TRAFFIC IMPACT STUDY

for

DONELSON STATION

Metro Nashville – Davidson County, Tennessee

March 30, 2017
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DONELSON STATION
TRAFFIC IMPACT STUDY

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EXECUTIVE SUMMARY

INTRODUCTION

Donelson Station is located on the east side of Donelson Pike near the intersection of Bluefield Avenue in Metropolitan Nashville – Davidson County, Tennessee. When completed, Donelson Station will consist of 9,500 square feet of commercial space and 208 apartments. Access to Donelson Station will be provided via one location approximately 200 feet south of Bluefield Avenue.

BACKGROUND TRAFFIC

Based upon the proposed development schedule, the year 2020 will be used to analyze the impact of Donelson Station.

To establish background traffic growth, TDOT historical traffic data was obtained in the project vicinity. Traffic growth due to general population growth was based upon linear regression analysis of the historical traffic count data. Background traffic growth was established by increasing existing traffic by ***1 percent annually*** for the period from 2017 to 2020.

SITE TRAFFIC

The traffic impact of Donelson Station is based upon a calculation of the number of vehicle trips that will enter and/or exit the site. The analysis periods of this report are the a.m. and p.m. peak hours of a typical weekday. Therefore, trips were generated according to the *Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition*. The total estimated trip generation for Donelson Station is shown in the table below.

TOTAL TRIP GENERATION: DONELSON STATION

Land Use	Total Units	Daily Trips	A.M. Peak Hour			P.M. Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total
Commercial	9,500 sf	1,208	57	46	103	56	38	94
Apartments	208 units	1,384	21	85	106	86	46	132
TOTAL		**2,592**	**78**	**131**	**209**	**98**	**84**	**226**

TRAFFIC ANALYSIS

The following public intersections were analyzed for capacity deficiencies and improvement needs:

- Donelson Pike at Lebanon Pike
- Donelson Pike at Bluefield Avenue
- Donelson Pike at McCampbell Avenue
- Donelson Pike at Project Access

For these intersections, the following traffic scenarios were analyzed, where applicable:

- 2017 Existing Traffic
- 2020 Background Traffic
- 2020 Total Traffic that contains all traffic projected in the study area, including Donelson Station

CONCLUSIONS AND RECOMMENDATIONS

Donelson Pike at Lebanon Pike

- No intersection control changes, traffic signal modifications, or additional laneage are recommended at the intersection of Donelson Pike at Lebanon Pike as part of Donelson Station to provide traffic operations that meet Metro Nashville – Davidson County's policy goal for level of service.

Donelson Pike at Bluefield Avenue

- No intersection control changes or additional laneage are recommended at the intersection of Donelson Pike at Bluefield Avenue as part of Donelson Station to provide vehicular traffic operations that meet Metro Nashville – Davidson County's policy goal for level of service.

- Crosswalk markings across the south approach of Donelson Pike and across Bluefield Avenue should be installed to meet current Metro Public Works standards.

- Pedestrian signal heads and push buttons should be installed by the developer at this intersection for each installed crosswalk.

Donelson Pike at McCampbell Avenue

- No intersection control changes, traffic signal modifications, or additional laneage are recommended at the intersection of Donelson Pike at McCampbell Avenue as part of Donelson Station to provide traffic operations that meet Metro Nashville – Davidson County's policy goal for level of service.

Donelson Pike at Primary Project Access

- The Donelson Station access to Donelson Pike should be a Metro Public Works ST-324 driveway ramp with a width of 35 feet of pavement to allow for two egress lanes (11 feet each) and one ingress lane (13 feet).

- The Donelson Station access will be a private drive, therefore, the existing two-way left turn lane on Donelson Pike should remain in place to service the new development access and existing driveways along Donelson Pike.

- A Tennessee Department of Transportation Highway Entrance Permit or Grading Permit may be required since Donelson Pike is a State Route.

Donelson Pike at Secondary Project Access

- The Donelson Station secondary access to Donelson Pike should be a Metro Public Works ST-324 driveway ramp with a width of 24 feet of pavement to allow for two lanes for ingress/egress.

- The secondary access could be restricted to emergency use only, if desired. The analysis of this study indicates that all site traffic can use the primary project access and that traffic operations will be characterized by acceptable levels of service.

- Due to the proximity of the Nashville and Eastern Railroad at-grade crossing north of this access, left turn movements into the site should be prohibited to prevent queueing across the railroad crossing. The left turn movement into the site should be restricted with a physical barrier in the existing two-way center turn lane and flush median of Donelson Pike. This physical barrier could be an arrangement of plastic delineators, a raised concrete median, or another solution acceptable to the developer and Metro Nashville Public Works. At the time of this study, discussions related to the final design of this barrier were ongoing with Metro Nashville Public Works staff. To provide time for continued discussions with Metro Nashville Public Works and for

internal review and discussion by Public Works staff, the final design for this barrier should be determined prior to or as part of the Final SP for Donelson Station.

- A Tennessee Department of Transportation Highway Entrance Permit or Grading Permit may be required since Donelson Pike is a State Route.

I. INTRODUCTION

The purpose of this study is to analyze the transportation related impacts due to the future development at Donelson Station in Metro Nashville – Davidson County, Tennessee. Donelson Station will include a mix of residential and retail land uses at full build-out. This report has been requested by Metropolitan Nashville – Davidson County staff as part of the Preliminary SP approval process.

In order to evaluate the Donelson Station future development, an inventory of the existing transportation system was carried out, along with an assessment of its adequacy. Based on the project schedule, a final build-out horizon year was established and future traffic growth was added to existing traffic volumes. Transportation analyses were performed in order to assess any site or non-site related impacts on the roadway. Finally, recommendations for roadway improvements and/or transportation system improvements were offered.

II. PROJECT DESCRIPTION

A. Proposed Development

As shown in Figure 1, Donelson Station is located on the east side of Donelson Pike near the intersection of Bluefield Avenue in Metropolitan Nashville – Davidson County, Tennessee. The site property contains approximately 6.39 acres and is comprised of Parcels 95, 96, 99 and 137 on Davidson County Map 96. Donelson Station will be rezoned as an SP (Specific Plan) development to develop the following:

- 9,500 square feet Commercial
- 208 Apartment Units

The proposed site is bound by the Nashville and Eastern Railroad to the north, residential uses to the south and east, and Donelson Pike to the west.

Figure 2 shows a site layout of Donelson Station.

B. Project Access

Access to Donelson Station will be provided at two locations as described below.

- Primary Project Access – The primary location for ingress/egress will be located on Donelson Pike approximately 200 feet south of the intersection of Donelson Pike and Bluefield Avenue. This access will have a width of 35 feet and will include one 11' lane for site traffic turning right onto Donelson Pike, one 11' lane for site traffic turning left onto Donelson Pike, and one 13' lane for traffic entering Donelson Station.

- Secondary Project Access – A secondary access will be located on Donelson Pike approximately 140 feet north of Bluefield Avenue and 100 feet south of the Nashville and Eastern Railroad at-grade crossing. This access is shown on the Donelson Station Preliminary SP as a two-lane ingress/egress with a width of 24 feet. The analysis of this report has been completed with all site traffic utilizing the primary project access only to demonstrate that the secondary access could be constructed as a gated access for emergency use only or for other restricted use, if desired.

C. Phasing and Timing

For the analysis of this report, the full build-out of Donelson Station has been assumed to occur in the year 2020. The year 2020 is established as the horizon year for this study.

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JOB NO: 16160/0729
DATE: 05-02-2017

RENDERING EXHIBIT

Donelson Station

BNA INVESTMENTS, LLC

0 40 80 120

Donelson Station
Location Map

Figure
1

III. EXISTING CONDITIONS

A. Transportation System

The existing transportation system in the area that provides access to Donelson Station consists of arterial, collector, and local roadways. The following roadways will comprise the study area for consideration of traffic mitigation measures at Donelson Station.

- **Donelson Pike (State Route 255)** is classified as an arterial-boulevard (T4-M-AB5-LM, T4-M-AB5-LM) on the Nashville Major and Collector Street Plan functional classification system. The Donelson Pike corridor travels in a north-south direction from Lebanon Pike to Harding Place, and is the primary access route to the Nashville International Airport. Donelson Pike is generally a five-lane roadway with two travel lanes in each direction and a two-way continuous left turn lane in the vicinity of the project. The posted speed limit on Donelson Pike is 40 mph.

- **Lebanon Pike (US Highway 70, State Route 24)** in the study area is classified as an arterial-boulevard (T4-M-AB5-IM). The street is oriented in an east-west direction, and provides access from Wilson County to downtown Nashville. Lebanon Pike is generally a five-lane roadway with two travel lanes in each direction and a two-way continuous left turn lane in the vicinity of the project. The posted speed limit on Lebanon Pike is 40 mph.

- **Bluefield Avenue** in the study area is classified as a local collector street. The street is oriented in an east-west direction, and provides access from the existing residential areas to Donelson Pike and Lebanon Pike. The roadway generally consists of a two-lane section with one travel lane in each direction. The posted speed limit on Bluefield Avenue is 30 mph.

- **McCampbell Avenue** in the study area is classified as a collector-avenue (T3-R-CA2). The roadway generally consists of a two-lane section with one travel lane in each direction. The posted speed limit on McCampbell Avenue is 35 mph.

B. Transit Facilities

The following Nashville Metropolitan Transit Authority (MTA) Route uses Lebanon Pike in the study area:

- Route 6 (Lebanon Pike)

Marked and posted bus stops in the study area are located on Lebanon Pike at Donelson Pike approximately 1,350 feet from the proposed site.

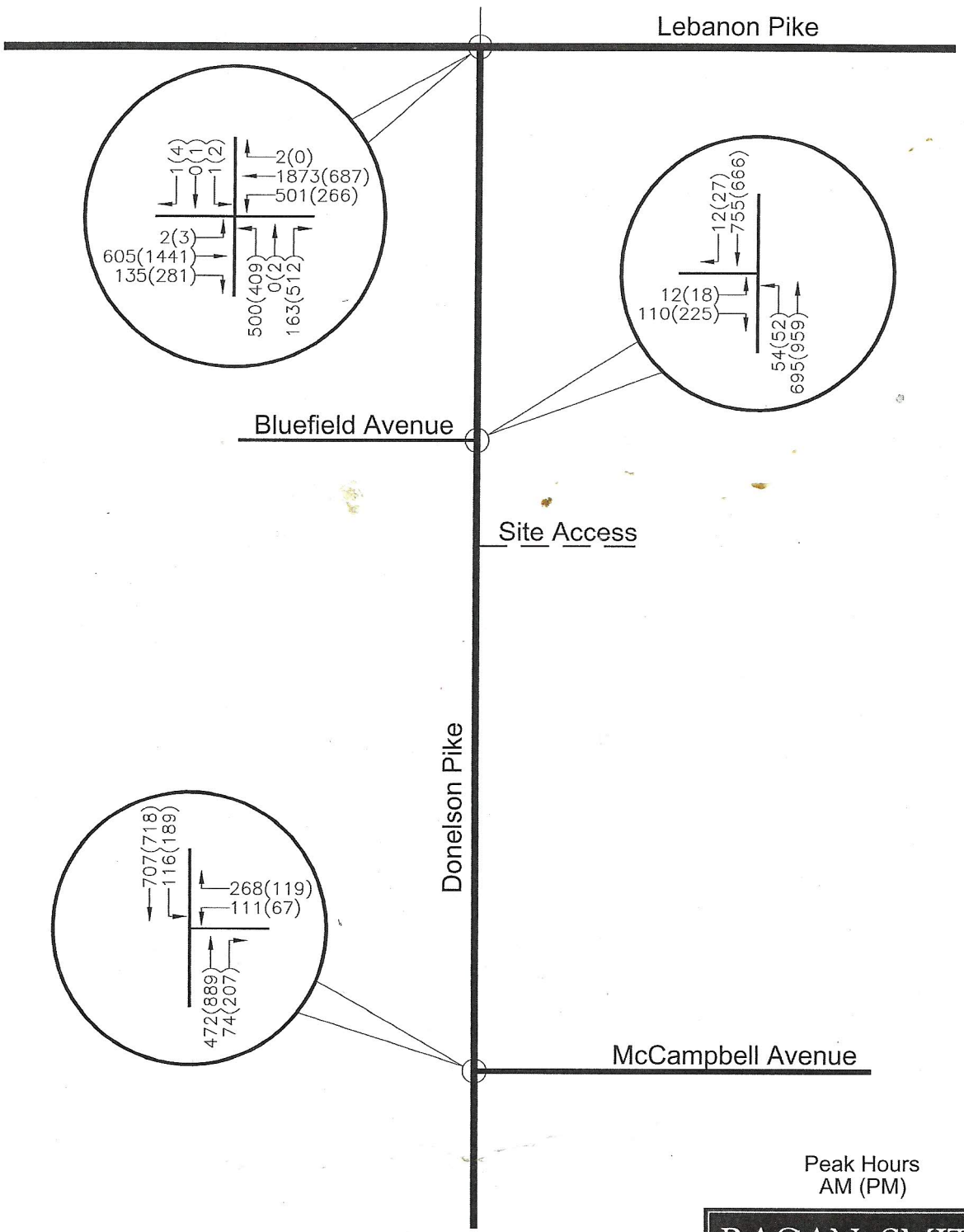
C. Traffic Volumes

In order to assess the adequacy of the local transportation system, an evaluation of the current operational quality of intersections within the study area was required.

The peak hour of the adjacent street traffic was used to evaluate the traffic operations for access at Donelson Station. In order to identify the peak periods for analysis, traffic counts were conducted in February 2017 at the following intersections:

- Donelson Pike at Lebanon Pike
- Donelson Pike at Bluefield Avenue
- Donelson Pike at McCampbell Avenue

Figure 3 shows the existing peak hour traffic volumes for the intersections in the study area.



Peak Hours
AM (PM)

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Donelson Station
Existing Traffic Volumes

Figure
3

IV. FORECASTED BACKGROUND TRAFFIC

A. Introduction

Based on the proposed development schedule, the year 2020 will be used to analyze the traffic impact of Donelson Station.

Before any impacts to the study area could be addressed, some estimate of background traffic volumes for the horizon year 2020 had to be established. Background traffic volumes were established by estimating potential growth due to small scale development and/or general population growth in the area.

B. Specific Development Growth

Based on discussions with Public Works staff, there are no specific approved developments in the general study area that will contribute new traffic to the system prior to the completion of Donelson Station in 2020.

C. Annual Growth

To establish traffic growth due to population growth or small scale development, Tennessee Department of Transportation (TDOT) historical traffic count data was obtained at locations within the general project vicinity. The TDOT historical traffic count data includes traffic volume counts conducted annually on Donelson Pike beginning in 1985. The available historical count data was tabulated and analyzed to identify patterns or growth trends.

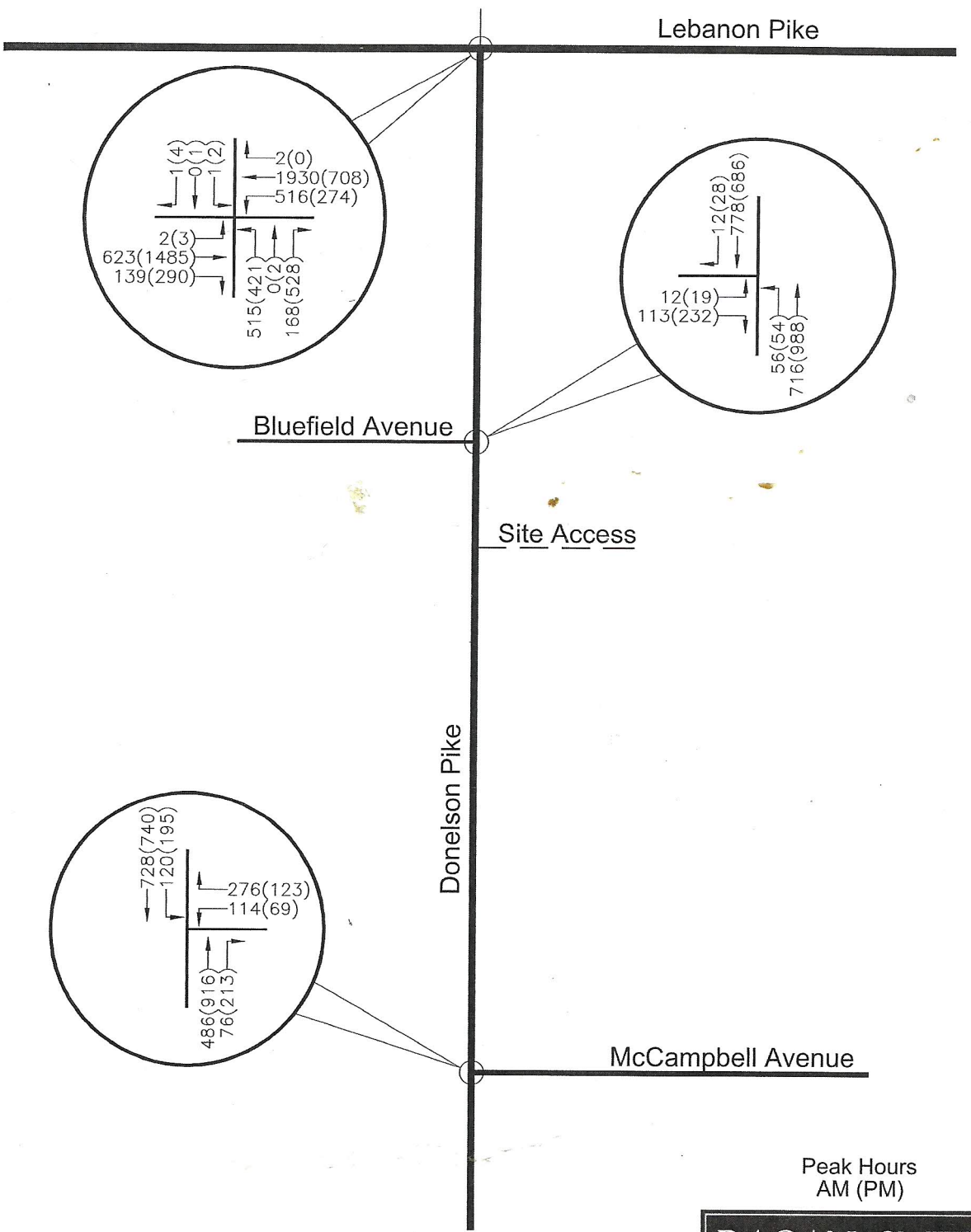
Based upon linear regression analysis of this data, we will use a ***1.0 percent annual growth rate*** as the base growth for the existing traffic volumes.

D. Background Traffic

Background traffic for the future traffic forecasts was compiled based on the following:

- 2017 existing traffic data
- 1.0% annual increase of traffic volumes for the period from 2017 to 2020

Background traffic volumes on the future roadway, representing existing traffic volumes plus background growth, for the year 2020 are shown in Figure 4.



Peak Hours
AM (PM)

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Donelson Station
2020 Background Traffic Volumes

Figure
4

V. PROPOSED SITE TRAFFIC

A. Site Trip Generation

In order to quantify site-related impacts within the study area, some estimates of site trip generation and traffic assignment had to be established. Trip generation rates for the development were established using information for the weekday a.m. and p.m. peak hour of the adjacent street as shown in the ITE *Trip Generation Manual, 9th Edition.* For this study, horizon year 2020 will include the completion of Donelson Station. Trip generation for Donelson Station is shown in Table 1.

TABLE 1

TRIP GENERATION: DONELSON STATION 2020 HORIZON YEAR

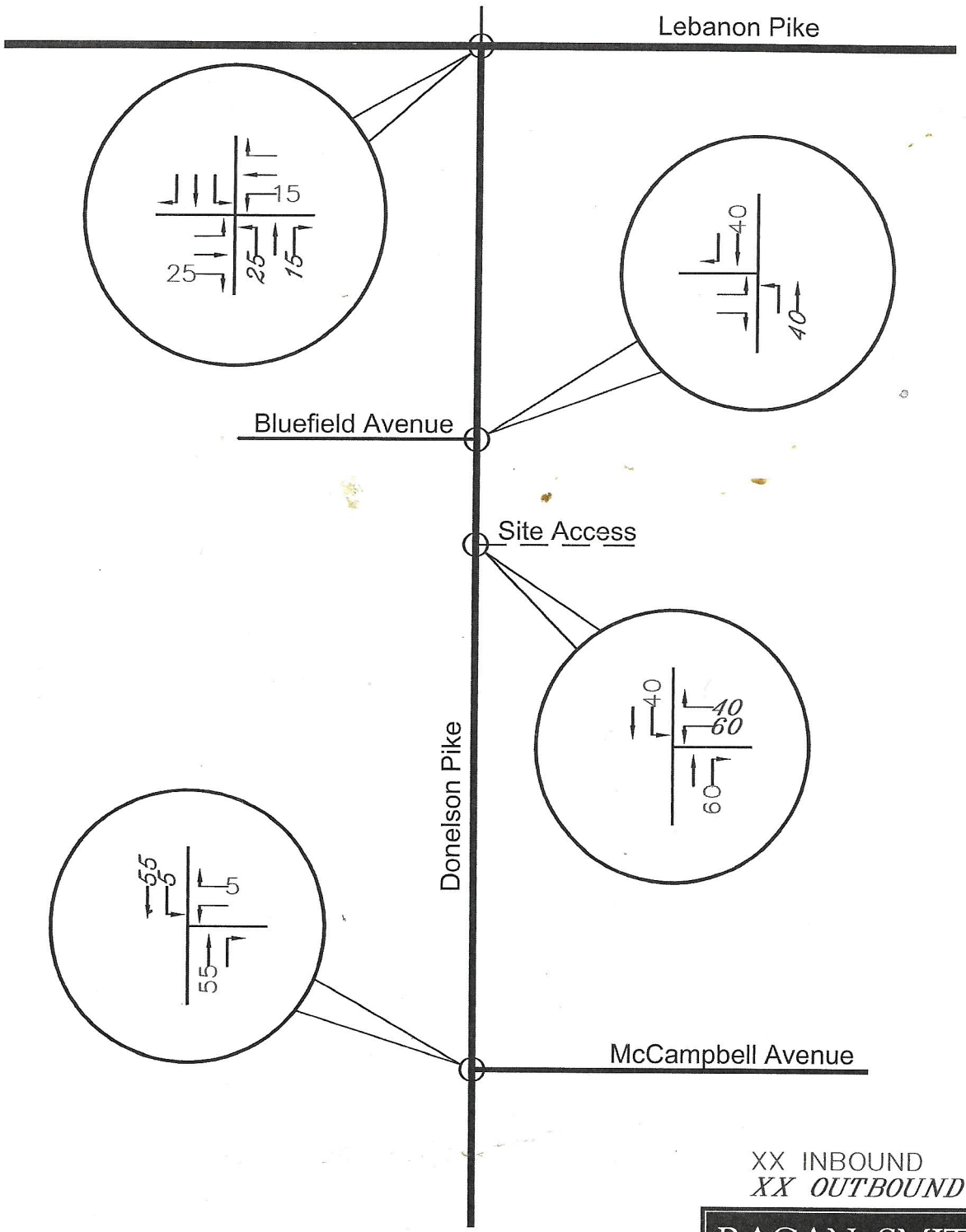
Land Use	Total Units	Daily Trips	A.M. Peak Hour			P.M. Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total
Commercial	9,500 sf	1,208	58	46	103	56	38	94
Apartments	208 units	1,384	21	85	106	86	46	132
TOTAL		**2,592**	**79**	**131**	**209**	**142**	**84**	**226**

For the commercial use, the generation rates for a higher turnover (sit down) restaurant were applied since they will be higher than other uses allowed by the SP zoning.

B. Site Trip Distribution and Assignment

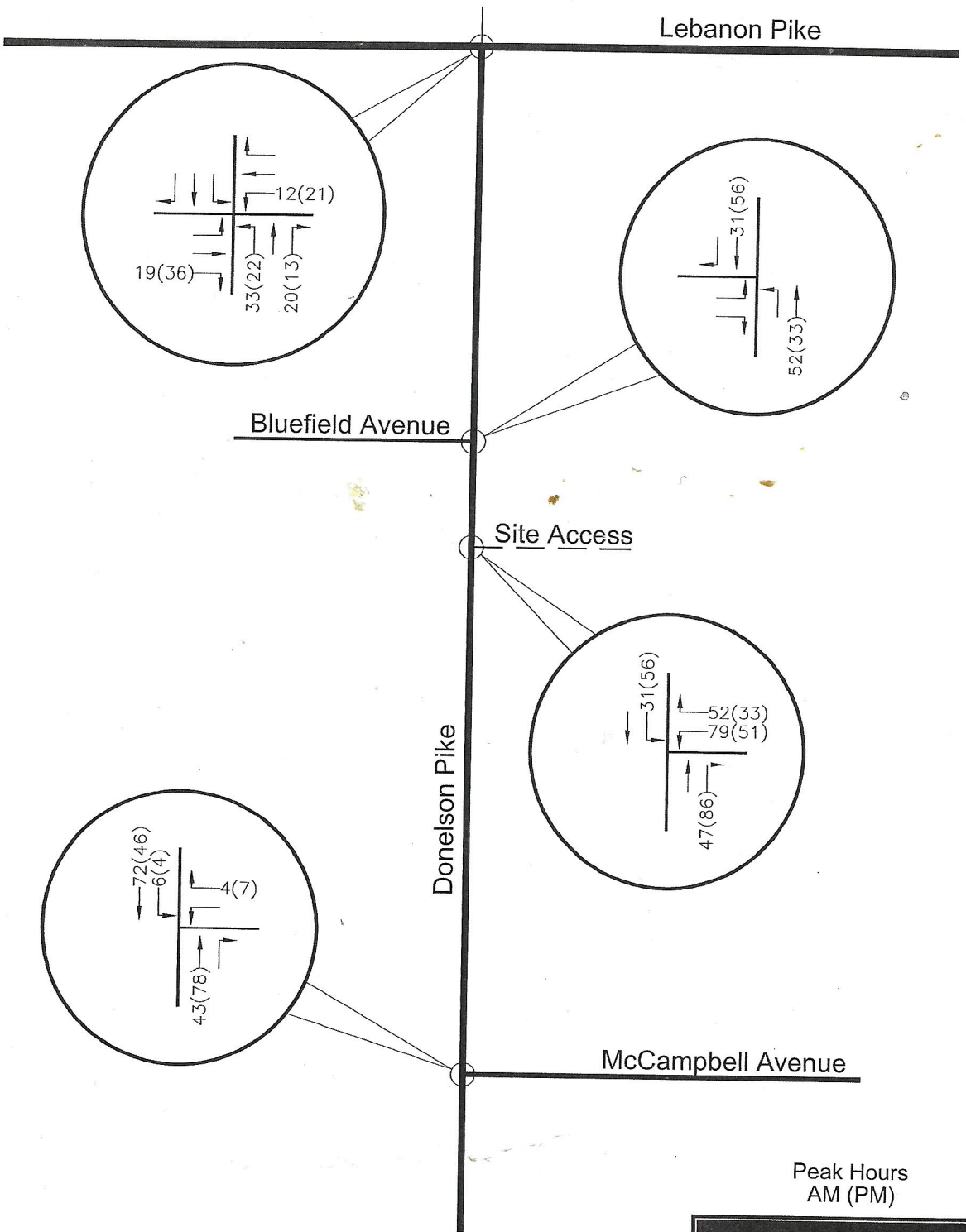
Site trips were distributed based primarily upon the prevalent commuter patterns in the area and the proximity and routes to major transportation facilities. Figure 5 shows the distribution of site trips for Donelson Station.

Site traffic volumes generated by future sections of Donelson Station in the horizon year 2020 are shown in Figure 6. The accumulation of existing, background growth, and site-generated traffic for the horizon year 2020 is shown in Figure 7.



Donelson Station
Site Trip Distribution

Figure
5



Peak Hours
AM (PM)

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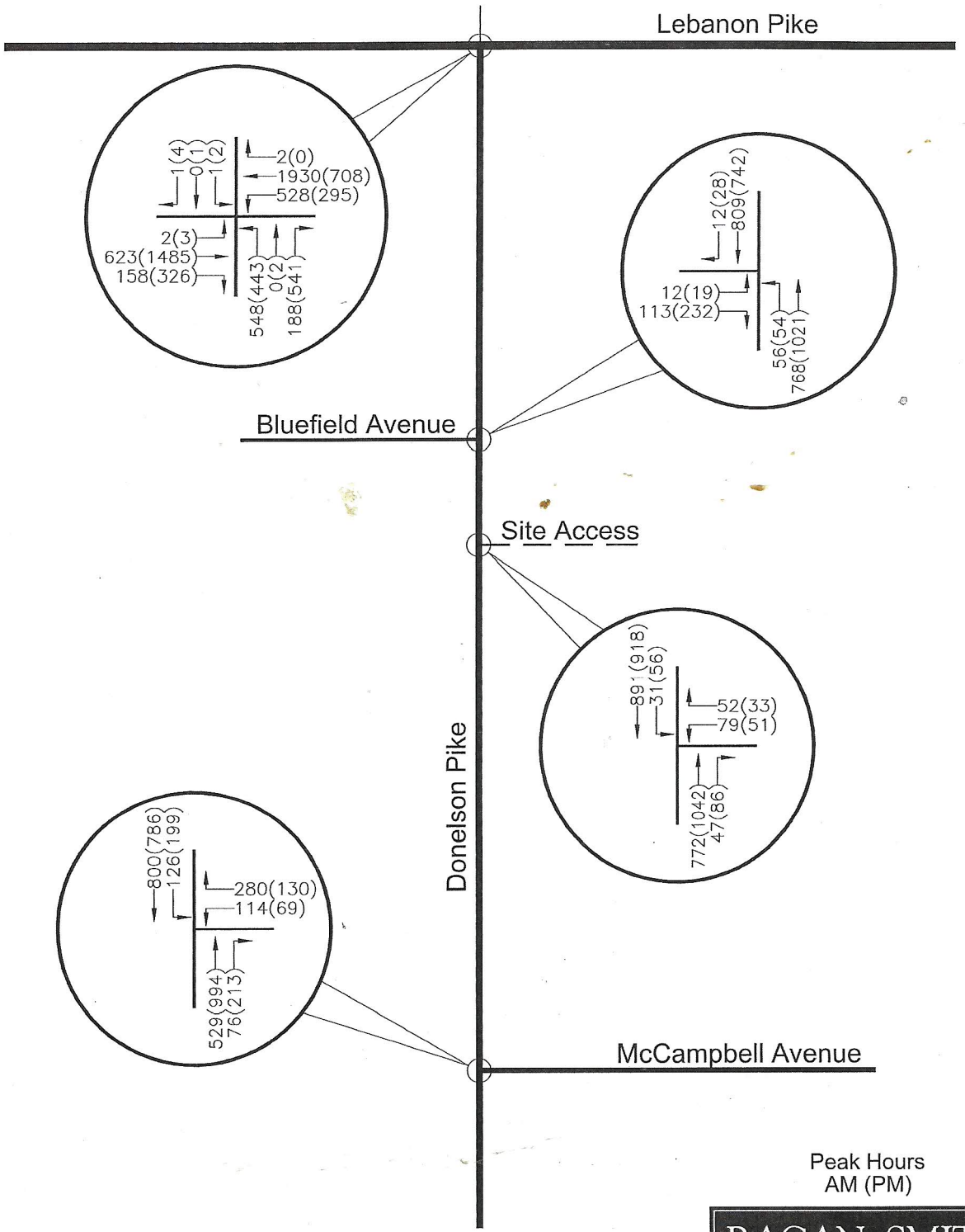
Donelson Station
Site Traffic Volumes

Figure
6



Peak Hours
AM (PM)

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Donelson Station
2020 Total Traffic Volumes

Figure
7

VI. TRANSPORTATION ANALYSIS

A. Intersection Capacity Analysis

In order to determine the quality of existing traffic operations and identify capacity deficiencies, intersection capacity analyses were conducted at the following intersections.

- Donelson Pike at Lebanon Pike
- Donelson Pike at Bluefield Avenue
- Donelson Pike at McCampbell Avenue
- Donelson Pike at Primary Project Access

Capacity analyses were conducted according to the methodology and procedures outlined in the *Highway Capacity Manual*, HCM 2010, published by Transportation Research Board. Capacity analysis results for the a.m. peak hour are shown in Table 2.

TABLE 2

INTERSECTION CAPACITY ANALYSIS RESULTS – A.M. PEAK HOUR

Intersection	Condition[1]	Level of Service (avg. delay/vehicle – sec.)		
		2017 Existing	2020 Background	2020 Total
Donelson Pike at Lebanon Pike	Overall Intersection	D (37.0)	D (39.8)	D (41.5)
Donelson Pike at Bluefield Avenue	Overall Intersection	A (4.7)	A (5.2)	A (5.4)
Donelson Pike at McCampbell Avenue	Overall Intersection	A (7.4)	A (7.5)	A (7.6)
Donelson Pike at Project Access	SB Left	-	-	A (10.0)
	TWSC WB Left	-	-	D (26.6)
	TWSC WB Right	-	-	B (12.1)

[1] TWSC = Two-way Stop Control

Capacity analysis results for the p.m. peak hour are shown in Table 3.

TABLE 3

INTERSECTION CAPACITY ANALYSIS RESULTS – P.M. PEAK HOUR

Intersection	Condition[1]	Level of Service (avg. delay/vehicle – sec.)		
		2017 Existing	2020 Background	2020 Total
Donelson Pike at Lebanon Pike	Overall Intersection	C (33.2)	C (33.8)	D (36.2)
Donelson Pike at Bluefield Avenue	Overall Intersection	A (7.4)	A (7.7)	A (8.1)
Donelson Pike at McCampbell Avenue	Overall Intersection	A (9.2)	A (9.6)	B (10.4)
Donelson Pike at Project Access	SB Left	-	-	B (12.2)
	TWSC WB Left	-	-	E (35.1)
	TWSC WB Right	-	-	B (14.0)

[1] TWSC = Two-way Stop Control

Level of service (LOS) criteria for unsignalized intersections is shown in Table 4.

TABLE 4		
LEVEL OF SERVICE DESCRIPTIONS FOR UNSIGNALIZED INTERSECTIONS		
Level of Service	**Description**	**Control Delay (sec. /veh.)**
A	Usually no conflicting traffic	0 - 10
B	Occasionally some delay due to conflicting traffic	> 10 - 15
C	Delay is noticeable but not inconveniencing	> 15 - 25
D	Delay is noticeable and irritating, increased risk taking	> 25 - 35
E	Delay approaches tolerance level, risk taking likely	> 35 - 50
F	Delay exceeds tolerance level, high likelihood of risk taking	> 50
Source: Highway Capacity Manual, HCM 2010		

Level of service (LOS) criteria for signalized intersections is shown in Table 5.

TABLE 5		
LEVEL OF SERVICE DESCRIPTIONS FOR SIGNALIZED INTERSECTIONS		
Level of Service	**Description**	**Control Delay (sec. /veh.)**
A	Volume-to-capacity ratio is low, progression is extremely favorable, most vehicles travel through intersection without stopping.	0 - 10
B	Volume-to-capacity ratio is low, progression is good and/or short cycle lengths is present, more vehicles stop than for LOS A.	> 10 – 20
C	Progression is favorable and/or cycle length is moderate, number of vehicles stopping is significant although many still pass through intersection without stopping.	> 20 – 35
D	Volume-to-capacity ratio is high, progression is ineffective, cycle length is long, many vehicles stop.	> 35 – 55
E	Volume-to-capacity ratio is high, progression is unfavorable, cycle length is long, many vehicles stop.	> 55 – 80
F	Volume-to-capacity ratio is very high, progression is very poor, cycle length is long, most cycles fail to clear the queue.	> 80
Source: Highway Capacity Manual, HCM 2010		

B. Queue Interaction

The northbound left turn lane queue on Donelson Pike at Bluefield Avenue and the southbound left turn lane queue on Donelson Pike at the Primary Site Access will be located back-to-back in the existing center lane on Donelson Pike. To identify the possibility of queue interaction, the 95th percentile queues of these movements were checked to verify that the estimated queues could be stored in the existing center lane. A summary of the results is shown below.

- Storage length in center lane = 190 feet
- A.M. Peak Hour:
  - NB Left Turn 95% Queue: 25 feet (0.8 vehicles)
  - SB Left Turn 95% Queue: 25 feet (0.1 vehicles)
  - Total: 50 feet

- P.M. Peak Hour:
  - NB Left Turn 95% Queue: 25 feet (0.9 vehicles)
  - SB Left Turn 95% Queue: 25 feet (0.4 vehicles)
  - Total: 50 feet

As shown above, the sum of the 95th percentile queues between Bluefield Avenue and the Primary Project Access will be able to be stored within the existing center turn lane.

VII. CONCLUSIONS AND RECOMMENDATIONS

A. Introduction

At full build-out, Donelson Station may contribute up to approximately 2,600 trips per day to the local roadway network based on the commercial uses at the site. For this development, a specific review of access and traffic operations during peak periods of site traffic is warranted to provide efficiency and acceptable levels of service.

Based upon a review of the existing and future proposed conditions within the study area, we offer the recommendations shown below. These recommendations have been developed to provide efficient ingress and egress for Donelson Station while minimizing the impact to non-site trips on the roadway network.

Based upon a review of the existing and future proposed conditions within the study area, we offer the recommendations shown below.

B. Donelson Pike at Lebanon Pike

- No intersection control changes, traffic signal modifications, or additional laneage are recommended at the intersection of Donelson Pike at Lebanon Pike as part of Donelson Station to provide traffic operations that meet Metro Nashville – Davidson County's policy goal for level of service.

C. Donelson Pike at Bluefield Avenue

- No intersection control changes or additional laneage are recommended at the intersection of Donelson Pike at Bluefield Avenue as part of Donelson Station to provide vehicular traffic operations that meet Metro Nashville – Davidson County's policy goal for level of service.

- Crosswalk markings across the south approach of Donelson Pike and across Bluefield Avenue should be installed to meet current Metro Public Works standards.

- Pedestrian signal heads and push buttons should be installed by the developer at this intersection for each installed crosswalk.

D. Donelson Pike at McCampbell Avenue

- No intersection control changes, traffic signal modifications, or additional laneage are recommended at the intersection of Donelson Pike at McCampbell Avenue as part of Donelson Station to provide traffic operations that meet Metro Nashville – Davidson County's policy goal for level of service.

E. Donelson Pike at Primary Project Access

- The Donelson Station access to Donelson Pike should be a Metro Public Works ST-324 driveway ramp with a width of 35 feet of pavement to allow for two egress lanes (11 feet each) and one ingress lane (13 feet).

- The Donelson Station access will be a private drive, therefore, the existing two-way left turn lane on Donelson Pike should remain in place to service the new development access and existing driveways along Donelson Pike.

- A Tennessee Department of Transportation Highway Entrance Permit or Grading Permit may be required since Donelson Pike is a State Route.

- Although there is currently no bus route on Donelson Pike at the project frontage, a bus shelter may be beneficial in the future if transit services are increased in the vicinity. To accommodate this, as part of the Final SP the developer should reserve area for a future bus shelter along the project frontage.

F. Donelson Pike at Secondary Project Access

- The Donelson Station secondary access to Donelson Pike should include a Metro Public Works ST-324 driveway ramp with a width of 24 feet of pavement to allow for two lanes for ingress/egress.

- The secondary access could be restricted to emergency use only, if desired. The analysis of this study indicates that all site traffic can use the primary project access and that traffic operations will be characterized by acceptable levels of service.

- Due to the proximity of the Nashville and Eastern Railroad at-grade crossing north of this access, left turn movements into the site should be prohibited to prevent queueing across the railroad crossing. The left turn movement into the site should be restricted with a physical barrier in the existing two-way center turn lane and flush median of Donelson Pike. This physical barrier could be an arrangement of plastic delineators, a raised concrete median, or another solution acceptable to the developer and Metro Nashville Public Works. At the time of this study, discussions related to the final design of this barrier were ongoing with Metro Nashville Public Works staff. To provide time for continued discussions with Metro Nashville Public Works and for internal review and discussion by Public Works staff, the final design for this barrier should be determined prior to or as part of the Final SP for Donelson Station.

- A Tennessee Department of Transportation Highway Entrance Permit or Grading Permit may be required since Donelson Pike is a State Route.