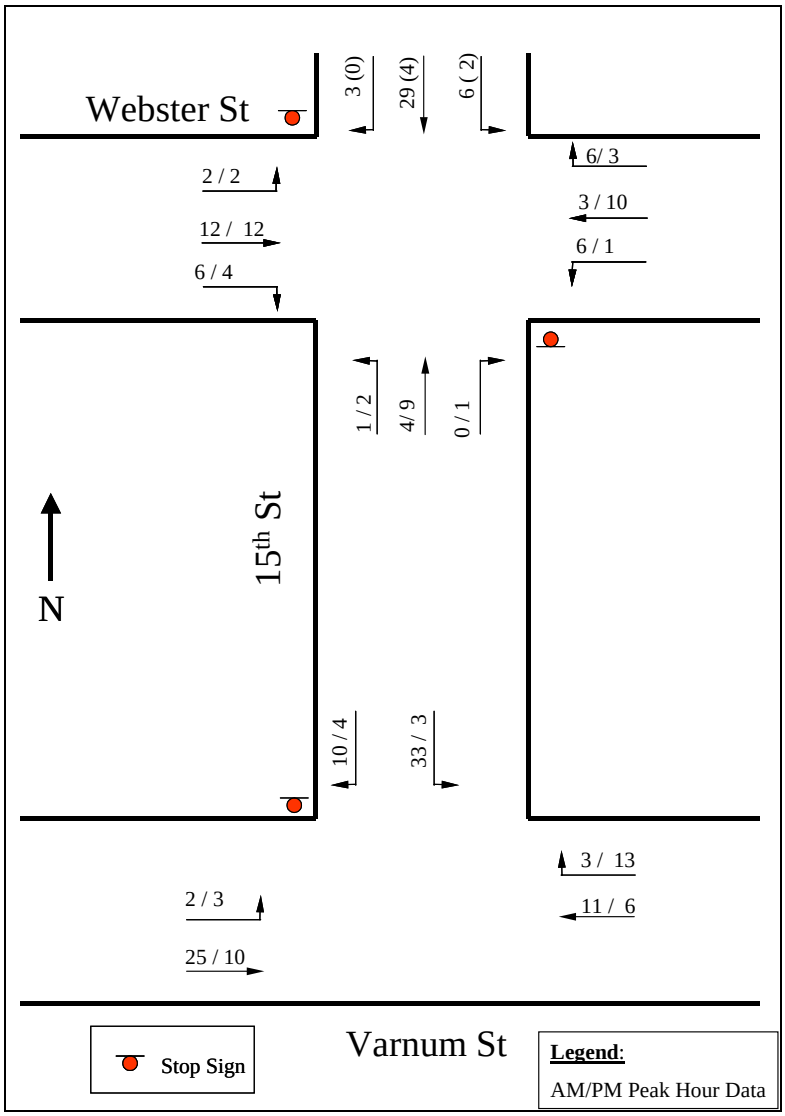

Figure 7. Weekday Peak Hour Traffic Data (Cont'd)

2.2.2 MACHINE COUNTS OF VEHICLE CLASS, VOLUME AND SPEED

Machine counts of vehicle class, volume, and speed were conducted on 15th Street and all 6 side streets. Figure 8 shows the locations of the counts. The data collection efforts were halted during atypical periods, such as the holiday and unforeseen situations whenever the road tubes were damaged by street sweeping activities.

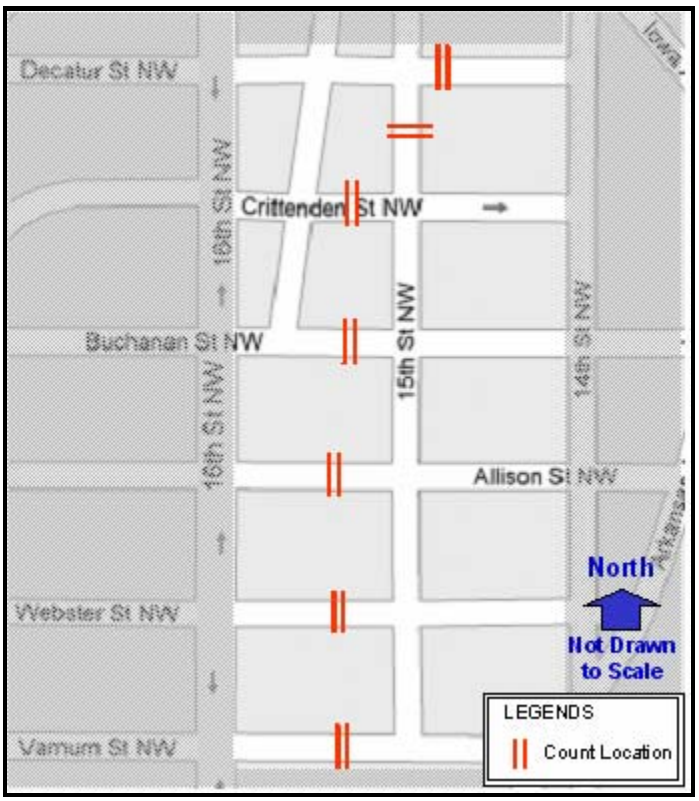

Figure 8. Locations of Machine Volume, Class and Speed Counts

Data were collected in 15-minute intervals for weekdays as well as weekend. Due to the occurrence of Memorial Day holiday during the data collection period, the data collection was extended for another week to capture a data for a bias-free weekend.

The classification data were collected using FHWA's F Classification (13 classifications based on vehicle types and axle lengths devised by the FHWA) Scheme[1]. The speed data were collected in bins[2] of various speed ranges.

The detailed volume, class and speed data are provided in Appendix C. The summary data are presented below.

Table 2 presents the traffic volume data for a 24-hour period for a typical weekday, Saturday and Sunday, respectively. It indicates a low to moderate average daily traffic (ADT), with the highest weekday ADT observed being 852 (weekday) on Buchanan Street. It also indicates a relatively steady daily traffic volume over various days of week (weekday data compared to weekend).

[1] Traffic Monitoring Guide, Federal Highway Administration, 2001.

[2] Speed bins are as follows (in terms of MPH): 0-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-Higher

Table 2. Traffic Volume Data (24-Hour)

Street Name	EB (or NB for 15th St.)	WB (or SB for 15th St.)	Average Daily Traffic (ADT) (i.e., Bi-Directional Total)
Typical Weekday			
15th St	172	217	389
Decatur St	426	323	749
Crittenden St	205	91	296
Buchanan St	434	418	852
Allison St	389	421	810
Webster St	273	193	466
Varnum St	225	236	461
Saturday			
15th St	168	223	391
Decatur St	434	361	795
Crittenden St	193	109	302
Buchanan St	318	271	589
Allison St	434	462	896
Webster St	291	192	483
Varnum St	263	276	539
Sunday			
15th St	178	189	367
Decatur St	471	366	837
Crittenden St	199	80	279
Buchanan St	484	324	808
Allison St	534	427	961
Webster St	293	139	378
Varnum St	296	275	571

Table 3 presents the traffic classification data for a 24-hour period for a typical weekday, Saturday and Sunday, respectively. It indicates a low percentage of truck traffic.

Table 3. Vehicle Classification Data (24-Hour)

Street name	Bi-Directional Counts (FHWA F-Classification*)													
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Total
Typical Weekday														
15th St	4	350	34	0	1	0	0	0	0	0	0	0	0	389
Decatur St	0	653	82	1	11	2	0	0	0	0	0	0	0	749
Crittenden St	5	249	42	0	0	0	0	0	0	0	0	0	0	296
Buchanan St	4	790	55	2	0	1	0	0	0	0	0	0	0	852
Allison St	0	680	126	0	4	0	0	0	0	0	0	0	0	810
Webster St	3	415	45	1	2	0	0	0	0	0	0	0	0	466
Varnum St	3	398	60	0	0	0	0	0	0	0	0	0	0	461
Saturday														
15th St	4	364	23	0	0	0	0	0	0	0	0	0	0	391
Decatur St	4	737	53	0	1	0	0	0	0	0	0	0	0	795
Crittenden St	2	262	38	0	0	0	0	0	0	0	0	0	0	302
Buchanan St	4	513	65	1	6	0	0	0	0	0	0	0	0	589
Allison St	1	831	59	0	5	0	0	0	0	0	0	0	0	896
Webster St	1	431	48	0	3	0	0	0	0	0	0	0	0	483
Varnum St	2	490	47	0	0	0	0	0	0	0	0	0	0	539
Sunday														
15th St	4	336	27	0	0	0	0	0	0	0	0	0	0	367
Decatur St	3	780	53	0	1	0	0	0	0	0	0	0	0	837
Crittenden St	1	245	33	0	0	0	0	0	0	0	0	0	0	279
Buchanan St	0	743	64	0	1	0	0	0	0	0	0	0	0	808
Allison St	2	889	65	0	5	0	0	0	0	0	0	0	0	961
Webster St	1	353	24	0	0	0	0	0	0	0	0	0	0	378
Varnum St	3	518	48	1	1	0	0	0	0	0	0	0	0	571

***Note:**

Class 1 - Motorcycles
Class 2 - Passenger cars
Class 3 - Pickups, Vans, other 2-axle, 4-tire single unit vehicles
Class 4 - Buses
Class 5 -Two-Axle, Six-Tire single unit Trucks
Class 6 - Three-Axle Single Unit Trucks
Class 7 -Four or More Axle Single Trailer Trucks
Class 8 -Four or Less Axle Single Trailer Trucks
Class 9 - Five-Axle Single Trailer Trucks
Class 10 -Six or More Axle single Trailer Trucks
Class 11 -Five or Less Axle Multi- Trailer Trucks
Class 12 -Six-Axle Multi-Trailer Trucks
Class 13 -Seven or More Axle Multi - Trailer Trucks

Table 4 presents the vehicle speed data (85th Percentile) for a 24-hour period for a typical weekday, Saturday and Sunday, respectively. It indicates some deviations from the speed limit of 25 mph in the area. The maximum 85th percentile speed was observed to be 29 mph.

Table 4. Vehicle Speed Data (24-Hour)

Street name	85th Percentile Speed	
	EB (NB for 15th St)	WB (SB for 15th St)
Typical Weekday		
15th St	25 MPH	25 MPH
Decatur St	26 MPH	21 MPH
Crittenden St	25 MPH	21 MPH
Buchanan St	19 MPH	22 MPH
Allison St	28 MPH	28 MPH
Webster St	27 MPH	27 MPH
Varnum St	28 MPH	23 MPH
Saturday		
15th St	24 MPH	24 MPH
Decatur St	25 MPH	22 MPH
Crittenden St	24 MPH	22 MPH
Buchanan St	28 MPH	28 MPH
Allison St	28 MPH	25 MPH
Webster St	25 MPH	27 MPH
Varnum St	29 MPH	27 MPH
Sunday		
15th St	26 MPH	23 MPH
Decatur St	26 MPH	21 MPH
Crittenden St	26 MPH	20 MPH
Buchanan St	27 MPH	25 MPH
Allison St	24 MPH	25 MPH
Webster St	27 MPH	28 MPH
Varnum St	28 MPH	25 MPH

2.3 DISTRIBUTION OF CUT-THROUGH VS. LOCAL TRAFFIC

A vehicle origin-destination (O-D) study was conducted to assess the distribution of cut-through traffic (from 14th Street to 16th Street and vice versa) and local traffic on the side streets through the neighborhood. The *license plate matching* method was used to determine the origins and destinations. Portal points were established at each end of the east-west streets to observes the vehicle in-out through the side street (refer to Figure 9). Short-term observations were made during AM and PM peak hours by rotating from one station pair (i.e., for a single side street) to another. For simplicity in data collection, it is assumed cut-through traffic stays in the same street.

Figure 9. Locations of O-D Survey Stations

Data were collected during morning peak period (7:00 AM - 9:00 PM) and afternoon peak period (4:00 PM-6:00 PM) on Wednesday, May 24, 2006. No weekend data was collected.

The license plate records of vehicles passing through a specific station (coming in) were matched against the records obtained at the other station (going out) in order to determine the trip origin and destination. Thus, trips entering at each side street are matched against trip exiting at the side street. If a match were found for a vehicle coming in, the resulting origin-destination pairs would represent a *cut-through trip* (i.e., external-external). If no match were found, it would imply that the vehicle trip started from or ended within the area or a *local trip (*i.e., internal-external or external-internal).

Table 5 shows the cut-through and local trip distributions for the side streets, by direction and peak. It is to be noted that the overall traffic volume on these side streets are very low and as a result, the sample sizes for the O-D study during the limited durations were very low. The highest amount of cut-through traffic was observed on Allison Street during the AM peak in the eastbound direction, while Crittenden Street exhibited all local traffic in both peak periods.

Table 5. O-D Analysis

Street	Direction of Travel	Time of Day	Duration	Origin Veh Counts	Dest. Veh Counts	Cut-Thru Traffic, i.e., Matching Plates	Ext-Int. Traffic	Int-Ext. Traffic	Total Local Traffic	Total traffic (Local+ Cut-thru)	Local Traffic (%)	Cut-Thru Traffic (%)
Decatur Street	Eastbound	7:00 - 7:15 am	15 min	6	5	2	4	3	7	9	78%	22%
		4:00 - 4:15 pm	15 min	13	12	4	9	8	17	21	81%	19%
	Westbound	7:00 - 7:15 am	15 min	7	6	4	3	2	5	9	56%	44%
		4:00 - 4:15 pm	15 min	4	10	1	3	9	12	13	92%	8%
Crittenden Street (One Way)	Eastbound	7:30 - 7:45 am	15 min	1	1	0	1	1	2	2	100%	0%
		4:20 - 4:35 pm	15 min	2	3	0	2	3	5	5	100%	0%
Buchanan Street	Eastbound	7:45 – 8:00 am	15 min	2	6	0	2	6	8	8	100%	0%
		4:40 – 4:55 pm	15 min	2	7	2	0	5	5	7	71%	29%
	Westbound	7:45 – 8:00 am	15 min	6	4	2	4	2	6	8	75%	25%
		4:40 – 4:55 pm	15 min	9	6	5	4	1	5	10	50%	50%
Allison Street	Eastbound	8:00 – 8:15 am	15 min	11	10	9	2	1	3	12	25%	75%
		5:00 – 5:15 pm	15 min	6	13	6	0	7	7	13	54%	46%
	Westbound	8:00 – 8:15 am	15 min	11	8	6	5	2	7	13	54%	46%
		5:00 – 5:15 pm	15 min	12	10	8	4	2	6	14	43%	57%
Webster Street	Eastbound	8:15 – 8:30 am	15 min	5	5	3	2	2	4	7	57%	43%
		5:20 – 5:35 pm	15 min	7	8	6	1	2	3	9	33%	67%
	Westbound	8:15 – 8:30 am	15 min	8	4	3	5	1	6	9	67%	33%
		5:20 – 5:35 pm	15 min	8	5	3	5	2	7	10	70%	30%
Varnum Street	Eastbound	8:30 – 9:00 am	30 min	10	26	7	3	19	22	29	76%	24%
		5:40 – 6:00 pm	20 min	6	8	4	2	4	6	10	60%	40%
	Westbound	8:30 – 9:00am	30 min	2	8	2	0	6	6	8	75%	25%
		5:40 – 6:00 pm	20 min	7	4	1	6	3	9	10	90%	10%

Table 6 shows the trip summaries by street by combining both peaks and directions. Allison Street exhibits the highest percentage of cut-through traffic (56%), while Crittenden Street showed 0 percent cut-through traffic.

Table 6. O-D Trip Summary by Side Street

Street	Direction of Travel	Total Traffic Volume Observed	Local Traffic (%)	Cut-Thru Traffic (%)
Decatur Street	East & West	52	79%	21%
Crittenden Street (One Way)	East	7	100%	0%
Buchanan Street	East & West	33	73%	27%
Allison Street	East & West	52	44%	56%
Webster Street	East & West	35	57%	43%
Varnum Street	East & West	57	75%	25%

2.4 TRAFFIC LEVEL OF SERVICE

Turning movement counts at the six intersections of 15th Street were analyzed using Synchro a traffic signal analysis software program. The software estimates the congestion at each signalized intersection, defined by Level of Service (LOS). LOS is a qualitative assessment of road user's perceptions of roadway quality of flow and is represented by the letters A through F. LOS A represents the most favorable conditions and LOS F represents the least favorable. LOS C or D is widely regarded as the desirable design objective for intersections.[3] The definition of LOS for unsignalized and signalized intersections are shown in Table 7 and Table 8. This study involves unsignalized intersections only and in this document, the reported LOS (for an unsignalized intersection) is based on the worst LOS of all approaches.

Table 7. Definition of Level of Service (LOS) at Unsignalized (Both Two-Way and All-Way Stop-Controlled) Intersections

LOS	Description	Control Delay Per Vehicle (sec)
A	Free flow	≤10
B	Stable flow with slight delay	>10 – 15
C	Stable flow with acceptable delay	>15 – 25
D	Approaching unstable flow with tolerable delay	>25 – 35
E	Unstable flow. Congestion with intolerable delay.	>35 – 50
F	Unstable flow. Heavy congestion. Total breakdown with stop-and-go operation.	>50

Table 8. Definition of Level of Service (LOS) at Signalized Intersections

LOS	Description	Control Delay Per Vehicle (sec)
A	Free flow	≤10
B	Stable flow with slight delay	>10 – 20
C	Stable flow with acceptable delay	>20 – 35
D	Approaching unstable flow with tolerable delay	>35 – 55
E	Unstable flow. Congestion with intolerable delay.	>55 – 80
F	Unstable flow. Heavy congestion. Total breakdown with stop-and-go operation.	>80

[3] According to the Highway Capacity Manual.

The analysis shows that traffic at all six intersections is operating at a level of service of A during both morning and evening peak periods (shown in Figure 10). The detailed results are provided in Appendix D.

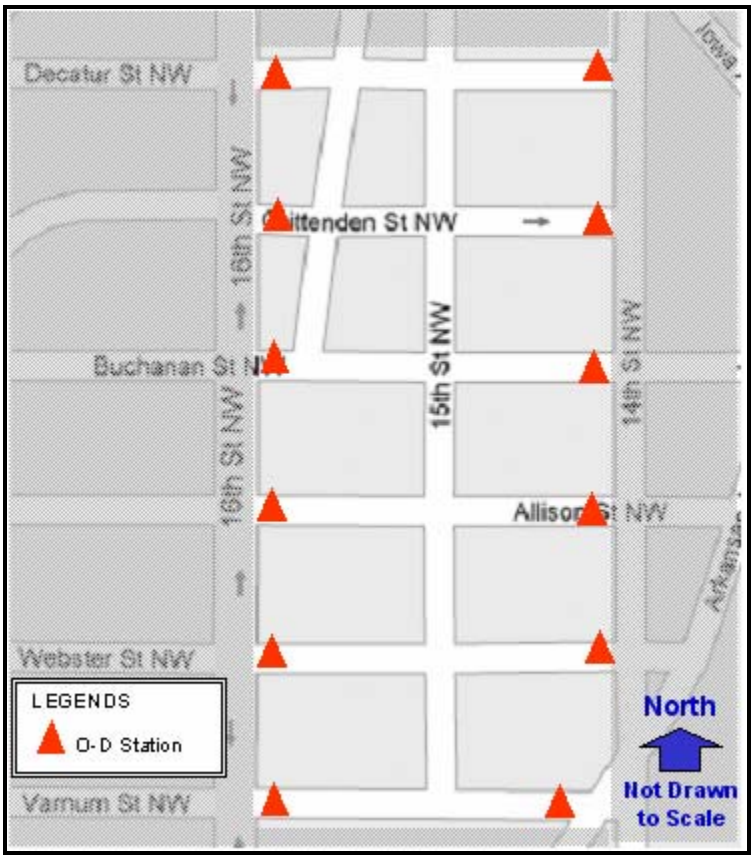

Figure 10. Level of Service during the Peak Periods

2.5 PARKING OVERVIEW

There is on-street parking throughout the study area. Residential Parking Permit Parking (RPP) regulates the street parking during the daytime hours, from 7:00 AM to 8:30 PM on Monday through Friday, as shown in Figure 11. On Mondays or Tuesdays, parking is restricted on one side of the street for several hours for street cleaning. During a survey of the street inventory, there were no cars found to be illegally parked.

Figure 11. Typical Parking Signs in the Study Area

2.6 ACCIDENT DATA

The most recent three-year (2003-2005) accident data were retrieved from DDOT's accident database (TARAS) for locations within and around the study area. The total number of accidents for the three-year period is summarized by intersection and mid-block as presented in Figure 12. The highest number of accidents was noted at the intersection of 15th Street and Buchanan Street.

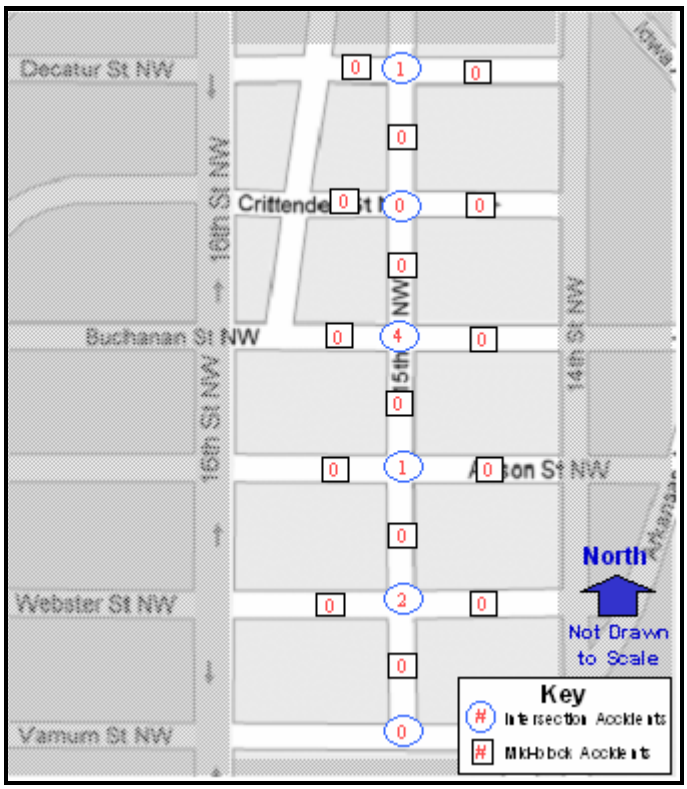

Figure 12. Three-Year (2003-2005) Accident Total

2.7 PEDESTRIANS

Pedestrian data were collected at the six intersections with 15th Street as part of the traffic data collection. There are not many pedestrian activities in the study area due to the residential nature of the area during the data collection period on weekdays. The pedestrian data are presented with the turning movement counts in Appendix B.

In addition, physical inventories of pedestrian facilities (sidewalk, crosswalk and wheelchair ramp) were carried out in the study area (see Appendix A). The past 3-year crash data did not report any pedestrian related accidents.

2.8 PLANNED FUTURE DEVELOPMENTS

There is no future commercial developments recorded within the study area.

3. ANALYSIS AND FINDINGS

The Study Team derived a set of recommendations for transportation infrastructure improvements necessary to enhance traffic and pedestrian safety and mobility in the area. The following resources were utilized as the major study guidelines:

A. *District of Columbia Transportation Audit Guidelines*, District Department of Transportation, Government of the District of Columbia, 2006.

B. *Manual on Uniform Traffic Control Devices*, U.S. Department of Transportation, Federal Highway Administration, 2003.

C. *Design Guidelines for Traffic Calming Measures for Residential Streets in the District of Columbia*, District Department of Transportation, Government of the District of Columbia, July 2005.

This chapter presents the methodology used for identifying problems and determining the corresponding remedial solutions.

3.1 METHODOLOGY

Figure 13 presents an overview of the study approach. The approach consists of three phases: problem identification, investigation and analysis, and solution development.

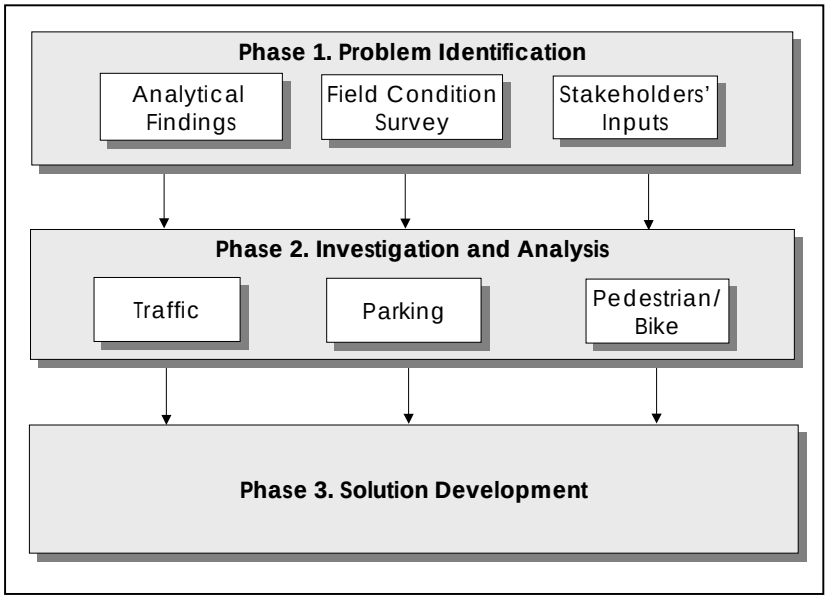

Figure 13. Study Methodology

As shown in Figure 13, the problem identification has its roots in three (3) primary sources:

1. Analytical Findings: The initial phase of the study involved data collection and subsequent analysis. The analysis included assessing the data to check the warrants for Stop signs or signals according to the Manual on Uniform Traffic Control Devices (MUTCD). Additional analysis was done using a transportation modeling software, called Synchro for determining the level of service (LOS). The traffic volume, lane geometrics and intersection control data were entered into the software to generate the LOS outputs.

2. Field Condition Survey: The Study Team walked through the study road network to collect inventory information for the existing infrastructure. This information includes existing traffic control, signs and markings, and pedestrian and bike facilities. It allows for the identification of deficiencies, warranting repair and maintenance of certain infrastructure elements.

3. Stakeholders' Input: Stakeholders' input was obtained through the Public Meetings conducted during the study and a number of Citizens' letters addressed to DDOT.

3.2 FINDINGS FROM TRANSPORTATION AUDIT

According to DDOT Transportation Audit Guidelines (2006), traffic calming measures should be considered if the following criteria are met: (1) the average daily traffic (ADT) is between 1,500 to 5,000 vehicles per day (vpd) or if the peak hour volume is greater than 150 vehicles for the roadway; or (2) the 85th percentile speed (i.e., the speed at or below which 85% of the vehicles travel) on a street segment exceeds the posted speed limit by at least 10 mph.

Based on the traffic counts conducted during May and June of 2006, none of the streets in the study area had an ADT above 1,500 vpd (as shown in Table 2). Based on the vehicular speed collected by pneumatic tubes in May and June of 2006, the 85th percentile speed on the Streets in the Study area is between 19 and 29 mph as shown in Table 4 during a typical weekday. The speed limit on the streets in the study area is 25 mph. Note that there is no speed limit sign in the study area, except for Crittenden Street; however, by DC regulations, the speed limit for all roads are 25 mph unless a sign is posted otherwise. In summary, neither the ADTs nor the 85th percentile speeds in the study area met the District's criteria for traffic calming.

It is noted that there are several streets in the neighborhood that experience large percent of cut through traffic as indicated in Section 2.3. However, the traffic volumes and speeds in the study area do not warrant traffic calming devices.

3.3 FINDINGS FROM LOS AND WARRANT ANALSYES

The analysis included an analytical evaluation of the 6 intersections. The analysis included – 1) levels of service for AM and PM peak hours, 2) traffic signal warrants, and 3) Stop sign warrants. The findings are discussed below.

3.3.1 LEVEL OF SERVICE ANALYSIS

A level of service (LOS) was conducted for AM and PM peaks of a typical weekday as discussed in Section 2.4. The analysis indicated LOS A for all 6 intersections during both peaks, indicating a comfortable state from a traffic operations point of view.

3.3.2 SIGNAL WARRANTS ANALYSIS

The MUTCD warrants for signals were checked for the 6 intersections. None met the requirements. The details of the analysis are presented in Appendix E.

3.3.3 ALL-WAY STOP SIGN WARRANTS ANALYSIS

Two-way Stop or all-way Stop signs installations are guided by the warrants suggested in the MUTCD. Table 9 presents the warrants and how it applies to the six study intersections:

Table 9. All-Way Stop Warrants

MUTCD Warrant	Study Intersections
A. Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.	None of the intersections warrant signals (Section 3.3.2); therefore, this criterion does not apply. *Does not meet the MUTCD requirement.*
B. A crash problem, as indicated by 5 or more reported crashes in a 12-month period that susceptible to correction by a multi-way Stop installation. Such crashed include right- and left-turn collisions as well as right-angle collisions.	The maximum number reported crashes in a 12-month period is 3 and it occurred at the intersection of 15th Street and Buchanan Street. *Does not meet the MUTCD requirement.*
C. Minimum volumes:	
1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day, and	None of the intersections services 300 vehicles per hour even during the peak period. *Does not meet the MUTCD requirement.*
2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total or both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic at least 30 seconds per vehicle during the highest hour, but	Not applicable, since C.1 is not met. *Does not meet the MUTCD requirement.*
3. If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the above rules.	The maximum 85th percentile speed is 29 mph, below the threshold. *Does not meet the MUTCD requirement.*
D. Where no single criterion is satisfied, but where Criteria B, C.1 and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.	The 80% requirements are not met. *Does not meet the MUTCD requirement.*

Therefore, none of the six intersections meet the requirements for All-Way Stop signs.

3.4 OVERVIEW OF OTHER IMPROVEMENT OPTIONS

In addition to the structured methodology for LOS determinations, warrant studies, the Study Team looked at other options for general improvement of transportation in the area, including safety and parking. These are discussed as follows.

3.4.1 TRAFFIC SIGNS

A lack of Speed Limit Signs was noted in the study area. The study recommends installation of speed limit signs on all side streets, where missing.

3.4.2 PEDESTRIAN FACILITIES

Appendix A presents the pedestrian facilities in the area, which include the sidewalk, crosswalk and wheelchair ramp information. It indicated that several wheelchair ramps are missing while crosswalks are present. The study recommends installation of these wheelchair ramps.

3.4.3 INTERSECTION SIGHT DISTANCE ISSUE

Citizens raised issues regarding site distance problem related to the cars parked too close to the intersection. Though during the Study Team's reconnaissance of the area, no illegal parked vehicles were seen, it is recommended that parking enforcement be done in the area from time to time.

It is recommended that painted bumpouts (12" white transverse lines enclosed by 4" white lines) be installed 4 feet from the curb on the intersection approaches along 15th Street where parking is not permitted, as shown in Figure 14. The pavement markings will reinforce the no parking signs installed on the streets and provide a visual narrowing of the streets. The no parking zones should also be adjusted to cover a minimum 25' (and a preferred 40') from the intersection curb line.

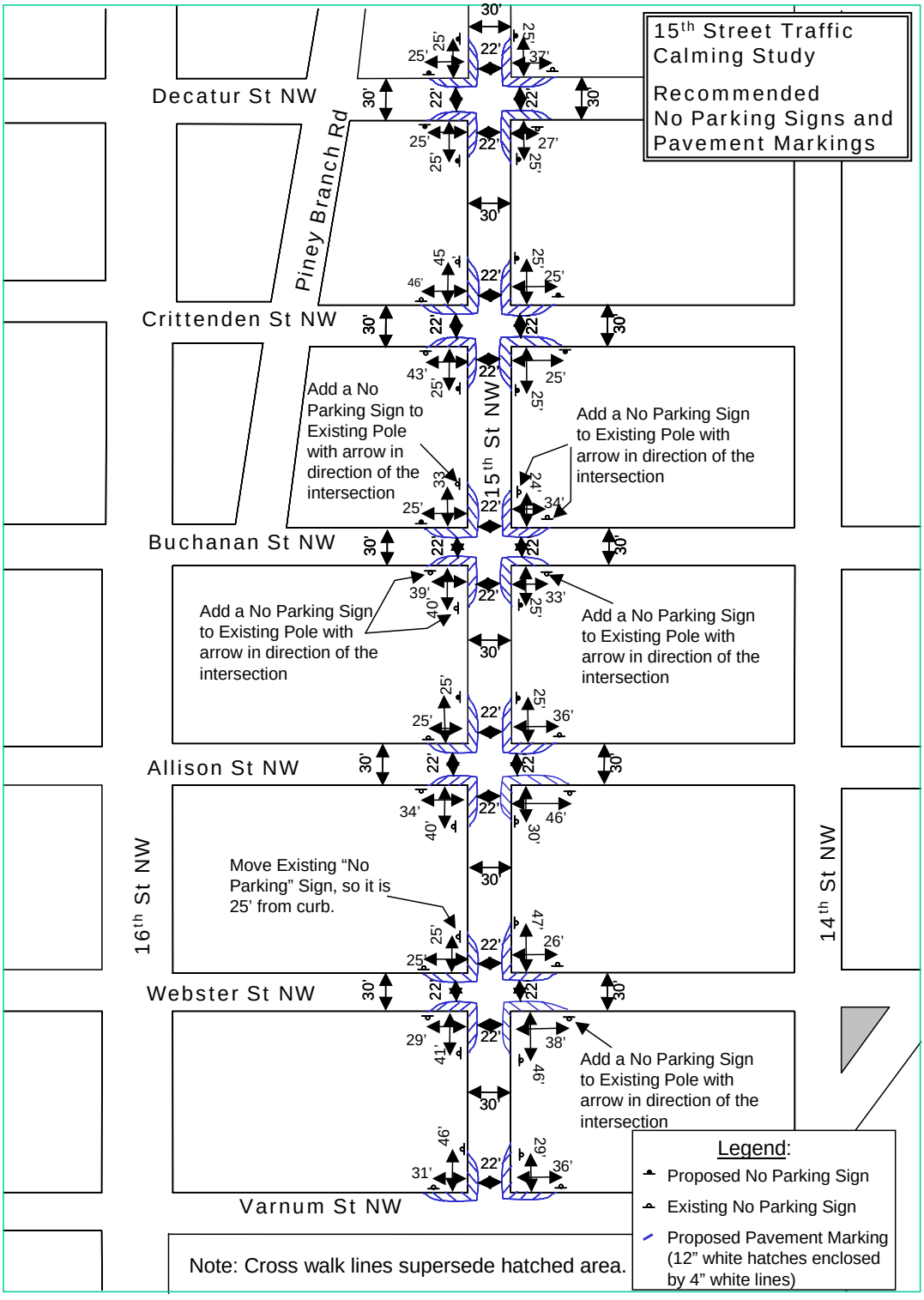

Figure 14. Recommended No Parking Marking and Signs

3.4.4 SPEEDING ISSUE

Citizens raised issues regarding vehicles speeding through the side streets. The study indicated that the 85th percentile speed is within a reasonable range. However, it is recommended that speeding enforcement be done in the area from time to time.

The proposed painted bumpouts (Section 3.4.3) is expected to help reduce any erratic speeding problems.

3.4.5 PARKING LANE MARKINGS

Placing parking markings on the road was researched but it is not recommended for this area because the width of the road, which is 30 feet on all streets, is too narrow. The width needed for parking markings is 8 feet and the width needed for each lane is 8 feet. For two-way traffic and parking on both sides of the street a minimum of 32 feet is needed.

3.4.6 PARKING LAYOUTS

At the first meeting, a citizen had requested that one-way streets with perpendicular parking be looked into. This is option is not recommended either. This option poses safety concerns, e.g. residents having to park on the opposite side of the street and crossing with children, groceries, etc. This would not allow residents a parking alternative on street cleaning days. The minimum width needed to convert to angled parking is 36 feet for parking on one side of the street with angled parking on the other.

4. RECOMMENDATIONS SUMMARY

The recommendations for the 15th Street NW area were developed based on a structured analysis. The level of service analysis indicated that no traffic operational improvements are necessary within the area. The all-way stop and signal warrant studies indicated that no additional traffic control devices (stop signs and signals) are warranted within the study area.

From the general observation of the area, a few recommendations are made to further enhance the traffic operations and safety (as discussed in the previous chapter). These are as follows:

No.	Identified Problems and/or Objective	Location	Recommended Improvements
1	Absence of Speed Limit signs	Both Directions of: • Decatur Street • Buchanan Street • Allison Street • Webster Street • Varnum Street • 15th Street	Install SPEED LIMIT 25 signs
2	Absence of wheelchair ramps	• Crittenden/15th Streets (NE corner – both; SE corner – both; SW corner – both) • Allison/15th Streets (NE corner – crossing north-south; SE corner – crossing north-south; SW corner – crossing north-south) • Webster/15th Streets (NE corner – crossing north-south; SE corner – crossing north-south; SW corner – crossing north-south; NW corner – crossing north-south)	Install wheelchair ramps.
3	Potential illegal parking creating sight distance problem at intersections and Potential speeding problem	All six intersection approaches along 15th Street.	Install painted bumpouts (12" white transverse lines enclosed by 4" white lines) 4 feet from the curb. Adjust No Parking signs.
4	Potential illegal parking creating sight distance problem at intersections	All six side streets	Conduct parking enforcement form time to time.
5	Potential speeding problem	All six side streets	Conduct speeding enforcement form time to time.