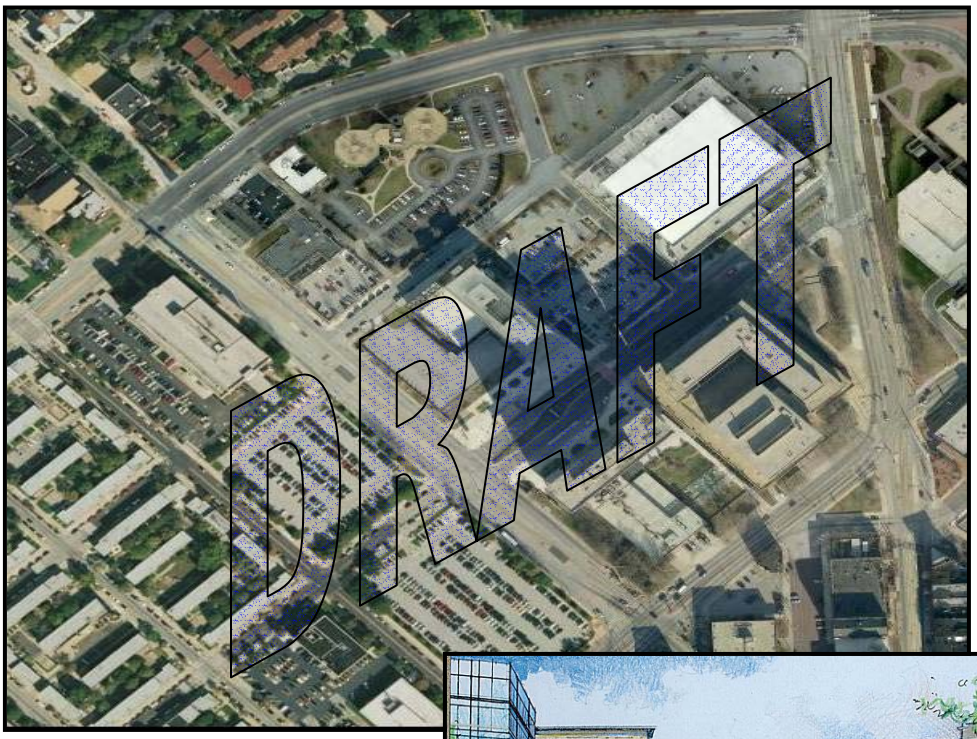
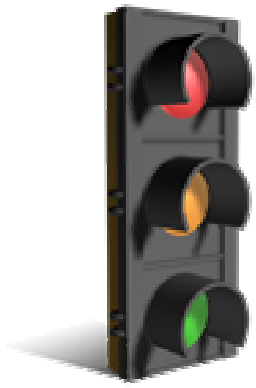
State Center Planned Unit Development
Traffic Impact Study

1100 N. Eutaw Street, 201, 300 and 301 W. Preston Street
231 29th Division Street





September 2008

Sabra, Wang & Associates, Inc.
Engineers • Planners • Analysts

1504 Joh Avenue Baltimore, MD 21227

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Traffic Impact Analysis Glossary:

Access Point = An intersection, driveway, or opening on a public street providing entry to a private development or property.
ADA = Americans with Disabilities Act
Adjacent Street Traffic = All traffic with direct access to a development site
Arterial = A signalized street that primarily serves through traffic and that secondarily provides access to abutting properties, with signal spacing of 2.0 miles or less.
At-Grade Intersection = The location at which two roadways cross and join at the same vertical elevation; access through the intersection may be controlled by traffic signals or stop/yield signs
Background Conditions = Conditions affecting the performance of the transportation network not directly related to the subject development over a designated time period, such as growth in existing traffic volumes, other planned, approved or current developments in the study area, and planned improvements to the transportation network
Capacity = The maximum sustainable flow rate at which vehicles or persons reasonably can be expected to traverse a point or uniform segment of a roadway during a specified time period under given roadway, geometric, traffic, environmental, and control conditions, usually expressed as vehicles per hour.
Collector = A roadway with no control of access linking residential communities with the arterial system
Cycle = The time period required for one complete sequence of traffic signal indications
Delay = The additional time experienced by a roadway user, typically motorists as a result of constrained movements and deviation from ideal or free flow travel speeds
Generator = A land use that attracts vehicle, pedestrian or other modes of traffic
Highway Capacity Manual = A publication of the National Academy of Sciences Transportation Research Board that provides a collection of the state-of-the-art techniques for estimating the capacity and determining the level of service for transportation facilities, first published in the 1950's and most recently published in 2000.
Internally Captured Trip = A trip originating and destined for different land uses within the same development but not traveling on a public street
Level of Service = A qualitative measure describing operational conditions within a traffic stream, based on service measures such as speed, travel time, freedom to maneuver, traffic interruption, comfort and convenience.
Modal Split = The percentage of people using a particular means of transport, such as auto, transit, or walking, to make a trip
Multi-modal = A transportation facility for different types of users, modes or vehicles.
Pass-by Trip = An intermediate stop on the way from an origin to a primary trip destination without a route diversion. Pass-by trips are attracted from traffic passing the site on an adjacent street or roadway that offers direct access to the development.
Peak Hour = The one-hour period of greatest utilization of a transportation facility; weekdays normally have two peaks, one in the morning and one in the afternoon
Phase = A portion of a traffic signal cycle allocated to any traffic movement or combination of traffic movements
Split-Phased Mode = A type of signal control where all movements from one side street at a time move concurrently

I. INTRODUCTION

The State Center Planned Unit Development (PUD) project in Baltimore City is proposing a development program that includes 2 million SF of office space (800,000 SF existing government office space, 500,000 SF new government office space and 700,000 SF private office space) 1,425 residential dwelling units, 200,000 square feet of retail space, 50,000 SF restaurant space, 340,000 SF civic space (museum, armory and amphitheater) and approximately 5,600 parking spaces. The development will be located adjacent to the Bolton Hill, Upton and Mount Vernon neighborhoods Baltimore City; north of Martin Luther King, Jr. (MLK) Boulevard, south of Dolphin Street, east of Madison Avenue and west of Howard Street. The purpose of this study is to assess the impacts of traffic associated with the proposed development on the surrounding transportation network, and determine what improvements are required to mitigate adverse impacts caused by the proposed development. Primary access to the site will be via MLK Boulevard, Eutaw Street, Madison Avenue, Howard Street, Dolphin Street, Twenty-Ninth Division Street, Preston Street and Bolton Street. A location of the study area is shown in **Figure 1.**

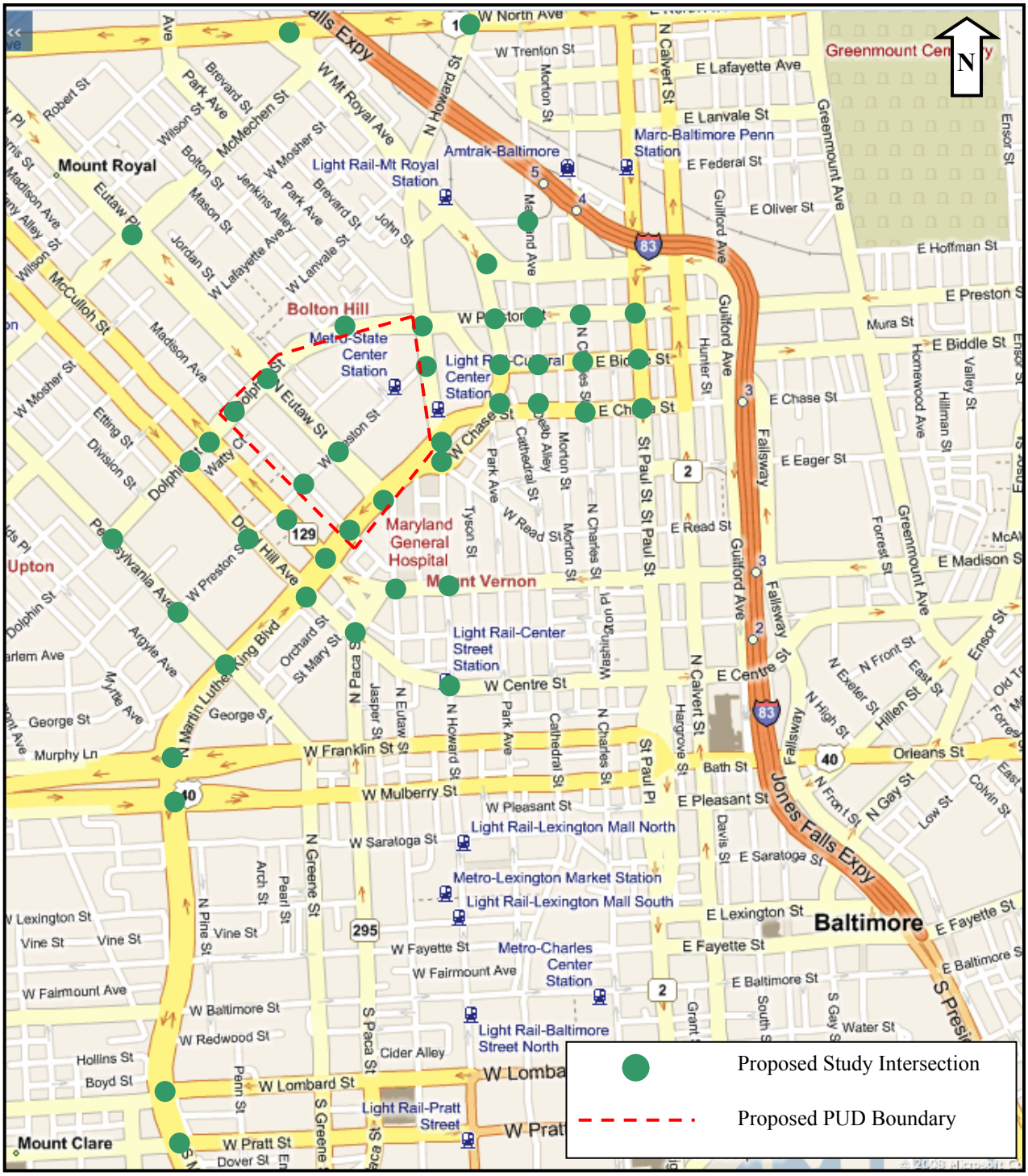
The report is divided in three sections; first the existing conditions are evaluated and documented including the existing roadway network, existing traffic volumes, and existing intersection capacity and level of service. Secondly, background conditions are analyzed including growth in existing traffic volumes, traffic from other nearby planned, approved or current development activity, and planned improvements to the transportation network. Lastly, the future conditions are evaluated including total future traffic volumes, and future intersection capacity and level of service.

II. EXISTING CONDITIONS

A. Study Area Roadways

The State Center PUD development will be located adjacent to the Bolton Hill, Upton and Mount Vernon neighborhoods Baltimore City. Based on discussions with the Baltimore City Department of Transportation, the study network includes forty-three (43) intersections along MLK Boulevard, North Avenue, Dolphin Street, Preston Street, Biddle Street, Chase Street, Madison Street, Centre Street, Druid Hill Avenue, Mt. Royal Avenue and Maryland Avenue. All intersections, except for Dolphin Street at Bolton Street, are controlled by traffic signals.

Figure 1. Area Map (Not to Scale)



* Not Shown: MLK Boulevard at Washington Boulevard

The following roadways were included in the analysis:

Bolton Street is a one-way southbound roadway north of Dolphin Street and a two-way roadway south of Dolphin Street. At Dolphin Street, access is restricted to right-turns in and out of Bolton Street only. The posted speed limit in the study area is 25 miles per hour. Permit parking is provided on both sides of the roadway.

Biddle Street is a one-way, three-lane eastbound roadway connecting Cathedral Street in the west to Edison Highway in East Baltimore. On-street parking is available on both sides of the roadway but is restricted to residential permit holders only for parking durations in excess of 2 hours. The posted speed limit in the study area is 25 miles per hour.

Cathedral Street is a two-way, four-lane roadway between Mt. Royal Avenue and Biddle Street and a three-lane one-way southbound roadway between Chase and Saratoga Streets. Cathedral Street is not a continuous street between Biddle and Chase Streets. It connects the Mount Vernon neighborhood to the Central Business District in the south. No parking is permitted between Mt. Royal Avenue and Biddle Street. The posted speed limit is 25 miles per hour.

Charles Street is a three-lane one-way northbound roadway connecting to Wells Street in South Baltimore and to Baltimore County in the north. Metered parking is available on both sides of the roadway in the study area, but is restricted during rush hour on the east side. The posted speed limit is 30 miles per hour.

Chase Street is primarily a two-way, two-lane roadway with in the study are but is one-way westbound between Maryland Avenue and MLK Boulevard and one-way eastbound between Howard Street and MLK Boulevard. Metered parking is available along both sides of the roadway between Howard and St. Paul Streets. The posted speed limit in the study area is 25 miles per hour.

Dolphin Street is a two-lane undivided roadway in the study area west of McCulloh Street and a four-lane divided roadway between McCulloh and Howard Streets. Dolphin Street connects Freemont Street in the west to Howard Street in the east. In the study area, the posted speed limit is 25 miles per hour. Four-hour metered parking is provided between Eutaw Street and Madison Avenue and ten-hour metered parking is provided between Madison Avenue and McCulloh Street. Unrestricted parking is provided between Howard and Eutaw Streets.

Druid Hill Avenue/ Centre Street is a two-lane one-way southbound roadway connecting Druid Park Lake Drive in the northwest to Eutaw Street to the southeast. In the study area, the posted speed limit is 25 miles per hour. Unregulated parking is provided on both sides of the roadway.

Intersections evaluated include Preston Street and Dolphin Street.

Eutaw Street is a four-lane divided roadway between MLK Boulevard and North Avenue. South of MLK Boulevard the roadway is four-lanes and undivided. In the study area, the

posted speed limit is 30 miles per hour. Between MLK Boulevard and Lanvale Street, metered parking is provided along the west side of the roadway with a combination of three- and four-hour meters and primarily two-hour meters along the east side of the roadway. South of MLK Boulevard a mix of parking exists including metered and residential restricted parking.

Intersections evaluated include Madison Street, Preston Street, Dolphin Street and McMechen Street.

Howard Street is primarily a five-lane undivided arterial between North Avenue and MLK Boulevard, and a two-lane primarily northbound roadway south of MLK that includes right-of-way for the Central Light Rail northbound and southbound tracks. In the study area, the posted speed limit is 30 miles per hour and no parking is permitted along the roadway expect for two-hour metered parking between Monument Street and Chase & Read Streets.

Intersections evaluated include Centre Street, Madison Street, Chase & Read Streets, Preston Street, Dolphin Street/Preston Street/Park Avenue and North Avenue.

Martin Luther King (MLK) Boulevard is primarily six-lane arterial roadway which connects Howard Street in the north to I-395 in the south and runs along the western edge of the Central Business District. The roadway is divided by a landscaped median south of Madison Avenue and a non-landscaped median between Madison Avenue and Howard Street. The posted speed limit is 35 miles per hour. No parking is permitted along the roadway except for a section of roadway between Howard and Biddle Streets where ten-hour metered parking is provided along the east side of the roadway. Additionally, unrestricted parking is provided along westbound MLK Boulevard between Park Avenue and Howard Street.

Intersections evaluated include: Washington Boulevard, Pratt Street, Lombard Street, Mulberry Street, Franklin Street, Pennsylvania Avenue, Druid Hill Avenue, McCulloh Street. Eutaw Street, Howard Street and Park Avenue/ Biddle Street.

Maryland Avenue is a four lane, one-way southbound roadway connecting 29th Street in the north to Chase Street in the south. Metered parking is available along the east side of the roadway. The posted speed limit is 30 miles per hour.

McCulloh Street is a two-lane one-way roadway northbound connecting MLK Boulevard in the southeast to Reisterstown Road to the northwest. In the study area, the posted speed limit is 25 miles per hour. Unregulated parking is provided on both sides of the roadway.

Intersections evaluated include Preston Street and Dolphin Street.

McMechen Street is a two-lane roadway divided by a landscaped median between McCulloh and Mason Street, and connects Pennsylvania Avenue in the west to Mt. Royal Avenue in the east. The posted speed limit in the study area is 25 miles per hour. Unregulated parking is provided on both sides of the roadway.

Mt. Royal Avenue is primarily a two-way, four-lane roadway divided by a landscaped median. It connects to North Ave in the northwest and Guilford Avenue in the east. Parking is available along both sides of the roadway. The posted speed limit is 30 miles per hour.

North Avenue is primarily a six-lane arterial divided roadway which connects Hilton Parkway in the west to Belair Road to the east. The posted speed limit is 30 miles per hour. Parking is permitted along both sides of the roadway east of Howard Street. No parking is permitted along the roadway between Park Avenue and Howard Street.

Paca Street is a one-way two-lane northbound roadway with a posted speed limit of 25 miles per hour which connects from Russell Street to the south and McCulloh Street to the north. Permit parking is provided on both sides of the roadway in the study area.

Park Avenue is a one-way, three-lane eastbound roadway between Howard Street and Cathedral Street. Permit parking is available along the north side of the roadway. The posted speed limit is 25 miles per hour. Park Avenue is one-way, two-lane northbound roadway south of Chase Street. Metered parking is available along both sides of the roadway south of Chase Street. The posted speed limit is 25 miles per hour.

Pennsylvania Avenue is a two-lane two-way roadway connecting Reisterstown Road in the northwest to Franklin Street to the southeast. In the study area, the posted speed limit is 25 miles per hour. Metered on-street parking is provided on both sides of the roadway.

Intersections evaluated include Preston Street and Dolphin Street

Preston Street - is a two-lane undivided roadway in the study area west of Eutaw Street, a two-lane divided roadway with a landscaped median between Eutaw and Howard Streets. Metered on-street parking is provided on both sides between Eutaw and McCulloh Streets with four-hour meters along the north side of the of the roadway and two-hour meters along the south side. Two-hour metered parking is also provided on the north side the roadway between Eutaw and Mason Streets and along the south side no parking is permitted east of Eutaw Street except for a few metered spaces near the intersection with Howard Street. The posted speed limit is 25 miles per hour.

East of Howard Street, Preston Street is a three-lane, one-way westbound roadway connecting Edison Highway in eastern Baltimore to Howard and Dolphin Streets in the west. Three-hour metered parking is available along both sides of the roadway east of Cathedral Street. The posted speed limit in the study area is 25 miles per hour.

Read Street is a two-way, two-lane roadway connecting Howard Street to Guilford Avenue in the east. One-hour metered parking is available along both sides of the roadway between Howard Street and Park Avenue. The posted speed limit in the study area is 25 miles per hour.

St. Paul Street is a three-lane one-way southbound arterial roadway connecting to University Parkway in the north to Light Street in the Central Business District. Permit parking is available on both sides of the roadway but is restricted during rush hour on the west side. The posted speed limit is 30 miles per hour.

Photographs and lane diagrams for the study intersections are included in **Appendix A** for cross-reference.

B. Pedestrian and Bicycle Facilities

Pedestrian amenities generally include the presence of sidewalks along the study area roadways, and the following at study area intersections: curb ramps, marked crosswalks, pedestrian signals and bus shelters. Existing **pedestrian facilities** within the PUD boundaries include sidewalks along all study area roadways. **Table 1** describes the presence and location of pedestrian amenities within the PUD boundaries.

Table 1. Pedestrian Amenities at Study Intersections within PUD Boundary

Intersection	Side-walks	Marked Crosswalks	Pedestrian Signals	Curb Ramps	Bus Stop	Bus Stop Amenities
		(leg of intersection)		(corner of intersection)		
MLK Blvd at Eutaw	Yes	All	All	All	NW, SE	No
MLK Blvd at Howard St	Yes	All	All	All	SE	SE
Howard St at Preston St	Yes	South, West	South, West	NE, SE, SW	NW, NE	No
Howard St at Dolphin St	Yes	All	All	All	SW	No
Dolphin St at Bolton St[1]	Yes	No	No	SE, SW	SE	No
Eutaw St at Dolphin St	Yes	West	All	All	NW, SE	No
Eutaw St at Preston St	Yes	All	All	All	SE, SW	Yes
Eutaw St at 29th Division St[1]	Yes	No	No	Yes	SE, SW	Yes

[1]Stop-controlled intersection

There are no known **bicycle facilities**, i.e. marked bike lanes/trails or amenities such as bike lockers, rentals or changing rooms, within the vicinity of State Center.

Figures 2a-2c illustrate the existing pedestrian movements across MLK Blvd, Howard Street and Eutaw Streets, including the location of existing pedestrian traffic generators. Field observations revealed jay walking to be common along Eutaw Street, however non-compliance with crosswalks and pedestrian signals indication was also noted along Howard Street.

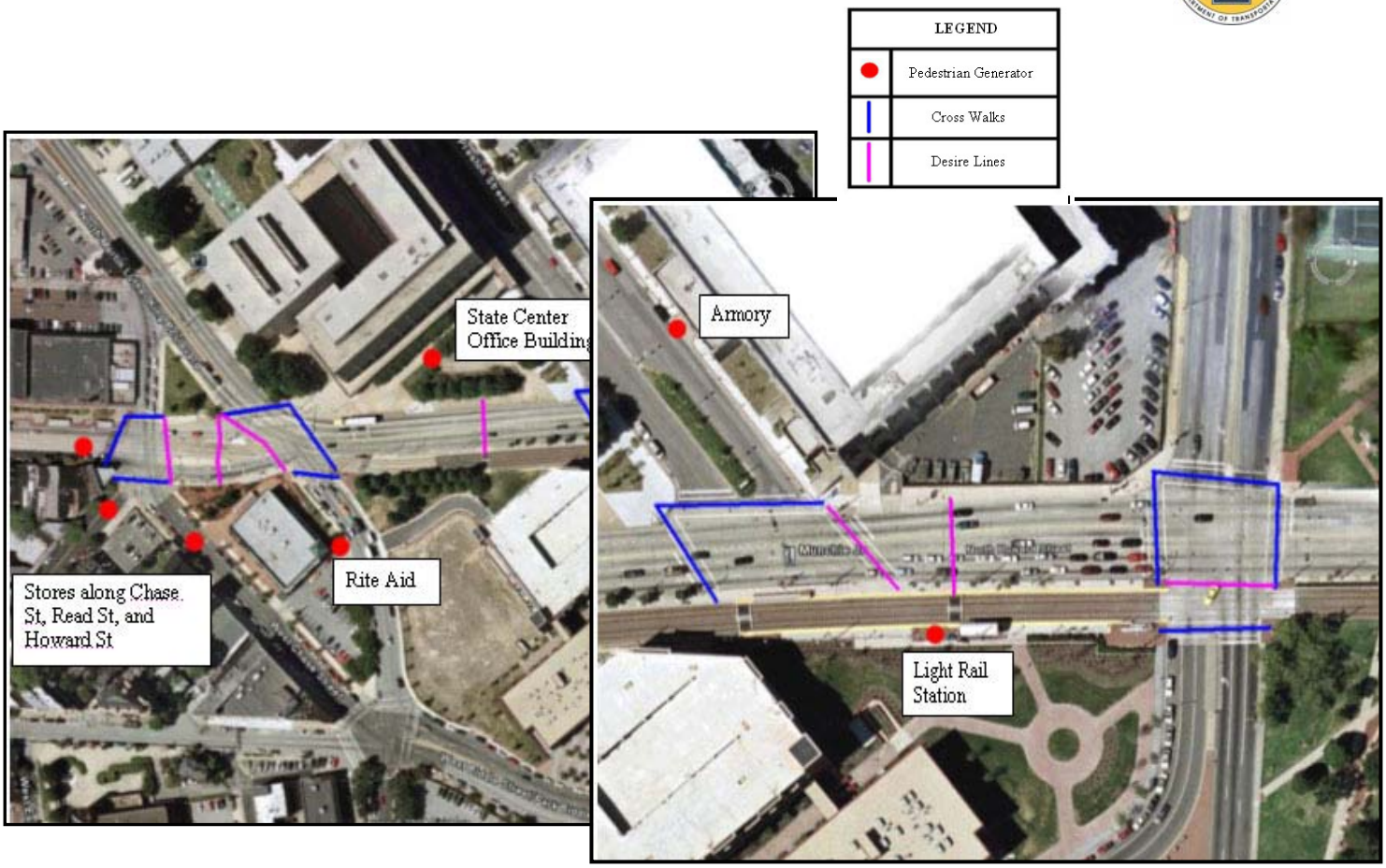


Figure 2a. Existing Pedestrian Movements - Howard Street – MLK Blvd to Dolphin Street

Figure 2b. Existing Pedestrian Movements - MLK Blvd – Eutaw St to Howard St

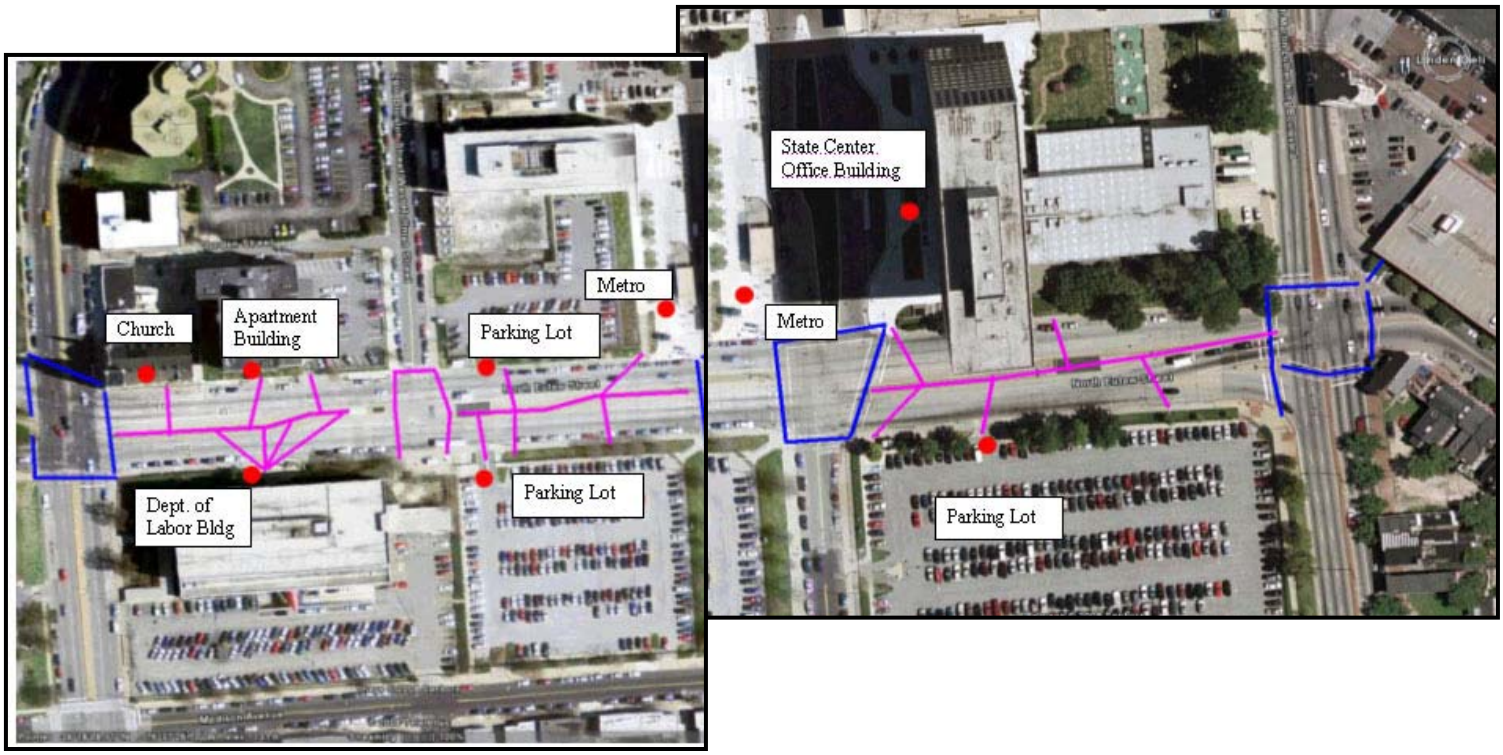


Figure 2c. Existing Pedestrian Movements – Eutaw Street – MLK Blvd to Dolphin St

C. Public Transportation

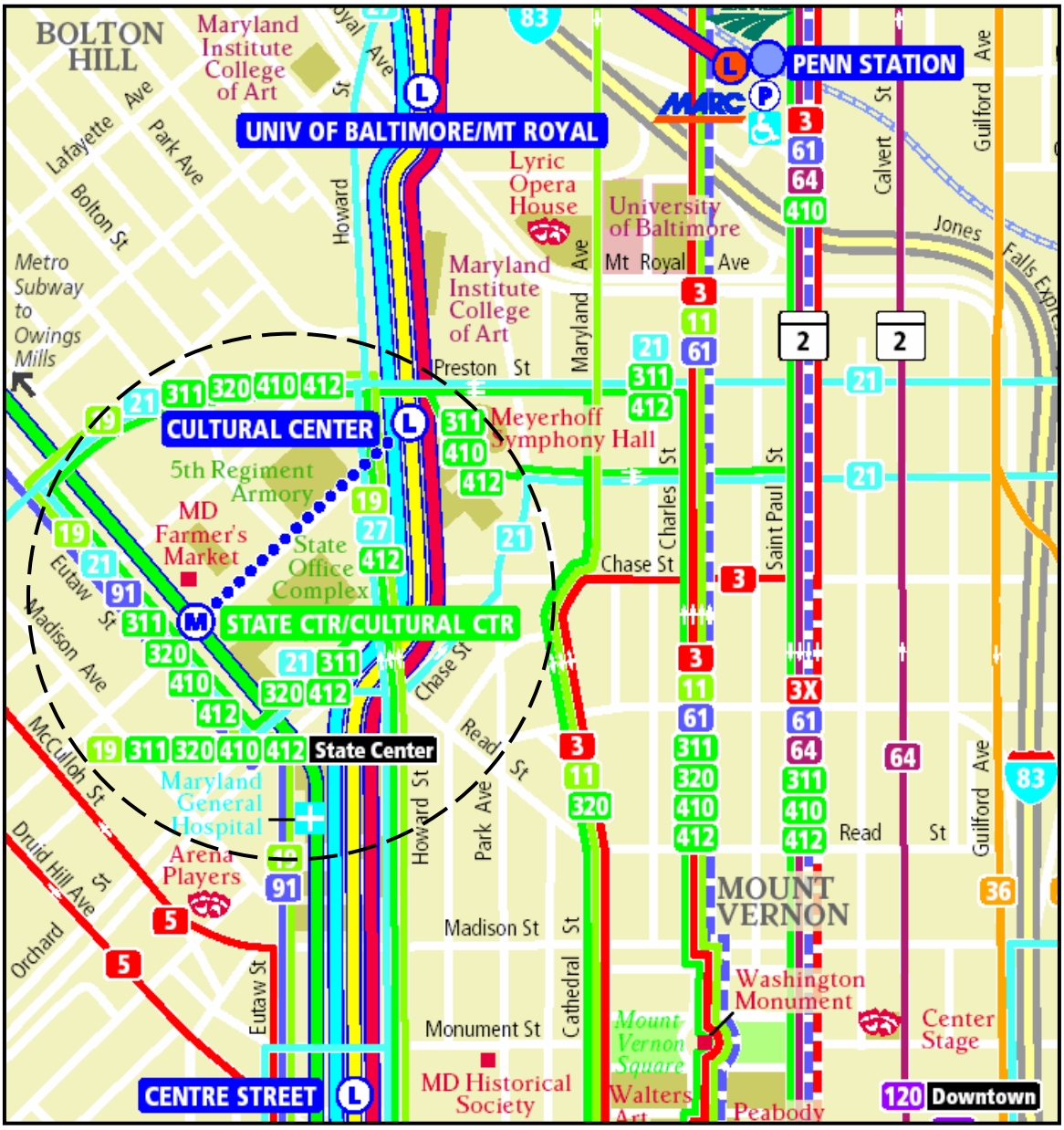
In addition the State Center project site is served by several **public transportation** modes. The Maryland Transit Administration's (MTA) **Central Light Rail** line between BWI airport and Hunt Valley has stops at University of Baltimore/Mount Royal and Cultural Center, with service from 5 AM to midnight weekdays and Saturdays, and service from 11 AM to 7 PM on Sundays. The **Metro Subway** State Center Station is located at Eutaw and Preston Streets with service between Owings Mills and Johns Hopkins Hospital via Downtown Baltimore. Service is provided from 5 AM to midnight weekdays and 6 AM to midnight on Saturday and Sunday. MTA **intra-city bus line** numbers 3, 5, 11, 19, 21, 27 and 91 provide local bus service in the vicinity of State Center and MTA Commuter bus lines 311, 320, 410, and 412 provide service to State Center from outlying suburban locations including, Columbia, Laurel, Churchville and Forest Hill/Bel Air. Light Rail headways are approximately 10 minutes in the peak hours, approximately 8 minutes for Subway headways and bus headways are approximately 15 to 20 minutes in the peak hours. **Figure 3** illustrates the existing public transportation routes and **Table 2** summarizes the area bus route ridership.

Table 2. Summary of MTA Bus Routes

Route No.	Limits	Current Ridership (Daily Weekday Average)	Project Area Rider-ship	Service Hours	Headway (peak)/(off-peak) minutes
Local Bus Routes					
5	Cedonia to Mondawmin Metro Station	10,934	3,546	24 hours/day, 7 days/week	5/15
19	State Center to Carney/Goucher & Taylor	7,199	800	4 AM-2:30 AM (weekdays); 4:30 AM-2 AM (Sat/Sun)	6/15
21	Fells Point Cumberland & Carey Streets	2,021	611	5 AM-1 AM (weekdays, Sat); 6 AM-1 AM (Sun)	15/27
27	Reisterstown Plaza to Cherry Hill	3,598	342	4 AM-2:30 AM (weekdays); 5 AM-3 AM (Sat/Sun)	20/30
91	Sinai Hospital to City Hall	6,931	858	24 hours/day, 7 days/week	15/20
Commuter Bus Routes					
311	Columbia to Downtown Baltimore	148	4	Weekdays – AM & PM peaks	8 trips/day; (3 AM/5PM)
320	Laurel to Downtown Baltimore	173	6	Weekdays – AM & PM peaks	11 trips/day; (6 AM/5PM)
410	Churchville to Downtown Baltimore	279	17	Weekdays – AM & PM peaks	10 trips/day; (5 AM/5PM)
412	Forest Hill to Downtown Baltimore	152	11	Weekdays – AM & PM peaks	6 trips/day; (3 AM/3PM)

Source: Maryland Department of Transportation: State Center Existing Conditions Report, July 2007. Rummel, Klepper & Kahl, LLP

Figure 3. MTA Transit Lines and Connections in the Vicinity of State Center



Existing transit boarding, alighting, capacity and utilization data provided by MTA were obtained and analyzed for the Cultural Center Light Rail station, the State Center Subway station as well as system capacity for both modes of transit. The analysis indicates that both the Metro Subway and the Central Light Rail line are underutilized and have excess reserve capacity both at the State Center and Cultural Center Stations as well as system-wide. Transit ridership and capacity data is summarized in **Table 3;** and detailed boarding and alighting data are included in **Appendix C**.

Table 3. MTA Subway and Light Rail Ridership and Capacity Summary

	Subway	Light Rail
Capacity per Car	275	84
Cars per Train	2	2
Trains per hour (*two directions)	14	14
No. Hours of Operation	19	19
System Capacity (No. of passengers)	133,000	44,688
Average Weekday Ridership	State Center Sta.: 1,793	Cultural Center Sta.: 940
Total System: Average Weekday Ridership	47,055	25,781
% Utilized Capacity	35%	58%
% Reserve Capacity	65%	42%

Based on survey data provided by the Maryland Department of Transportation, the current mode split for State Center employees is approximately 18.3% for transit, which includes MTA Bus, Light Rail and Metro Subway, 1.72% for individuals who walk and 0.3% for people who bike. The remaining 79.68% arrive via automobile.

D. Parking Facilities

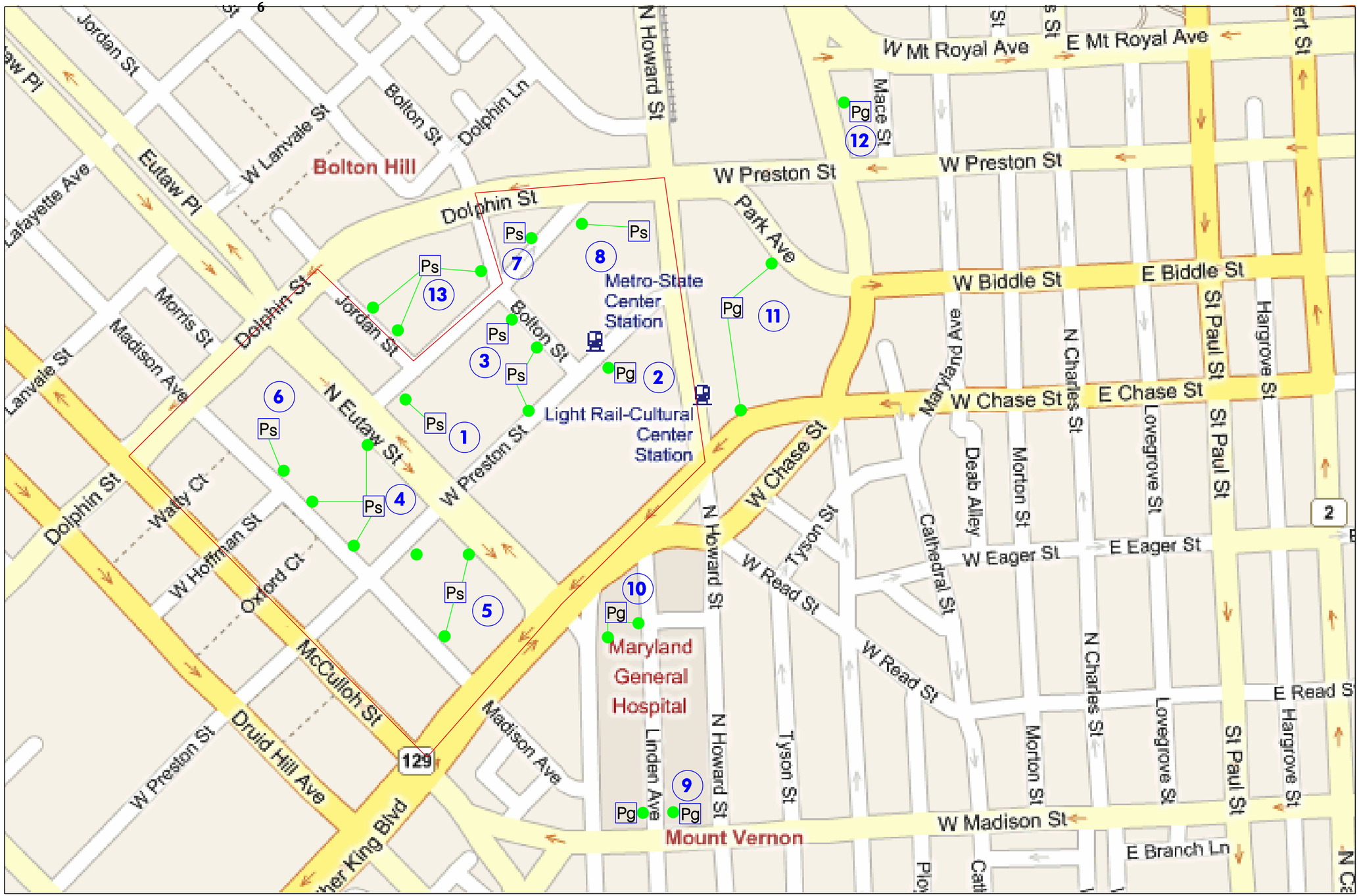
In addition to available on-street metered and un-metered parking noted above, there are approximately 13 off-street parking facilities within the vicinity of State Center which have a total of 3,660 parking spaces of which, 2,005 spaces are dedicated to State Center employees with visitor parking also available. Five of these parking facilities are privately-owned and the remaining facilities are owned by the State of Maryland. **Figure 4** illustrates the existing State Center campus and parking facilities. **Table 4** lists the 13 parking facilities and available parking spaces in each.

Table 4. State Center Area Parking Facilities

	Parking Facility	Location	Total No. of Spaces	Spaces Available to State Center Employees	Fee (Y/N)
State-Owned / Operated Facilities					
1	PMI Lot – Lot "B"	In front of State Office Bldg	97	97	Y
2	201 W. Preston St. Garage	Under Dept. of Health & Mental Hygiene Bldg.	649	649	N
3	Preston St. Surface Parking Lots – Lot "A" & Lot "C"	29th Division St at Eutaw St and at Mason St	129	129	N
4	Surface Lot – Lot "E"	Eutaw and Preston Streets	206	206	N
5	Surface Lot – Lot "F"	Eutaw St and MLK Blvd.	292	292	N
6	DLLR[1] Surface Lot	1100 N. Eutaw St	194	194	N
7	MD Army Nat. Guard Lot #1	29th Division St, Bolton, Dolphin St.	38	0	N
8	MD Army Nat. Guard Lot #2	Near Howard & Dolphin St intersection	35	0	N
Private Parking Facilities (Available to the Public)					
9	Standard Parking Garage #1	South end of Linden Ave.	540	54	Y
10	Standard Parking Garage #2	North end of Linden Ave.	320	32	Y
11	Symphony Center Garage	1030 Park Ave	650	260	Y
12	Baltimore Symphony Orchestra Garage	1311 Cathedral St	360	72	Y
13	1100 Bolton House Lot	Dolphin, Bolton & 29th Division Streets	150	20	Y
TOTAL			**3,660**	**2,005**	**-**

Source: Maryland Department of Transportation: State Center Existing Conditions Report, July 2007. Rummel, Klepper & Kahl, LLP

[1] Department of Labor, Licensing and Regulation



LEGEND	
Ps	PARKING SURFACE LOT
Pg	PARKING GARAGE
	PUD BOUNDARY
	PARKING ACCESS POINT
6	PARKING FACILITY (Refer to Table 4)

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State Center Planned Unit Development (PUD) Traffic Impact Study

EXISTING PARKING FACILITIES

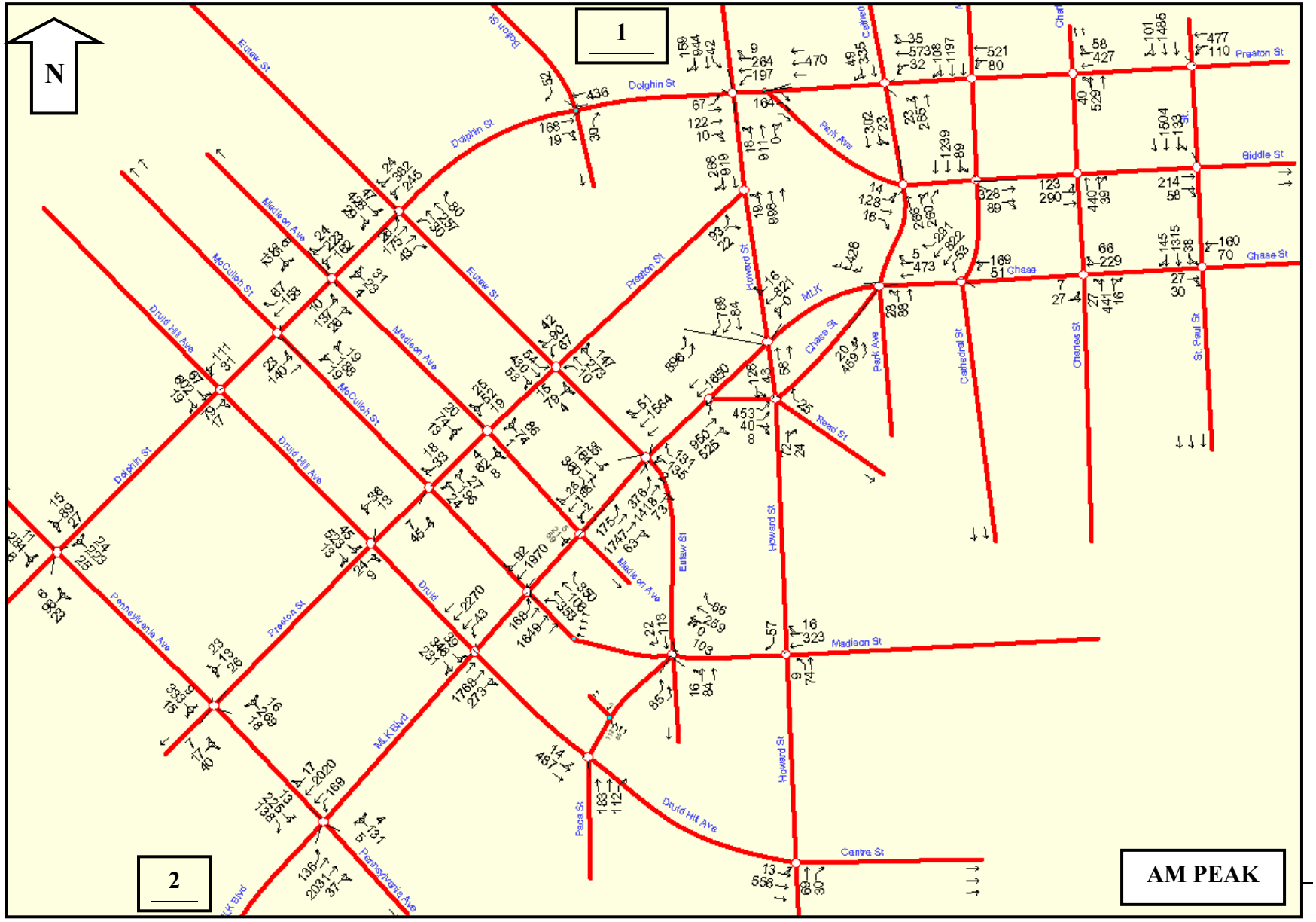
Figure 4

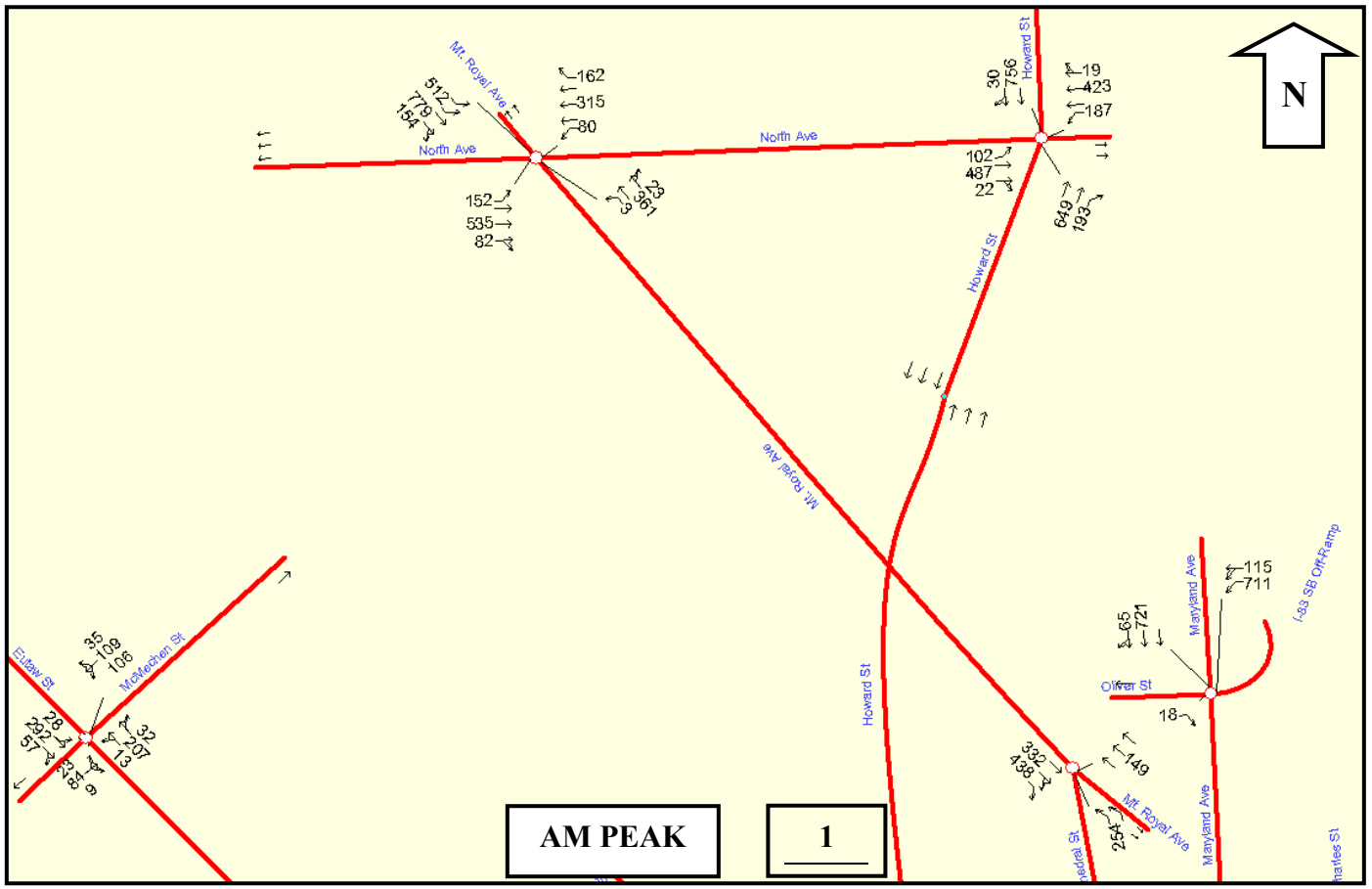
Not to Scale

E. Existing Traffic Volumes

Data collection was performed in April, May and June of 2008 at the majority of study intersections. Where available, recent traffic counts were also obtained from recent traffic studies including *UMB BioPark Traffic Impact Study* and *Signal Timing Optimization for the Central Business District,* both performed by Sabra, Wang & Associates, Inc. New traffic data was collected during the morning and evening peak hours from 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM on typical weekdays. **Figure 5** summarizes the existing peak hour traffic volumes; detailed traffic count data is included in **Appendix B.**

Figure 5. Existing Peak Hour Traffic Volumes and Lane Configuration

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Mt. Royal Ave
North Ave
Howard St
Howard St
Mt. Royal Ave
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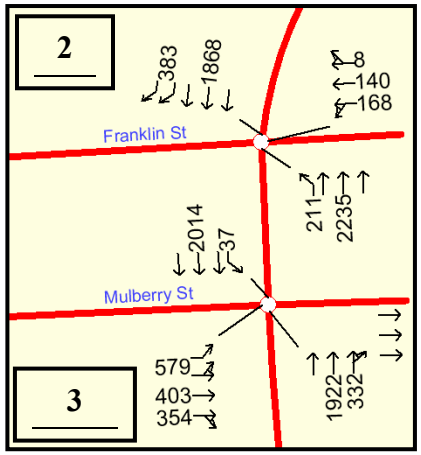
Maryland Ave
I-83 SB Off-Ramp
Mt. Royal Ave
Maryland Ave
McMechen St
Eutaw St
Oliver St
AM PEAK
1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Franklin St
Mulberry St
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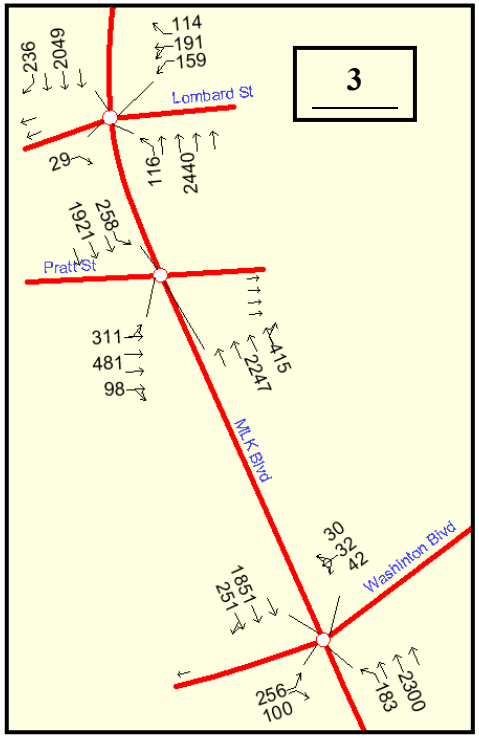
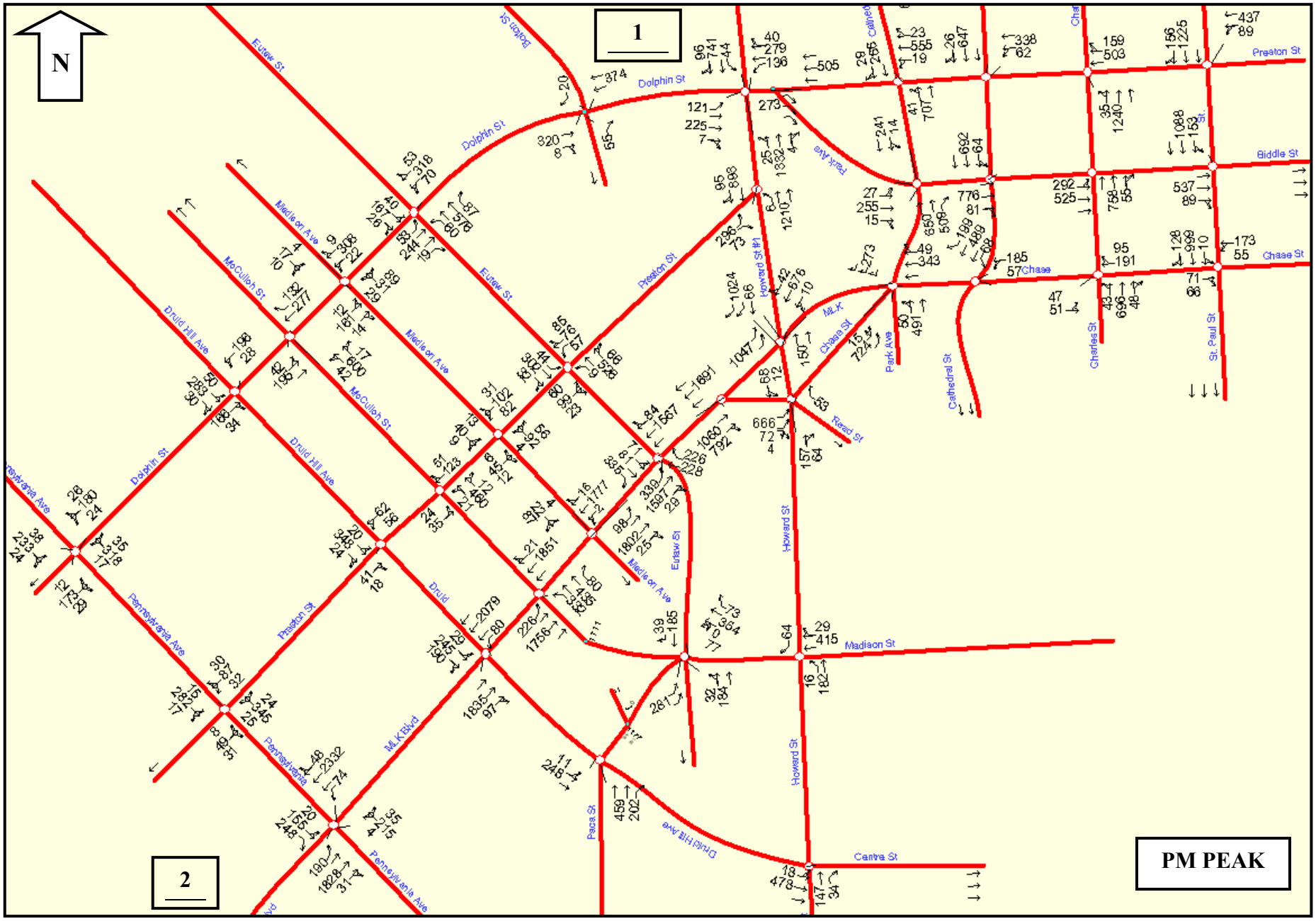

3
Lombard St
Pratt St
MLK Blvd
Washington Blvd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McCulloh St
Druid Hill Ave
Preston St
Pennsylvania Ave
Druid
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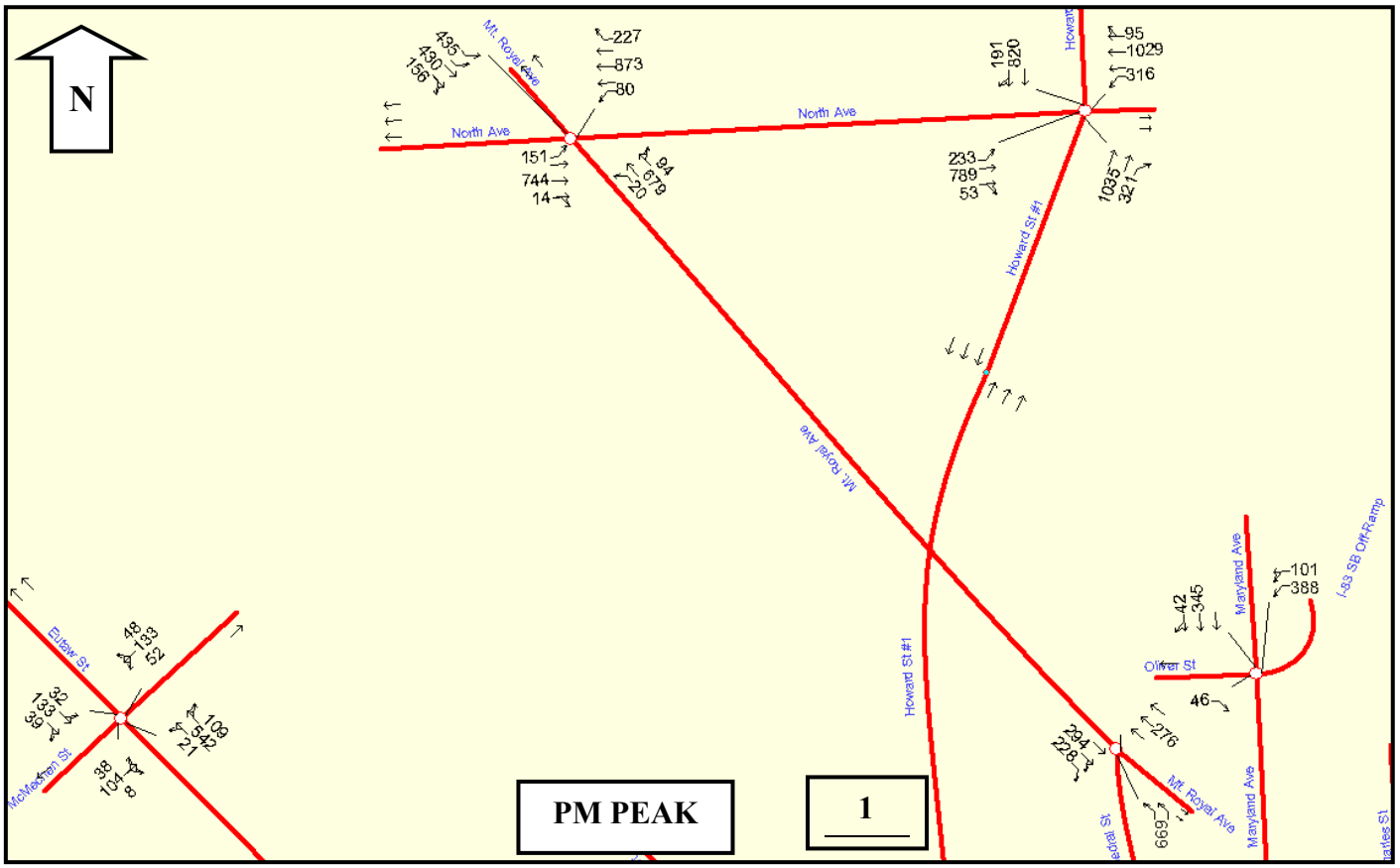
Howard St
Howard St NB
Park Ave
Cathedral St
Chase St
Read St
Biddle St
Preston St
Madison St
Centre St
Paca St
Druid Hill Ave
Charles St
St. Paul St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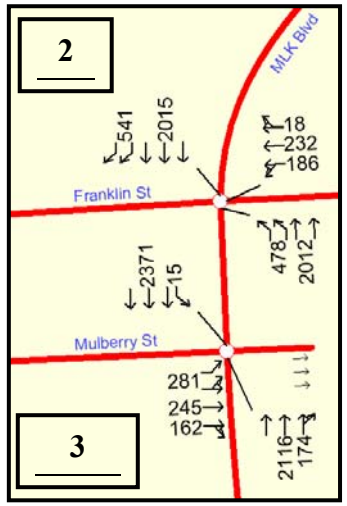
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Franklin St
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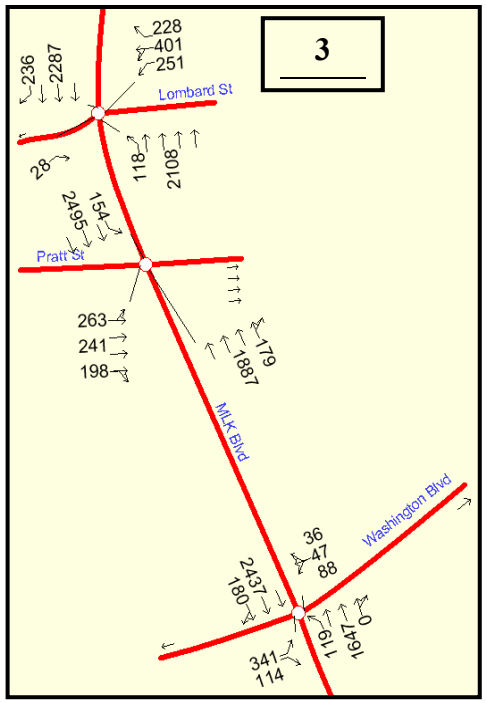
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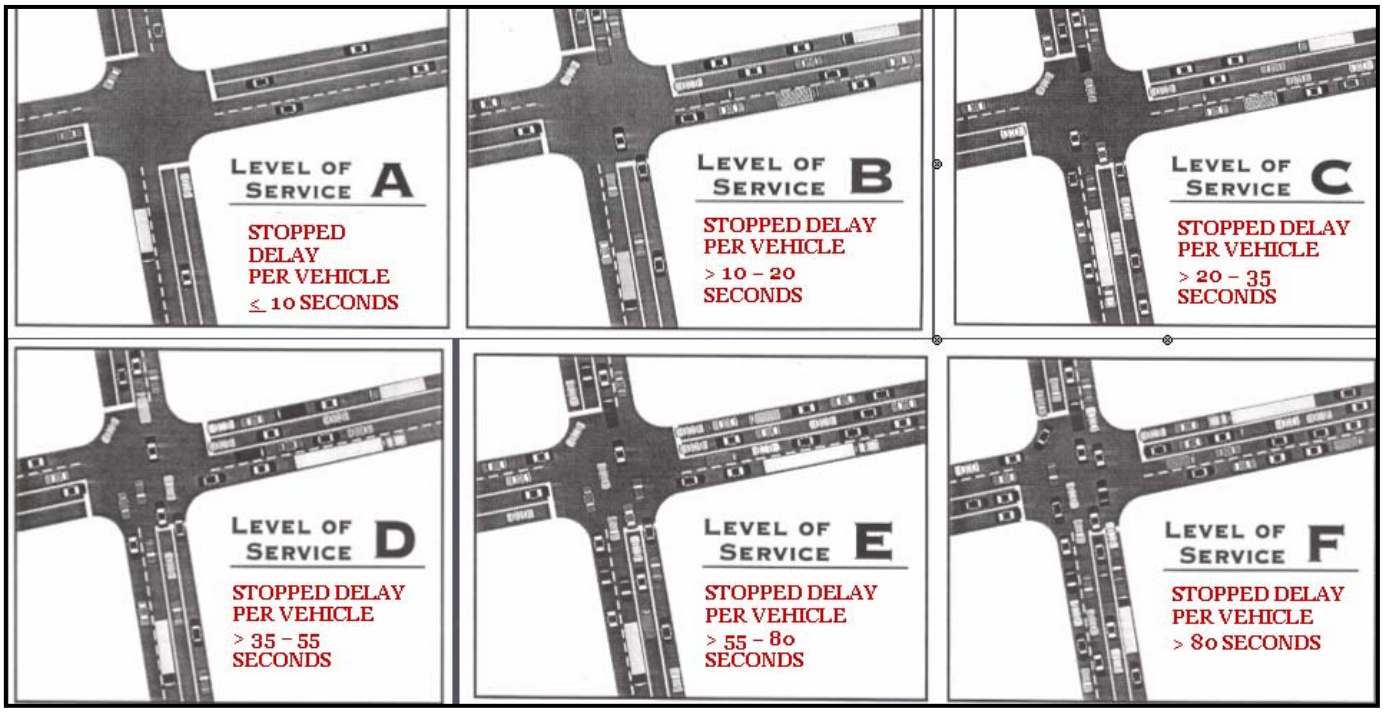
Lombard St
Pratt St
MLK Blvd
Washington Blvd

F. Existing Intersection Capacity and Level of Service

The methodology of the Highway Capacity Manual (HCM) was used to evaluate capacity for selected intersections during the AM and PM peak hours. A Synchro traffic model, which incorporates the HCM methodology, was developed and coded for each peak period with the existing conditions data including roadway geometry, traffic volumes and signal timing and phasing data as inventoried and documented in the field or as provided by Baltimore City.

Performance measures of effectiveness for HCM intersection analysis include level of service, delay and volume-to-capacity ratio. The level of service (LOS) is a letter designation that corresponds to a certain range of roadway operating conditions. The levels of service range from A to F, with A indicating the best operating conditions and F indicating the worst, or a failing, operating condition. The volume-to-capacity ratio (v/c ratio) is the ratio of current flow rate to the capacity of the intersection. This ratio is often used to determine how sufficient capacity is on a given roadway. Generally speaking, a ratio of 1.0 indicates that the roadway is operating at capacity. A ratio of greater than 1.0 indicates that the facility is failing as the number of vehicles exceeds the roadway capacity. **Figure 6** graphically illustrates the intersection level of service concepts.

Figure 6 – Intersection Level of Service Concepts

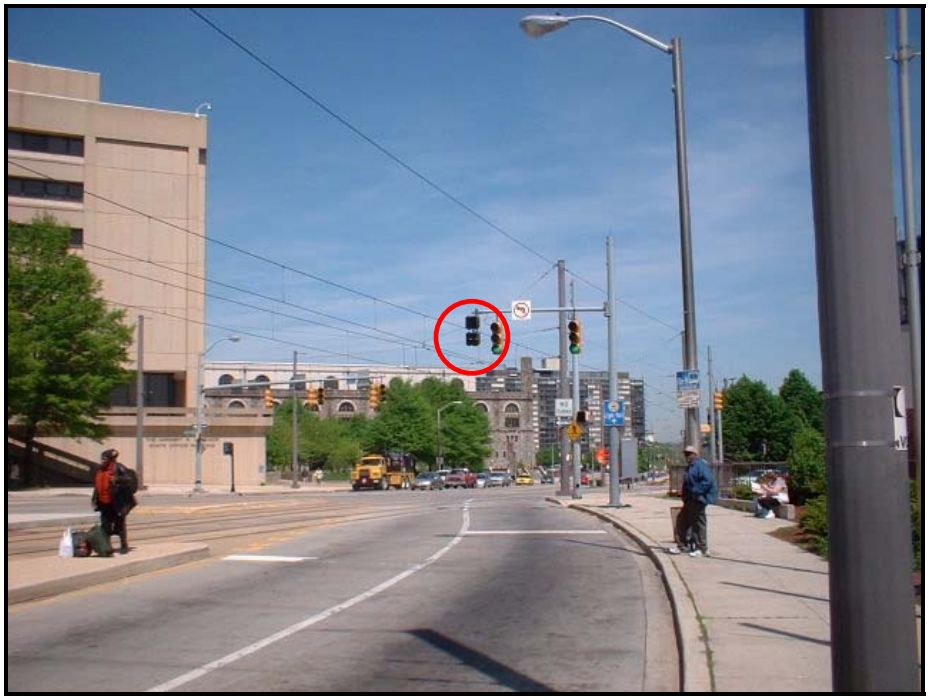


Prior to evaluating existing intersection capacity and level of service, a brief summary of the Light Rail movements is presented to give a better understanding of the phasing and accommodation of transit movements through several critical study intersections. Existing signal timing is coordinated to give right-of-way to both vehicular movements and Light Rail vehicles. Traffic movements which conflict with the Light Rail movement do not operate concurrently. The Light Rail movement is the coordinated phase, which means that it reallocates green time from vehicular movements to Light Rail movements when Light Rail vehicles approach, thus limiting the ability to coordinate vehicular movements. Special consideration also needs to be given to clearance (yellow and red intervals) for Light Rail vehicles due to the length of the trains.

- At Howard Street and Read/ Chase Streets, Light Rail vehicles move in a separate phase of the traffic signal while all vehicular movements are stopped.
- At Howard Street and MLK Blvd, the Light Rail vehicles move concurrently with southbound Howard Street to westbound MLK Boulevard and eastbound MLK Boulevard to northbound Howard Street phase.

Pedestrian movements are also accommodated concurrently with non-conflicting vehicular movements. Photographs of the study intersections illustrating existing Light Rail and pedestrian signals are shown below.

It should be noted that the train length and headways are currently limited due to the on-street operation in the downtown area which requires trains not to block intersections and maintain minimum headways.



Light Rail Signal: Howard Street northbound at MLK Boulevard crossing railroad tracks

Pedestrian Signal across Howard Street at MLK Boulevard

The results of the existing conditions intersection capacity analysis are summarized in **Table 5;** detailed capacity analysis worksheets are included in **Appendix D.**

Table 5. Summary of Existing Intersection Capacity Analysis, AM (PM)

Intersection	Control	Delay (sec/veh)	Volume-to-Capacity Ratio	Level of Service
Study Intersections Within and Adjacent to the PUD				
MLK Blvd at Eutaw St	Signal	48.9 (24.4)	0.81 (0.89)	D (C)
Howard St at Chase & Read Sts	Signal	35.0 (39.1)	0.36 (0.53)	D (D)
MLK Blvd at Howard St	Signal	40.0 (41.4)	0.75 (0.66)	D (D)
Howard St at Preston St	Signal	7.2 (10.3)	0.49 (0.67)	A (B)
Eutaw St at Preston St	Signal	18.8 (13.6)	0.26 (0.39)	B (B)
Eutaw St at Dolphin St	Signal	16.5 (15.8)	0.53 (0.41)	B (B)
Dolphin St at Bolton St	Stop[1]	10.2 (9.7)	0.08 (0.03)	B (A)
Howard St at Dolphin St (Preston St/Park Ave)	Signal	14.8 (15.7)	0.68 (0.68)	B (B)
MLK Blvd at Madison Ave	Signal	16.2 (15.2)	0.81 (0.69)	B (B)
Madison Ave at Preston St	Signal	20.1 (25.8)	0.16 (0.28)	C (C)
Madison Ave at Dolphin St	Signal	17.8 (19.0)	0.20 (0.20)	B (B)

1- Level of Service, Delay, and V/C for stop-controlled movement only

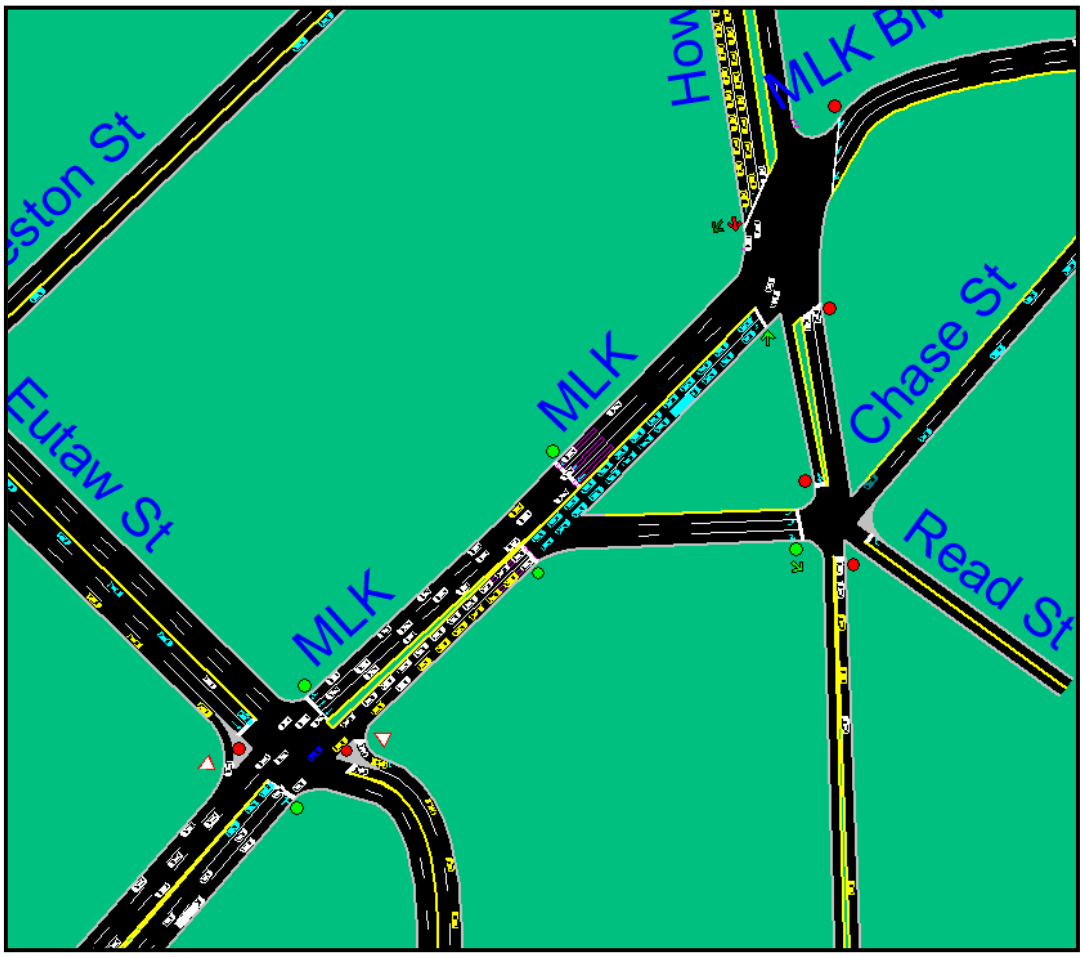
Intersection	Control	Delay (sec/veh)	Volume-to-Capacity Ratio	Level of Service
Other Study Intersections				
MLK Blvd at Washington Blvd	Signal	33.1 (63.6)	0.93 (1.14)	C **(E)**
MLK Blvd at Pratt St	Signal	31.4 (19.4)	1.02 (0.88)	C (B)
MLK Blvd at Lombard St	Signal	17.2 (71.3)	0.77 (1.00)	B **(E)**
MLK Blvd at Mulberry St	Signal	42.1 (23.9)	0.92 (0.78)	D (C)
MLK Blvd at Franklin St	Signal	16.1 (23.5)	0.68 (0.82)	B (C)
MLK Blvd at Pennsylvania Ave	Signal	26.3 (34.7)	0.77 (0.89)	C (C)
MLK Blvd at Druid Hill Ave	Signal	10.8 (10.9)	0.75 (0.99)	B (B)
MLK Blvd at McCulloh St	Signal	20.0 (17.3)	0.89 (0.82)	B (B)
MLK Blvd at Chase St & Park Ave	Signal	29.8 (32.7)	0.55 (0.68)	C (C)
Pennsylvania Ave at Preston St	Signal	14.7 (17.7)	0.29 (0.45)	B (B)
Pennsylvania Ave at Dolphin St	Signal	18.6 (21.8)	0.33 (0.43)	B (C)
Druid Hill Ave at Paca St	Signal	14.2 (12.7)	0.29 (0.28)	B (B)
Druid Hill Ave at Preston St	Signal	7.8 (16.9)	0.26 (0.26)	A (B)
Druid Hill Ave at Dolphin St	Signal	22.3 (13.2)	0.37 (0.31)	C (B)
McCulloh St at Preston St	Signal	18.2 (12.6)	0.14 (0.34)	B (B)
McCulloh St at Dolphin St	Signal	12.0 (10.3)	0.19 (0.45)	B (B)
Eutaw St at Madison & Paca Sts	Signal	11.9 (19.2)	0.26 (0.49)	B (B)
Eutaw St at McMechen St	Signal	20.8 (20.0)	0.40 (0.47)	C (B)
Howard St at Centre St	Signal	10.4 (10.9)	0.21 (0.25)	B (B)
Howard St at Madison St	Signal	16.4 (16.1)	0.25 (0.35)	B (B)
Howard St at North Ave	Signal	34.7 (65.8)	0.70 (1.05)	C **(E)**
North Ave at Mt. Royal Ave	Signal	48.6 (54.9)	0.72 (0.85)	D (D)
Cathedral St at Mt. Royal Ave	Signal	16.3 (11.2)	0.32 (0.44)	B (B)
Cathedral St at Preston St	Signal	9.3 (8.9)	0.32 (0.50)	A (A)
Cathedral St at Biddle St (Park Ave/MLK Blvd)	Signal	10.5 (15.3)	0.20 (0.34)	B (B)
Maryland Ave at Oliver St & I-83 SB Off-Ramp	Signal	38.2 (21.9)	0.55 (0.31)	D (C)
Maryland Ave at Preston St	Signal	9.9 (13.0)	0.60 (0.35)	A (B)
Maryland Ave at Biddle St	Signal	6.2 (27.6)	0.53 (0.43)	A (C)
Maryland Ave at Chase St	Signal	4.5 (19.5)	0.50 (0.38)	A (B)
Charles St at Preston St	Signal	11.8 (15.0)	0.44 (0.62)	B (B)
Charles St at Biddle St	Signal	9.3 (8.4)	0.34 (0.42)	A (A)
Charles St at Chase St	Signal	14.4 (19.4)	0.41 (0.47)	B (B)
St. Paul St at Preston St	Signal	15.4 (15.9)	0.52 (0.60)	B (B)
St. Paul St at Biddle St	Signal	5.0 (14.5)	0.42 (0.51)	A (B)
St. Paul St at Chase St	Signal	5.2 (11.0)	0.44 (0.48)	A (B)

The results of the existing conditions capacity analysis indicate that ***three intersections are performing at a level of service E – MLK Boulevard at Washington Boulevard (PM peak hour), MLK Boulevard at Lombard Street (PM peak hour) and Howard Street at North Avenue (PM peak hour).*** All other intersections are currently performing at a level of service *D* or better.

As the capacity analysis was performed for each individual node or link, further analysis is required to evaluate the interaction between intersections, such as the effects of residual queues and queue spillback, particularly on Howard Street and MLK Blvd. Further analysis and simulation was performed using SimTraffic software to 'observe' the network under existing

conditions, and validate field observations of traffic flow. The simulation further illustrates the resulting queues on MLK Boulevard. Eastbound MLK Boulevard approaching Howard Street experiences queues which extend back towards Eutaw Street in the PM peak hour. **Figure 7** illustrates a snapshot of the future conditions micro-simulation for the PM peak hour.

Figure 7. PM Peak Hour Existing Conditions Simulation Snapshot



AM Peak Field Observations

1. Queuing along EB MLK Boulevard approaching Howard Street extends back to Read Street.

PM Peak Field Observations

1. Queuing along EB MLK Boulevard approaching Howard Street extends back to Eutaw Street creating spillback.
2. Queuing along EB Read Street approaching Howard Street extends back to MLK Boulevard causing spillback into the right lane on EB MLK Boulevard.

Recommendations for alternatives to mitigate the existing network deficiencies will be discussed under Chapter IV, Future Conditions.

III. BACKGROUND CONDITIONS

Background conditions refer to factors that will affect the performance of the transportation network but are not directly related to the subject development including:

- Growth in existing traffic volumes over the study period;
- Other planned, approved or current developments in the study area;
- Planned improvements to the transportation network by the City in the study area;

A. Growth in Existing Traffic Volumes

Growth in existing traffic volumes was estimated to be 1% per year for through traffic on MLK Boulevard, Howard Street, Mt. Royal Avenue, North Avenue and 0.5% on all minor roadways in the study area through 2019, the projected delivery date for the subject development. The growth rate is based on historical growth rates, as well as extrapolated from traffic forecasts for beyond the study year in this report. **Table 6** summarizes historical traffic volumes along MLK Blvd near Washington Blvd.

Table 6 – Summary of Historical Traffic Data for MLK Blvd

Year	Average Daily Traffic Volume	% Change from Previous Year
2000	42,575	--
2001	43,450	2.1
2002	35,075	-19.3
2003	35,150	0.2
2004	35,525	1.1
2005	44,575	25.5
2006	44,581	0.0
2007	44,582	0.0
Average	***40,689***	***1.4***

1 –Source: Traffic Volume Maps (2000-07), Annual Average Daily Traffic. Maryland Department of Transportation: State Highway Administration, Highway Information Services Division. www.sha.state.md.us/SHAServices/mapsBrochures/maps/OPPE/tvmaps.asp

B. Approved Developments

Information on planned, approved and current develpoment activity in the study area is provided by the Baltimore City Department of Planning. The major background developments evaluated in this study, including projected peak hour trips, are summarized in **Table 7** and **Figure 8** illustrates the location of each background development. Detailed trip generation and trip assignment calculations for all background developments are included in **Appendix E**.

Table 7. Summary of Projected Development Activity in the State Center PUD Area

Development	Program	Total AM Peak Hour Trips	Total PM Peak Hour Trips
UMB BioPark[1]	• 938,000 SF Research & Development Facilities	1,047	951
Poppleton PUD	• 800 Townhouse Dwelling Units[2] • 25,000 SF Office[1] • 15,000 SF Retail[3]	274	361
The Fitzgerald[6]	• 280 High-rise Dwelling Units • 14,000 SF Retail[4,5]	59	90
Waxter[6]	• 600 High-rise Dwelling Units • 20,000 SF Retail[4,5]	174	249
Maryland General Hospital[6]	• 97,000 SF Hospital space expansion	198	257
University of Baltimore – Station North[6]	• 100 High-rise Dwelling Units • 15,000 SF Retail[4,5]	40	100
Penn Station Hotel[7]	• 77 Hotel Rooms	22	23
University of Baltimore – Student Dormitory[2]	• 250 Beds	9	23
TOTAL NET EXTERNAL TRIPS		1,823	2,054

1 A 10% Pedestrian & Transit discount applied to all uses;

2 A 20% Transit & Pedestrian discount applied to this use;

3 A 50% Pass-by discount & a 50% Internal Capture discount applied to this use;

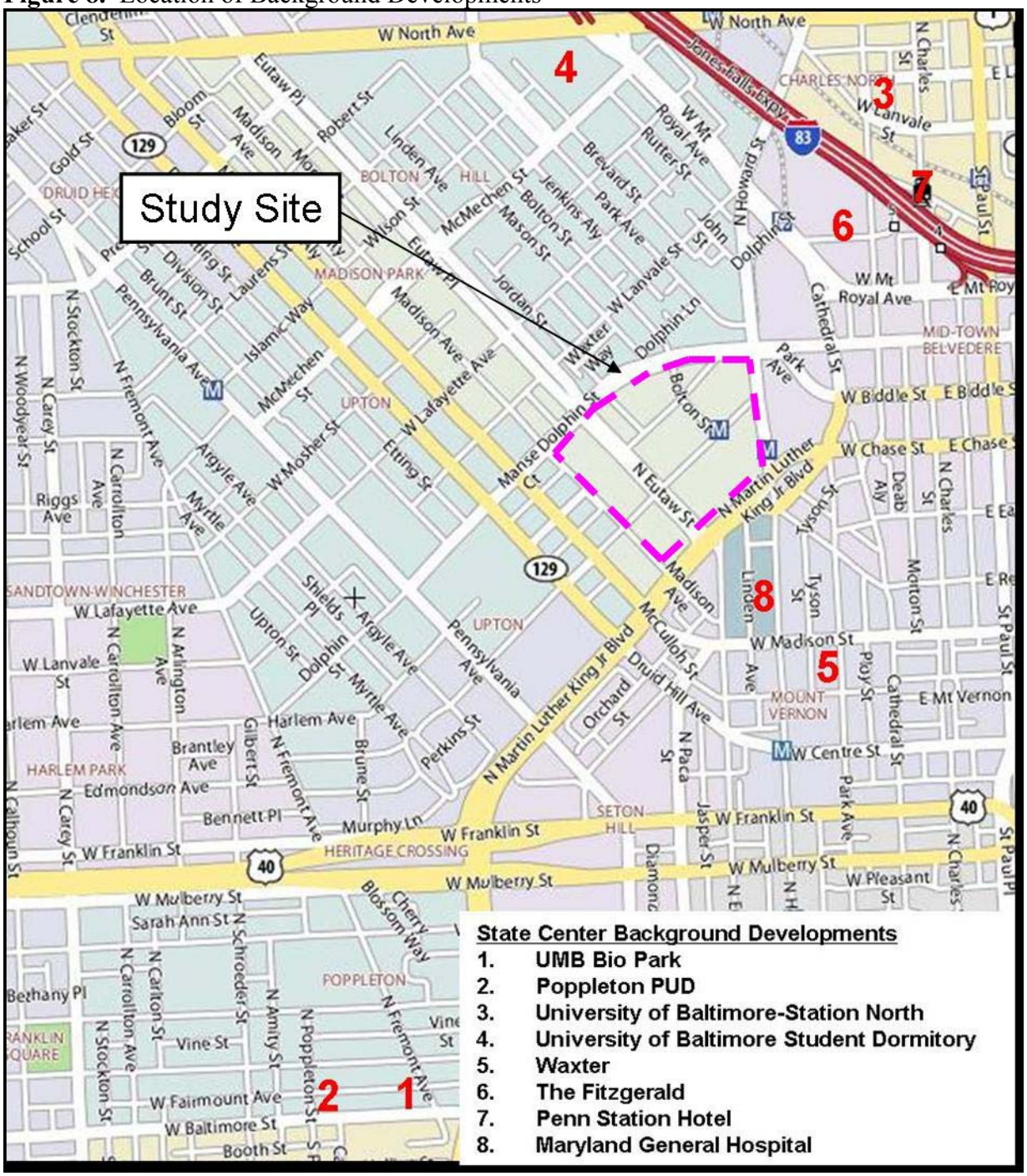
4 A 15% Internal Capture discount applied to retail use;

5 A 35% Pass-By discount applied to retail use;

6 A 15% Pedestrian & Transit discount applied to all uses;

7 A 50% Transit & Pedestrian discount applied to this use.

Figure 8. Location of Background Developments



C. Transportation Network Improvements

Based on conversations with the City of Baltimore Department of Transportation, there are no planned roadway improvements in the study area through 2019. Additionally, the proposed Downtown Shuttle (DASH) is scheduled to begin phased-in service in 2009. It will not service State Center directly but will operate along Charles and St. Paul Streets to the east of State Center.

D. Background Intersection Capacity and Level of Service.

A capacity analysis was performed for the background conditions. The results of the capacity analysis are summarized in **Table 8**; detailed capacity analysis worksheets are included in **Appendix D.** **Figure 9** illustrates the total background traffic volumes.

Table 8. Summary of Background Intersection Capacity Analysis – AM (PM)

Intersection	Control	Delay (sec/veh)	Volume-to-Capacity Ratio	Level of Service
Study Intersections Within and Adjacent to the PUD				
MLK Blvd at Eutaw St	Signal	77.3 (34.9)	0.93 (0.98)	**E** (C)
Howard St at Chase & Read Sts	Signal	41.0 (168.2)	0.44 (0.69)	D **(F)**
MLK Blvd at Howard St	Signal	53.5 (35.2)	0.92 (0.81)	D (D)
Howard St at Preston St	Signal	7.5 (10.5)	0.55 (0.76)	A (B)
Eutaw St at Preston St	Signal	19.2 (13.7)	0.27 (0.41)	B (B)
Eutaw St at Dolphin St	Signal	17.1 (16.0)	0.57 (0.44)	B (B)
Dolphin St at Bolton St	Stop[1]	9.3 (10.0)	0.04 (0.08)	A (A)
Howard St at Dolphin St (Preston St/Park Ave)	Signal	14.6 (18.8)	0.75 (0.76)	B (B)
MLK Blvd at Madison Ave	Signal	37.4 (42.4)	0.87 (0.82)	D (D)
Madison Ave at Preston St	Signal	22.9 (25.8)	0.16 (0.29)	C (C)
Madison Ave at Dolphin St	Signal	18.0 (19.1)	0.21 (0.20)	B (B)

1- Level of Service, Delay, and V/C for northbound stop-controlled movement only

Table 8. (continued)

Intersection	Control	Delay (sec/veh)	Volume-to-Capacity Ratio	Level of Service
Other Study Intersections				
MLK Blvd at Washington Blvd	Signal	85.6 (136.4)	1.08 (1.35)	**F (F)**
MLK Blvd at Pratt St	Signal	83.6 (72.2)	1.13 (1.08)	**F (E)**
MLK Blvd at Lombard St	Signal	25.3 (151.7)	0.94 (1.24)	C **(F)**
MLK Blvd at Mulberry St	Signal	85.9 (37.0)	1.04 (0.95)	**F** (D)
MLK Blvd at Franklin St	Signal	16.2 (66.0)	0.82 (0.98)	B **(E)**
MLK Blvd at Pennsylvania Ave	Signal	43.1 (70.4)	0.93 (1.02)	D **(E)**
MLK Blvd at Druid Hill Ave	Signal	23.1 (10.9)	0.90 (1.04)	C (B)
MLK Blvd at McCulloh St	Signal	32.3 (18.5)	1.02 (0.95)	C (B)
MLK Blvd at Chase St & Park Ave	Signal	33.4 (40.9)	0.71 (0.87)	C (D)
Pennsylvania Ave at Preston St	Signal	14.8 (17.8)	0.31 (0.47)	B (B)
Pennsylvania Ave at Dolphin St	Signal	18.9 (21.9)	0.34 (0.45)	B (C)
Druid Hill Ave at Paca St	Signal	14.4 (13.0)	0.31 (0.31)	B (B)
Druid Hill Ave at Preston St	Signal	7.7 (16.8)	0.28 (0.27)	A (B)
Druid Hill Ave at Dolphin St	Signal	22.7 (13.3)	0.39 (0.33)	C (B)
McCulloh St at Preston St	Signal	18.2 (12.6)	0.15 (0.36)	B (B)
McCulloh St at Dolphin St	Signal	12.3 (10.3)	0.20 (0.48)	B (B)
Eutaw St at Madison & Paca Sts	Signal	12.5 (22.1)	0.30 (0.59)	B (C)
Eutaw St at McMechen St	Signal	21.1 (20.3)	0.42 (0.50)	C (C)
Howard St at Centre St	Signal	10.6 (11.2)	0.24 (0.30)	B (B)
Howard St at Madison St	Signal	19.3 (17.7)	0.32 (0.40)	B (B)
Howard St at North Ave	Signal	35.9 (85.2)	0.79 (1.17)	D **(F)**
North Ave at Mt. Royal Ave	Signal	50.7 (60.0)	0.78 (0.94)	D **(E)**
Cathedral St at Mt. Royal Ave	Signal	16.1 (42.9)	0.41 (0.57)	B (D)
Cathedral St at Preston St	Signal	9.0 (9.9)	0.35 (0.61)	A (A)
Cathedral St at Biddle St (Park Ave/MLK Blvd)	Signal	11.1 (19.0)	0.24 (0.44)	B (B)
Maryland Ave at Oliver St & I-83 SB Off-Ramp	Signal	49.1 (23.0)	0.67 (0.36)	D (C)
Maryland Ave at Preston St	Signal	13.1 (13.2)	0.69 (0.40)	B (B)
Maryland Ave at Biddle St	Signal	7.2 (27.7)	0.62 (0.51)	A (C)
Maryland Ave at Chase St	Signal	6.0 (24.5)	0.61 (0.44)	A (C)
Charles St at Preston St	Signal	12.6 (16.0)	0.47 (0.68)	B (B)
Charles St at Biddle St	Signal	9.9 (9.4)	0.37 (0.48)	A (A)
Charles St at Chase St	Signal	17.1 (31.6)	0.51 (0.53)	B (C)
St. Paul St at Preston St	Signal	15.9 (16.5)	0.56 (0.64)	B (B)
St. Paul St at Biddle St	Signal	5.1 (15.2)	0.46 (0.56)	A (B)
St. Paul St at Chase St	Signal	5.8 (11.7)	0.51 (0.52)	A (B)

The results of the background conditions capacity analysis indicate that with growth in existing traffic volumes, as well as additional traffic from background developments, ***six intersections will experience failing conditions during at least one peak hour:***

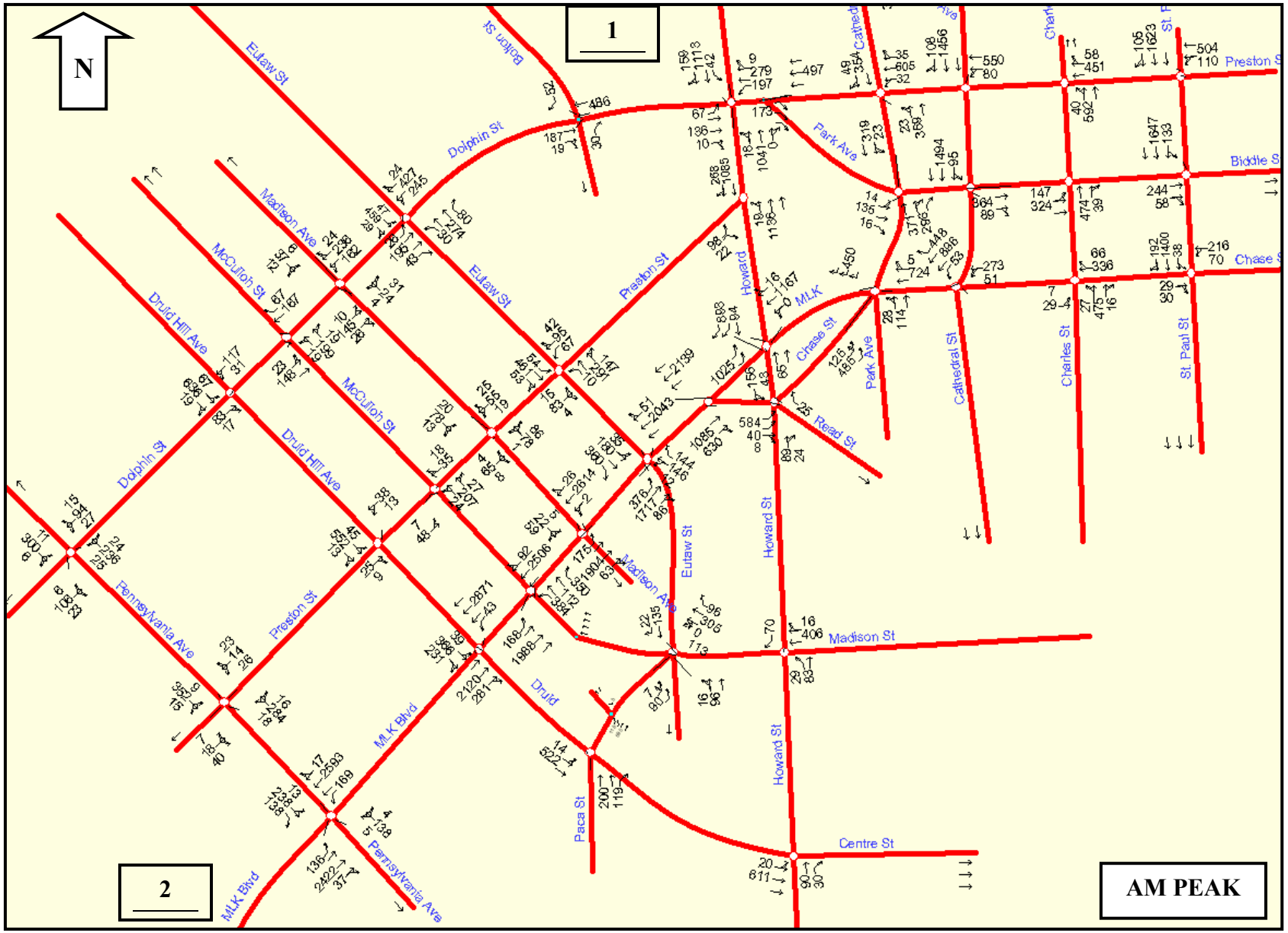
- ***Howard Street at Chase & Read Streets (PM peak hour);***
- ***MLK Boulevard at Washington Boulevard (AM and PM peak hours);***
- ***MLK Boulevard at Pratt Street (AM peak hour);***
- ***MLK Boulevard at Lombard Street (PM peak hour);***
- ***MLK Boulevard at Mulberry Street (AM peak hour);***
- ***Howard St at North Ave (PM peak hour).***

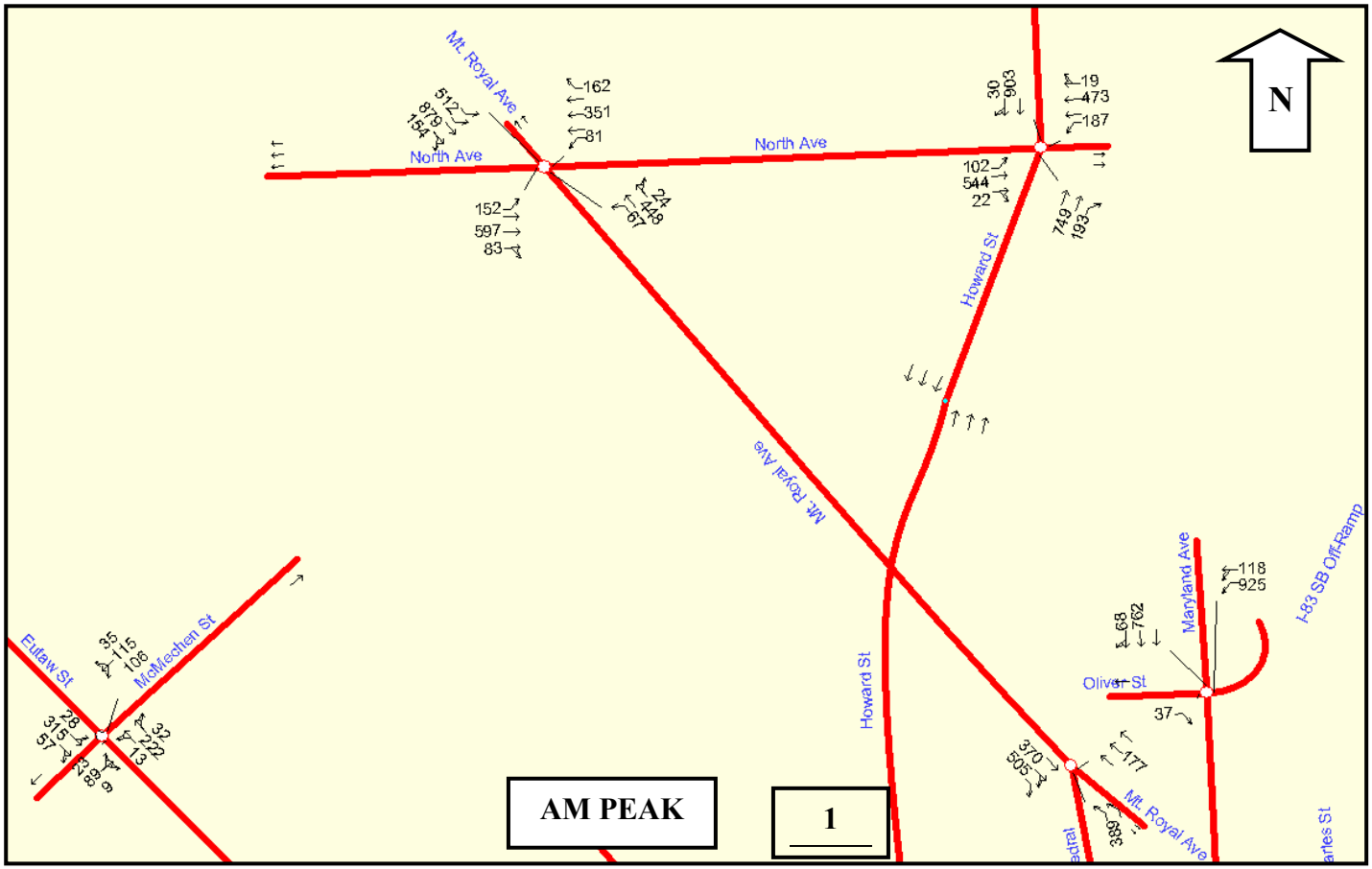
Additionally, five intersections will operate at a level of service **E during at least one peak hour*:***

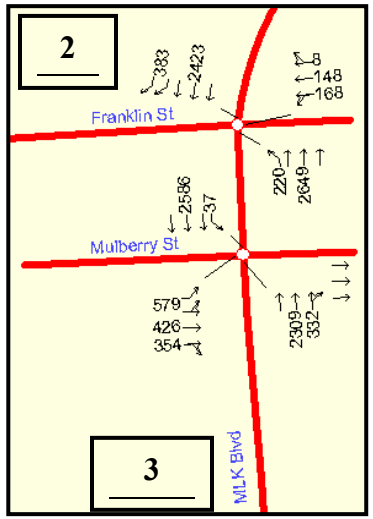
- ***MLK Boulevard at Eutaw Street (AM peak hour);***
- ***MLK Boulevard at Pratt Street (PM peak hour);***
- ***MLK Boulevard at Franklin Street (PM peak hour);***
- ***MLK Boulevard at Pennsylvania Avenue (PM peak hour), and;***
- ***North Ave at Mt. Royal Ave (PM peak hour).***

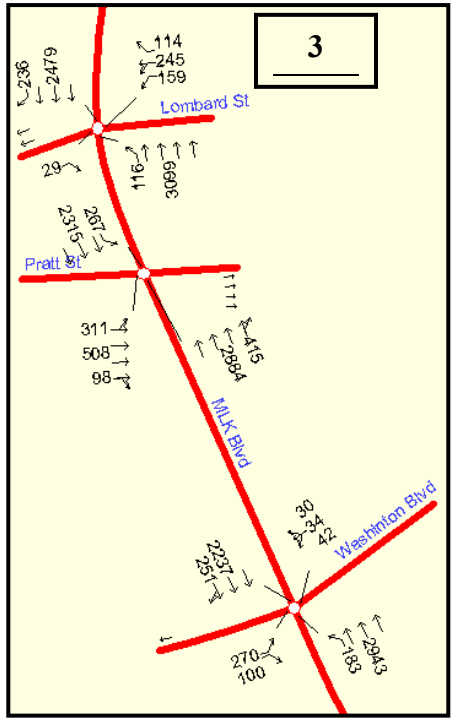
All other intersections will continue to operate at a level of service *D* or better.

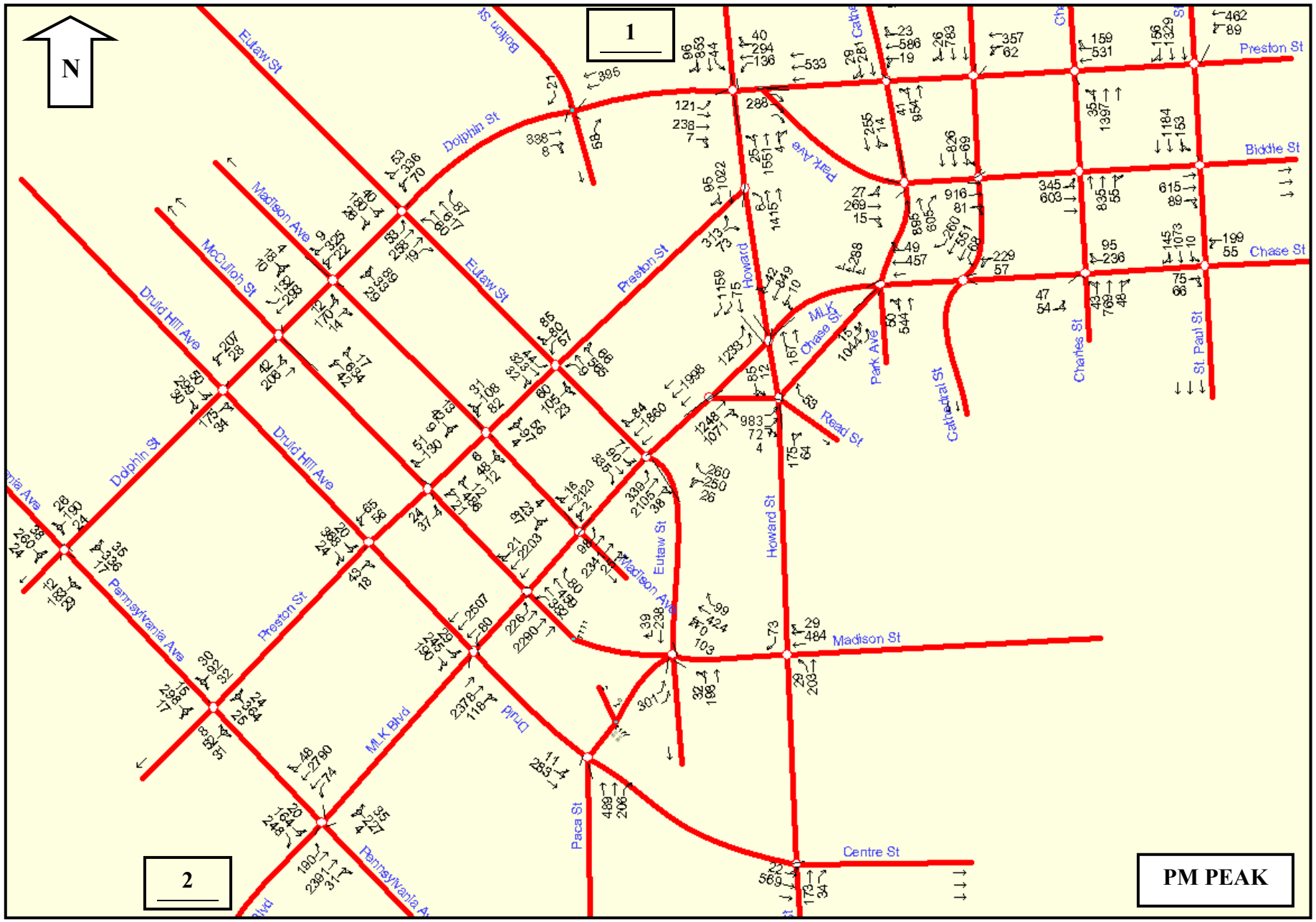
Figure 9. Total Background Peak Hour Volumes

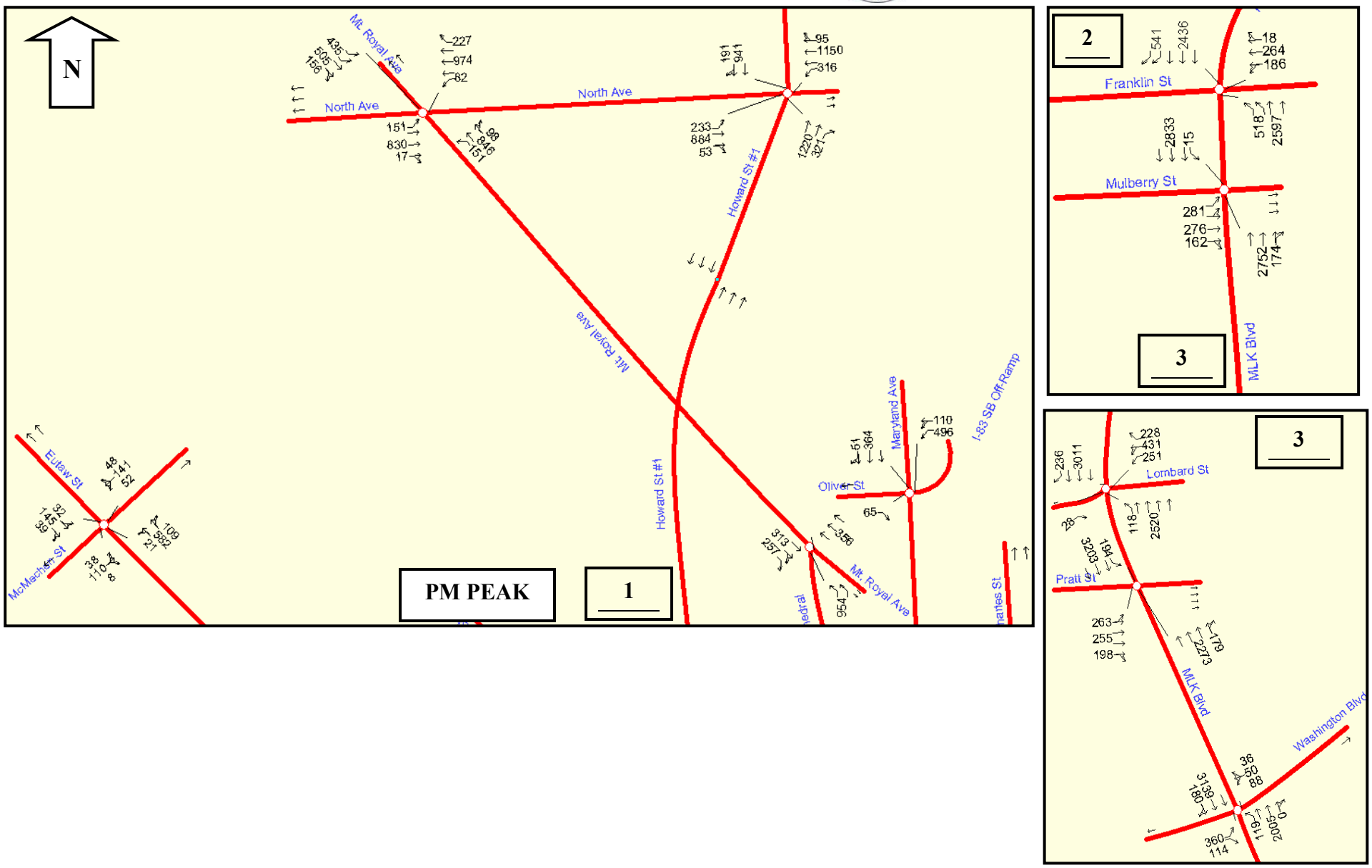



N
Mt. Royal Ave
North Ave
Howard St
Eutaw St
McMechen St
Maryland Ave
Oliver St
I-83 SB Off-Ramp
AM PEAK
1


2
Franklin St
Mulberry St
MLK Blvd
3


3
Lombard St
Pratt St
MLK Blvd
Washington Blvd


N
1
2
PM PEAK
Eutaw St
Dolphin St
Madison Ave
McCulloh St
Druid Hill Ave
Preston St
Pennsylvania Ave
MLK Blvd
Howard St
Park Ave
Read St
Chase St
Biddle St
Madison St
Centre St
Paca St
Charles St
St. Paul St
Cathedral St


N
Mt. Royal Ave
North Ave
Howard St #1
Eutaw St
McMechen St
Maryland Ave
Oliver St
I-83 SB Off-Ramp
PM PEAK
1
2
3
Franklin St
Mulberry St
MLK Blvd
Lombard St
Pratt St
Washington Blvd

IV. FUTURE CONDITIONS

A. Proposed Development

The State Center Planned Unit Development (PUD) project in Baltimore City is proposing a development program that includes 2 million SF of office space (800,000 SF existing government office space, 500,000 SF new government office space and 700,000 SF private office space) 1,425 residential dwelling units, 200,000 square feet of retail space, 50,000 SF restaurant space, 340,000 SF civic space (museum, armory and amphitheater) and approximately 5,600 parking spaces. Primary access to the site will be via MLK Boulevard, Eutaw Street, Madison Avenue, Howard Street, Dolphin Street, Twenty-Ninth Division Street, Preston Street and Bolton Street.

B. Projected Site Traffic Volumes

Projecting the number of new vehicular trips generated by a proposed development is the most critical aspect of assessing traffic impact. The objective of a trip generation analysis is to forecast the number of new trips that will begin or end at a proposed land use. A primary source for data on vehicular trip generation is the *Trip Generation Handbook* published by the Institute of Transportation Engineers. The *Handbook* compiles data from over 4,000 surveys of trip rates at hundreds of specific types of land uses such as recreational, residential, commercial, office, institutional, and industrial throughout the country. The data is sorted by various time periods such as morning and evening peak hour, and plotted against independent variables for specific land uses such as square feet of commercial space, number of hotel rooms, number of dwelling units, etc. The data is presented in graphical format with weighted averages, and fitted curve linear regression equations, where enough data is available.

Several site-specific factors can reduce the number of new personal vehicular trips generated by a new development or land use. These include the 1) the availability of ***alternative modes*** of transportation such as sidewalks, bicycle facilities, and public transportation; 2) the effect of ***pass-by*** traffic which includes vehicles already on the roadway network making a intermediate stop on the way from an origin to a primary trip destination without a route diversion, and 3) the effect of ***internally captured*** trips composed of traffic originating and destined for different land uses within the same development that do not travel on the external public roadway network. An example of an internal trip would be a trip from an office building to a restaurant or from a hotel to an office building within the same development. It should be cautioned however that internal capture trips are ***not*** intended to account for Central Business District travel characteristics, or synergy within large office campuses that have internal supporting retail uses. Graphical illustrations of pass-by traffic and internal captured trips are shown in **Figures 10 and 11**.

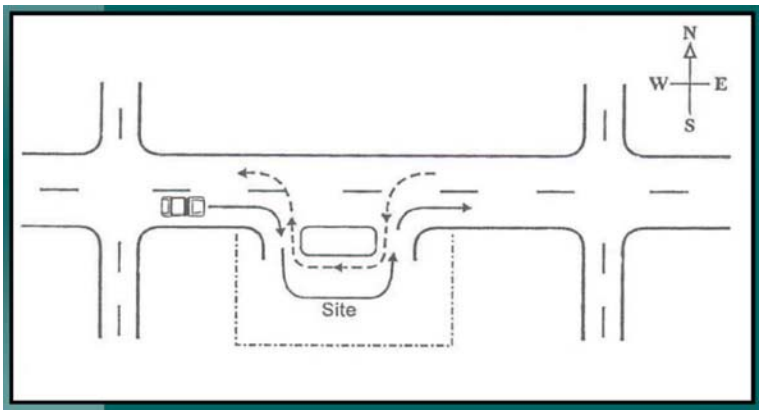


Figure 10. Illustration of Pass-By Traffic

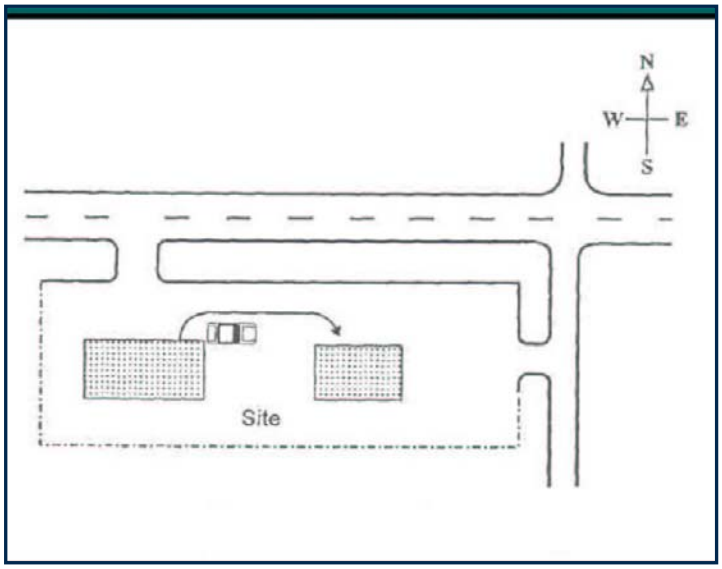


Figure 11. Illustration of Internal Capture Traffic

Using the ITE Trip Generation Manual, 7th Edition (2003) peak hour trip generation rates were determined based on the future land uses. The average number of vehicle trip ends and percentage of entering and exiting volumes were calculated. Land use categories 220 – Apartment, 230 – Townhome, 441 – Amphitheater, 710 – General Office, 733 – Government Office Complex, 820 – Retail, and 932 – High-Turnover Restaurant were selected.

The effect of pass-by traffic is also quantified from data available in *Trip Generation Handbook.* For certain developments, primarily retail and service-oriented land uses, the traffic entering and exiting the site may be significantly different than the total number of new personal vehicle trips added to the roadway network. The difference between the total entering and exiting traffic and new vehicle trips - pass-by traffic – can range from 20% to 60%, but averages around 34%. The variance is largely dependent on the specific type(s) of retail or service uses and size of the development.

Information for internal capture trip rates for mixed-use developments can also be found in the *Trip Generation Handbook.* Again, the size and intensity of the development affect the interplay of uses within a site and thus the amount of trips captured internally. The suggested unconstrained capture rates for trip origins and destinations for each land use are entered into a spreadsheet format, and balanced to calculate the adjusted site-specific rates.

Mode share information was estimated based on several factors including: 1) existing surplus transit capacity as documented in the existing conditions; 2) existing mode share data in the State Center PUD as surveyed by MDOT (20.6% non-auto share) and is included in **Appendix E**; 3) *Baltimore Central Business District Trip Characteristics Report*, 2006 Update, prepared by the Baltimore Metropolitan Council of Governments (22% transit share) and is included in **Appendix E,** and; 4) proposed parking capacity on-site.

Based on the above factors and guidelines, a 25% global pedestrian, bicycle and transit reduction was applied to all land uses within the PUD. An internal capture rate of 15% was applied to the retail and restaurant uses. Lastly, a pass-by trip discount of 34% was applied to the retail use and 43% was applied to restaurant use. The projected trip generation is summarized in **Table 9;** detailed internal capture worksheets are included in **Appendix G.**

Table 9. Summary of Proposed Land Uses and Trip Generation AM (PM)

Land Use (ITE Code)	Variable	Total Daily Trips	Avg. New Vehicle Trips	Entering		Exiting	
				%	Vehicles	%	Vehicles
Government Office Complex (733)	500K SF	13,960	1,105 (1,425)	89 (31)	983 (442)	11 (69)	122 (983)
General Office Building (710)	700K SF	5,969	890 (863)	88 (17)	783 (147)	12 (83)	107 (716)
Residential (220)	712 Units	4,429	353 (409)	20 (65)	71 (266)	80 (35)	282 (143)
Residential (230)	713 Units	3,409	249 (301)	17 (67)	42 (202)	83 (33)	206 (99)
Retail (820)	200K SF	10,656	237 (989)	61 (48)	145 (475)	39 (52)	93 (514)
Less 34% Pass-By Trip Discount		*-3,623*	*-81 (-336)*	-	*-49 (-161)*	-	*-31 (-175)*
Less 15% Internal Capture Discount		*-1,598*	*-36 (-148)*	-	*-22 (-71)*	-	*-14 (-77)*
Subtotal: Retail		5,435	121 (504)	-	74 (242)	-	47 (262)
High-Turnover Restaurant (932)	50K SF	6,358	576 (546)	52 (61)	300 (333)	48 (39)	276 (213)
Less 43% Pass-By Trip Discount		*-2,734*	*-248 (-235)*	-	*-129 (-143)*	-	*-119 (-92)*
Less 15% Internal Capture Discount		*-954*	*-86 (-82)*	-	*-45 (-50)*	-	*-41 (-32)*
Subtotal: Restaurant		2,670	242 (229)	-	126 (140)	-	116 (89)
Amphitheater, etc. (441)	1,000 Seats	660	-- (330)	-- (50)	-- (165)	-- (50)	-- (165)
Total Raw New Trips		**45,441**	**3,409 (4,863)**	-	**2,323 (2,029)**	-	**1,086 (2,834)**
Less 25% Transit & Pedestrian Discount		*-11,360*	*-852 (-1,216)*	-	*-581 (-507)*	-	*-271 (-709)*
TOTAL NET EXTERNAL TRIPS		**25,172**	**2,106 (2,846)**	**--**	**1,498 (1,096)**	**--**	**609 (1,750)**

The proposed development is projected to generate, after applying applicable trip reduction factors, a total of 25,172 new daily vehicular trips, of which 2,106 will occur during the morning peak hour and 2,846 will occur during the evening peak hour.

C. Distribution of Site Trips

Distribution of site trips to the subject development is assumed based on existing traffic patterns, land uses within the site, and access points to the proposed development, and is summarized below in **Table 10**. The distribution of trips to and from the State Center PUD is illustrated in **Figure 12**.

Table 10. Summary of Trip Distribution for State Center PUD

Land Use	Distribution
Office, Residential, Retail, Restaurant, Amphitheater et al.	• 30% to/from the north via I-83; • 32% to/from the south via CBD, I-95, I-395, and MD 295; • 10% to/from the west via Mulberry, Franklin, Eutaw, McCulloh Streets and Druid Hill Avenue; • 10% to/from North Avenue & Howard Street; • 5% to/from St. Paul and Charles Streets; • 13% to/from East/Southeast Baltimore.

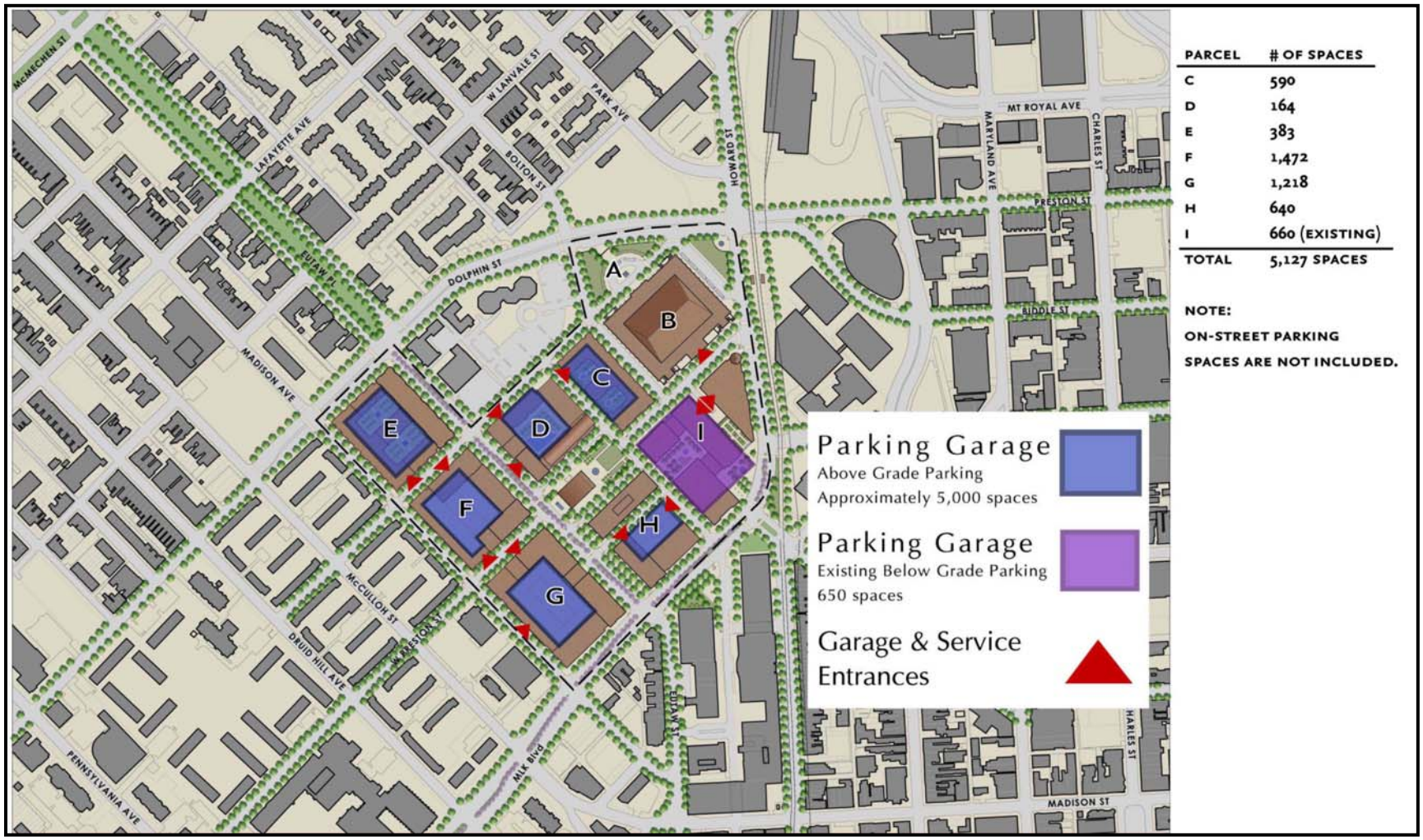
In addition, future traffic was assigned to future parking facilities as follows:

- Garage *C* (12%);
- Garage *D* (5%);
- Garage *E* (10%);
- Garage *F* (33%);
- Garage *G* (25%), and;
- Garage *H* (15%).

The proposed parking facilities are illustrated in **Figure 13** and site generated traffic volumes, excluding pass-by trips, are illustrated in **Figure 14.**

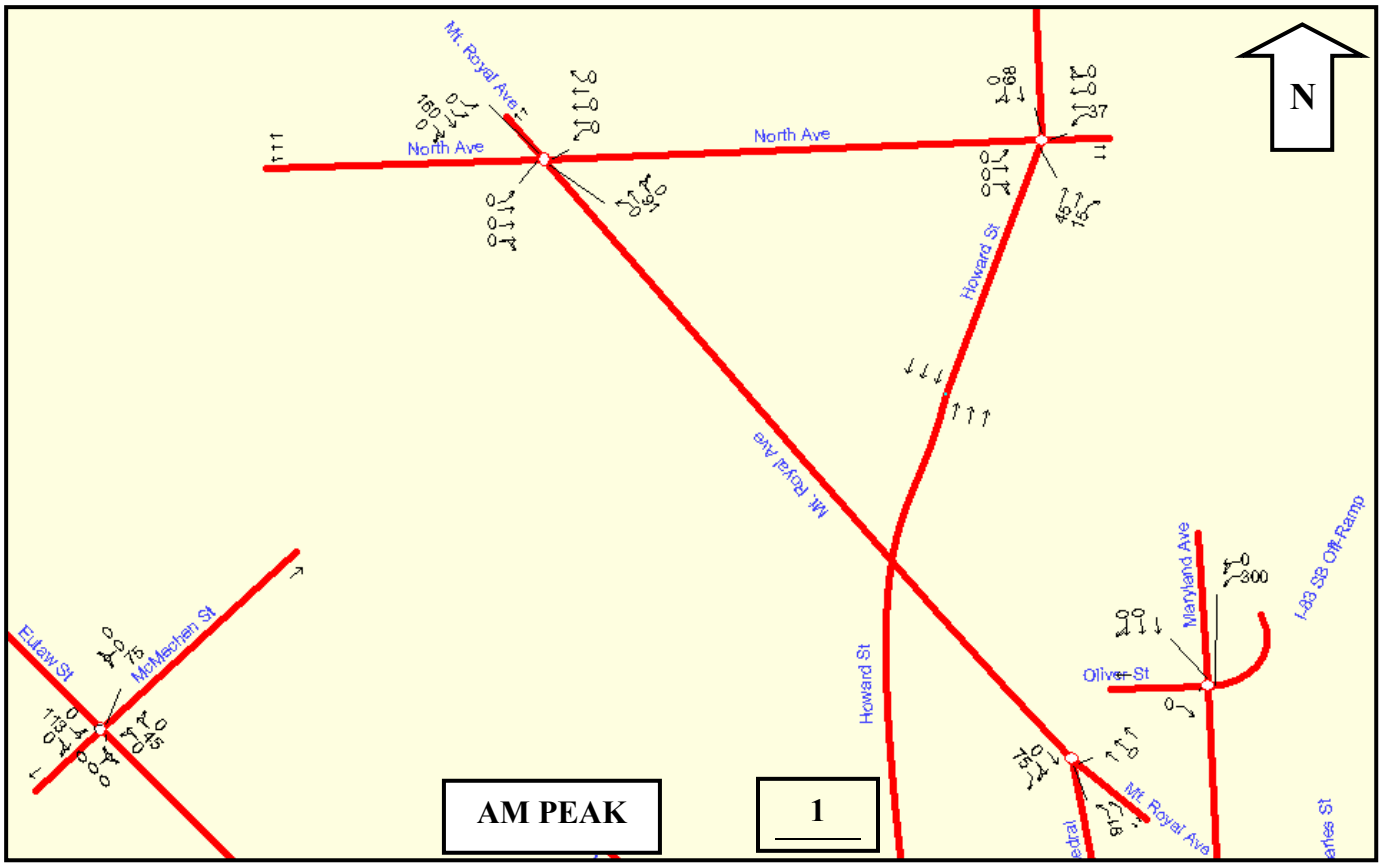
Figure 12. Distribution of Site Trips

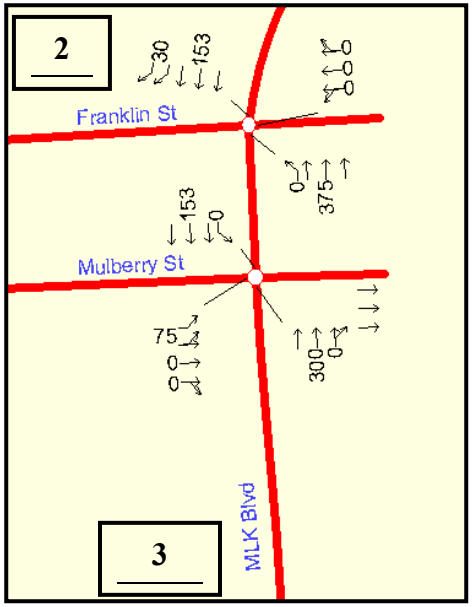
Figure 13. Proposed Parking Facilities [1]

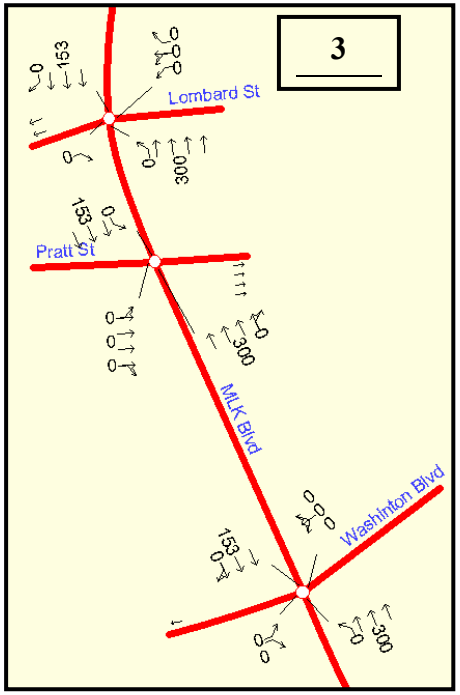


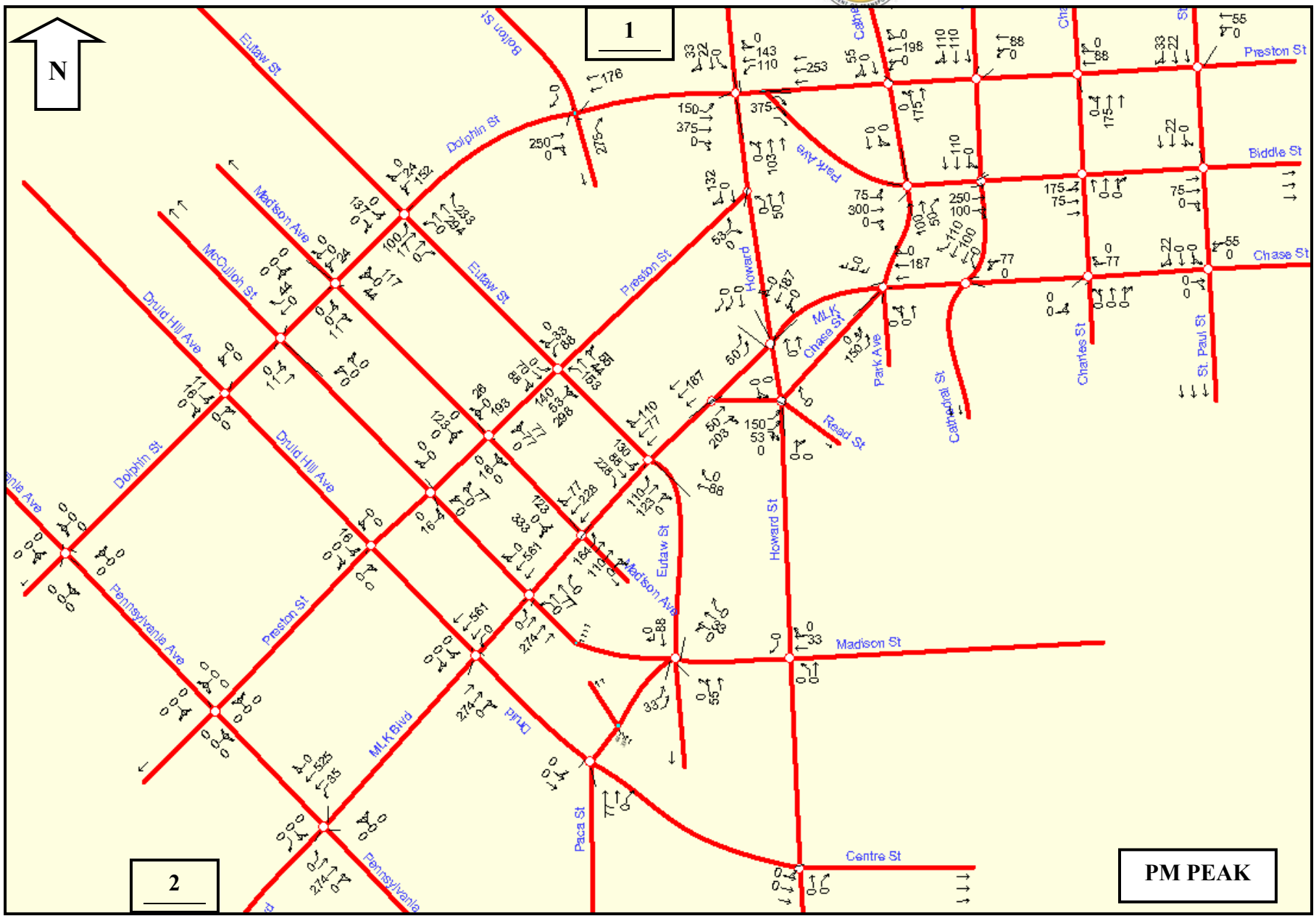
[1] Graphic prepared by Design Collective, Inc.

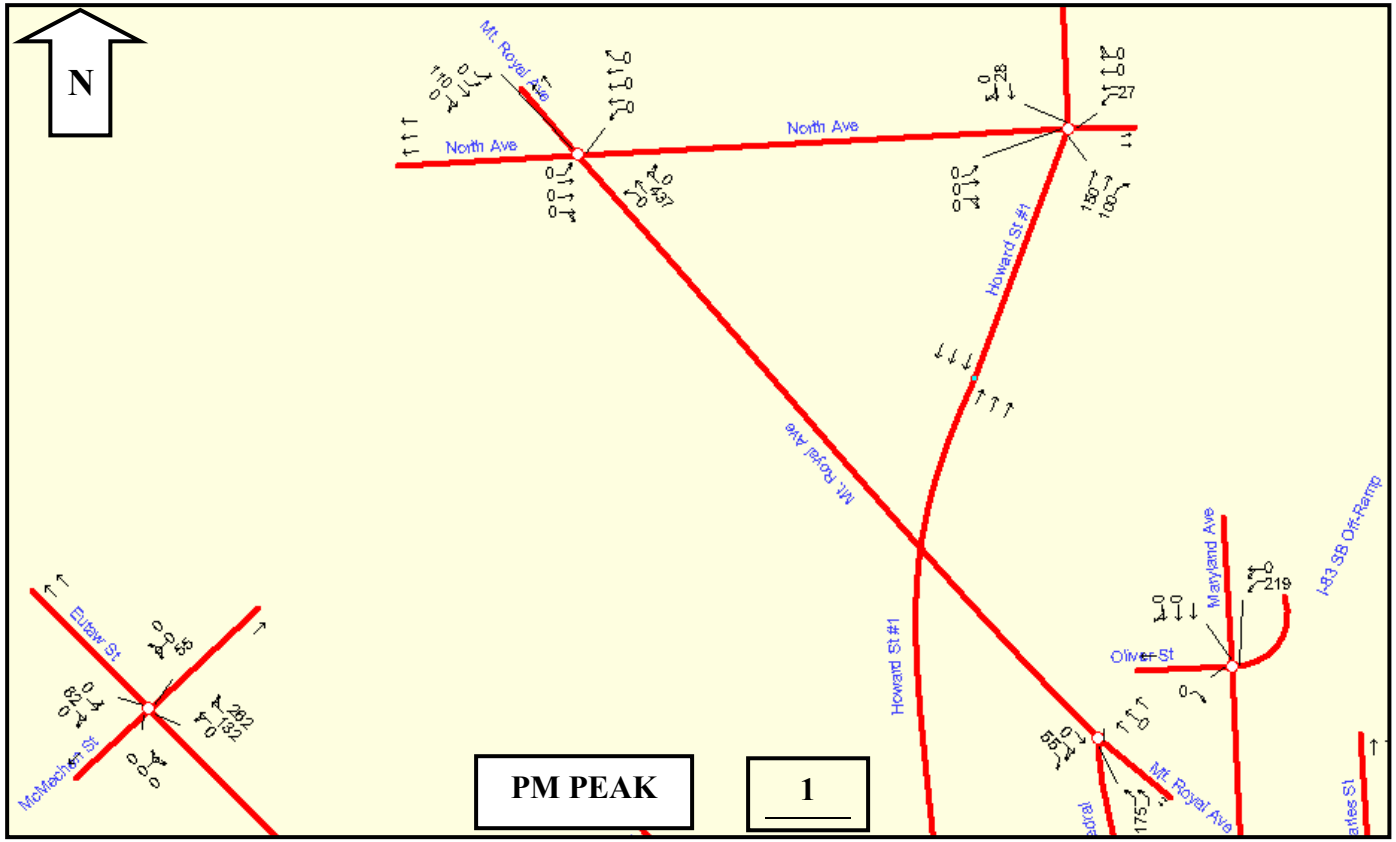
Figure 14. Site Generated Peak Hour Traffic Volumes

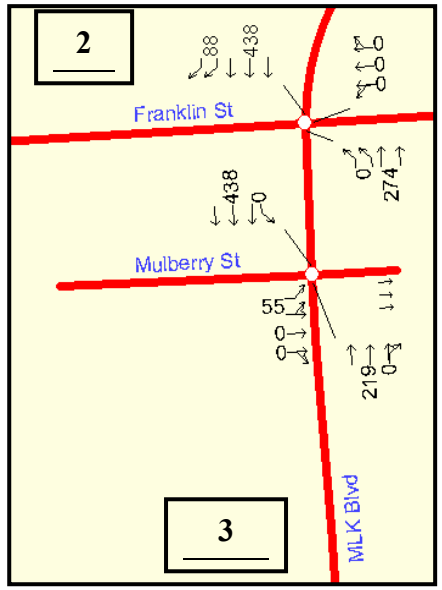

N
Mt. Royal Ave
North Ave
North Ave
Howard St
Mt. Royal Ave
Howard St
Maryland Ave
I-83 SB Off-Ramp
Olive St
Mt. Royal Ave
Eutaw St
McMechen St
AM PEAK
1

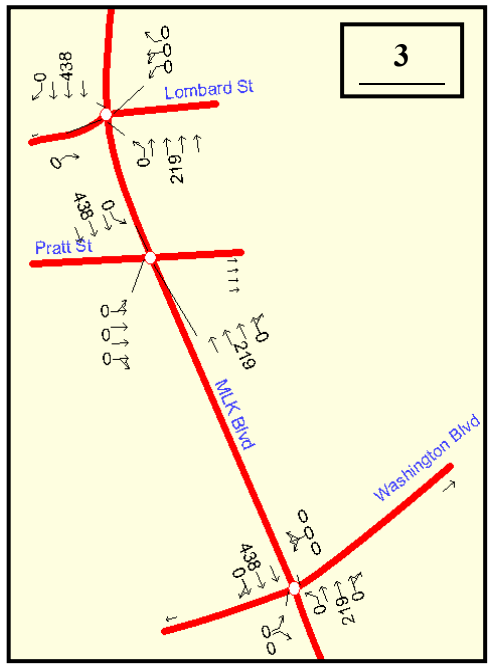

2
Franklin St
Mulberry St
MLK Blvd
3


3
Lombard St
Pratt St
MLK Blvd
Washington Blvd


N
1
2
Eutaw St
Dolphin St
Madison Ave
McCulloh St
Druid Hill Ave
Preston St
Howard
Park Ave
Chase St
Read St
Howard St
Madison St
Centre St
Biddle St
Charles St
St. Paul St
Cathedral St
Pennsylvania Ave
MLK Blvd
Paca St
PM PEAK


N
Mt. Royal Ave
North Ave
North Ave
Howard St #1
Mt. Royal Ave
Howard St #1
Maryland Ave
Oliver St
I-83 SB Off-Ramp
Mt. Royal Ave
Eutaw St
McMechen St
PM PEAK
1

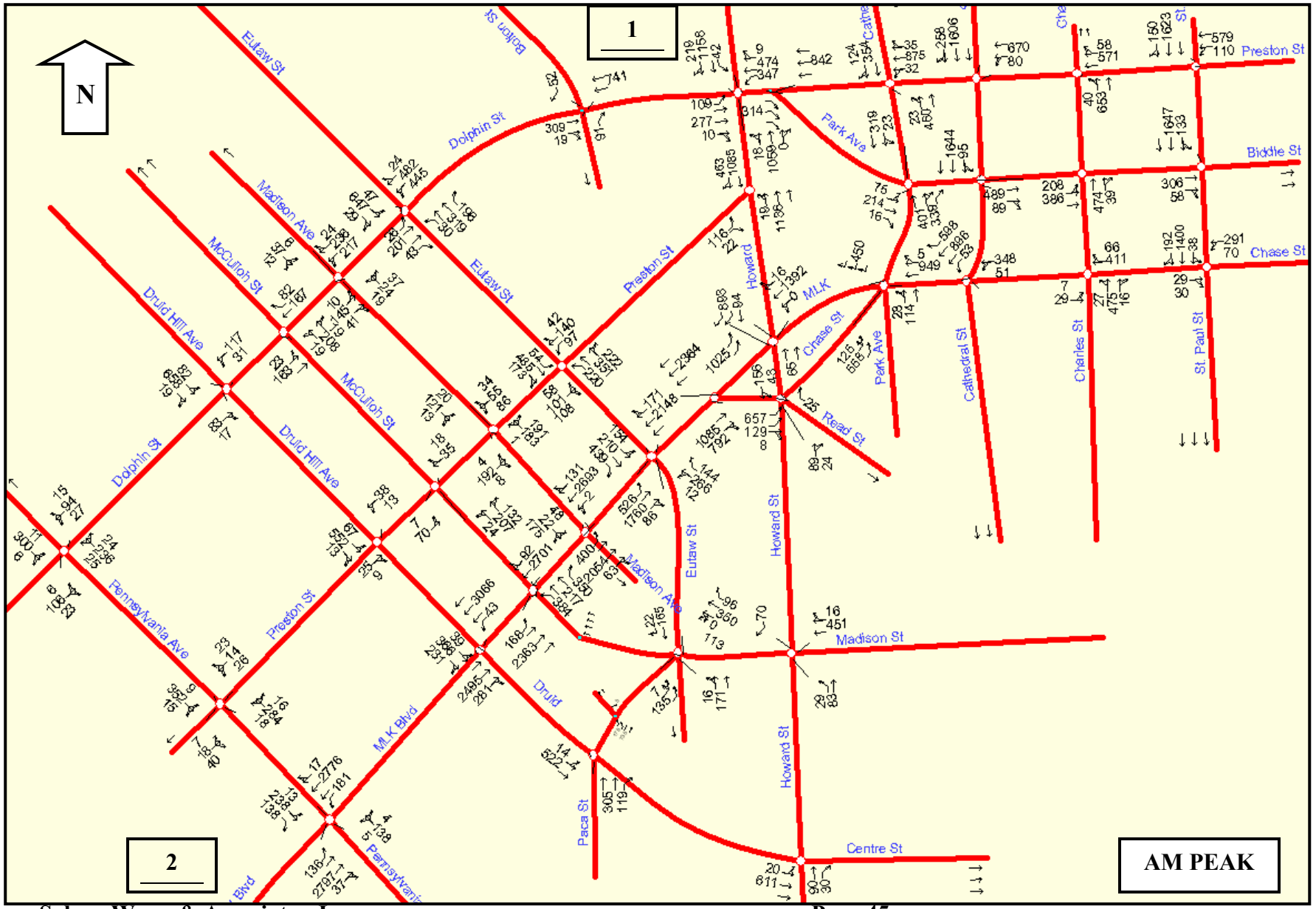

2
Franklin St
Mulberry St
MLK Blvd
3

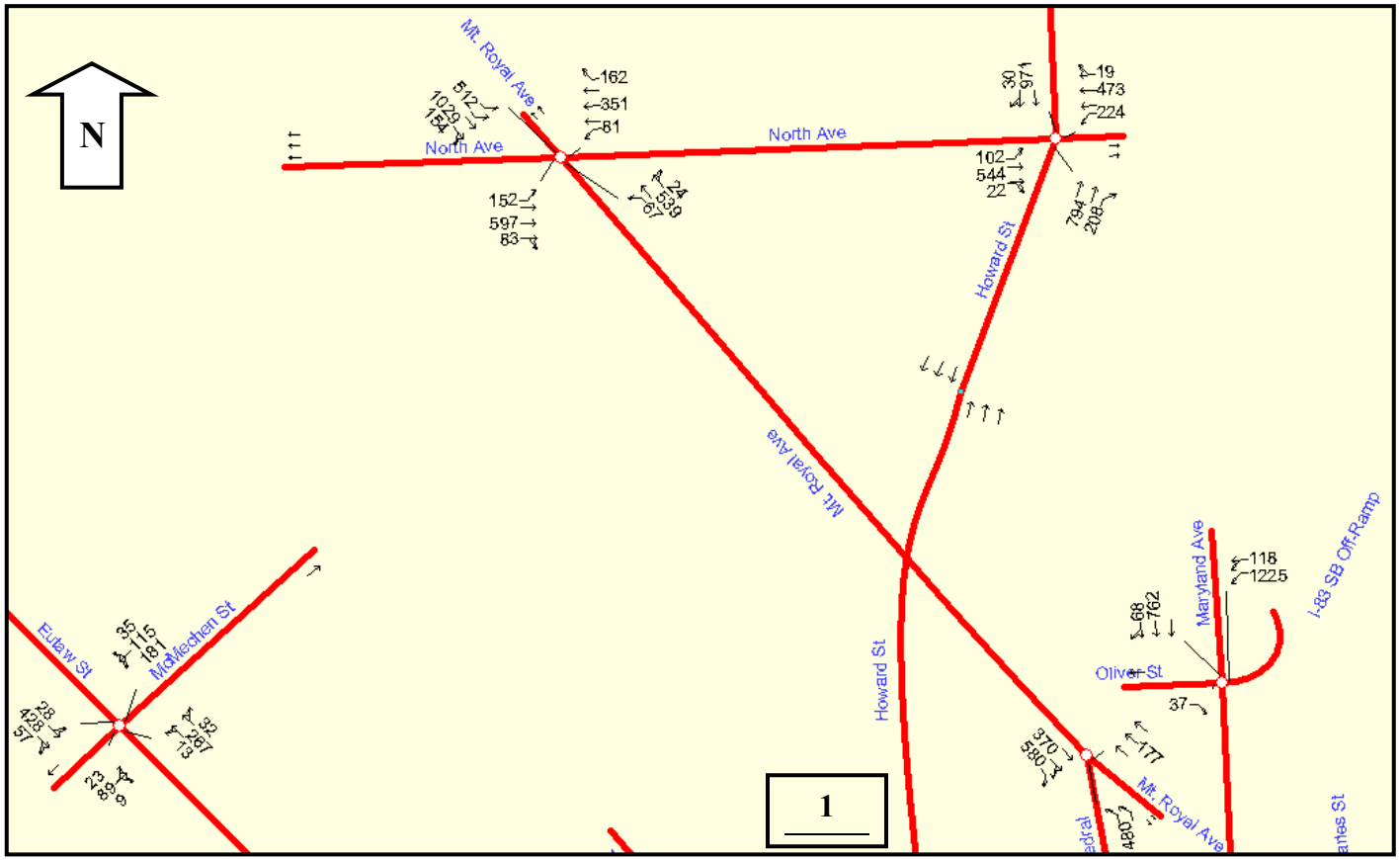

3
Lombard St
Pratt St
MLK Blvd
Washington Blvd

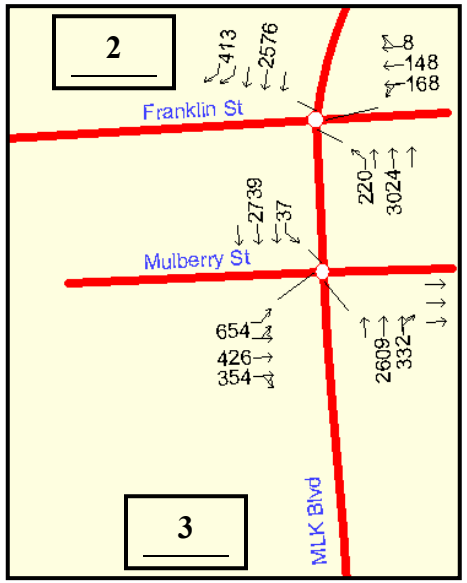
D. Future Traffic Volumes

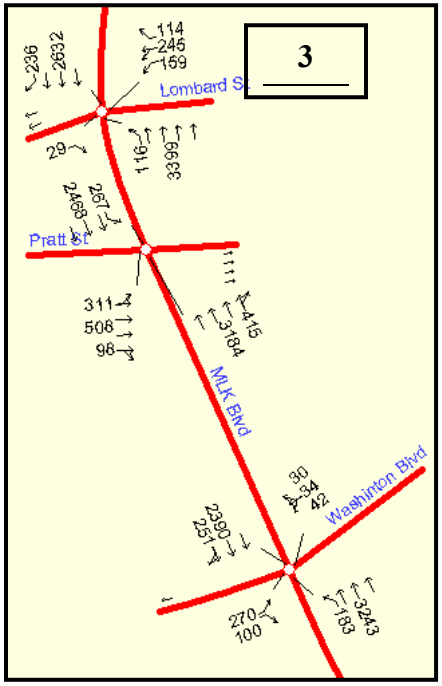
Future year 2019 traffic volumes were obtained by adding the existing traffic volumes + growth in the existing traffic volumes + traffic generated by other developments in the study area + the new traffic generated by the subject development, including pass-by trips. The total year 2019 future traffic volumes are shown in **Figure 15.**

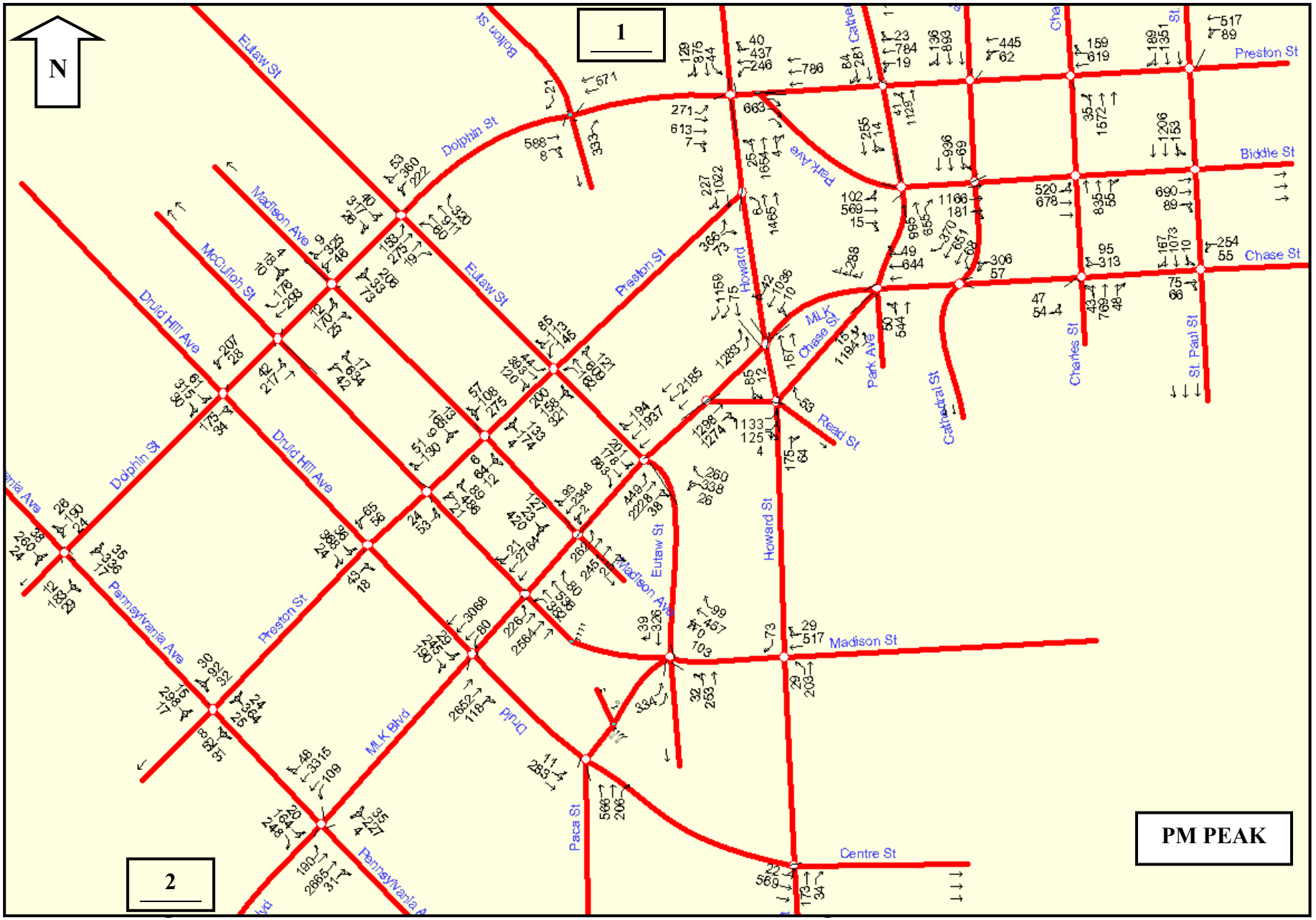
Figure 15. Year 2019 Total Peak Hour Traffic Volumes

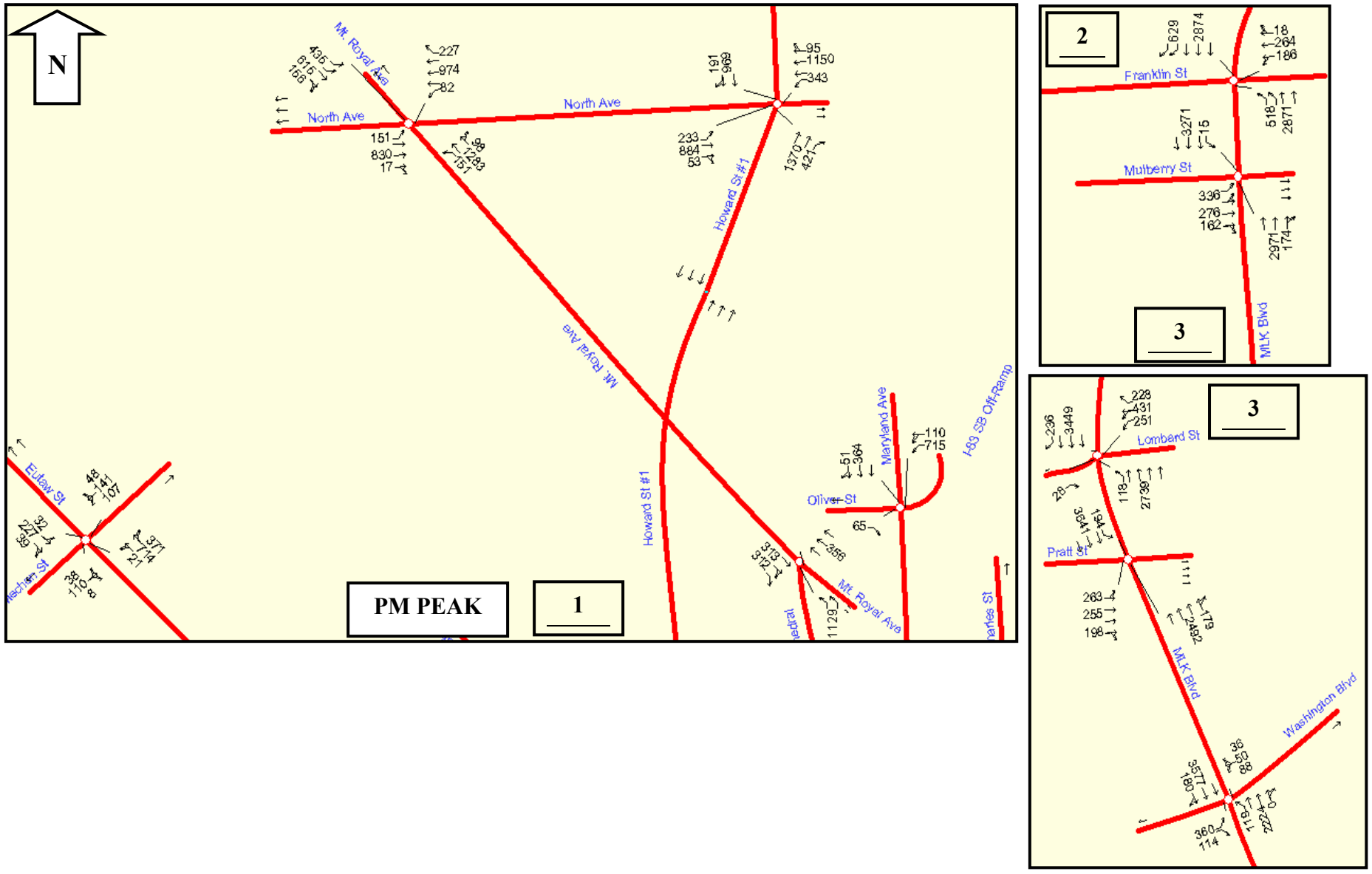



N
Mt. Royal Ave
North Ave
Howard St
Mt Royal Ave
Howard St
Eutaw St
McMechen St
Maryland Ave
Oliver St
I-83 SB Off-Ramp
Mt. Royal Ave
1


2
Franklin St
Mulberry St
MLK Blvd
3


3
Lombard St
Pratt St
MLK Blvd
Washington Blvd


N
1
2
Eutaw St
Dolphin St
Madison Ave
McCulloh St
Druid Hill Ave
Preston St
Howard
Park Ave
MLK Chase St
Read St
Cathedral St
Biddle St
Chase St
Charles St
St. Paul St
Howard St
Madison St
Centre St
Pennsylvania Ave
MLK Blvd
Paca St
PM PEAK


N
Mt. Royal Ave
North Ave
Howard St #1
Howard St #1
Mt. Royal Ave
Eutaw St
Oliver St
Maryland Ave
I-83 SB Off-Ramp
Mt. Royal Ave
PM PEAK
1
2
Franklin St
Mulberry St
MLK Blvd
3
3
Lombard St
Pratt St
MLK Blvd
Washington Blvd

E. Future Intersection Capacity and Level of Service.

A capacity analysis was performed for the total future 2019 conditions. The results of the capacity analysis are summarized in **Table 11**; detailed capacity analysis worksheets are included in **Appendix D.**

Table 11. Summary of Future Intersection Capacity Analysis - Background (Future)

Intersection	Control	Delay (sec/veh)	Volume-to-Capacity Ratio	Level of Service
Study Intersections Within and Adjacent to the PUD				
AM Peak Hour				
MLK Blvd at Eutaw St	Signal	77.3 (109.7)	0.93 (1.17)	**E (F)**
Howard St at Chase & Read Sts	Signal	41.0 (41.3)	0.44 (0.48)	D (D)
MLK Blvd at Howard St	Signal	53.5 (74.0)	0.92 (0.99)	D **(E)**
Howard St at Preston St	Signal	7.5 (9.4)	0.55 (0.63)	A (A)
Eutaw St at Preston St[2]	Signal	19.2 (23.0)	0.27 (0.56)	B (C)
Eutaw St at Dolphin St[2]	Signal	17.1 (25.6)	0.57 (0.79)	B (C)
Dolphin St at Bolton St	Stop[1]	9.3 (10.2)	0.04 (0.13)	A (B)
Howard St at Dolphin St (Preston St/Park Ave)[2]	Signal	14.6 (35.5)	0.75 (1.02)	B (D)
MLK Blvd at Madison Ave	Signal	37.4 (107.4)	0.87 (1.26)	D **(F)**
Madison Ave at Preston St	Signal	22.9 (22.1)	0.16 (0.42)	C (C)
Madison Ave at Dolphin St	Signal	18.0 (18.1)	0.21 (0.25)	B (B)
PM Peak Hour				
MLK Blvd at Eutaw St	Signal	34.9 (69.1)	0.98 (1.07)	C **(E)**
Howard St at Chase & Read Sts	Signal	168.2 (230.9)	0.69 (0.75)	**F (F)**
MLK Blvd at Howard St	Signal	35.2 (42.8)	0.81 (0.88)	D (D)
Howard St at Preston St	Signal	10.5 (12.9)	0.76 (0.81)	B (B)
Eutaw St at Preston St[2]	Signal	13.7 (48.8)	0.41 (1.00)	B (D)
Eutaw St at Dolphin St	Signal	16.0 (19.4)	0.44 (0.71)	B (C)
Dolphin St at Bolton St	Stop[1]	10.0 (17.1)	0.08 (0.55)	A (C)
Howard St at Dolphin St (Preston St/Park Ave)[2]	Signal	18.8 (44.3)	0.76 (0.98)	B (D)
MLK Blvd at Madison Ave	Signal	42.4 (108.6)	0.82 (1.39)	D **(F)**
Madison Ave at Preston St	Signal	25.8 (30.5)	0.29 (0.65)	C (C)
Madison Ave at Dolphin St	Signal	19.1 (22.3)	0.20 (0.33)	B (C)

1- Level of Service, Delay, and V/C for northbound stop-controlled movement only
2- Assumed introduction of new left-turn signal phasing

Table 11. (continued)

Intersection	Control	Delay (sec/veh)	Volume-to-Capacity Ratio	Level of Service
Other Study Intersections				
AM Peak Hour				
MLK Blvd at Washington Blvd	Signal	85.6 (121.4)	1.08 (1.09)	**F (F)**
MLK Blvd at Pratt St	Signal	83.6 (110.8)	1.13 (1.20)	**F (F)**
MLK Blvd at Lombard St	Signal	25.3 (36.9)	0.94 (0.99)	C (D)
MLK Blvd at Mulberry St	Signal	85.9 (121.1)	1.04 (1.13)	**F (F)**
MLK Blvd at Franklin St	Signal	16.2 (17.8)	0.82 (0.85)	B (B)
MLK Blvd at Pennsylvania Ave	Signal	43.1 (50.7)	0.93 (0.98)	D (D)
MLK Blvd at Druid Hill Ave	Signal	23.1 (45.6)	0.90 (0.95)	C (D)
MLK Blvd at McCulloh St	Signal	32.3 (48.0)	1.02 (1.08)	C (D)
MLK Blvd at Chase St & Park Ave	Signal	33.4 (42.8)	0.71 (0.83)	C (D)
Pennsylvania Ave at Preston St	Signal	14.8 (14.8)	0.31 (0.31)	B (B)
Pennsylvania Ave at Dolphin St	Signal	18.9 (18.9)	0.34 (0.34)	B (B)
Druid Hill Ave at Paca St	Signal	14.4 (14.7)	0.31 (0.33)	B (B)
Druid Hill Ave at Preston St	Signal	7.7 (7.5)	0.28 (0.29)	A (A)
Druid Hill Ave at Dolphin St	Signal	22.7 (22.8)	0.39 (0.40)	C (C)
McCulloh St at Preston St	Signal	18.2 (15.4)	0.15 (0.20)	B (B)
McCulloh St at Dolphin St	Signal	12.3 (13.1)	0.20 (0.21)	B (B)
Eutaw St at Madison & Paca Sts	Signal	12.5 (12.3)	0.30 (0.35)	B (B)
Eutaw St at McMechen St	Signal	21.1 (23.4)	0.42 (0.57)	C (C)
Howard St at Centre St	Signal	10.6 (10.6)	0.24 (0.24)	B (B)
Howard St at Madison St	Signal	19.3 (19.7)	0.32 (0.34)	B (B)
Howard St at North Ave	Signal	35.9 (41.6)	0.79 (0.85)	D (D)
North Ave at Mt. Royal Ave	Signal	50.7 (57.7)	0.78 (0.85)	D **(E)**
Cathedral St at Mt. Royal Ave	Signal	16.1 (16.4)	0.41 (0.46)	B (B)
Cathedral St at Preston St	Signal	9.0 (11.4)	0.35 (0.46)	A (B)
Cathedral St at Biddle St (Park Ave/MLK Blvd)	Signal	11.1 (12.1)	0.24 (0.32)	B (B)
Maryland Ave at Oliver St & I-83 SB Off-Ramp	Signal	49.1 (51.3)	0.67 (0.81)	D (D)
Maryland Ave at Preston St	Signal	13.1 (29.6)	0.69 (0.82)	B (C)
Maryland Ave at Biddle St	Signal	7.2 (7.4)	0.62 (0.71)	A (A)
Maryland Ave at Chase St	Signal	6.0 (23.3)	0.61 (0.67)	A (C)
Charles St at Preston St	Signal	12.6 (15.3)	0.47 (0.54)	B (B)
Charles St at Biddle St	Signal	9.9 (12.5)	0.37 (0.42)	A (B)
Charles St at Chase St	Signal	17.1 (21.2)	0.51 (0.57)	B (C)
St. Paul St at Preston St	Signal	15.9 (16.5)	0.56 (0.59)	B (B)
St. Paul St at Biddle St	Signal	5.1 (5.3)	0.46 (0.48)	A (A)
St. Paul St at Chase St	Signal	5.8 (7.4)	0.51 (0.56)	A (A)

Table 11. (continued)

Intersection	Control	Delay (sec/veh)	Volume-to-Capacity Ratio	Level of Service
Other Study Intersections				
PM Peak Hour				
MLK Blvd at Washington Blvd	Signal	136.4 (183.7)	1.35 (1.47)	**F (F)**
MLK Blvd at Pratt St	Signal	72.2 (115.7)	1.08 (1.20)	**E (F)**
MLK Blvd at Lombard St	Signal	151.7 (204.5)	1.24 (1.36)	**F (F)**
MLK Blvd at Mulberry St	Signal	37.0 (52.5)	0.95 (1.03)	D (D)
MLK Blvd at Franklin St	Signal	66.0 (121.7)	0.98 (1.13)	**E (F)**
MLK Blvd at Pennsylvania Ave	Signal	70.4 (133.7)	1.02 (1.15)	**E (F)**
MLK Blvd at Druid Hill Ave	Signal	10.9 (25.9)	1.04 (1.04)	B (C)
MLK Blvd at McCulloh St	Signal	18.5 (40.9)	0.95 (1.06)	B (D)
MLK Blvd at Chase St & Park Ave	Signal	40.9 (57.9)	0.87 (1.00)	D **(E)**
Pennsylvania Ave at Preston St	Signal	17.8 (17.8)	0.47 (0.47)	B (B)
Pennsylvania Ave at Dolphin St	Signal	21.9 (22.0)	0.45 (0.45)	C (C)
Druid Hill Ave at Paca St	Signal	13.0 (13.1)	0.31 (0.34)	B (B)
Druid Hill Ave at Preston St	Signal	16.8 (16.5)	0.27 (0.28)	B (B)
Druid Hill Ave at Dolphin St	Signal	13.3 (13.5)	0.33 (0.34)	B (B)
McCulloh St at Preston St	Signal	12.6 (10.5)	0.36 (0.40)	B (B)
McCulloh St at Dolphin St	Signal	10.3 (10.6)	0.48 (0.48)	B (B)
Eutaw St at Madison & Paca Sts	Signal	22.1 (29.2)	0.59 (0.70)	C (C)
Eutaw St at McMechen St	Signal	20.3 (27.5)	0.50 (0.74)	C (C)
Howard St at Centre St	Signal	11.2 (11.2)	0.30 (0.30)	B (B)
Howard St at Madison St	Signal	17.7 (18.1)	0.40 (0.41)	B (B)
Howard St at North Ave	Signal	85.2 (103.2)	1.17 (1.26)	**F (F)**
North Ave at Mt. Royal Ave	Signal	60.0 (110.0)	0.94 (1.11)	**E (F)**
Cathedral St at Mt. Royal Ave	Signal	42.9 (50.7)	0.57 (0.66)	D (D)
Cathedral St at Preston St	Signal	9.9 (16.5)	0.61 (0.74)	A (B)
Cathedral St at Biddle St (Park Ave/MLK Blvd)	Signal	19.0 (28.2)	0.44 (0.69)	B (C)
Maryland Ave at Oliver St & I-83 SB Off-Ramp	Signal	23.0 (27.4)	0.36 (0.42)	C (C)
Maryland Ave at Preston St	Signal	13.2 (14.1)	0.40 (0.50)	B (B)
Maryland Ave at Biddle St	Signal	27.7 (28.0)	0.51 (0.63)	C (C)
Maryland Ave at Chase St	Signal	24.5 (35.5)	0.44 (0.54)	C (D)
Charles St at Preston St	Signal	16.0 (19.8)	0.68 (0.76)	B (B)
Charles St at Biddle St	Signal	9.4 (10.9)	0.48 (0.55)	A (B)
Charles St at Chase St	Signal	31.6 (41.0)	0.53 (0.59)	C (D)
St. Paul St at Preston St	Signal	16.5 (17.4)	0.64 (0.68)	B (B)
St. Paul St at Biddle St	Signal	15.2 (15.7)	0.56 (0.58)	B (B)
St. Paul St at Chase St	Signal	11.7 (15.6)	0.52 (0.57)	B (B)

The results of the future conditions capacity analysis indicate that with the addition of traffic from the proposed development and without any improvements to the transportation network, ***eleven (11) intersections will experience failing conditions during at least one peak hour:***

- ***MLK Boulevard at Eutaw Street (AM peak hour);***
- ***Howard Street at Chase & Read Streets (PM peak hour);***
- ***MLK Boulevard at Madison Streets (AM and PM peak hour)***
- ***MLK Boulevard at Washington Boulevard (AM and PM peak hours);***
- ***MLK Boulevard at Pratt Street (AM and PM peak hours);***
- ***MLK Boulevard at Lombard Street (PM peak hour);***
- ***MLK Boulevard at Mulberry Street (AM peak hour);***
- ***MLK Boulevard at Franklin Street (PM peak hour);***
- ***MLK Boulevard at Pennsylvania Avenue (PM peak hour);***
- ***Howard St at North Avenue (PM peak hour);***
- ***North Ave at Mt. Royal Avenue (PM peak hour);***

Additionally, four (4) intersections will operate at a level of service* E*:

- ***MLK Boulevard at Eutaw Street (PM peak hour);***
- ***MLK Blvd at Howard Street (AM peak hour);***
- ***MLK Boulevard at Chase Street & Park Avenue (PM peak hour),and;***
- ***North Ave at Mt. Royal Ave (PM peak hour).***

All other intersections will continue to operate at a level of service *D* or better.

Further analysis and simulation was performed using SimTraffic software to 'observe' the network under future conditions. The simulation illustrates the residual queues on the following links, and is illustrated in **Figures 16a and 16b** below:

AM Peak Hour Field Observations

1. Queuing along SB Howard Street from Preston Street to north of Dolphin Street.
2. Queuing along SB Maryland Avenue from Preston Street to I-83 ramp
3. Queuing along WB Preston Street from Howard Street to St. Paul Street
4. Queuing of the eastbound left-turn lane along MLK Blvd from Eutaw Street to Pennsylvania Avenue

PM Peak Hour Field Observations

1. Queuing along EB MLK Boulevard approaching Howard Street extends back to Pennsylvania Avenue
2. Queuing along SB MLK Blvd from Pratt Street extends back to Mulberry Street.
3. Queuing along SB Eutaw Street from MLK Blvd to Dolphin Street

Figure 16a. Illustration of AM Peak Hour Queuing on Preston Street, Howard Street and Maryland Avenue

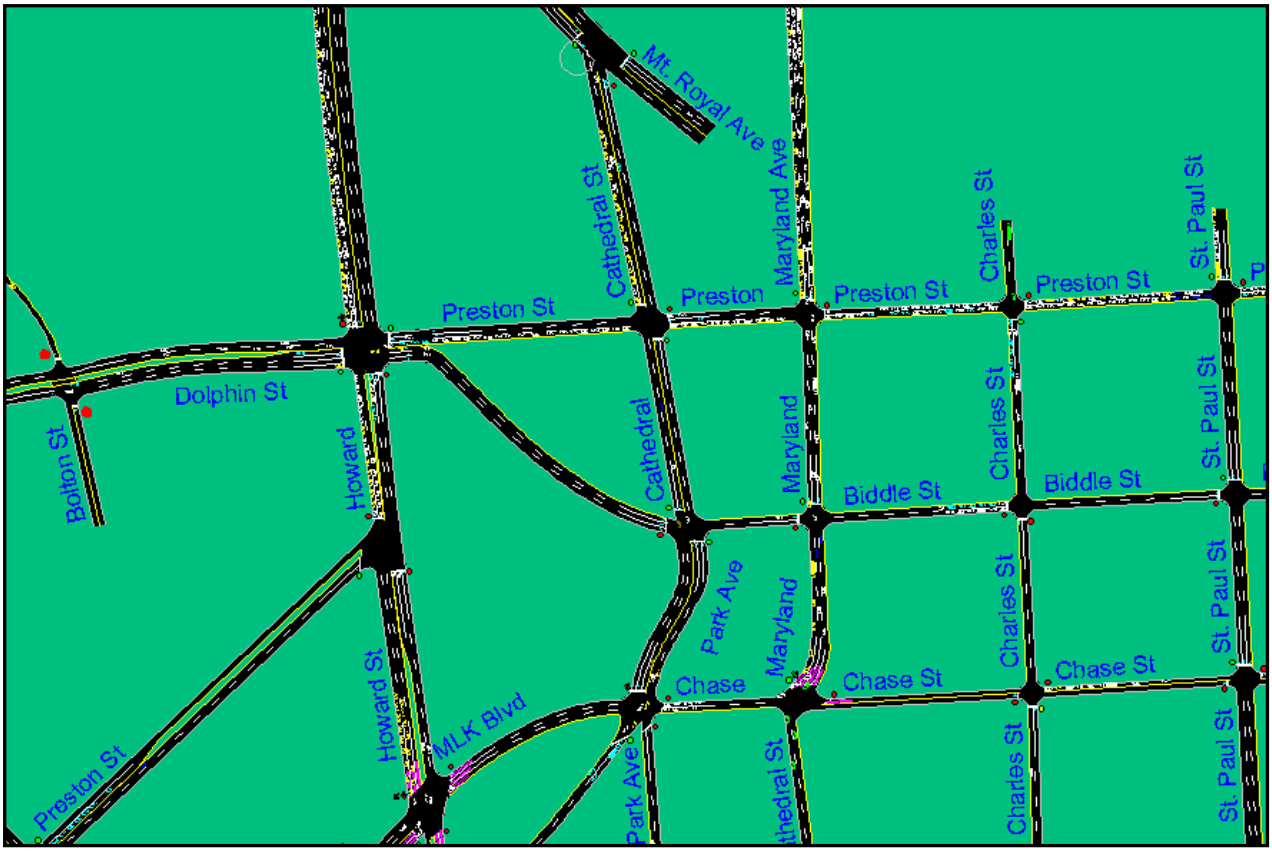


Figure 16b. Illustration of PM Peak Hour Queuing on MLK Boulevard and Eutaw Street

F. Future Parking Analysis

The future parking requirements were calculated based on the Baltimore City Zoning Ordinance and were compared to the *Institute of Transportation Engineer's Parking Generation* demand estimates. The results of the analysis are shown in **Table 12** and indicate that 3,475 new parking spaces will be required ***per code without any shared parking arrangements***, and 6,903 parking spaces would be required based on ITE 85th-percentile values. A discussion of shared parking concepts is provided below.

Table 12. Future Parking Supply Analysis

Land Use (Variable)	Development Intensity (000's SF)	Zoning Requirement[1]	ITE Parking 50th (85th) percentile demand	Variable Multiplier	Number of Required Spaces	ITE Recommended Parking Spaces[2]	Peak Parking Period
Office (1000 SF)	1200	1.0 spaces / 800 SF in excess of 2K SF	2.40 (2.97) spaces / 1K SF	1.25	1,498	3,564	weekday - daytime
Residential - Townhome (Dwelling Units)	713	1.0 spaces / D.U.	1.46 (1.68) vehicles / D.U.	1	713	1,198	weekday - evening
Residential - Apartment (Dwelling Units)	712	1.0 spaces / D.U.	1.00 (1.17) spaces / D.U.	1	712	833	weekday - evening
Retail (1000 SF)	200	1.0 spaces / 600 SF in excess of 4K SF	2.65 (3.35) spaces / 1K SF	1.67	327	670	weekday - evening
Restaurant (High-turnover)	50	1.0 spaces / 400 SF	5.55 (6.37) spaces / 1K SF	2.5	125	319	weekday - evening
Amphitheater (seats)	1000	1.0 space / 10 persons of rated capacity	0.25 (0.32) vehicles / seat	0.1	100	320	weekday - evening
Subtotal Raw Parking					**3,475**	**6,903**	

[1] Source: Zoning Code of Baltimore City, 2008. Subtitle 4: Required Number of Off-Street Spaces

[2] Based on ITE 85th-Percentile Parking Demand

A shared parking program would be aimed at developing an effective parking system to optimize efficient use of each parking space for various times of the day, consolidate parking into centralized, shared, consumer oriented facilities in each grid block, developing clear permanent way-finding signage for motorists, and integrating intermodal connections from parking facilities, i.e. bus stops, sidewalks and trails.

The total number of shared parking spaces is based on the temporal occupancy distribution illustrated in **Table 13**. The maximum loading period is the weekday daytime (6AM to 6PM). However, after accounting for a shared parking arrangement, as well as assuming a 25% non-auto mode share, an approximately 55% reduction in total ITE-based required parking spaces can be achieved with a total of 3,856 parking spaces recommended.

Table 13. Proposed Shared Parking Space Usage[1,2]

Parking Period	Land Use	Number of Required Spaces[3]	Parking Occupancy Rate	Adjusted Number of Spaces	No. of Spaces with 25% Pedestrian, Bike & Transit Reduction
Weekday (6AM to 6PM)	Retail	670	60%	402	302
	Office	3,564	100%	3,564	2,673
	Residential	2,031	50%	1,016	762
	Restaurant	319	50%	160	120
	Amphitheater	320	0%	0	0
Weekday Evening (6PM to 12AM)	Retail	670	90%	603	452
	Office	3,564	10%	356	267
	Residential	2,031	100%	2,031	1,523
	Restaurant	319	100%	319	239
	Amphitheater	320	100%	320	240
Weekend Day (6AM to 6PM)	Retail	670	100%	670	503
	Office	3,564	10%	356	267
	Residential	2,031	100%	2,031	1,523
	Restaurant	319	100%	319	239
	Amphitheater	320	100%	320	240
Weekend Evening (6PM to 12AM)	Retail	670	70%	469	352
	Office	3,564	5%	178	134
	Residential	2,031	100%	2,031	1,523
	Restaurant	319	100%	319	239
	Amphitheater	320	100%	320	240
Weekend Nighttime (12AM to 6AM)	Retail	670	5%	34	25
	Office	3,564	5%	178	134
	Residential	2,031	100%	2,031	1,523
	Restaurant	319	5%	16	12
	Amphitheater	320	0%	0	0
Total New Weekday Spaces				**5,141**	**3,856**
Total New Weekday Evening Spaces				**3,629**	**2,722**
Total New Weekend Day Spaces				**3,696**	**2,772**
Total New Weekend Evening Spaces				**3,317**	**2,488**
Total New Weekend Nighttime Spaces				**2,259**	**1,694**

1- It should be qualified that the 438 privately owned parking spaces in parking facilities *9* through *13* (see Table 4 and Figure 4) which are currently leased by State Center employees were assumed to be unavailable under future conditions due to short-term lease agreements currently in place. However, the 918 spaces in the state-owned surface parking lots – facilities *1, 3, 4, 5,* and *6* – were assumed to be replaced within the proposed structured parking garages on parcels *C, D, E, F,* and *G* (see Figure 13). One existing facility, the 201 W. Preston Street parking garage on parcel *I*, is assumed to remain in place. ***These 1,356 spaces (i.e. existing land uses) are not reflected in the Table 13 calculations***.

2 – Although the residential parking may be sold and privately owned and therefore unavailable for sharing, it is assumed that not all of the residential units will purchase parking spaces, thus a percentage may be available for sharing

3- Based on ITE 85th-percentile values

V. SUMMARY

The following summary of findings is based on the analysis and observations presented in the report:

- Forty-six intersections were evaluated; eleven within or bordering the PUD, and thirty-five along principal arterials such as MLK Boulevard, and Howard, Chase, and Biddle Streets;

- Although the study area is accessible via multiple arterial roadways, excellent public transportation access is available including bus, light rail and heavy rail. Reserve system capacity on the Central Light Rail line is approximately 42%, and 65% on the Metro Subway;

- Pedestrian amenities such as sidewalks, crosswalks, curb ramps and bus stops are numerous within the PUD area, however field observations noted that not all pedestrian desire lines are served. In addition, the presence of several long blocks and wide roadways strain pedestrian connections with adjacent neighborhoods.

- No bicycle facilities or amenities are currently provided in the State Center area.

- The presence of the Light Rail tracks along Howard Street results in several restricted pedestrian movements as well as increased vehicular delays at key intersections adjacent to the PUD;

- The current mode split for State Center employees, based on a 2008 Maryland Department of Transportation Survey, is approximately 18.3% for transit, which includes MTA Bus, Light Rail and Metro Subway, 1.72% for individuals who walk and 0.3% for people who bike. The remaining 79.68% arrive via automobile;

- There are approximately 13 off-street parking facilities within the vicinity of State Center which have a total of 3,660 parking spaces of which, 2,005 spaces are dedicated to State Center employees with visitor parking also available. Five of these facilities, approximately 438 spaces, are privately owned and do not have long-term leases in place;

- Under existing conditions, ***three intersections are performing at a level of service E*** – MLK Boulevard at Washington Boulevard (PM peak hour), MLK Boulevard at Lombard Street (PM peak hour) and Howard Street at North Avenue (PM peak hour). Within or bordering the PUD, three intersections are at a level of service *D* (Howard and Chase, Howard and MLK and MLK and

Eutaw. However, residual queuing along MLK Blvd was noted between Howard and Eutaw Streets;

- There are nine planned, approved, or current developments in the State Center study area that are projected to add 1,823 AM and 2,054 PM new peak hour vehicle trips to portions of the roadway network;

- Under background conditions, ***six intersections will experience failing conditions during at least one peak hour*** (Howard Street at Chase & Read Streets and North Avenue, MLK Boulevard at Washington Boulevard, Pratt Street, Lombard Street, and Mulberry Street. ***Additionally, three intersections will operate at a level of service E*** during at least one peak hour (MLK Boulevard at Franklin Street, and Pennsylvania Avenue, North Ave at Mt. Royal Ave);

- The proposed development is projected to generate, after applying a 25% global transit, pedestrian and bicycle reduction, 15% internal capture rate for retail/ restaurant uses and 34% - 43% pass-by discount, a total of 25,712 new daily vehicular trips, of which 2,106 will occur during the morning peak hour and 2,846 will occur during the evening peak hour;

- With the addition of State Center PUD traffic, ***a total of eleven (11) intersections will fail in at least one peak hour, and four will operate at a level of service*** **E** ***during at least one peak hour***;

- In addition, micro-simulation of the roadway network under future conditions illustrates residual AM queuing along 1) SB Howard Street from Preston Street to north of Dolphin Street, 2) SB Maryland Avenue from Preston Street to the I-83 ramp, 3) WB Preston Street from Howard Street to St. Paul Street and 4) eastbound left-turn bay spillover along MLK Blvd from Eutaw Street to Pennsylvania Avenue. PM residual queuing was noted 1) along EB MLK Boulevard from Howard Street to Pennsylvania Avenue, 2) along SB MLK Boulevard from Pratt Street extends back to Mulberry Street and 3) along SB Eutaw Street from MLK Boulevard past Dolphin Street;

- Parking calculations indicate that 3,475 new parking spaces will be required per Baltimore City zoning code without any shared parking arrangements, and 6,903 parking spaces would be required based on ITE 85th-percentile values. However, after accounting for a shared parking arrangement, as well as assuming a 25% non-auto mode share, an approximately 55% reduction in total ITE-based required parking spaces can be achieved with a total of 3,856 parking spaces recommended.

VI. ALTERNATIVES ANALYSIS

As part of the continuing visioning process for this development, three alternatives have been refined within the study area to meet the following overall transportation goals for this development:

- To provide an adequate transportation network with sufficient capacity to meet future travel demand, at or near an acceptable level of service;
  - To improve roadway/intersection performance by creating additional roadway capacity, reducing the number of signal phases, eliminating/restricting turning movements, and/or consolidating redundant movements***. Based on existing transit access, a Level of Service E is suggested as the threshold for peak hour intersection operations;***
- To identify traffic calming measures that will support a pedestrian-friendly State Center, reduce cut-through traffic on neighborhood streets, and enhance roadway safety and aesthetic environment for all users;
- To provide safe, reliable transportation alternatives such as transit, on- and off-street bicycle routes, and pedestrian networks with integrated service and seamless intermodal connections to reduce the need for vehicular travel and parking spaces;
  - To improve the pedestrian experience by reducing the crossing width of and distances between intersections, allowing for wider sidewalks and implementing traffic calming measures where feasible;
  - To improve overall streetscape aesthetics by creating and maintaining view corridors.

Each of these alternatives is summarized below; detailed conceptual schematics are included in **Appendix H**.

Alternative 1 Consolidated Intersection proposes eliminating Read Street west of Howard Street and diverting the eastbound movements to a widened Howard and MLK intersection. The existing Howard/ Chase/ Read Street intersection would be closed and/ or eliminated.

Alternative 2 Howard Street Closure proposes eliminating through movements along Howard Street between MLK and Read Street to allow for reduced conflicts at the Howard Street and MLK/Chase intersections. Eastbound vehicles destined to Chase and Cathedral Streets would still use the MLK/ Read Street spur, while through traffic on Howard Street would be diverted south via Linden Avenue and north via Chase Street.

Table 14. Summary of Future (Alternative 1 and 2) Intersection Capacity Analysis - AM (PM)

Intersection	Control	Delay (sec/veh)	Volume-to-Capacity Ratio	Level of Service
Alt 1 - MLK Blvd at Howard Street	Signal	160.1 (116.)	1.14 (1.10)	F (B)
Alt 2 - MLK Blvd at Howard Street	Signal	26.6 (20.4)	0.88 (0.76)	C (C)

Between Alternative 1 and 2, only Alternative 2 proves to be viable, but would require providing a 3rd eastbound lane along MLK between Eutaw Street and Linden Avenue.

Alternative 3 One-Way Couplets proposes creating a set of one-way pairs along MLK / Howard Street between Druid Hill Avenue and Preston Street, and Dolphin Street between Druid Hill and Preston Street. The single directional roadways would require diversion of exiting and future traffic; however the one-way pairs would reduce the number of conflicts at intersections, provide additional opportunities for on-street parking, as well as potentially allow for roadway narrowing as fewer total lanes may be required. In addition, Preston Street and Hoffman Street extended are recommended as west and east one-way pairs, respectively.

Table 14. Summary of Future (Alternative 3) Intersection Capacity Analysis - AM (PM)

Intersection	Control	Delay (sec/veh)	Volume-to-Capacity Ratio	Level of Service
MLK Blvd at Eutaw St	Signal	10.1 (17.6)	0.57 (0.95)	B (B)
Howard St at Chase & Read Sts[3]	Signal	Intersection closed		
MLK Blvd at Howard St	Signal	22.8 (59.1)	0.80 (1.11)	C **(E)**
Howard St at Preston St	Signal	17.9 (23.7)	0.38 (0.73)	B (C)
Eutaw St at Preston St[1]	Signal	44.3 (21.5)	1.05 (0.62)	D (C)
Eutaw St at Dolphin St	Signal	43.1 (39.2)	1.00 (0.96)	D (D)
Dolphin St at Bolton St	Stop[2]	11.9 (20.0)	0.10 (0.09)	B (C)
Howard St at Dolphin St (Preston St/Park Ave)	Signal	46.3 (53.0)	1.03 (1.05)	D (D)
MLK Blvd at Madison Ave	Signal	17.4 (9.5)	0.75 (0.72)	B (A)
Madison Ave at Preston St	Signal	16.7 (37.9)	0.72 (0.94)	B (D)
Madison Ave at Dolphin St	Signal	24.4 (15.8)	0.69 (0.60)	**C** (B)
MLK Blvd at Druid Hill Ave	Signal	75.6 (58.5)	1.07 (1.00)	**E (E)**
MLK Blvd at McCulloh St	Signal	15.8 (20.2)	0.64 (0.71)	B (C)
MLK Blvd at Chase St & Park Ave	Signal	24.4 (45.9)	0.42 (0.90)	C (D)
Druid Hill Ave at Preston St	Signal	118.1 (78.4)	1.18 (1.09)	**F (E)**
Druid Hill Ave at Dolphin St	Signal	65.2 (35.2)	1.08 (0.83)	**E** (D)
McCulloh St at Preston St	Signal	8.3 (25.3)	0.44 (0.73)	A (C)
McCulloh St at Dolphin St	Signal	8.0 (24.6)	0.79 (0.87)	A (C)
Cathedral St at Preston St	Signal	20.9 (26.2)	0.66 (0.85)	C (C)
Cathedral St at Biddle St (Park Ave/MLK Blvd)	Signal	10.2 (6.2)	0.28 (0.65)	A (A)
Maryland Ave at Preston St	Signal	15.4 (14.9)	0.87 (0.53)	B (B)
Maryland Ave at Biddle St	Signal	7.1 (20.6)	0.51 (0.54)	A (C)
Maryland Ave at Chase St	Signal	22.8 (22.8)	0.67 (0.54)	C (C)
Eutaw Street at Hoffman Street	Signal	13.8 (21.8)	0.45 (0.77)	B (C)

1- Assumed introduction of new left-turn signal phasing
2- Level of Service, Delay, and V/C for southbound stop-controlled movement only
3- Intersection closed, but NB Howard Street movements assumed to cross tracks at Read/ Chase

The results of the alternatives analysis indicate that while the one-way pair configuration provides overall acceptable levels of service at all intersections within the PUD, and reduces

the total number of lanes required along MLK Boulevard and Dolphin Streets (6 to 4), it does not alleviate failing conditions at the eight external intersections along MLK Boulevard and North Avenue.

VII. IDEAS AND SUGGESTIONS

The findings of the report demonstrate that congestion and failing operations along portions of Martin Luther King, Jr. Boulevard as well as North Avenue would occur with the full build-out of 9 developments within the area including:

1. UMB BioPark
2. Poppelton
3. The Fitzgerald
4. Waxter
5. Maryland General Hospital
6. University of Baltimore - Station North
7. Penn Station Hotel
8. University of Baltimore – Student Dormitory
9. State Center

In recognition of the subject development occurring in an area with surplus transit capacity, and limited ability to widen arterial or neighborhood streets, combinations of the following ideas, implemented by various parties, should be considered to minimize the traffic impact of the proposed developments to the fullest extent possible, to improve pedestrian and bicycle connections, and to provide increased alternative transportation solutions:

1. **Improvement to the following intersections within or adjacent to the PUD to improve intersection performance.**

    a. **MLK Blvd @ Howard Street and Howard Street at Chase / Read Streets** – eliminate through movements along Howard Street between MLK and Read Street to allow for reduced conflicts at the Howard Street and MLK / Chase intersections

    b. **MLK Blvd @ Linden Avenue** – widen to provide 3rd eastbound through lane. Allow for full vehicular access with the exception of eastbound left turns.

    c. **Eutaw Street** – Maintain 2 through travel lanes along Eutaw Street between MLK Blvd and Dolphin Street during all peak hours

    d. **Dolphin Street @ Bolton Street** – Construct a channelized break in the median along Dolphin Street and new traffic signal to allow westbound left-turns into Bolton Street and southbound left-turns. Movement across Dolphin Street would be physically prohibited by the median channel.

    e. **MLK Blvd @ Eutaw Street** – Add 2nd eastbound left turn lane;

f. **Linden Avenue** – Extend Linden Avenue from MLK Blvd to Hoffman Street

g. **Hoffman Street** – Extend Hoffman Street from Madison Street to Eutaw Street, including installation of new signal at Eutaw Street;

h. In the long term, further consideration of a one-way grid system as evaluated in Alternative 3 is suggested

Consideration of the above physical alterations will result in less traffic congestion. It must be noted that it is not an exclusive list nor must all be employed in order to achieve acceptable levels of service.

2. **Alternative Routing and Traffic**
   - **a.** Encourage the use of Fulton Street and Monroe Street as an alternative to MLK Blvd for through traffic along the western edge of the CBD from Washington Blvd to North Avenue. Design and construction of signing, marking and signal upgrades, similar to those recently implemented along Central Avenue will be required.
   - **b.** Install new traffic cameras/ detectors, optimization of signal timing, and transit signal priority to assist the City in traffic management in the State Center area. These devices would be linked to Baltimore City's Traffic Management Center.

3. **Parking –** the provision of on-site parking in excess of City zoning requirements has a long-term and negative impact on the viability and success of providing sustainable alternative transportation modes in the downtown area
   - **a.** Limit the amount of on-site off-street parking, through provision of shared parking facilities on-site, and designated car-share and car-pool spaces.
   - **b.** Replace all existing on-street parking meters within the PUD with new meters per the Baltimore City Parking Authority specifications.
   - **c.** Create a designated Transportation Center within or adjacent to garages C, D, or H, with direct pedestrian connections to Metro and Light Rail, bicycle access, bus stops, commuter parking, car shares and taxi stands.

4. **Create a State Center Transportation Management Association (TMA)** to develop implement and manage a Transportation Demand Management Program to include parking, cash-outs, carpools, car-shares, etc.

5. **Construct pedestrian upgrades**
   - **a.** Construct ADA-compatible curb ramps at all intersections and countdown signals within the PUD.
   - **b.** Install pedestrian countdown signals at all signalized intersections within the PUD
   - **c.** Upgrade all bus stops along Eutaw, MLK, and Howard Streets to provide amenities including benches, shelters and real-time transit info

6. **Traffic Calming** should be considered in adjacent neighborhoods. A traffic calming study can be requested through community associations.

7. **Develop and Implement a comprehensive bicycle program for State Center. At a minimum, the program should include:**
   - **a.** Bicycle lanes on Eutaw and Dolphin Streets
   - **b.** Construct secure and convenient bicycle parking in all public parking garages and provide bike racks adjacent to retail areas.
   - **c.** Provide restroom and changing area for bike commuters adjacent to secure bike parking.