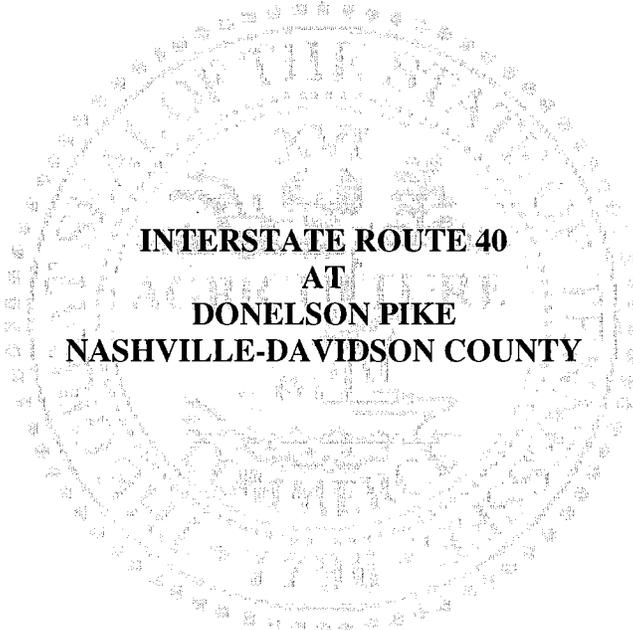


INTERCHANGE MODIFICATION STUDY

The seal of the Tennessee Department of Transportation is a circular emblem. It features a central figure of a person on horseback, surrounded by a wreath. The outer ring of the seal contains the text "TENNESSEE DEPARTMENT OF TRANSPORTATION" at the top and "1820" at the bottom. The text "INTERSTATE ROUTE 40 AT DONELSON PIKE NASHVILLE-DAVIDSON COUNTY" is superimposed over the seal.

**INTERSTATE ROUTE 40
AT
DONELSON PIKE
NASHVILLE-DAVIDSON COUNTY**

PREPARED FOR

**TENNESSEE DEPARTMENT OF TRANSPORTATION
ENVIRONMENTAL AND PLANNING BUREAU**

BY

**CONSOER TOWNSEND ENVIRODYNE ENGINEERS
NASHVILLE, TN**

December 2004

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Traffic Volumes – 2005 ADT and 2025 ADT

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Functional Plans (2005 and 2025)

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CHAPTER ONE

INTRODUCTION

A. Purpose of Study

The purpose of this study is to determine the feasibility of providing an alternate geometric configuration of Donelson Pike (SR 255) at the interchange of Donelson Pike and Interstate Route 40 in Nashville-Davidson County to allow the Nashville International Airport to expand their facilities and improve the overall operational and safety issues of the interchange.

This report will review the background, current and future needs for traffic operations, develop functional plans, estimate the costs of the proposed improvements, and identify the environmental concerns for the proposed project.

B. Description of Project Location

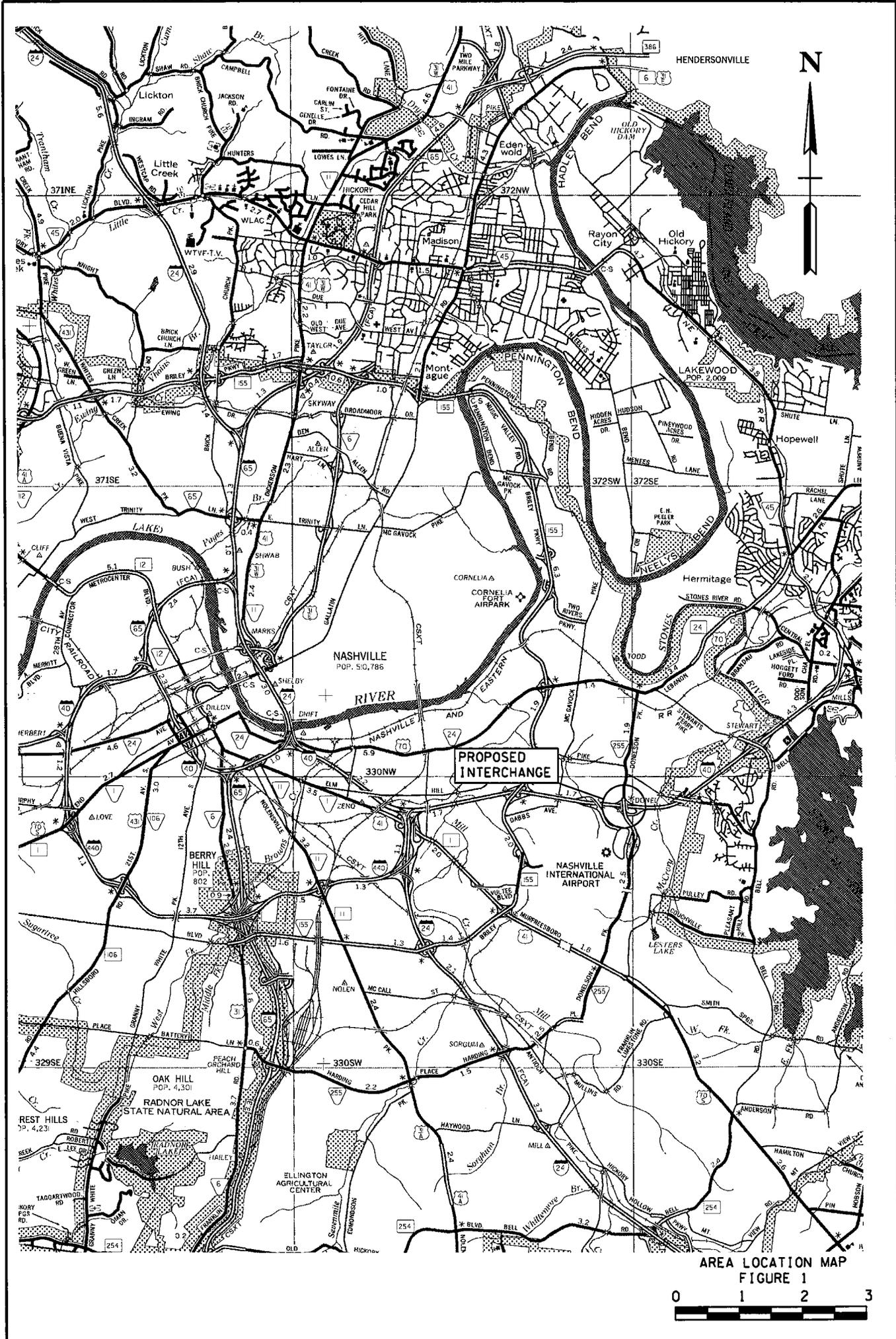
The proposed modification is located on Donelson Pike at Interstate Route 40 in Nashville-Davidson County, Tennessee (See Area Location Map, Figure 1). The Project Location Map (Figure 2) shows the proposed modifications are located 1.73 miles east of the Briley Parkway (State Route 155) interchange and 2.42 miles west of the Stewarts Ferry interchange. The Long Range Transportation Plan indicates that the Harding Place Extension from (U.S. 41 and U.S. 70S – Murfreesboro Pike) to I-40. The proposed extension will include an interchange with I-40 as shown in Figure 3.

The section of Interstate Route 40 within this study area is currently an eight-lane barrier-divided access controlled facility. H.O.V. lanes are scheduled to be constructed (2004) for both eastbound and westbound lanes from the Donelson Pike interchange to Briley Parkway. The section of Donelson Pike within this study area is a four and five-lane urban roadway.

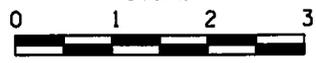
The Donelson Pike interchange bridge was modified in 2002 by the Tennessee Department of Transportation to allow additional lanes along I-40 and a future urban diamond configuration along Donelson Pike. Donelson Pike, south of the interchange, traverses the airport's property. The current configuration of Donelson Pike through this section restricts the airport from being able to expand to meet future needs.

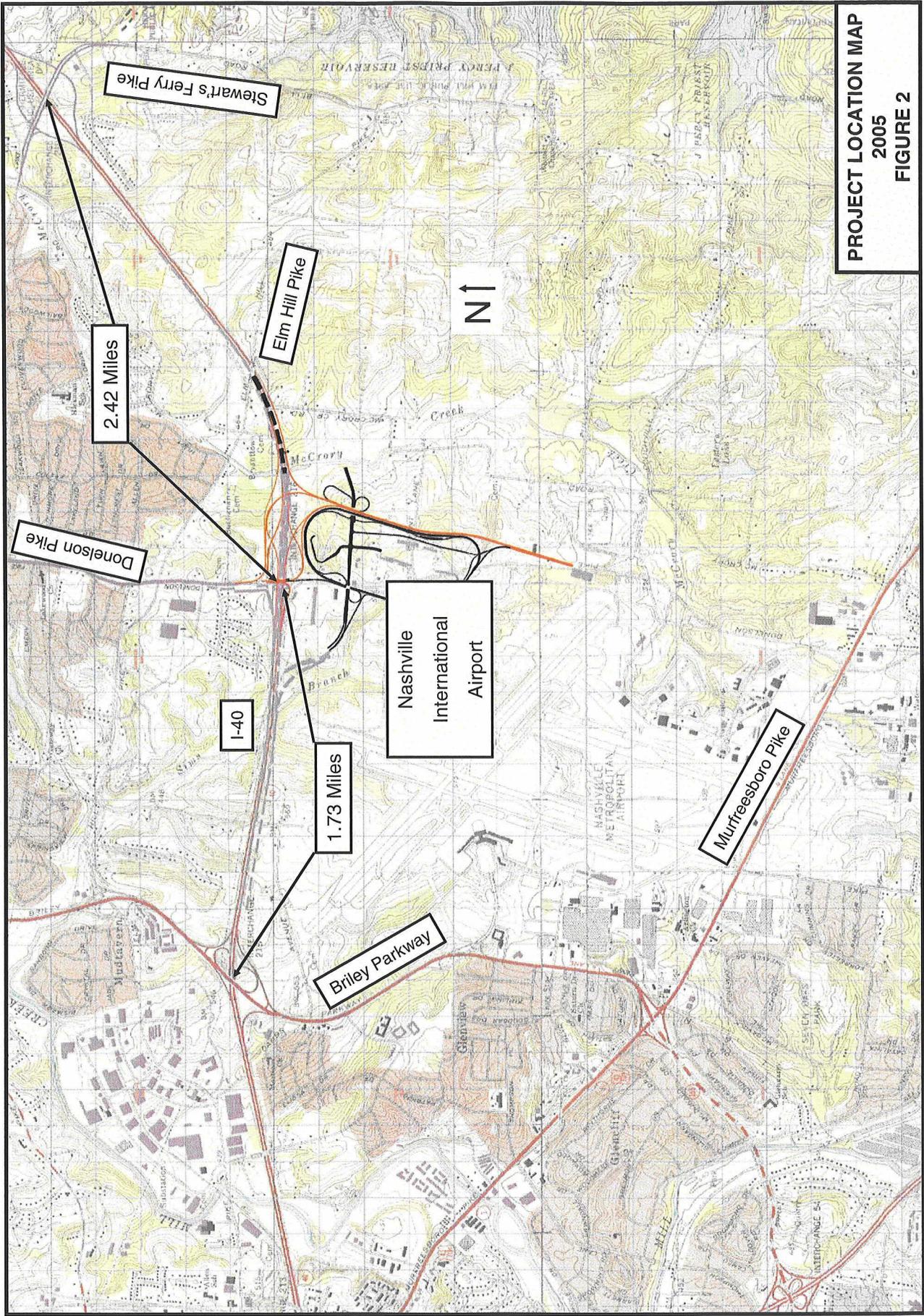
C. Background

In 1964, Interstate Route 40 was constructed as part of the Federal Aid Highway Act of 1944 and the congressional spending bill of 1956. As with most Interstate systems, Interstate Route 40 has experienced tremendous traffic growth east of downtown Nashville.

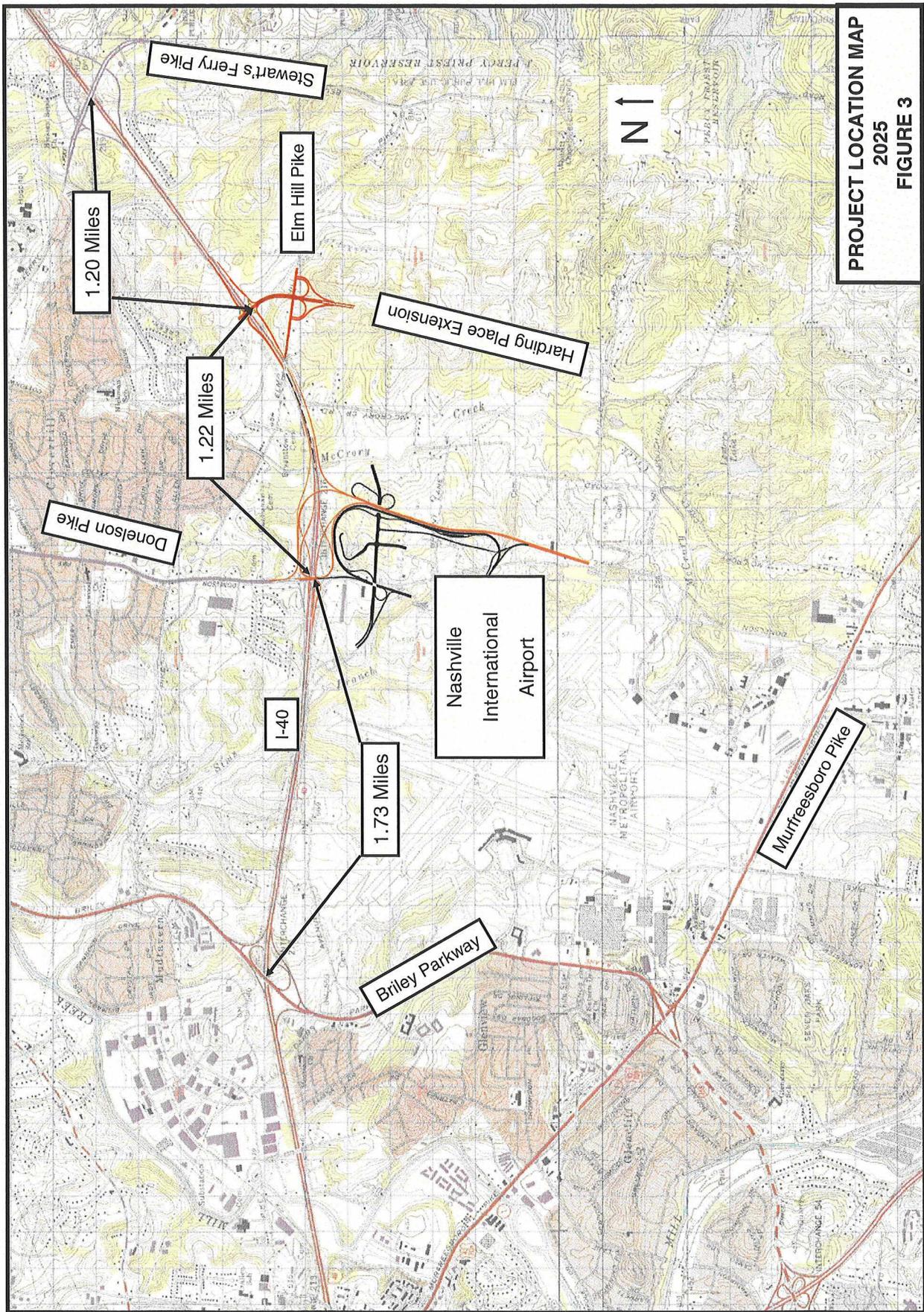


AREA LOCATION MAP
FIGURE 1





PROJECT LOCATION MAP
 2005
FIGURE 2



PROJECT LOCATION MAP
2025
FIGURE 3

In 1970 the Metropolitan Government of Nashville and Davidson County formed the Metropolitan Nashville Airport Authority (MNAA). To accommodate the rapid growth in air travel, the 1973 long range plan called for a new terminal and new parallel runway west of Donelson Pike. The terminal is located on Donelson Pike (State Route 255) approximately 0.60 miles south of I-40. To provide the needed access to the new terminal, Donelson Pike was widened to four traffic lanes between Harding Place and Interstate 40. An interchange was also constructed to provide access from Donelson Pike/Interstate 40 to the new terminal. This project was completed in 1986 and the new terminal opened in September, 1987.

In July 1988, the airport was designated an international airport and the name was changed from Nashville Metropolitan Airport to Nashville International Airport. With air travel continuing to grow, MNAA constructed a new parallel runway (2R-20L) in 1989. The total passengers whose origin/destination was Nashville has increased from 3,509,560 in 1988 to 7,980,680 in 2000. The total tonnage of cargo during this same period has increased from 40,815 to 64,671 – an average increase of 4.3% per year.

To serve this increased volume, several improvements both internally and externally have been made. They include:

1. A discrete access interchange on Interstate Route 40, west of State Route 255 (Donelson Pike) and ramp modifications at the Donelson Pike interchange were completed in 1988. These improvements provided access to and from the airport into the downtown area and decreased the traffic demands on the Donelson Pike interchange.
2. A new runway (2R-20L) and taxiway on the east side of Donelson Pike was opened in November, 1989.
3. In May, 1994 the extension of the north-south runway (2C-20C) over State Route 1 (U.S. 41 and U.S. 70S) was completed.

Even with the above improvements the airport will be unable to meet the forecasted travel demands. MNAA's current Master Plan forecasts total passengers will increase by an average annual amount of 3.0% until 2020 (total O/D from 7,980,680 in 2000 to 14,413,995 in 2020) and the total tonnage would increase from 64,671 to 171,591 over the same period of time.

In order to serve this projected growth, the Airport Authority's Master Plan proposes a second parallel runway east of Donelson Pike, as well as other internal improvements. To accommodate these improvements and to be consistent with the Master Plan, the Authority requested Donelson Pike be relocated to minimize the traffic demand impacts on the airport's landside movements and allow for expanded landside facilities.

D. Relationship to Other Highway Improvement Plans and Programs.

The Nashville Metropolitan Area HOV Study recommended widening I-40 East from Nashville, Davidson County, to State Route 26 (U.S. 70) in Lebanon, Wilson County, to provide two HOV lanes (one in each direction). The completed widening project from State Route 45 (Old Hickory Boulevard) in Nashville to just east of State Route 171 (Mt. Juliet Road) in Wilson County provided the HOV lanes for this section.

The long range plan for future implementation of HOV lanes along this corridor is for two HOV lanes (one in each direction) between State Route 155 (Briley Parkway) and the existing HOV lanes at State Route 45 (Old Hickory Boulevard) to be constructed. Construction for the additional lanes is to begin by 2004.

Since a large portion of the through traffic volumes now using Donelson Pike interchange will be diverted to the proposed ramps, it will be necessary to modify the existing interchange. This modification provides the required storage for queued vehicles at the signals. The bridge at the interchange of State Route 255 (Donelson Pike) and Interstate Route 40 was modified in 2002 to accommodate the planned HOV lanes. The modification is adequate for the proposed improvements.

In 1998, the Tennessee Department of Transportation submitted an Interchange Justification Study (IJS) for a proposed interchange along Interstate 40 and a proposed Harding Place Extension. The study illustrated the location of the proposed interchange to be between the Donelson Pike interchange and the Stewarts Ferry interchange. The proposed Harding Place Extension is in the Long Range Plan.

In May, 2000, the first commuter rail demonstration project was initiated from Lebanon-Wilson County to downtown Nashville. According to the Nashville Transit Analysis Study completed in 1990, the other corridors that did show promise are to the northeast (Briley Parkway-Hendersonville-Gallatin), southeast (Hickory Hollow-LaVergne-Smryna-Murfreesboro), south (Brentwood-Cool Springs-Franklin) and west (Belle Meade-Bellevue-Kingston Springs). The Tennessee Department of Transportation is currently reviewing the existing long range plan and developing a proposed long range rail plan.

Several multi-modal terminals, including the Clement Landport (located on Demondreun Street next to Cummins Station) has been developed to allow for the future connections to downtown Nashville. This facility would accommodate Metro Transit Authority (MTA) bus transfers, airport express service, HOV parking, rental car agencies and a future AMTRAK station. In addition, the Nance/Arena Landport (located on Demonbreun Street near the downtown arena) and the Petway Transit Center (located on on Deadrick Street between Fourth and Fifth Avenue) will continue to provide bus transfer locations. Metropolitan Transit Authority is currently planning a new multi-modal/pedestrian facility in the downtown area. The location has not been determined.

CHAPTER TWO

PRELIMINARY PLANNING DATA

A. Land Use

The project area bound by the Nashville International Airport on the west, State Route 1 (U.S. 41 and U.S. 70S – Murfreesboro Pike) on the south, and Elm Hill Pike on the east and north is predominantly commercial/industrial. There are over 30,000 people currently employed in the Airport/ Elm Hill Pike area.

B. Traffic Served

Traffic data for this study was supplied by the Tennessee Department of Transportation (TDOT) and was based on proposed land use and existing conditions. Present and projected Average Daily Traffic (ADT) volumes and Design Hourly Volumes (DHV) for both existing configuration and the proposed Alternate “A” are shown in Appendix A.

The modified Donelson Pike will be a fully controlled access roadway between I-40 and Murfreesboro Road. The total average daily volume of traffic expected to be served by the modified interchange in the design year (2005) is 44,785 vehicles for the proposed configuration, with about 5% of these being trucks. The daily volume that would presently (2003) use the modified interchange, if it were in place, is the same volume as existing. Since the traffic along three ramps will not be required to traverse the signal, only 18,255 of the 44,785 vehicles would traverse the interchange signal. This will allow the interchange signal to operate more efficiently.

C. Design Alternatives

The existing interchange of Donelson Pike with Interstate 40 is a trumpet design with restricted turning movements. Currently there is one signal on the north section of the interchange which controls the westbound on-ramp, south bound Donelson, north bound Donelson and westbound off-ramp movements. In order to increase the efficiency of the interchange, a partial single point urban diamond is proposed. The modification will remove several turning movements from Donelson Pike and allow for some other movements to become free-flow movements onto and off of the interstate system. The proposed alternative is the most feasible configuration for the Donelson Pike interchange with Interstate 40. A brief summary of the proposed alternate is represented in section D (Proposed Improvements).

D. Proposed Improvements.

The specific improvements needed to provide the traffic service and ease of movements are discussed below and are shown on the attached Functional Plans, see Appendix B:

- a. Reconstruct Donelson Pike interchange as a single-point including the structures for the braided ramps and northbound Donelson Pike. The proposed configuration would remove two left turns from the interchange by placing them onto independent free-flow ramps. As mentioned previously in this report, the existing dual-bridge layout has been replaced with a single bridge. This new structure should be acceptable to the modifications necessary to accommodate the proposed single-point configuration.
- b. Construct relocated Donelson Pike directional roadways and the required structures, acceleration lanes and deceleration lanes associated with these roadways. Northbound Donelson Pike traffic accessing the interstate system, both to the east and west, will receive fully directional access. Eastbound I-40 traffic accessing southbound Donelson Pike will also receive fully directional access. These movements will no longer be required to traverse the Donelson Pike interchange.
- c. Construct the auxiliary lanes (one in each direction) on I-40 for the entrance and exit ramps for Donelson Pike.

An additional HOV lane (one in each direction) through the project is part of the Long Range Plan for the I-40 corridor and is scheduled for construction in 2004. These lanes are shown as existing on the Functional Plans.

In addition to the improvements listed above, the Long Range Plan contains a project to extend Harding Place from Murfreesboro Road to I-40. The project will include the construction of a new interchange on I-40. The initial intent of the new interchange was to move all traffic from existing Donelson Pike to the new Harding Place Extension. Since the submittal of the Interchange Justification Study (IJS) and with the development of this Interchange Modification Study (IMS), the Department has elected to leave Donelson Pike as a thru street and modify the geometry of the Harding Place interchange as illustrated in the 2025 Functional Plans (see Appendix B).

E. Environmental Concerns.

McCrorry Creek traverses the proposed interchange ramps approximately 0.50 miles east of Donelson Pike. The existing 2 @ 12' x 10' concrete box bridge under I-40 is proposed to be extended, therefore, the flood boundary for McCrorry Creek will not be affected.

Fill material being placed into this area is governed by U.S. Army Corp of Engineers, Section 404 permitting requirements. Erosion controls should be implemented and maintained throughout the construction project.

Impacts associated with flood plain encroachment will be limited, because the project will be designed to accommodate projected flood waters. Design of the project will utilize current hydrological data to insure the flood waters are not impeded.

This corridor has been examined in a previous Environmental Assessment and a FONSI determination was made on an alternate on December 13, 2001. The Tennessee Department of Transportation has reviewed the proposed alternate and determined that no change has occurred since the 2001 study, thus the FONSI is still valid. See Appendix D for confirmation of validity for the FONSI.

CHAPTER THREE

ENGINEERING INVESTIGATIONS

A. Traffic Operations

An analysis was made which determined that the existing interchange configuration was inadequate to handle design year volumes. Appendixes A-2 and A-3 contain figures that illustrate the levels-of-service (LOS) under the existing conditions for Year 2005 and Year 2025 traffic. Appendixes A-6 and A-7 contain figures that illustrate the levels-of-service (LOS) under the proposed conditions for Year 2005 and Year 2025 traffic. The LOS was determined using the peak hour volumes which represent the worst case condition for each location.

Existing Roadway System

The results of the capacity analyses conducted for the existing roadway system are shown in the following tables. Table 1 identifies the Level of Service (LOS) of the ramp junctions that do not result in a lane addition or lane drop. As shown in Tables 1 and 2, there are two ramps that will operate at a poor LOS in Year 2005, based on the existing roadway system. The following ramp junctions are projected to operate at LOS F during Year 2005:

- *Eastbound I-40 and the on-ramp from Donelson Pike (LOS F during PM peak)*
- *Westbound I-40 and the off-ramp to Donelson Pike (LOS F during AM peak)*

Additionally, there are four ramps that will operate at a poor LOS in Year 2025. The following ramp junctions are projected to operate at LOS F during Year 2025:

- *Eastbound I-40 and the on-ramp from Donelson Pike (LOS F during PM peak)*
- *Westbound I-40 and the off-ramp to Donelson Pike (LOS F during AM peak)*
- *Eastbound I-40 and the off-ramp to northbound Donelson Pike (LOS F during PM peak)*
- *Westbound I-40 and the on ramp from Donelson Pike (LOS F during PM peak)*

As noted in Table 1, a couple of locations within the study area include an interchange ramp that is associated with a lane addition or a lane drop on I-40. These locations are as follows:

- *Eastbound I-40 and the off-ramp to southbound Donelson Pike*
- *Westbound I-40 and the on ramp from Donelson Pike*

The information in Exhibit 13-20 of HCM2000 indicates that the service volume of a single-lane ramp is approximately 1,760 vehicles per hour. Table 2 includes the projected traffic volumes on each ramp, which results in a lane addition or lane drop on I-40 at the interchange within the study area.

Table 1
CAPACITY ANALYSES OF RAMP JUNCTIONS
WITHIN THE STUDY AREA

Ramp Junctions	Year 2005	Year 2025
EB I-40 and off-ramp to SB Donelson Pike (AM)	See note	See note
EB I-40 and off-ramp to SB Donelson Pike (PM)	See note	See note
EB I-40 and off-ramp to NB Donelson Pike (AM)	A	B
EB I-40 and off-ramp to NB Donelson Pike (PM)	C	F
EB I-40 and on-ramp from Donelson Pike (AM)	B	B
EB I-40 and on-ramp from Donelson Pike (PM)	F	F
WB I-40 and off-ramp to Donelson Pike (AM)	F	F
WB I-40 and off-ramp to Donelson Pike (PM)	B	C
WB I-40 and on-ramp from Donelson Pike (AM)	See note	See note
WB I-40 and on-ramp from Donelson Pike (PM)	See note	See note

Note: Some ramp junctions within the study area result in a lane addition or lane drop. The Highway Capacity Manual 2000 (HCM2000) states that in these cases, the capacity of the ramp is governed by the ramp geometry itself and not the ramp-freeway junction. Analyses for these locations are shown in Table 2

Table 2
CAPACITY ANALYSES OF RAMP JUNCTIONS
WHICH RESULT IN A LANE ADDITION OR LANE DROP

Ramp Location	Capacity (vph)	Year 2005		Year 2025	
		AM Peak (vph)	PM Peak (vph)	AM Peak (vph)	PM Peak (vph)
EB I-40 at the off-ramp to SB Donelson Pike	1,760	897	822	1,367	1,253
WB I-40 at the on-ramp from Donelson Pike	1,760	1,135	1,628	1,675	2,401

Currently no weaving sections are found within the study area due to the existing interchange geometry. Specifically, the off-ramps are located prior to the on-ramps. Therefore, motorists exiting the interstate onto Donelson Pike do not have to cross lanes with the motorists entering the interstate segment from Donelson Pike.

The results of the capacity analyses for the freeway segments within the study area are shown in Table 3. Since the freeway segments will be unchanged both to the east and to the west of the Donelson Pike interchange, Table 3 represents LOS for both the proposed and existing roadway system within the study area. Table 3 further illustrates that in Year 2005 and Year 2025 the I-40 general purpose lanes operate at a LOS F for both westbound AM and eastbound PM peaks (peak period in peak directions).

Table 3
CAPACITY ANALYSES OF FREEWAY SEGMENTS
WITHIN THE STUDY AREA

Freeway Segment	Year 2005	Year 2025
EB I-40 west of Donelson Pike (AM)	B	B
EB I-40 west of Donelson Pike (General Purpose lanes) (PM)	E	F
EB I-40 west of Donelson Pike (H.O.V. lanes) (PM)	C	E
EB I-40 east of Donelson Pike (AM)	A	B
EB I-40 east of Donelson Pike (General Purpose lanes) (PM)	F	F
EB I-40 east of Donelson Pike (H.O.V. lanes) (PM)	C	D
WB I-40 west of Donelson Pike (PM)	B	C
WB I-40 west of Donelson Pike (General Purpose lanes) (AM)	D	F
WB I-40 west of Donelson Pike (H.O.V. lanes) (AM)	C	E
WB I-40 east of Donelson Pike (PM)	B	C
WB I-40 east of Donelson Pike (General Purpose lanes) (AM)	F	F
WB I-40 east of Donelson Pike (H.O.V. lanes) (AM)	C	E

Note: H.O.V. lanes are only operable for the westbound AM and eastbound PM peak periods.

The existing Donelson Pike with Interstate 40 interchange consists of two intersections, one to the north of I-40 and one to the south of I-40. The northern intersection is a signalized intersection and consists of the eastbound off-ramp from I-40 and the eastbound on-ramp from Donelson Pike. There are no left turns from southbound Donelson Pike or right turns from northbound Donelson Pike. See Appendix A-2 and A-3 for the DHV turning movements at these intersections. The Level of Service results of the signalized intersection are shown in Table 4.

Table 4
CAPACITY ANALYSES AT EXISTING
SIGNALIZED SURFACE STREET INTERSECTION

Signalized Description	NB		SB		WB		Intersection	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
	(sec/veh)		(sec/veh)		(sec/veh)		(sec/veh)	
Existing 2005 AM	548	F	734	F	594	F	625	F
Existing 2005 PM	912	F	906	F	238	F	849	F
Existing 2025 AM	1289	F	1916	F	1610	F	1628	F
Existing 2025 PM	*	F	2128	F	942	F	*	F

* An asterisk is used in the Highway Capacity Software to represent an oversaturated condition that exceeds the criteria for level of service F.

The southern intersection is not signalized and consists of the eastbound off-ramp from I-40 and the westbound on-ramp from Donelson Pike. The northbound right turn onto the on-ramp to I-40 is a channelized lane with a yield condition. The left turn lane on southbound Donelson Pike is a storage lane that extends onto the Donelson Pike

interchange bridge. There are two separate off-ramps for eastbound I-40. The first exit is for southbound Donelson Pike only and intersects Donelson Pike on the west. The second exit is for northbound Donelson Pike only and intersects Donelson Pike on the east. See Appendix A-2 and A-3 for the DHV turning movements at these intersections. The Level of Service results of the signalized intersection are shown in Table 5.

Table 5
CAPACITY ANALYSES AT EXISTING
UNIGNALIZED SURFACE STREET INTERSECTIONS

Unsignalized Description	NB	SB	EB	Intersection
	RT	LT	RT	
	LOS	LOS	LOS	LOS
Existing 2005 AM	**	E	F	F
Existing 2005 PM	**	F	F	F
Existing 2025 AM	**	F	F	F
Existing 2025 PM	**	F	F	F

** Channelized right turn lane with free flow (dependent upon LOS of corridor)

Proposed Roadway System

The results of the capacity analyses conducted for the proposed roadway system are shown in the following tables. Since the new Harding Place Extension is anticipated to be constructed by year 2025, the 2025 DHV's used for capacity analyses reflect the addition of the Harding Place Extension interchange. For informational purposes, Table 8 also includes the capacity analyses of the Harding Place Extension interchange.

The proposed construction of the Harding Place interchange also includes the implementation of a collector-distributor (C-D) system along I-40 between Donelson Pike and the Harding Place Extension. With the C-D system, eastbound I-40 and westbound C-D (west of the Donelson Pike interchange) will result in a lane drop and lane addition, respectfully. Consequently, the eastbound C-D and westbound I-40 (into the C-D) will result in merging and diverging ramps, respectfully.

Table 6 identifies the Level of Service (LOS) of the ramp junctions that do not result in a lane addition or lane drop. As shown in Tables 6 and 7, there are two ramps that will operate at a poor LOS in Year 2005, based on the proposed roadway system. Specifically, the westbound off-ramp to northbound and southbound Donelson Pike (AM peak) is projected to operate at LOS F during Year 2005. Table 6 also illustrates that the implementation of a two-lane collector-distributor system will allow all ramp junctions from Donelson Pike and Harding Place to operate at acceptable LOS in Year 2025.

As with the existing roadway system network, no weaving sections are found within the proposed roadway network. Specifically, the on and off-ramps will be configured in the same basic layout with the exception of being two identical ramps for each movement. Therefore, no weaving analyses were performed for this study.

Since the freeway configuration will remain the same (no additional lanes), Table 3 illustrates the proposed freeway segment's level-of-service as well as the existing. The lane additions and lane drops along the existing I-40 will simply operate as lane additions and lane drops to and from the collector-distributor system. As with the existing, Table 3 illustrates that in Year 2005 and Year 2025 the I-40 general purpose lanes operate at a LOS F for both westbound AM and eastbound PM peaks (peak period in peak directions).

Table 6
CAPACITY ANALYSES OF RAMP JUNCTIONS
WITHIN THE STUDY AREA WITH THE
PROPOSED IMPROVEMENTS

Ramp Junctions	Location Number	Year 2005	Year 2025 C-D System 1-lane	Year 2025 C-D System 2-lane
EB I-40 and off-ramp to NB Donelson Pike (AM)	1	B	F	B
EB I-40 and off-ramp to NB Donelson Pike (PM)	1	D	F	C
EB I-40 and off-ramp to SB Donelson Pike (AM)	2	See note	D	B
EB I-40 and off-ramp to SB Donelson Pike (PM)	2	See note	F	B
EB I-40 and on-ramp from SB Donelson Pike (AM)	3	A	C	B
EB I-40 and on-ramp from SB Donelson Pike (PM)	3	B	D	B
EB I-40 and on-ramp from NB Donelson Pike (AM)	4	A	B	A
EB I-40 and on-ramp from NB Donelson Pike (PM)	4	B	F	B
WB I-40 and off-ramp to NB Donelson Pike (AM)	5	F	F	D
WB I-40 and off-ramp to NB Donelson Pike (PM)	5	B	B	A
WB I-40 and off-ramp to SB Donelson Pike (AM)	6	F	F	A
WB I-40 and off-ramp to SB Donelson Pike (PM)	6	B	A	A
WB I-40 and on-ramp from NB Donelson Pike (AM)	7	See note	C	B
WB I-40 and on-ramp from NB Donelson Pike (PM)	7	See note	B	B
WB I-40 and on-ramp from SB Donelson Pike (AM)	8	C	F	B
WB I-40 and on-ramp from SB Donelson Pike (PM)	8	B	D	B
EB I-40 and off-ramp to SB Harding Place (AM)	9	N/A	D	B
EB I-40 and off-ramp to SB Harding Place (PM)	9	N/A	F	C
EB I-40 and on-ramp from NB Harding Place (AM)	10	N/A	B	A
EB I-40 and on-ramp from NB Harding Place (PM)	10	N/A	F	C
WB I-40 and on-ramp from NB Harding Place (AM)	11	N/A	F	C
WB I-40 and on-ramp from NB Harding Place (PM)	11	N/A	B	A
WB I-40 and off-ramp to SB Harding Place (AM)	12	N/A	F	B
WB I-40 and off-ramp to SB Harding Place (PM)	12	N/A	A	A

Note: Some ramp junctions within the study area result in a lane addition or lane drop. The Highway Capacity Manual 2000 (HCM2000) states that in these cases, the capacity of the ramp is governed by the ramp geometry itself and not the ramp-freeway junction. Analyses for these locations are shown in Table 7

Table 7
CAPACITY ANALYSES OF RAMP JUNCTIONS
WHICH RESULT IN A LANE ADDITION OR LANE DROP

Ramp Location	Capacity (vph)	Year 2005		Year 2025*	
		AM Peak (vph)	PM Peak (vph)	AM Peak (vph)	PM Peak (vph)
EB I-40 at the off-ramp to SB Donelson Pike	1,760	897	822	N/A	N/A
WB I-40 at the on-ramp from NB Donelson Pike	1,760	631	1,144	N/A	N/A

Note: Lane additions and lane drops will be a result of the beginning and ending of the collector-distributor system not ramp junctions.

Intersection capacity analyses were conducted for the new configuration of the Donelson Pike interchange with I-40. In addition, intersection capacity analyses were performed on the Harding Place Extension interchange for Year 2025. For the purpose of this study, the following assumptions were made:

- The eastbound off-ramp to southbound Donelson Pike will be a free-flow fully directional ramp that will not traverse the signalized intersection.
- The westbound on-ramp from northbound Donelson Pike will be a free-flow fully directional ramp that will not traverse the signalized intersection.
- The eastbound on-ramp from northbound Donelson Pike will be a free-flow fully directional ramp that will not traverse the signalized intersection.
- The northbound Donelson Pike traffic will function as a through movement along with the westbound off traffic to northbound Donelson Pike at the intersection.
- The eastbound off-ramp to northbound Donelson Pike will be a two-lane ramp and will have a separate signal that will operate in conjunction with the signal located at the intersection of Donelson Pike with westbound off-ramp.
- Harding Place Extension will terminate at I-40.
- An interchange will be placed on the Harding Place Extension at Elm Hill Pike.

The results of these analyses are shown in Table 8. The analyses show that the proposed intersection geometry will operate at acceptable LOS in both the AM and PM peak periods. However, the 2025 eastbound movement will operate at a LOS E in the PM peak period.

Table 8
CAPACITY ANALYSES AT PROPOSED
I-40/DONESLON PIKE INTERCHANGE

Signalized Description	EB		SB		WB		Intersection	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
	(sec/veh)		(sec/veh)		(sec/veh)		(sec/veh)	
Proposed 2005 AM	23.6	C	16.9	B	27.1	C	21.6	C
Proposed 2005 PM	26.9	C	28.8	C	20.3	C	22.3	C
Proposed 2025 AM	30.2	C	38.5	D	24.2	C	30.2	C
Proposed 2025 PM	55.6	E	10.3	B	41.6	D	19.0	B

Table 9
CAPACITY ANALYSES AT PROPOSED
I-40/HARDING PLACE EXTENSION INTERCHANGE

Signalized Description	NB		WB		Intersection	
	Delay	LOS	Delay	LOS	Delay	LOS
	(sec/veh)		(sec/veh)		(sec/veh)	
Proposed 2025 AM	19.0	B	30.3	C	25.3	C
Proposed 2025 PM	8.0	A	9.8	A	8.7	A

B. Access Analysis

This study has been undertaken in accordance with the Federal Highway Administration's (FHWA) policy for granting new or revised interchange access. The FHWA policy, as described in FHWA Docket 98-3460, "Additional Interchanges to the Interstate System (Federal Register 63, No. 28, February 11, 1998) is provided in the following paragraphs accompanied by comments for consideration.

It is in the national interest to maintain the Interstate System to provide the highest level of service in terms of safety and mobility. Adequate control of access is critical to providing such service. Therefore, new or revised access points to the existing Interstate System should meet the following requirements.

1. *The existing interchanges and/or local roads and streets in the corridor can neither provide the necessary access nor be improved to satisfactorily accommodate the design year traffic demands while at the same time providing the access intended by the proposal.*

State Route 255 (Donelson Pike) is an Urban Principal Arterial route on the National Highway System traversing the southeast quadrant of Nashville-Davidson County. A large percentage of traffic using this route is through volumes between I-65 south, I-24 east and I-40 east.

Since the opening of the new terminal for Nashville International Airport in September, 1987 traffic on Donelson Pike between Murfreesboro Pike and I-40 has increased rapidly. The total number of passengers whose origin/destination was Nashville has increased from 3,509,560 in 1988 to 7,980,680 in 2000. The total tonnage of cargo during this same period has increased from 40,815 to 64,671 – an average increase of 4.3% per year. MNAA's current Master Plan forecasts total passengers will increase by an average annual amount of 3.0% until 2020 (total O/D from 7,980,680 in 2000 to 14,413,995 in 2020) and the total tonnage would increase from 64,671 to 171,591 over the same period of time.

In order to serve this projected growth, the Airport Authority's Master Plan proposes a second parallel runway east of Donelson Pike, as well as other internal improvements. To accommodate these improvements and to be consistent with the Master Plan, the Authority requested Donelson Pike be relocated to minimize the traffic demand impacts on the airport's landside movements and allow for expanded landside facilities.

To allow these traffic volumes to move more freely and efficiently along State Route 255 (Donelson Pike) by separating them from airport traffic, it is proposed that State Route 255 (Donelson Pike) be relocated to allow unimpeded movements to and from Interstate Route 40. Relocation of State Route 255 (Donelson Pike) is in the Nashville Metropolitan Area Long Range Transportation Plan and provided the impetus for this study.

To accommodate the proposed fully access controlled interchange modification, the forecasted traffic volumes that would use the interchange, and the relief it would provide to the congestion now occurring on the Donelson Pike bridge and existing I-40 interchange, the modified access is needed.

2. ***All reasonable alternatives for design options, location and transportation system management type improvements (such as ramp metering, mass transit, and HOV facilities) have been assessed and provided for if currently justified, or provisions are included for accommodating such facilities if a future need is identified.***

The Proposed alternative discussed within this report is a modification to an existing interchange. Due to ROW and business constraints, economic consideration and disruption to existing traffic, the proposed alternate is the most efficient means to increase capacity and efficiency of the existing interchange. After the proposed alternate was developed, it was reviewed and evaluated in meeting with representatives from MNAA's Office, FHWA's Division Office, and TDOT's Design, Environmental and Planning Divisions, the proposed alternative was accepted and preferred.

The HOV lanes (one in each direction) between State Route 155 (Briley Parkway) and State Route 255 (Donelson Pike) have been designed and are scheduled for construction in 2004. In addition, the HOV lanes from Donelson Pike to State Route 45 (Old Hickory

Boulevard) are part of the long range plan for this corridor, but are not a part of this study. In May, 2000, the first commuter rail demonstration project was initiated from Lebanon- Wilson County to downtown Nashville. According to the Nashville Transitional Analysis Study completed in 1990, the corridors that also showed promise are to the northeast (Briley Parkway-Hendersonville-Gallatin), southeast (Hickory Hollow-LaVergne-Smyrna-Murfreesboro), south (Brentwood-Cool Springs-Franklin) and west (Belle Meade-Bellevue-Kingston Springs). The Tennessee Department of Transportation is currently reviewing the existing long range plan and developing a proposed long range rail plan.

3. ***The proposed access point does not have a significant adverse impact on the safety and operation of the interstate facility based upon an analysis of current and future traffic. The operational analysis for existing conditions shall, particularly in urbanized areas, include an analysis of sections of interstate to and including at least the first adjacent existing or proposed interchange on either side. Crossroads and other roads and streets shall be included in the analysis to the extent necessary to assure their ability to collect and distribute traffic to and from the interchange with new or revised access points.***

Freeway and ramp junction analyses were performed to determine what impacts, if any, the proposed interchange geometry would have on the existing interstate system. Based upon design Year 2005 projected traffic volumes, the existing interstate system (both east and west of Donelson Pike) will operate at a Level-of-Service F for the peak directions during peak periods (westbound lanes in the AM peak and eastbound lanes in the PM peak). The implementation of the planned HOV lanes will improve the overall performance of the system but will remain operating at a LOS F. There are currently no plans to add additional lanes (other than the planned HOV lanes) to Interstate 40 within the study area. Therefore, an analysis was performed to determine if ramp spacing and acceleration / deceleration lanes would improve the ramp junction LOS.

Based upon existing traffic volumes and configuration, several existing ramp junctions will operate at a LOS F. The proposed configuration distributes the traffic entering and exiting Interstate 40 from five access points to seven. However, the basic movements have not been changed; the gore areas have been slightly moved. With the increase of the number of access points as well as the increased spacing of the access points, all but one ramp junction will operate at an acceptable LOS in design Year 2005.

Capacity analyses were also performed on Donelson Pike to determine if the proposed configuration will have adverse impacts on the intersection of interstate ramps with Donelson Pike. The analyses show that the proposed intersection geometry will operate at an acceptable LOS in both the AM and PM peak periods.

4. ***The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" for special purpose access***

for transit vehicles, for HOV's, or into park and ride lots may be considered on a case-by-case basis. The proposed access will be designed to meet or exceed current standards for Federal-Aid projects on the Interstate System.

The proposed modifications would allow fully directional movements for northbound Donelson Pike traffic accessing the interstate system, both to the east and west and eastbound I-40 traffic accessing southbound Donelson Pike. These movements will no longer be required to traverse the existing Donelson Pike interchange (bridge). The interchange would provide for all traffic movements. The interchange design will meet or exceed all American Association of State Highway and Transportation Officials (AASHTO) criteria.

5. *The proposed considers and is consistent with local and regional land use and transportation plans. Prior to final approval, all requests for new or revised access must be consistent with the metropolitan and/or statewide transportation plan; as appropriate, the applicable provisions of 23 CFR part 450 and the transportation conformity requirements of 40 CFR parts 51 and 93.*

The proposal is consistent with the Nashville Metropolitan Area Long-Range Transportation Plan, the Nashville Airport Authority's Master Plan, and the applicable provisions of 23 CFR part 450 and the transportation conformity requirements of 40 CFR parts 51 and 93.

6. *In areas where the potential exists for future multiple interchange additions, all requests for new or revised access are supported by a comprehensive interstate network study with recommendations that address all proposed and desired access within the context of a long-term plan.*

The Nashville Metropolitan Area Long-Range Transportation Plan currently indicates the potential for a new interchange within the study area. The addition of the Harding Place Extension from Murfreesboro Road to Interstate 40 is anticipated to be constructed by year 2025. The extension will include a new interchange along I-40 and is supported by the proposed Donelson Pike interchange modifications. In addition, the State Route 155 (Briley Parkway) interchange is scheduled for reconstruction in 2004-5.

7. *The request for a new or revised access generated by a new or expanded development demonstrates appropriate coordination between the development and related or otherwise required transportation system improvements.*

The primary objective of the revised access is to allow the Nashville International Airport to expand their facilities. Since the opening of the new terminal along Donelson Pike in September of 1987, the traffic has increased rapidly. The Metropolitan Nashville Airport Authority's recent Master Plan shows that both the total passenger and cargo tonnage

have doubled between 1987 and 2000. The Plan further forecasts that both the passenger and cargo tonnage will double again prior to 2020.

In order to serve this projected growth, the Airport Authority's Master Plan proposes a second parallel runway east of Donelson Pike, as well as other internal improvements. To accommodate these improvements and to be consistent with the Master Plan, the Authority requested Donelson Pike be relocated to minimize the traffic demand impacts on the airport's landside movements and allow for expanded landside facilities

8. *The request for a new or revised access contains information relative to the planning requirements and the status of environmental processing of the proposal.*

Due to the observed low level of environmental consequences and the previous EA and 1989 FONSI and subsequent 2001 FONSI, no substantial impacts are anticipated

C. Cost

The total estimated project cost for interchange Alternate "A" is \$19,131,750. A detailed estimate for the alternate is shown on the following page.

COST DATA SHEET

Clearing and Grubbing.....	\$56,250
Earthwork.....	\$3,940,550
Pavement Removal.....	\$374,100
Drainage (Includes Erosion Control).....	\$931,650
Structures.....	\$3,870,000
Paving.....	\$3,078,100
Retaining Walls.....	\$240,000
Maintenance of Traffic.....	\$265,100
Topsoil.....	\$448,000
Seeding.....	\$71,300
Sodding.....	\$6,000
Signing.....	\$246,400
Signalization.....	\$270,000
Fence.....	\$84,000
Guardrail.....	\$116,700
Other Construction Items (8.5%).....	\$1,169,800
Mobilization.....	\$880,000
Construction Cost.....	\$15,811,250
10% Engineering and Contingencies.....	\$1,581,200
Total Construction Cost.....	\$17,392,450
10% Preliminary Engineering.....	\$1,739,300

Total Engineering and Construction.....\$19,131,750

Utility Relocation

Reimbursable.....\$100,000

Non-Reimbursable.....\$25,000

Total Adjustment Cost.....\$125,000

Total Project Cost.....\$19,256,750

CHAPTER FOUR

SUMMARY AND CONCLUSIONS

The purpose of this study is to determine the feasibility of providing an alternate geometric configuration of Donelson Pike (SR 255) at the interchange of Donelson Pike and Interstate Route 40 in Nashville-Davidson County to allow the Nashville International Airport to expand their facilities.

Analyses indicate that the existing roadway network within this study currently operates at an unacceptable level-of-service. HOV lanes are planned to be constructed in the following year (2004). With the addition of the HOV lanes, the existing system will continue to operate at a LOS F in design year 2005 and 2025 for the westbound AM and eastbound PM peak periods. Furthermore, analyses show that the signalized intersection at the Donelson Pike interchange with Interstate 40 ramps will also operate at a LOS F for the AM and PM peak periods.

The proposed modifications to roadway system within this study area include the relocation of Donelson Pike, new egress and ingress locations onto and off of Interstate 40, and modifications to the existing signalized intersection. The westbound on ramp from northbound Donelson Pike, the eastbound off-ramp to southbound Donelson Pike, the eastbound on ramp from northbound Donelson Pike, the eastbound on ramp from southbound Donelson Pike and the eastbound off-ramp to southbound Donelson Pike will be fully directional ramps. With the proposed modifications, analyses illustrate that the signalized intersection's average intersection delay would decrease from over 600 (sec/veh) to under 90 (sec/veh). The analyses further illustrate that the proposed intersection will operate at an acceptable LOS in the PM compared to the existing LOS F with an over 780 (sec/veh) delay.

In addition, the Long-Range Transportation Plan includes the addition of a Harding Place Extension. This study considers the impacts of the proposed Harding Place Extension from Murfreesboro Road to I-40. The extension will include an interchange with I-40 and an interchange with Elm Hill Pike. This study also illustrates a collector-distributor system between the Donelson Pike interchange and the Harding Place interchange.

This study shows that there are no adverse affects from the proposed modifications to the existing roadway system within this study area. In fact, the analyses show that several ramp junctions' LOS will improve with the proposed modifications. As mentioned previously, the signalized intersection at the interchange of Donelson Pike and Interstate 40 will also have an improved LOS.