INTERCHANGE MODIFICATION STUDY

Interstate 240
and
Airways Boulevard
Shelby County
Memphis, Tennessee

PREPARED BY
CLINARD ENGINEERING ASSOCIATES, LLC
BRENTWOOD, TENNESSEE
FOR
THE TENNESSEE DEPARTMENT OF TRANSPORTATION
PROJECT PLANNING DIVISION

August 2009

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CHAPTER 1

Introduction

A. Purpose of Study

The purpose of this study is to evaluate the existing interchange at Interstate 240 and Airways Boulevard, and to request the approval for modifications of this interchange to improve both operation and safety. Benefits of this project include reduced congestion, reduced conflict points and improved access to and from the Memphis International Airport and the surrounding roadway network. Numerous project options have been evaluated during the development process with a proposed concept developed to maximize public safety through the use of appropriate design standards, while minimizing negative impacts to adjacent development and the environment.

Interstate 240 is currently a six-lane median-divided facility with auxiliary lanes and access control. Airways Boulevard carries four travel lanes north of the interchange and five lanes to the south. This study was conducted to:

- Determine any operational deficiencies in the existing interchange.
- Develop interchange improvements to provide the desired level of service for the design year.
- Evaluate operational characteristics of the proposed improvements for the current conditions (2012) and the design year (2032).
- Develop construction cost estimates and evaluate the land use impacts of the construction.

B. Project Location and Description of the Area

The I-240 and Airways Boulevard Interchange is located southeast of downtown Memphis and serves as a primary route to access the Memphis International Airport as well as the FedEx Hub. As seen in the graphic below, the adjacent interchanges are greater than one (1) mile from the project.

Photo 1 – Other Interchanges in relation to Project Area

The existing I-240/Airways Boulevard interchange is a partial cloverleaf design with loop ramps in three of the four quadrants. The design speed for these loops is approximately twenty-five (25) miles per hour and based upon historical crash data (2002-2006), numerous angle and rear-end collisions have occurred within this area. Crash data and conflict areas can be seen in the photo below.

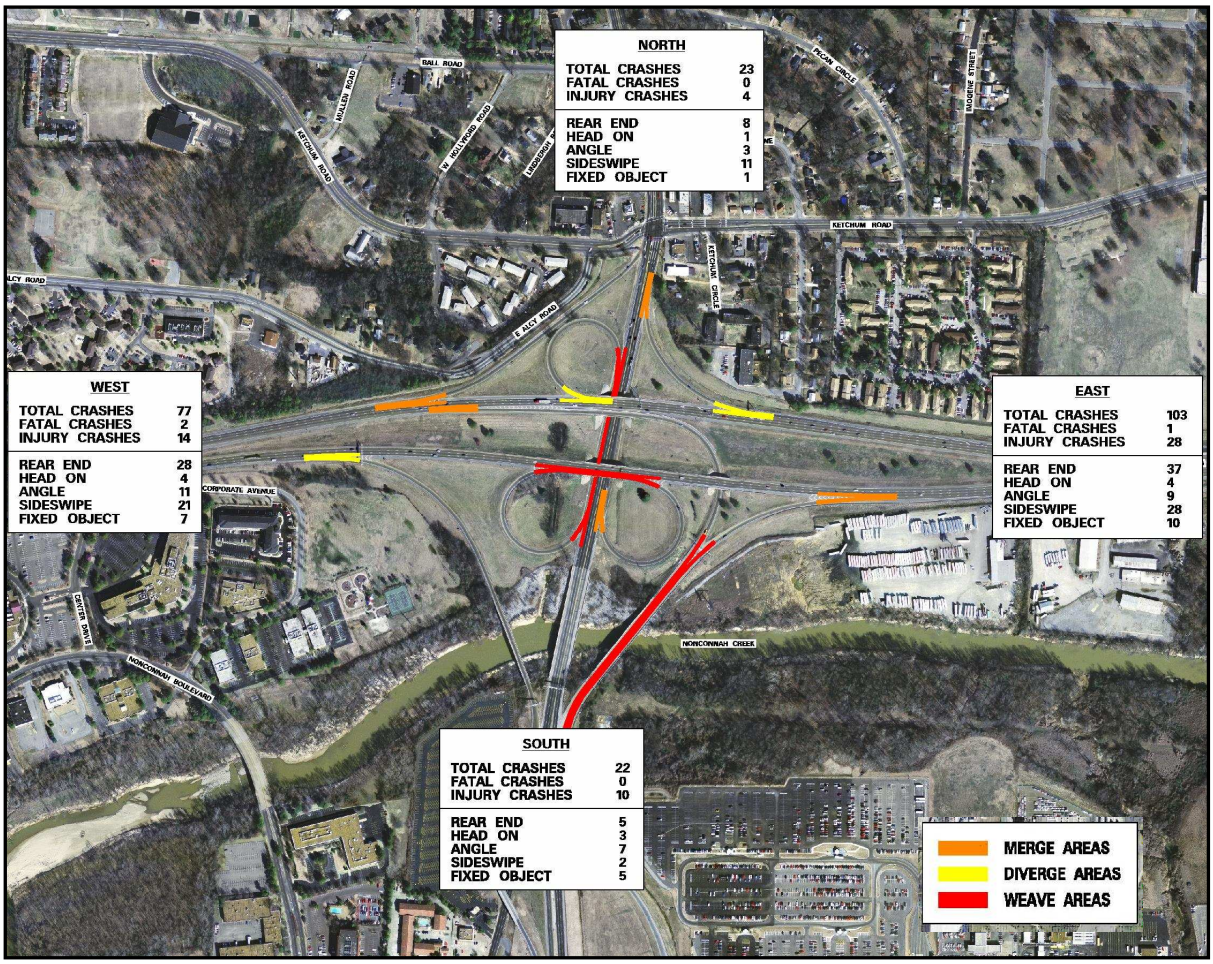


Photo 2 – Project Crash Data

Memphis International Airport/FedEx WorldHub is the world's leader in air cargo as well as being a primary economic engine for the city of Memphis and the entire region. A study conducted by Sparks Bureau of Business and Economic Research/Center for Manpower Studies at The University of Memphis, documented that the airport has a $21.7 billion annual impact on the local community and one in four jobs in the community can be tied to the airport. In addition, there are almost 300 daily passenger flights to and from the Memphis airport. The FedEx WorldHub currently covers 550 acres on the airport grounds and has plans for future expansion (103 acres) north of Rental Road once the Tennessee Air National Guard relocation is complete.

Memphis-Shelby County Airport Authority currently plans to construct a $48 million, 78-acre ground transportation center at the corner of Winchester Road and Airways Boulevard, just south of the project interchange (see picture below). This facility will house all of the current rental facilities and will transport passengers to the airport by bus and potentially by light-rail in the future. This new facility is expected to be complete by 2011.

Photo 3 – Proposed Ground Transportation Center

North of I-240 along Airways Boulevard is the old Memphis Defense Depot Site (Photo 4). This site covers 640 acres and has 5.5 million square feet under roof. Primarily a light manufacturing and distribution center, the Depot is expected to generate up to 800 trucks trips per day. Most of these trucks must travel through the I-240 and Airways Boulevard interchange to access their final destinations.

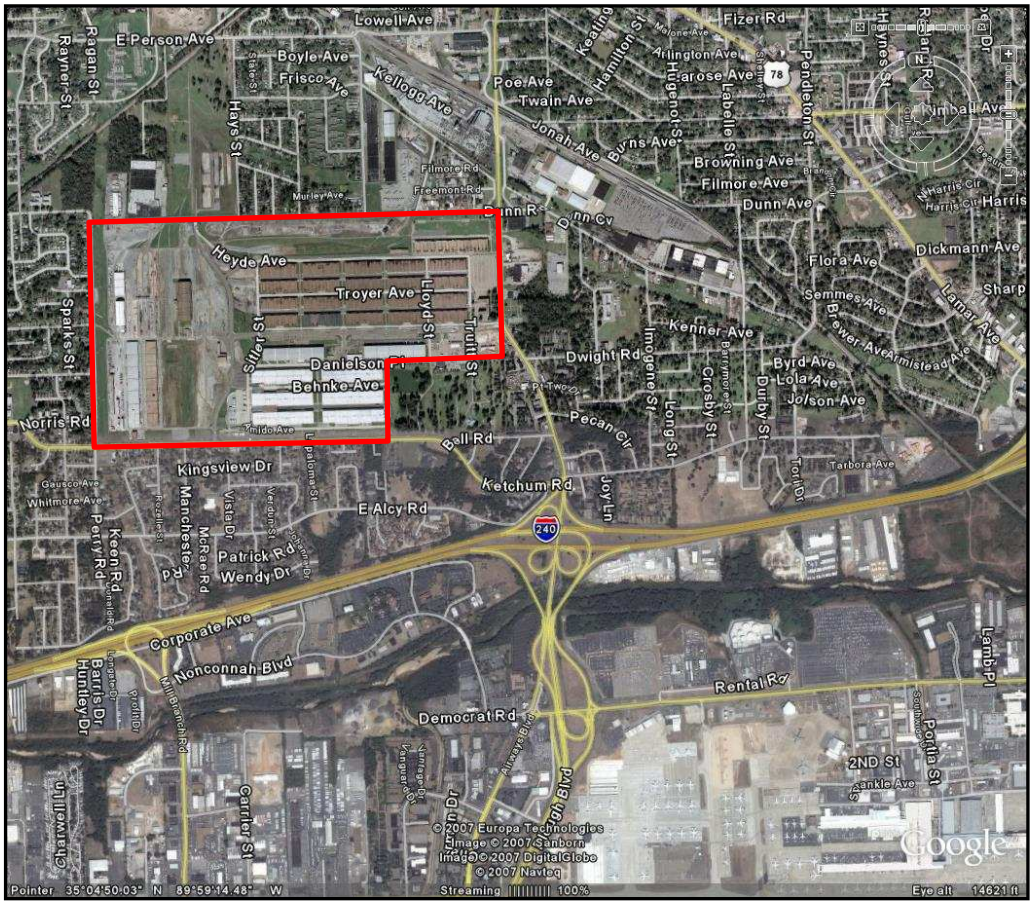
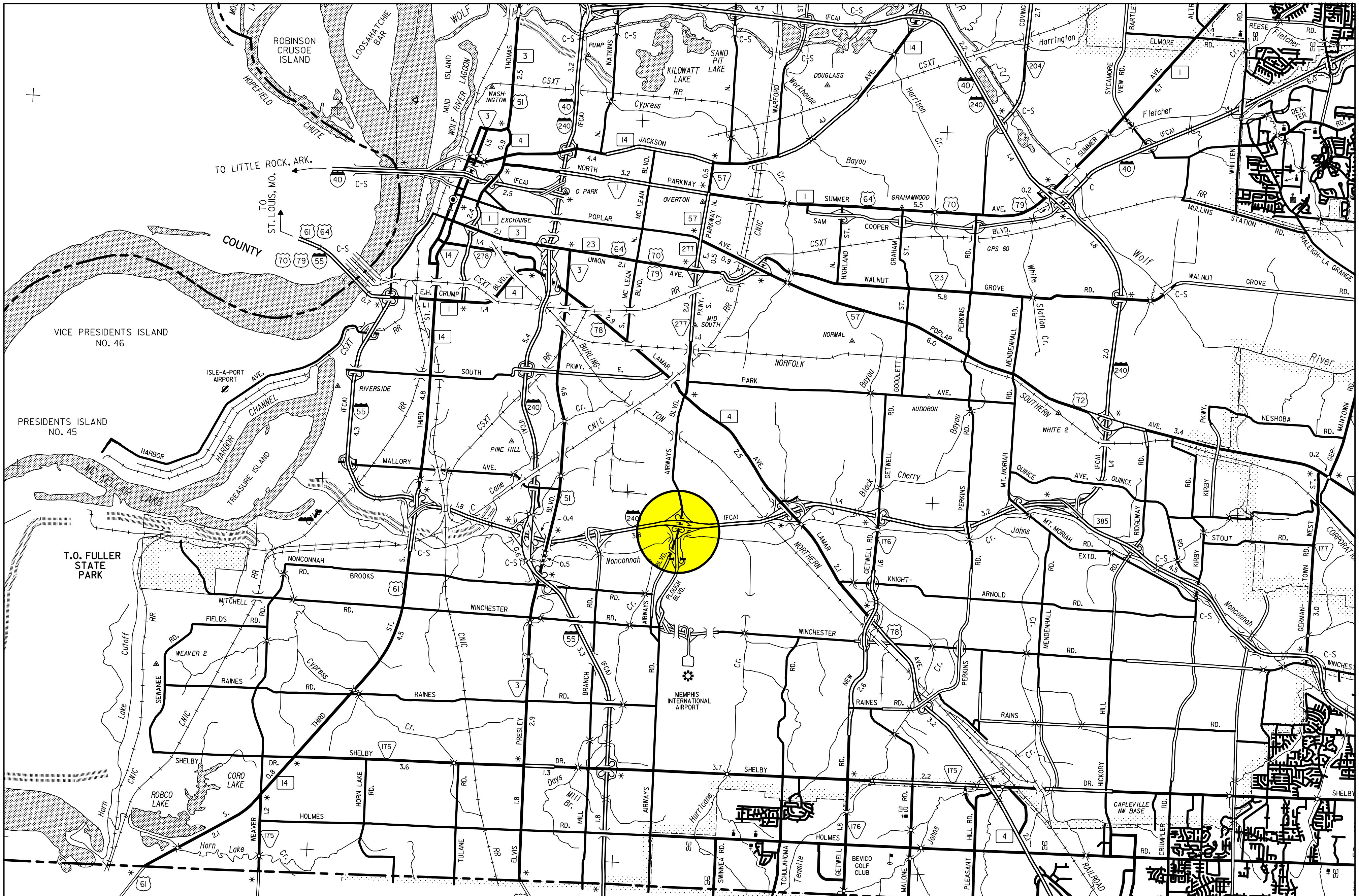


Photo 4 – Old Defense Depot Site in relation to the Project

Nonconnah Creek is located directly south of the interchange and currently three structures carrying either ramps or Airways Boulevard cross the creek.

Considerable congestion occurs throughout the study area for several reasons:

1. Minimal design speed loop ramps
2. Insufficient freeway and ramp laneage
3. Large traffic volumes (approximately 171,000 AADT in the design year)
4. Multiple weave sections associated with entrance and exit ramps
5. Heavy truck traffic



INTERCHANGE MODIFICATION STUDY
INTERSTATE 240 AND AIRWAYS BLVD
SHELBY COUNTY, MEMPHIS, TENNESSEE

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FIGURE 1
VICINITY MAP
SCALE 1"=2 MILES

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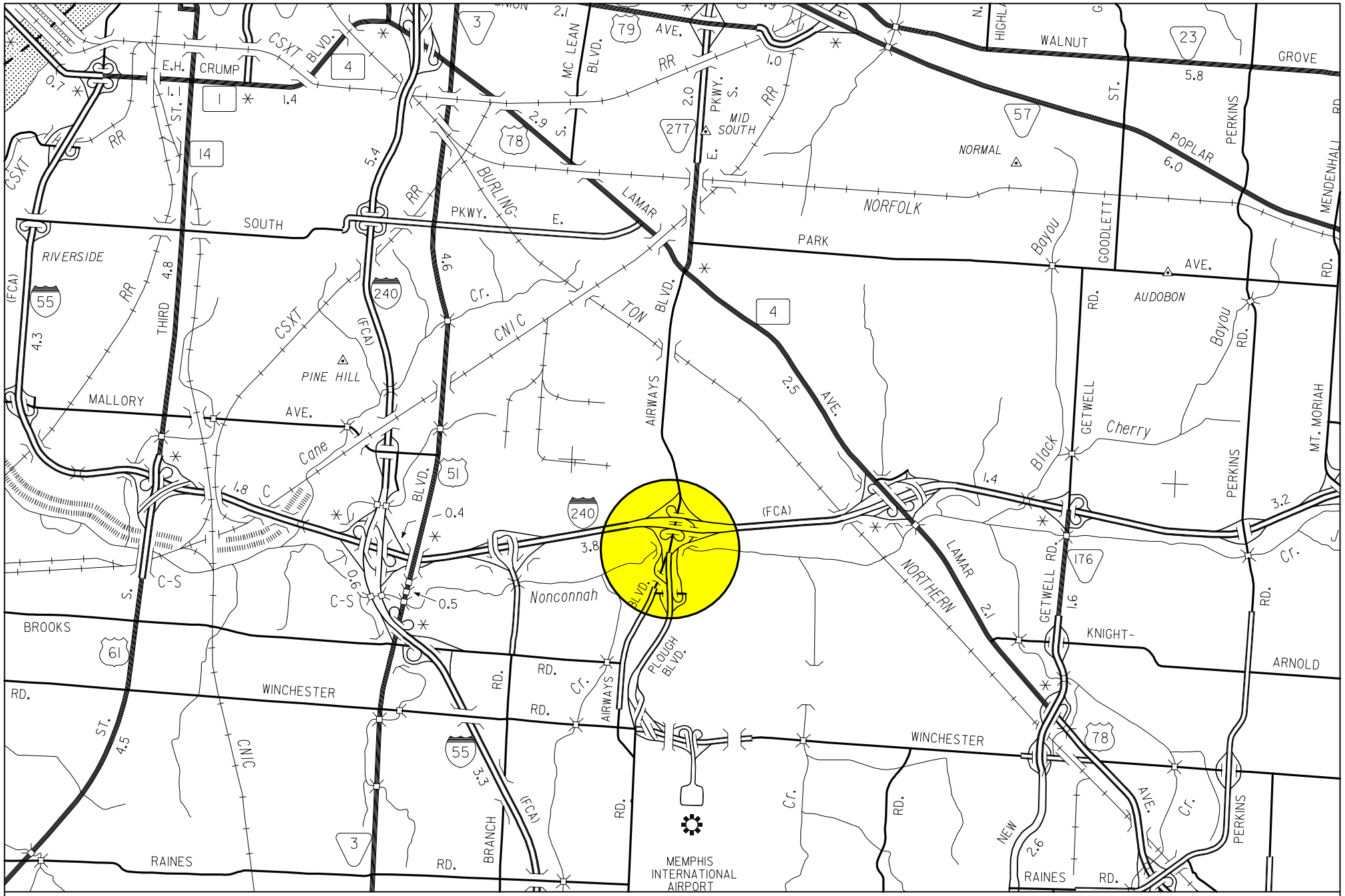

INTERCHANGE MODIFICATION STUDY
INTERSTATE 240 AND AIRWAYS BLVD
SHELBY COUNTY, MEMPHIS, TENNESSEE

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FIGURE 2
VICINITY MAP
SCALE 1"=1 MILE

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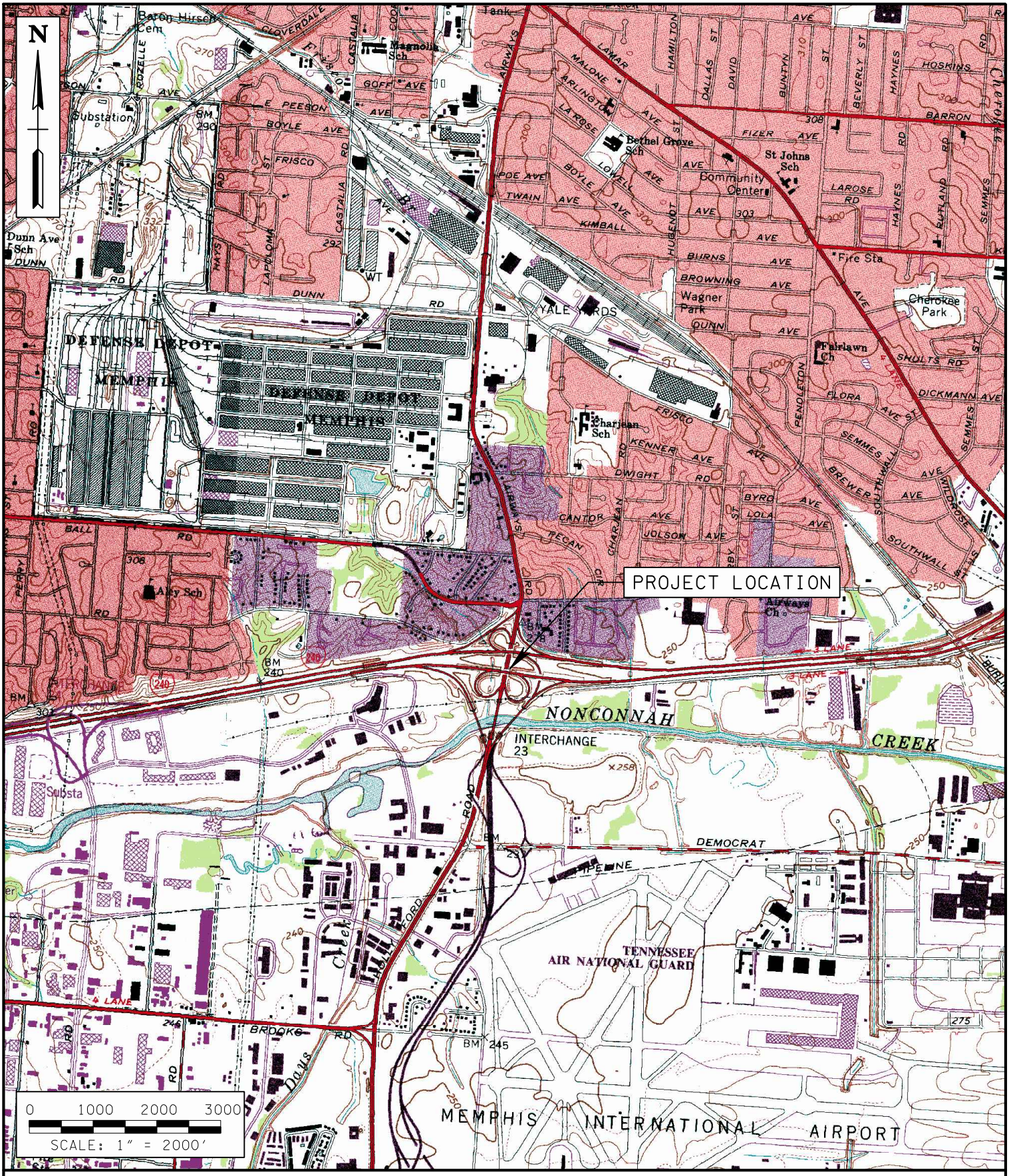


FIGURE 3

INTERCHANGE MODIFICATION STUDY
INTERSTATE 240 AND AIRWAYS BLVD
SHELBY COUNTY, MEMPHIS, TENNESSEE

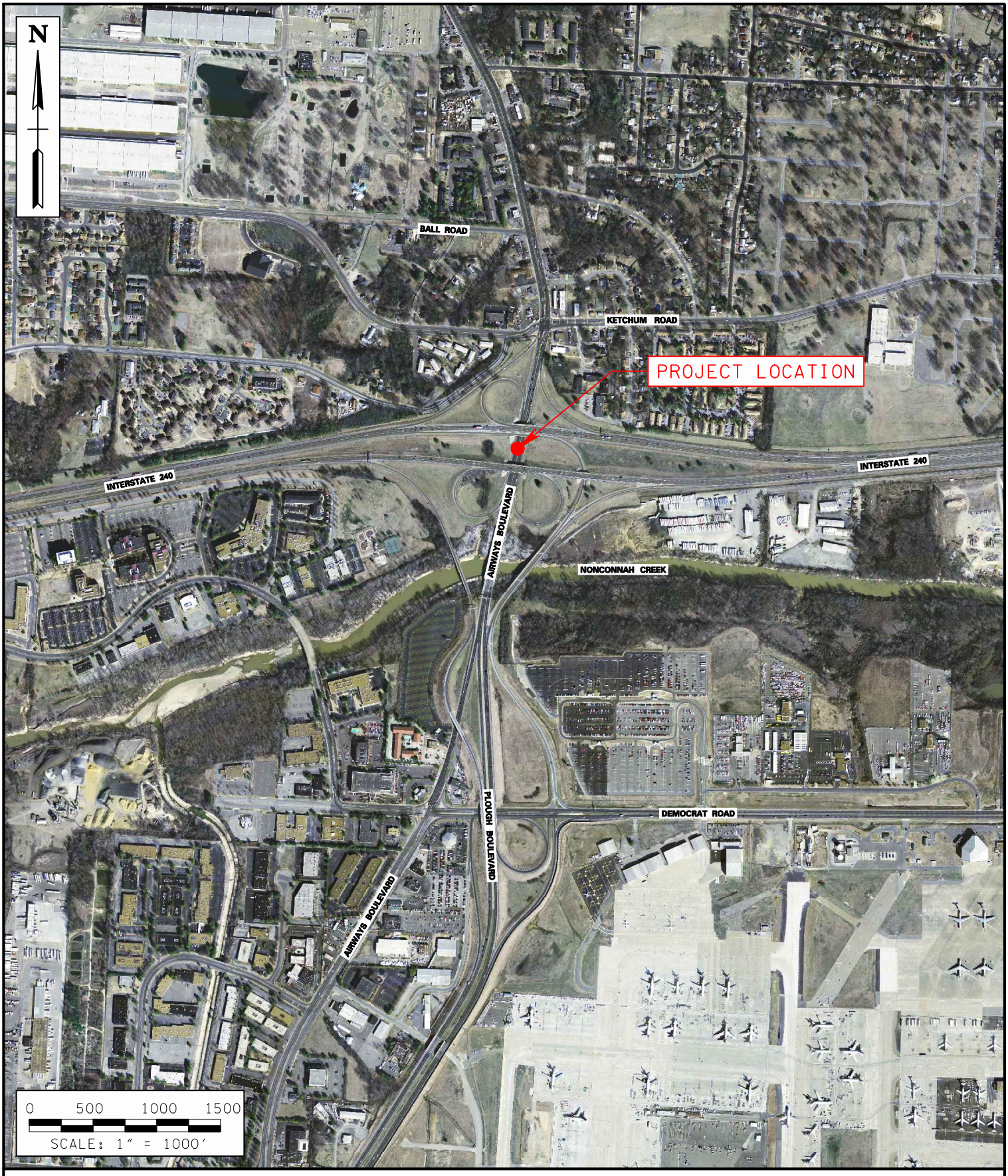


FIGURE 4

INTERCHANGE MODIFICATION STUDY
INTERSTATE 240 AND AIRWAYS BLVD
SHELBY COUNTY, MEMPHIS, TENNESSEE

C. Relationship to Other Highway Improvement Programs and Plans

Interstate 240 is listed in the Memphis/Shelby County MPO Long Range Thoroughfare Plan for improvements (widening) from I-55 to US 78 (Lamar Avenue) in the year 2016. Also listed in the same horizon year are improvements for the interchange of Plough Boulevard and Winchester Road, south of the Airways Boulevard Interchange.

CHAPTER 2

Preliminary Planning Data

A. Land Use

The land use in the vicinity of the study area is a mixture of various commercial, industrial and residential developments. It includes hotels, industrial and manufacturing facilities, as well as the Memphis International Airport and the FedEx Airport Hub.

B. Traffic Served

The traffic data for this study was supplied by the Tennessee Department of Transportation (TDOT) and was based on proposed land use and existing conditions as well as the Memphis-Shelby County MPO traffic model. The Design Hourly Volumes (DHV) for the years 2012 and 2032 are shown in Appendix A.

Interstate 240 is currently a six-lane section with auxiliary lanes in each direction between the adjacent interchanges. The base year (2012) design hour volumes along I-240 range from 11,900 to 13,500 vehicles per hour. The design year (2032) design hour volumes along I-240 range from 12,500 to 14,400 vehicles per hour.

C. Proposed Modifications

The proposed modifications for the I-240 and Airways Boulevard interchange will improve traffic flow and mobility as well as improve motorist safety. All of the existing weave sections have been eliminated with ramp junctions designed to meet current standards. In addition to these improvements, there will be additional lanes along the mainline of the interstate to provide increased capacity.

The main focus of the proposed improvements is the development of the Single Point Urban Interchange (SPUI). This type of interchange allows for a 'tighter' design area, making it more feasible then the typical Tight Diamond Urban Interchange (TDUI). The SPUI also allows for easier signal coordination because it only requires one signal with three phases to operate.

Important to the development of any major project within a heavily traveled urban corridor, careful attention has been taken to minimize the necessity of additional right-of-way and to avoid relocations of residents or commercial establishments. The proposed improvements in the study area will require some minor additional right-of-way; however, no relocations will be necessary. In order to accomplish this, numerous retaining walls throughout the project area are required.

Below, details of the proposed improvements are outlined and described for each portion of the project area.

Eastbound I-240

For motorists traveling eastbound I-240, one additional travel lane will be developed west of the Airways Boulevard / Plough Boulevard exit ramp. The exit ramp will be redesigned to accommodate all vehicles wishing to access both northbound and southbound Airways Boulevard, as well as southbound Plough Boulevard. Once on the exit ramp, motorists that wish to reach Airways Boulevard will diverge to the left and enter the SPUI. Those motorists that desire to travel southbound on Plough Boulevard or to the Memphis International Airport will travel to the right and cross a proposed three (3) lane structure over Nonconnah Creek before connecting with existing Plough Boulevard just north of Democrat Road. This ramp will also require a new structure over the existing Airways Boulevard.

Westbound I-240

It was determined during review of the project traffic that westbound morning peak hour volumes are extremely high, especially the number of vehicles using the existing loop ramp to travel to southbound Airways Boulevard and southbound Plough Boulevard. With the substandard design speed on this one-lane loop ramp, the ramp is no longer sufficient. The volumes are so high that they will cause the proposed single point interchange to not operate properly. This creates the need for an additional ramp to separate these vehicles and allow them to bypass the proposed traffic signal and still be able to reach Plough Boulevard southbound and/or the Memphis International Airport. This 'fly-over' ramp will tie to the previously mentioned ramp from southbound Airways and the new three (3) lane structure over Nonconnah Creek. The remaining motorists that wish to reach Airways Boulevard would be directed towards the SPUI and their movements would be controlled by the proposed traffic signal.

Airways Boulevard / Plough Boulevard

Airways Boulevard will be widened to maintain six (6) travel lanes throughout the project area. Double left turn lanes will be added at the SPUI to accommodate the volume of vehicles wishing to access eastbound and westbound I-240 at the interchange.

Motorists that are traveling southbound along Airways from north of the interchange and want to continue south towards Plough Boulevard and/or the Memphis International Airport will be directed to the proposed two lane ramp just south of the intersection with Ketchum Road. This new ramp will allow the heavy volume of vehicles to bypass the single point intersection and minimize their travel time. The two travel lanes will 'fly-over' the mainline interstate just west of the SPUI and will merge with the new structure over Nonconnah Creek mentioned previously.

Democrat Road

There are no direct improvements along Democrat Road, but the entrance ramp located south of the project interchange has been altered slightly. Those wishing to access I-240 eastbound will no longer have to deal with any weaving traffic traveling from Plough Boulevard. Access to I-240, Airways Boulevard, and Plough Boulevard will remain as currently signed.

D. Discussion of Constructability

An important factor in the planning process is determining the constructability of the proposed improvements. Special care should be taken to minimize the impact to motorists that will continue to travel through the project area during construction. The following is one possible concept for staging the construction. The yellow shading depicts the proposed construction for each phase and the orange shading refers to the existing to remain segments or sections that were constructed in a prior phase.

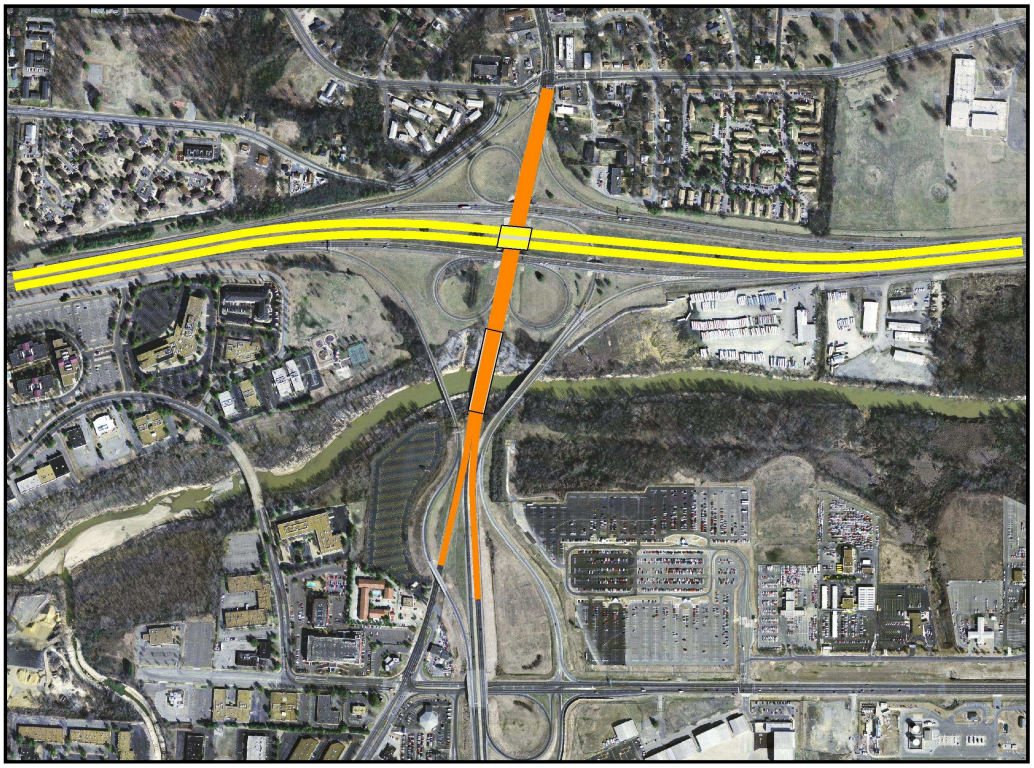


Photo 5 – Phase 1 Construction

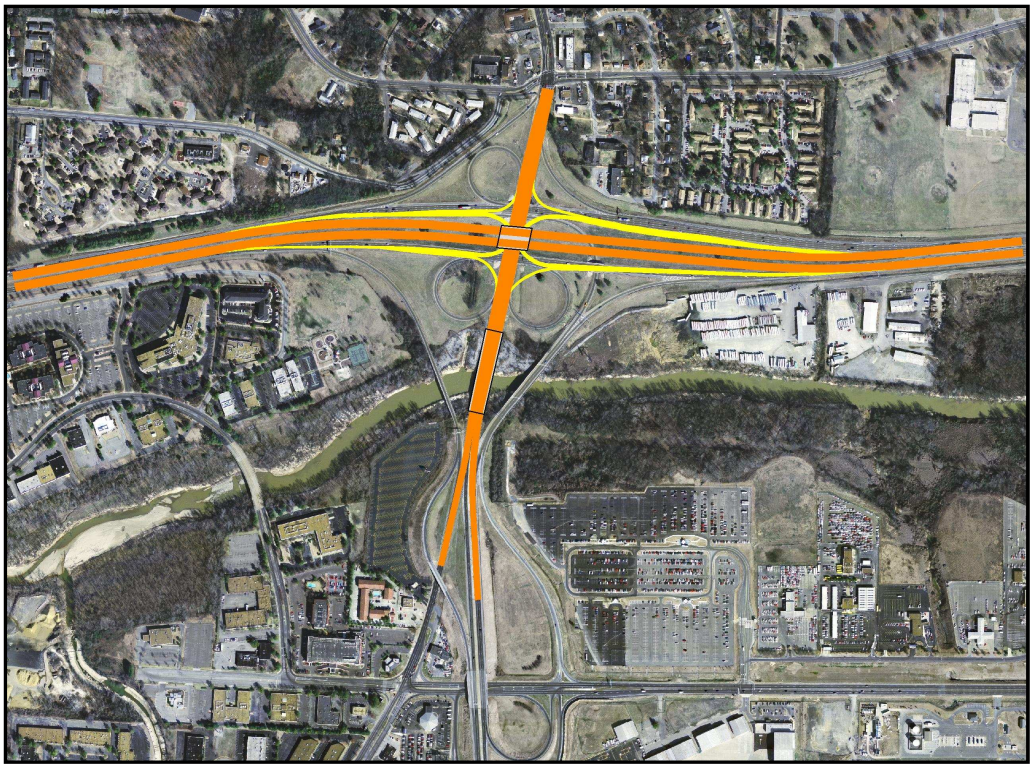


Photo 6 – Phase 2 Construction

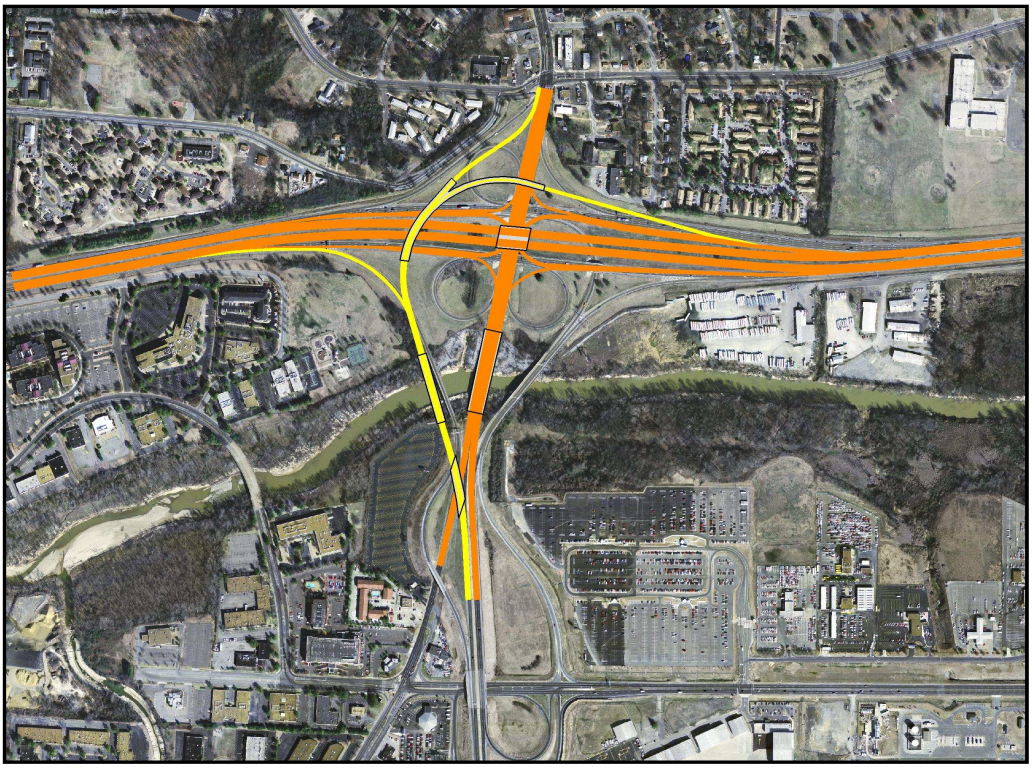


Photo 7 – Phase 3 Construction

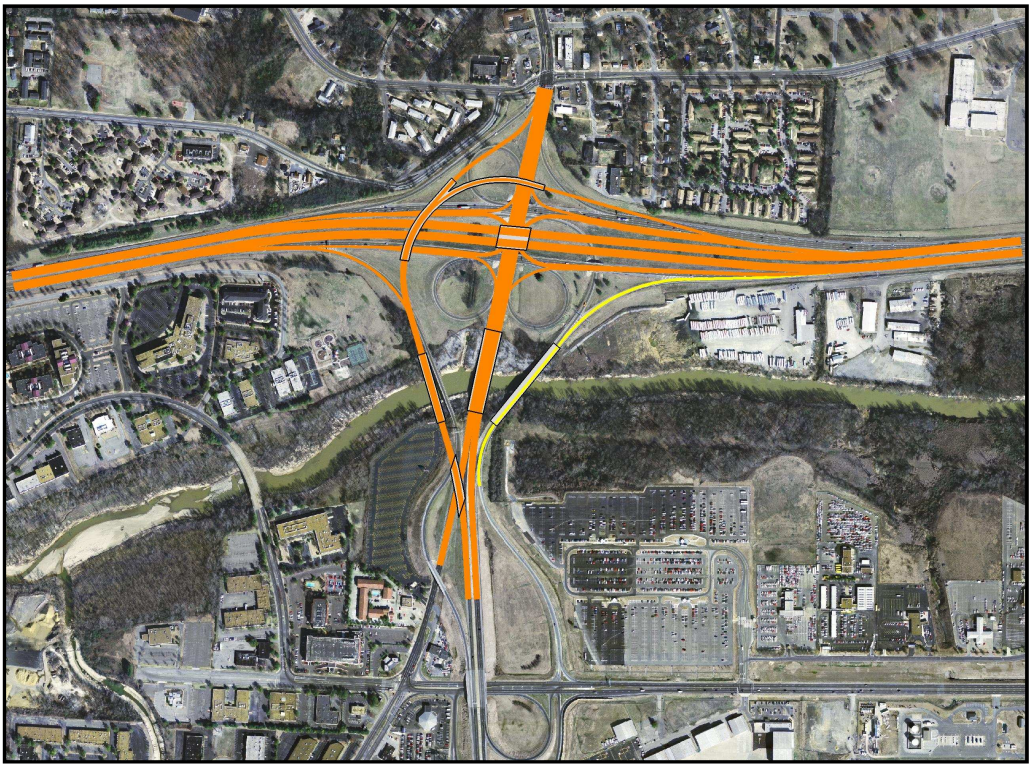


Photo 8 – Phase 4 Construction (Final)

E. Discussion of Initial Concepts

Several concepts to improve the safety and operational inadequacies of the existing I-240 and Airways Boulevard interchange were assessed. During a meeting on Wednesday, April 18, 2007, it was decided that only one option would be carried forward in the planning process (functional plans, cost estimates, etc.)

The following is a brief description of each of the initial concepts as well as the determination of further development. Conceptual plans are contained in Appendix E of this study.

Concept A

Concept A investigated the implication of creating a single point interchange in the project area. A Single Point Urban Interchange (SPUI) requires less overall space to operate than a standard diamond interchange in the same location. A SPUI allows for easy signal coordination because it only requires a single signal with three-phase operations.

It was determined that the high volume of vehicles traveling westbound on I-240 that desire to travel southbound on either Airways Boulevard or Plough Boulevard would exceed the capacity of the single point interchange. Concept A removes those vehicles from the single point and provides a new flyover ramp to southbound Plough Boulevard. Those vehicles wishing to travel to southbound Airways Boulevard would still use the existing loop ramp. Unfortunately, with this

concept, the single point interchange does not perform adequately due to the high volume of vehicles traveling southbound on Airways Boulevard from north of the interchange.

Concept B

Concept B was developed as a modification to Concept A. The loop ramp from Concept A that served vehicles traveling westbound on I-240 wishing to reach southbound Airways Boulevard has been removed. These vehicles have been brought into the single point interchange design. The major difference between Concept A and Concept B is the addition of a two lane ramp to remove the large number of southbound travelers from the single point interchange. This ramp provides a route for vehicles to travel from north of the interchange to southbound Plough Boulevard without entering the proposed signalized intersection.

Based upon agency review meetings early in the process, it was determined that this concept be carried forward as the proposed recommended improvements.

Concept C

Concept C was developed to provide improvements to the existing system with minimal impacts at the least cost. The median for the mainline of I-240 would be reduced and both the westbound and eastbound lanes would be shifted into this existing grass median area. This shift would allow for the existing eastbound lanes to be used as a frontage road or collector-distributor road, thus reducing the number of conflict points along the mainline of the interstate. This centerline shift also allows the entrance ramp from Airways Boulevard/Democrat Road that currently joins westbound I-240 from the left to travel underneath the entire interstate section and join westbound I-240 as a right-hand merge as typically desired for ramp junctions.

The existing loop ramp that allows vehicles traveling southbound on Airways Boulevard to enter I-240 eastbound would be removed. This movement would be assigned to a new ramp that travels from the westbound on ramp (from southbound Airways Boulevard) underneath the new I-240 mainline and join the newly designated collector-distributor road mentioned previously.

Due to the high volume of traffic traveling westbound on I-240 towards Plough Boulevard southbound, it is necessary to improve the current loop ramp from one lane to two lanes.

Concept C-1

Concept C-1 was developed from the improvements as outlined in Concept C, with modifications to the westbound and eastbound exit ramps. The two lane loop ramp concept was removed and replaced with a two lane flyover ramp. This proposed flyover would allow vehicles traveling westbound a means to reach southbound Airways and Plough Boulevards with minimal reduction in speed.

The eastbound exit ramp was altered to require drivers to choose their destination earlier. The ramp would still provide access to both Airways Boulevard and Plough Boulevard, however this modification would separate the volumes between two ramp segments. This design would require two additional structures to be built over Nonconnah Creek.

After further evaluation, this concept was refined and developed into Concept C-2 as described below.

Concept C-2

Concept C-2 was developed to analyze the impact of the Democrat Road interchange on the project area. Democrat Road currently provides access to the rental car businesses for Memphis International Airport and the FedEx Airport Hub.

This concept includes all of the improvements of Concept C-1 and contains additional improvements that modify access to and from Democrat Road as well as to both eastbound and westbound I-240. Vehicles traveling northbound along Plough Boulevard wishing to reach I-240 are routed off of Plough Boulevard at the Democrat Road exit ramp and are then allowed to make their choice as to eastbound or westbound without any weaving maneuvers. Those wishing to reach I-240 from Democrat Road will use the existing ramp which has been modified to remove any weaving maneuvers.

While this concept improves the operation of the project interchange as well as the entrance and exit ramps connecting Democrat Road, the proposed improvements include numerous new structures and additional right-of-way. It is anticipated that construction costs of this concept would be significantly higher than the other concepts investigated. In addition to the costs associated with this concept, the proposed improvements would likely be difficult from both a directional signing and driver expectancy stand-point. Because this interchange area serves as a “gateway” to the airport, it is likely that numerous drivers unfamiliar with the area travel through this area and would find this concept difficult to safely maneuver.

F. Environmental Concerns

The Tennessee Department of Transportation will perform all necessary studies including ecological and historical studies. At the current time, the proposed design does not appear to impact any areas of environmental or historical significance.

CHAPTER 3

Engineering Investigations

A. Traffic Operations

An initial analysis was made which determined that the existing interchange configuration was inadequate to handle the projected base and design year volumes. Appendix B contains figures summarizing the levels-of-service under the existing conditions for the years 2012 and 2032. The levels-of-service were determined using the peak hour volumes which represent the worst case condition for each location.

Existing Roadway Network

The capacity analyses of the existing ramp junctions of the study interchange are summarized below in Table 1 for the base year and design year (2032).

TABLE 1

CAPACITY ANALYSES OF RAMP JUNCTIONS OF THE STUDY INTERCHANGE

Ramp Junctions	Year 2012	Year 2032
EB I-240 Exit to SB Airways Boulevard (AM)	F	F
EB I-240 Exit to SB Airways Boulevard (PM)	E	F
EB I-240 Entrance from NB Airways Boulevard (AM)	see note	see note
EB I-240 Entrance from NB Airways Boulevard (PM)	see note	see note
WB I-240 Entrance from SB Airways Boulevard (AM)	B	B
WB I-240 Entrance from SB Airways Boulevard (PM)	B	B
WB I-240 Entrance from NB Airways Boulevard (AM)	D	D
WB I-240 Entrance from NB Airways Boulevard (PM)	F	F
WB I-240 Exit to SB Airways Boulevard (AM)	see note	see note
WB I-240 Exit to SB Airways Boulevard (PM)	see note	see note
WB I-240 Exit to NB Airways Boulevard (AM)	D	E
WB I-240 Exit to NB Airways Boulevard (PM)	D	D

Note: Some ramp junctions within the study area result in a lane addition or lane drop. Analyses for these locations are shown in Table 2.

As shown in Table 1, several of the ramp junctions will experience levels-of-service of D or worse in the design year.

In addition to the ramp junctions shown in Table 1, two ramp locations of the study interchange include a ramp that is associated with a lane addition or a lane drop on I-240.

The Highway Capacity Manual (HCM) states in Chapter 25 that capacity of lane additions and lane drops are governed by geometry and should be analyzed as ramp roadways.

The information in Exhibit 25-3 of the HCM indicates that a free-flow single-lane ramp has a capacity of 2,000 vehicles per hour. Table 2 includes the projected traffic volumes on each ramp which results in a lane addition or lane drop on I-240 at the Airways Boulevard interchange.

TABLE 2

CAPACITY ANALYSES AT RAMP JUNCTIONS
WHICH RESULT IN A LANE ADDITION OR LANE DROP

Location	# of lanes	capacity (vph)	Year 2012	Year 2032
EB I-240 Entrance from NB Airways Boulevard (AM)	1	2,000	978	1,174
EB I-240 Entrance from NB Airways Boulevard (PM)	1	2,000	1,572	1,886
WB I-240 Exit to SB Airways Boulevard (AM)	1	2,000	1,834	2,201
WB I-240 Exit to SB Airways Boulevard (PM)	1	2,000	1,023	1,228

The results of these analyses indicate that, with the existing roadway network, the traffic projected to use the westbound exit ramp to southbound Airways Boulevard will exceed the capacity of the ramp by the year 2032. The remaining ramp which currently results in a lane addition has adequate capacity to accommodate the traffic volumes projected on the existing roadway network in the Years 2012 and 2032.

In addition to the analyses performed at the study interchange, capacity analysis has also been performed on the adjacent interchanges of Mill Branch and US-78 (Lamar Avenue). Table 3 summarizes the operation of the base and design year ramp junctions based upon the existing roadway network.

TABLE 3

CAPACITY ANALYSES OF RAMP JUNCTIONS OF ADJACENT INTERCHANGES

Ramp Junctions	Year 2012	Year 2032
EB I-240 Exit to Mill Branch (AM)	see note	see note
EB I-240 Exit to Mill Branch (PM)	see note	see note
EB I-240 Entrance from Mill Branch (AM)	F	F
EB I-240 Entrance from Mill Branch (PM)	E	F
EB I-240 Exit to Lamar Avenue (AM)	D	D
EB I-240 Exit to Lamar Avenue (PM)	D	D
EB I-240 Entrance from Lamar Avenue (AM)	see note	see note
EB I-240 Entrance from Lamar Avenue (PM)	see note	see note

WB I-240 Exit to Lamar Avenue (AM)	C	D
WB I-240 Exit to Lamar Avenue (PM)	C	C
WB I-240 Entrance from Lamar Avenue (AM)	see note	see note
WB I-240 Entrance from Lamar Avenue (PM)	see note	see note
WB I-240 Exit to Mill Branch (AM)	E	E
WB I-240 Exit to Mill Branch (PM)	F	F
WB I-240 Entrance from Mill Branch (AM)	D	D
WB I-240 Entrance from Mill Branch (PM)	F	F

Note: Some ramp junctions within the study area result in a lane addition or lane drop. Analyses for these locations are shown in Table 4.

As shown in Table 3, three of the ramp junctions will experience levels-of-service of D or worse in the design year.

In addition to the ramp junctions shown in Table 3, three ramp locations of the adjacent interchanges include a ramp that is associated with a lane addition or a lane drop on I-240. The results of the analysis of these lane additions and lane drops indicate that acceptable operation can be expected for both the base and design years.

TABLE 4

CAPACITY ANALYSES AT RAMP JUNCTIONS
WHICH RESULT IN A LANE ADDITION OR LANE DROP

Location	# of lanes	capacity (vph)	Year 2012	Year 2032
EB I-240 Exit to Mill Branch (AM)	1	2,000	748	788
EB I-240 Exit to Mill Branch (PM)	1	2,000	438	462
EB I-240 Entrance from Lamar Avenue (AM)	2	3,800	893	952
EB I-240 Entrance from Lamar Avenue (PM)	2	3,800	1,337	1,425
WB I-240 Entrance from Lamar Avenue (AM)	1	2,000	1,317	1,404
WB I-240 Entrance from Lamar Avenue (PM)	1	2,000	1,247	1,329

Capacity analyses were conducted for the existing weaving movements within the study area, and these results are shown in Table 5. The analyses show that all of the existing weaving sections will operate at poor LOS in the base year 2012, as well as the design year 2032.

TABLE 5

CAPACITY ANALYSES AT WEAVING AREAS

Weaving Section	Year 2012	Year 2032
EB I-240 Between SB Airways On Ramp and NB Airways Off Ramp (AM)	F	F
EB I-240 Between SB Airways On Ramp and NB Airways Off Ramp (PM)	F	F
SB Airways Boulevard Between WB I-240 Off Ramp and EB I-240 On Ramp (AM)	F	F
SB Airways Boulevard Between WB I-240 Off Ramp and EB I-240 On Ramp (PM)	C	D
EB and WB I-240 On Ramp from NB Airways Boulevard (AM)	C	D
EB and WB I-240 On Ramp from NB Airways Boulevard (PM)	E	F

The results of the capacity analyses for the freeway segments within the study area are shown in Table 6. These results indicate that three of the four freeway segments are projected to operate at an unacceptable LOS in the Year 2032, based on the existing roadway network.

TABLE 6

CAPACITY ANALYSES OF FREEWAY SEGMENTS WITHIN THE STUDY AREA

Freeway Segments	Year 2012	Year 2032
EB I-240 West of Airways Boulevard (AM)	E	F
EB I-240 West of Airways Boulevard (PM)	E	E
EB I-240 East of Airways Boulevard (AM)	D	D
EB I-240 East of Airways Boulevard (PM)	D	D
WB I-240 West of Airways Boulevard (AM)	D	E
WB I-240 West of Airways Boulevard (PM)	E	F
WB I-240 East of Airways Boulevard (AM)	D	E
WB I-240 East of Airways Boulevard (PM)	D	D
EB I-240 At Mill Branch (AM)	D	D
EB I-240 At Mill Branch (PM)	D	D
EB I-240 At Lamar Avenue (AM)	D	D
EB I-240 At Lamar Avenue (PM)	E	E

WB I-240 At Mill Branch (AM)	C	C
WB I-240 At Mill Branch (PM)	D	E
WB I-240 At Lamar Avenue (AM)	E	E
WB I-240 At Lamar Avenue (PM)	D	E

Table 7 below summarizes the capacity analyses results for existing intersections within the project area. These results indicate that two of the three intersections are projected to operate at an unacceptable LOS in the Year 2032, based on the existing roadway network.

TABLE 7

CAPACITY ANALYSES OF EXISTING INTERSECTIONS

INTERSECTION	Year 2012	Year 2032
Airways Boulevard & Ketchum Road (AM)	F	F
Airways Boulevard & Ketchum Road (PM)	E	F
Airways Boulevard & Democrat Road (AM)	D	E
Airways Boulevard & Democrat Road (PM)	D	E
Democrat Road & Plough Blvd/I-240 Ramps (AM)	B	C
Democrat Road & Plough Blvd/I-240 Ramps (PM)	B	C

PROPOSED ROADWAY NETWORK

The results of the capacity analyses conducted for the proposed roadway network are shown in the following tables.

TABLE 8

CAPACITY ANALYSES OF RAMP JUNCTIONS OF THE STUDY INTERCHANGE

Ramp Junctions	Year 2012	Year 2032
EB I-240 Exit to SB Plough Boulevard (AM)	B	C
EB I-240 Exit to SB Plough Boulevard (PM)	B	B
EB I-240 Entrance from Airways Boulevard / Democrat Road (AM)	C	C
EB I-240 Entrance from Airways Boulevard / Democrat Road (PM)	C	C
WB I-240 Entrance from Airways Boulevard (AM)	C	C
WB I-240 Entrance from Airways Boulevard (PM)	C	C
WB I-240 Exit to Airways Boulevard / Plough Boulevard (AM)	D	F
WB I-240 Exit to Airways Boulevard / Plough Boulevard (PM)	C	C

In addition to the analyses performed at the study interchange, capacity analysis has also been performed on the adjacent interchanges of Mill Branch and US-78 (Lamar Avenue). Table 9 summarizes the operation of the base and design year ramp junctions based upon the proposed improvements for the I-240 and Airways Boulevard interchange as well as the future widening of I-240 from the I-55 interchange to the US-78 interchange.

TABLE 9

CAPACITY ANALYSES OF RAMP JUNCTIONS OF ADJACENT INTERCHANGES

Ramp Junctions	Year 2012	Year 2032
EB I-240 Exit to Mill Branch (AM)	see note	see note
EB I-240 Exit to Mill Branch (PM)	see note	see note
EB I-240 Entrance from Mill Branch (AM)	B	B
EB I-240 Entrance from Mill Branch (PM)	B	B
EB I-240 Exit to Lamar Avenue (AM)	D	D
EB I-240 Exit to Lamar Avenue (PM)	D	D
EB I-240 Entrance from Lamar Avenue (AM)	see note	see note
EB I-240 Entrance from Lamar Avenue (PM)	see note	see note
WB I-240 Exit to Lamar Avenue (AM)	C	D
WB I-240 Exit to Lamar Avenue (PM)	C	C
WB I-240 Entrance from Lamar Avenue (AM)	see note	see note

WB I-240 Entrance from Lamar Avenue (PM)	see note	see note
WB I-240 Exit to Mill Branch (AM)	D	E
WB I-240 Exit to Mill Branch (PM)	E	E
WB I-240 Entrance from Mill Branch (AM)	D	D
WB I-240 Entrance from Mill Branch (PM)	F	F

Note: Some ramp junctions within the study area result in a lane addition or lane drop. Analyses for these locations are shown in Table 10.

TABLE 10

CAPACITY ANALYSES AT RAMP JUNCTIONS WHICH RESULT IN A LANE ADDITION OR LANE DROP

Location	# of lanes	capacity (vph)	Year 2012	Year 2032
EB I-240 Exit to Mill Branch (AM)	1	2,000	748	788
EB I-240 Exit to Mill Branch (PM)	1	2,000	438	462
EB I-240 Entrance from Lamar Avenue (AM)	2	3,800	893	952
EB I-240 Entrance from Lamar Avenue (PM)	2	3,800	1,337	1,425
WB I-240 Entrance from Lamar Avenue (AM)	1	2,000	1,317	1,404
WB I-240 Entrance from Lamar Avenue (PM)	1	2,000	1,247	1,329

As shown in Tables 9 and 10, nine of the eleven ramp junctions will experience levels-of-service of D or better in the design year with improved operation provided by the additional capacity the future widening of I-240 will provide.

The results of the capacity analyses for the freeway segments within the study area are shown in Table 11.

TABLE 11

CAPACITY ANALYSES OF FREEWAY SEGMENTS

Freeway Segments	Year 2012	Year 2032
EB I-240 West of Airways Boulevard (AM)	C	D
EB I-240 West of Airways Boulevard (PM)	C	C
EB I-240 @ Airways Boulevard (AM)	C	C
EB I-240 @ Airways Boulevard (PM)	C	C
EB I-240 East of Airways Boulevard (AM)	D	D
EB I-240 East of Airways Boulevard (PM)	D	D

WB I-240 West of Airways Boulevard (AM)	C	C
WB I-240 West of Airways Boulevard (PM)	D	D
WB I-240 @ Airways Boulevard (AM)	C	C
WB I-240 @ Airways Boulevard (PM)	C	C
WB I-240 East of Airways Boulevard (AM)	D	E
WB I-240 East of Airways Boulevard (PM)	D	D
EB I-240 At Mill Branch (AM)	C	C
EB I-240 At Mill Branch (PM)	C	C
EB I-240 At Lamar Avenue (AM)	D	D
EB I-240 At Lamar Avenue (PM)	E	E
WB I-240 At Mill Branch (AM)	B	B
WB I-240 At Mill Branch (PM)	C	C
WB I-240 At Lamar Avenue (AM)	E	E
WB I-240 At Lamar Avenue (PM)	D	E

Capacity analyses were conducted for the new single point interchange that is included within the proposed roadway network, and these results are shown in Table 12. The analyses show that the signal will operate at acceptable levels of service in the base year and in the year 2022, which is the typical ten-year design horizon for urban signalization. Also shown in the table below is the LOS for the Democrat Road intersection with the Plough Blvd/I-240 Ramps with the altered traffic patterns due to proposed improvements. The two remaining intersections LOS were not changed by the modifications and are not listed in the table.

TABLE 12

CAPACITY ANALYSES OF PROPOSED INTERSECTIONS

INTERSECTION	Year 2012	Year 2032
Single Point Interchange I-240 & Airways Boulevard (AM)	C	C
Single Point Interchange I-240 & Airways Boulevard (PM)	C	C
Democrat Road & Plough Blvd/I-240 Ramps (AM)	B	C
Democrat Road & Plough Blvd/I-240 Ramps (PM)	B	D

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.

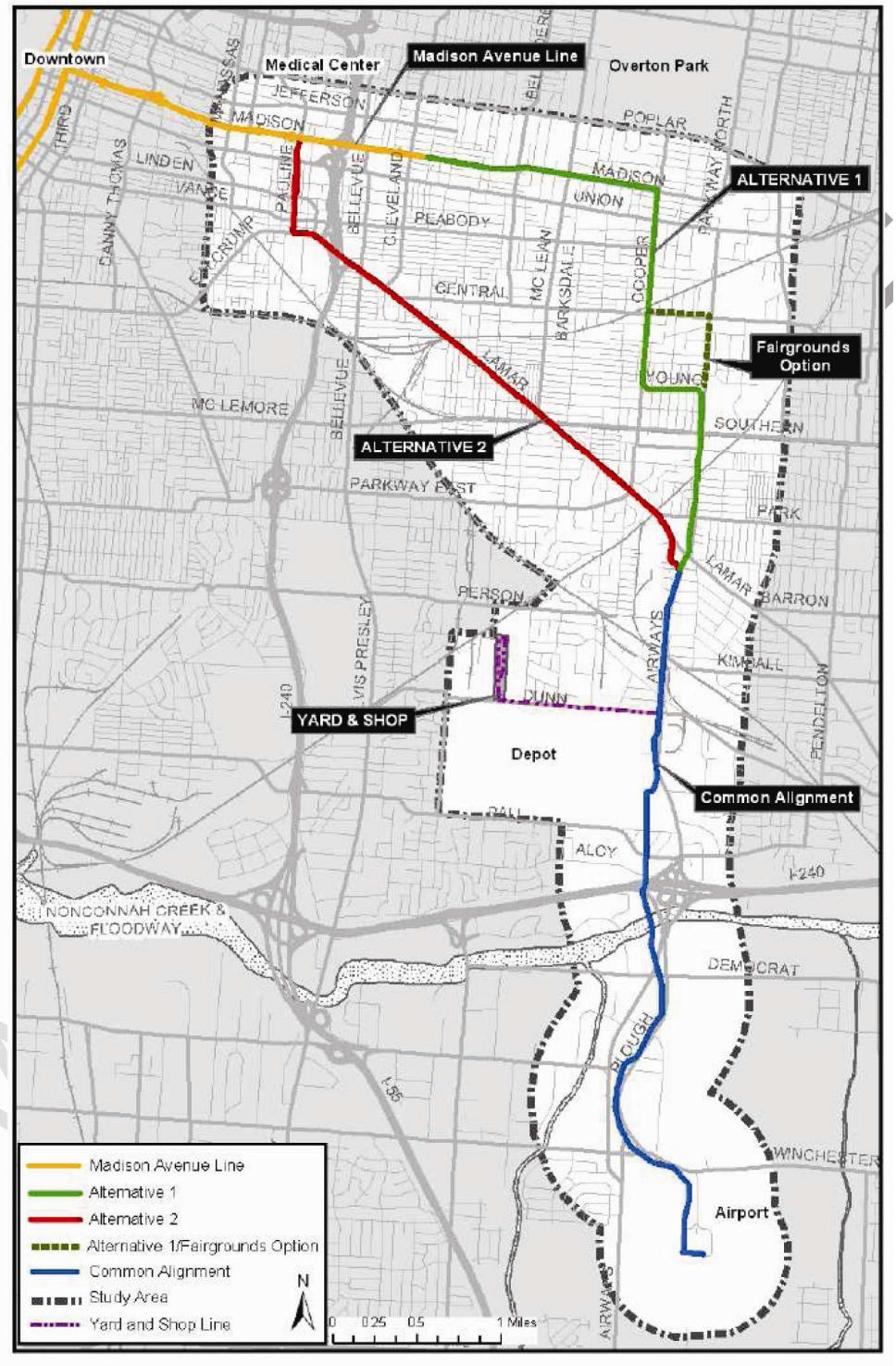
The existing interchange serves as a primary route to Memphis International Airport and the FedEx hub and is instrumental in moving traffic to/from these major regional destinations. In 2008, almost 3.7 million metric tons of cargo moved through Memphis International Airport again making this facility the world's busiest for cargo shipping. With the continual increase in traffic volumes along I-240, the merge, diverge and weave movements will continue to diminish the operation of the interstate system in the project area. This degradation will result in increased delay, reduced safety, and reduced air quality for the city of Memphis. No minor interchange improvements can be made (other than the recommended improvements) to eliminate the major issues outlined previously in this report.

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.

There were several different design options developed and assessed in this study to improve the operation of the I-240 and Airways Boulevard interchange as discussed in Section E of Chapter 2. However, the proposed concept is the only one that produced the desired levels of service and operational characteristics throughout the interchange.

The proposed modifications will reduce congestion and improve safety by eliminating many of the merge, diverge and weave movements that currently exist in the project area.

It is important to note that the Shelby County MPO is presently in the environmental documentation phase for a future light rail system which would serve to connect the Memphis Central Business District and the Memphis International Airport. Based upon the level of detail developed to date concerning this future light rail corridor, the proposed interchange modifications should not conflict or impact the potential corridor (Common Alignment in blue).



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.

The improvements proposed for this interchange will improve traffic operations through the study area by reducing conflict points and weave sections. The proposed modifications will not have any adverse impact on the safety and operation of the interstate facility. Furthermore, the proposed improvements should enhance safety by eliminating a westbound left hand merge ramp onto I-240 from the south. The I-240 and Mill Branch Interchange is located 1.2 miles west of the IMS location and the I-240 and US-78 (Lamar Avenue) Interchange is located 1.7 miles east of the IMS location. As shown in the analyses performed at both of these adjacent interchanges, no adverse impacts to their operation will occur due to the proposed improvements to the Airways Boulevard interchange.

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 proposal is a modification of the existing interchange at I-240 and Airways Boulevard. The proposed modifications will meet the American Association of State Highway and Transportation Officials (AASHTO) criteria with no design exceptions anticipated. The proposed improvements will maintain access to all local roadways and will provide for all traffic movements.

5. The proposal 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 study was coordinated with the Tennessee Department of Transportation, Shelby County MPO, City of Memphis and the Memphis International Airport Authority. The proposal is consistent with all local, regional, and statewide land use and transportation plans.

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.

As stated previously, Interstate 240 is listed in the Memphis/Shelby County MPO Long Range Thoroughfare Plan for improvements (widening) from I-55 to US 78 in the year 2016, but there are no long-range plans for additional interchanges in this area. The existing interchanges provide adequate access to the subject area.

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 proposed recommended improvements are intended primarily to correct operational inadequacies of the existing configuration; however, the proposed recommend improvements take into account projected traffic volumes due to the projected construction of the ground transportation center and future expansion of the FedEx WorldHub as discussed in Section B of Chapter 1.

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.

The proposed modifications will be submitted to the TDOT Environmental Division to begin environmental studies once this report is approved by the FHWA and funding is available for continued project development.

C. Proposed Interchange Cost

The total cost for the improvement to the I-240 and Airways Boulevard interchange is approximately $34,940,000. An estimated cost breakdown is shown in Appendix C. It is anticipated that the funding sources for the project will include a combination of Federal, State and Local funds.

CHAPTER 4

Summary of Findings and Conclusions

The purpose of this study was to evaluate the existing interchange of Interstate 240 and Airways Boulevard and to request the approval for modifications of this interchange to improve operation and safety. Several viable concepts were initially evaluated and thoroughly investigated.

The traffic analysis indicates that the existing interchange is inadequate to handle the current and design year traffic volumes. The current configuration and the associated weave, merge, and diverge problems severely congest this area. Crash history for the project area shows a high number of angle crashes and rear-end collisions, which are directly attributable to the interchange configuration and heavy traffic volumes.

During this study, numerous concepts for improvement were developed. All of the concepts contained both positive and negative aspects in regards to both access and operation. The proposed improvements recommended in this study provide the best overall operation and safety benefits.

Throughout the development process of the study, officials with the various divisions within the Tennessee Department of Transportation as well as representatives from the Federal Highway Administration, the City of Memphis and Memphis International Airport Authority have shared thoughts and ideas to fashion a proposed plan to provide these needed transportation improvements for the I-240 and Airways Boulevard Interchange.

Because these proposed improvements are substantial and will impact motorists and residents within the City of Memphis for several years during the construction process, the appropriate level of public involvement should begin early and continue throughout the life of this project.