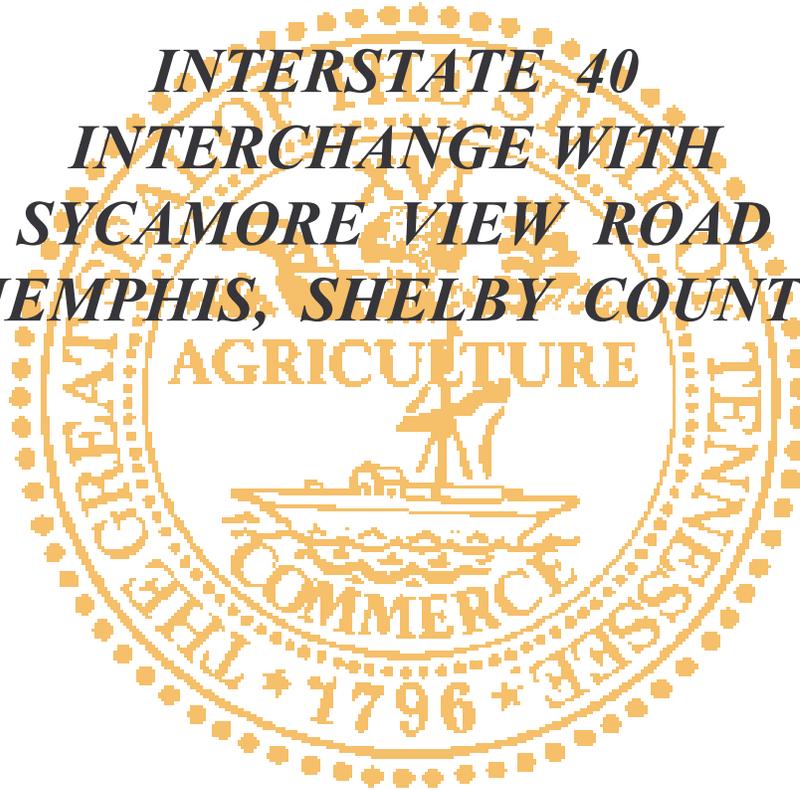


***INTERCHANGE MODIFICATION
STUDY***

***INTERSTATE 40
INTERCHANGE WITH
SYCAMORE VIEW ROAD
MEMPHIS, SHELBY COUNTY***



Prepared By

Parsons Transportation Group Inc.

For

Tennessee Department of Transportation

Planning Division

August, 2004

I-40 at Sycamore View Road Interchange Modification Study

Table of Contents

	Page
Chapter 1 – Introduction	1
Purpose of Study	1
Description of the Area	3
Relationship to Other Highway Improvement Plans and Programs	5
Chapter 2.- Preliminary Planning Data	6
Land Use	6
Traffic Served	7
Interstate 40	7
Sycamore View Road	9
Discussion of Alternatives	10
Environmental Concerns	15
Chapter 3 – Traffic Flow Investigation	16
Interstate 40	16
Eastbound Ramp Junctions	17
Westbound Ramp Junctions	18
Macon Cove	20
Sycamore View Road with Alternate A	20
Sycamore View Road with Alternate C	21
Macon Cove Off-Ramp	22
Cost Estimates	24
Chapter 4 – Access Investigation	25
Chapter 5 – Summary and Conclusions	31

Tables:

Table 2.1 - Capacity Analysis Summary for I-40.	8
Table 3.1 - Interstate 40 Ramps Levels of Service.	19
Table 3.2 - Sycamore View Road Intersections Levels of Service.	21

Figures:

Figure 1 - Vicinity Map	2
Figure 2 - Location Map	4

I-40 at Sycamore View Road Interchange Modification Study

Table of Contents

Appendices:

Appendix A - Intersection of Sycamore View Road and Macon Cove/
Macon Road

Appendix B - Traffic Volume Projections

Appendix C - Definitions of Levels of Service, and
Methodological Notes on Capacity Analysis

Appendix D - Capacity Worksheets for Interstate 40

Appendix E - Intersection Capacity Worksheets for Alternate A

Appendix F - Intersection Capacity Worksheets for Alternate C

Appendix G - Intersection Capacity Worksheets for Macon Cove Ramp

Appendix H - Estimates of Cost

Appendix I - Functional Plans

CHAPTER 1 - INTRODUCTION

Purpose of Study

The purpose of this study is to request approval for modifications to the interchange of Interstate-40 (I-40) with Sycamore View Road. This interchange is located in the eastern portion of the City of Memphis. See Figure 1 for a vicinity map of the project. The study was initiated as a result of Goal Team Two's identification of this location in the list of Interstate System "Choke Points." Goal Team Two was established by the Tennessee Department of Transportation to provide emphasis on its strategic goal of preserving Tennessee's transportation infrastructure and enhancing system capacity with full consideration of social and environmental issues.

At the existing interchange, I-40 is grade-separated over Sycamore View Road. The eastbound ramps are in a diamond configuration, with a traffic signal at the intersection of the eastbound ramps with Sycamore View Road. The westbound ramps feature a loop ramp for the northbound-to-westbound move in the northeast quadrant of the interchange.

Interchange operations are dependent on traffic flow on Sycamore View Road. Currently, there are times when congestion on Sycamore View Road causes queues to back up the ramps onto mainline I-40. The key to any improvement of the interchange will be relief of queue back-up from the congested intersection of Sycamore View Road with Macon Road.

The intersection of Sycamore View Road with Macon Road is a short distance south of the interchange. At peak times, the congestion at the intersection causes queues of waiting vehicles to form that are longer than can be served in one cycle of the traffic signal. When a queue forms on southbound Sycamore View, it interferes with the operation of the intersection of Sycamore View with the eastbound ramps, which results in the formation of a queue on the off-ramp. During afternoon peaks, traffic backs up the ramp onto the mainline of eastbound I-40.

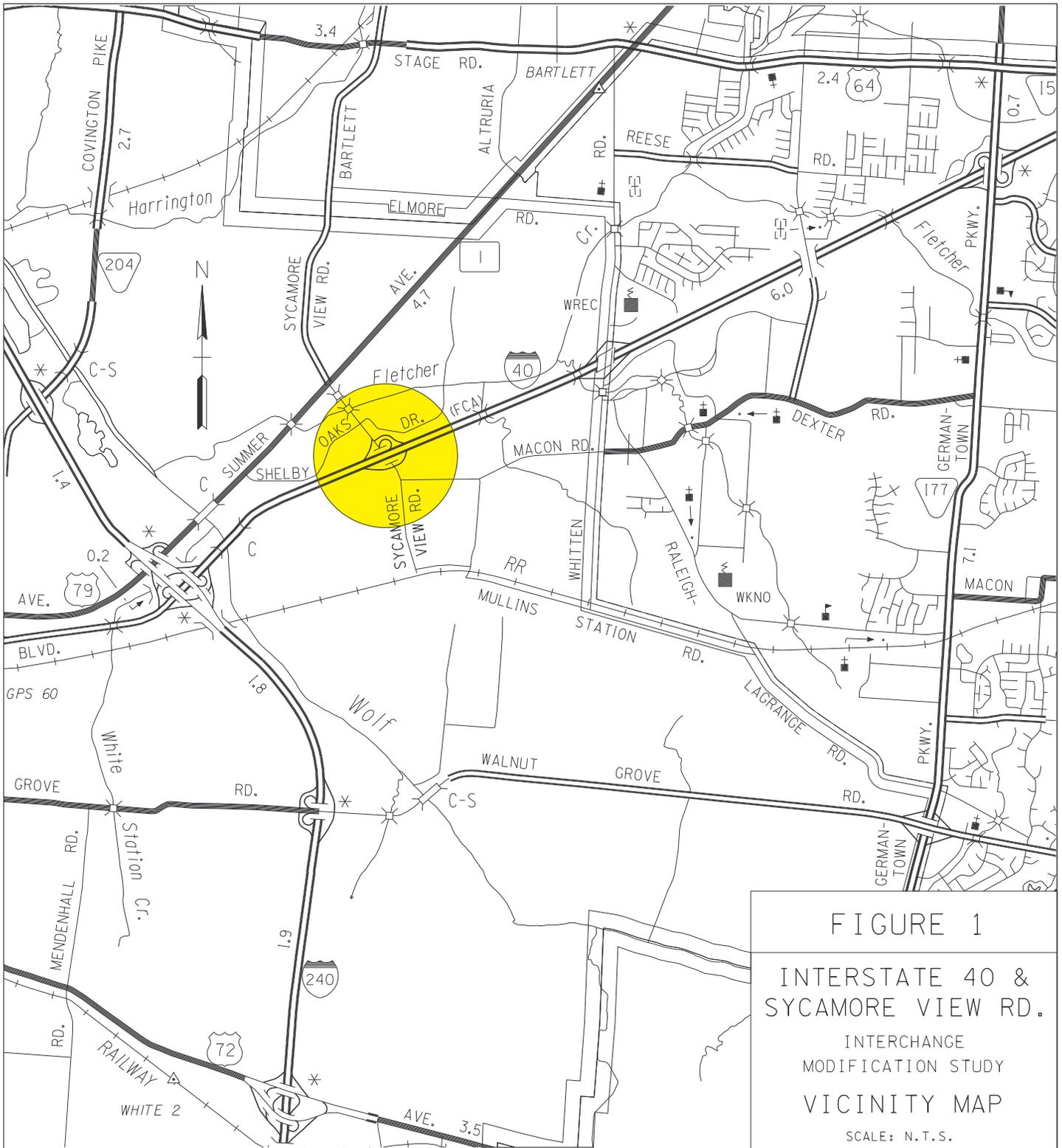


FIGURE 1
 INTERSTATE 40 &
 SYCAMORE VIEW RD.
 INTERCHANGE
 MODIFICATION STUDY
 VICINITY MAP
 SCALE: N.T.S.

At the Sycamore View intersection with Macon Road, there is a major movement of traffic from southbound Sycamore View to eastbound Macon Road. This flow of turning traffic is a higher volume of traffic than the north-and-south through traffic on Sycamore View. The heavy turn volumes are a primary contributor to traffic congestion.

Description of the Area

The project location is shown on Figure 2. The interchange is located along I-40, approximately 1.3 miles northeast of the interchange of I-40 with I-240. In this area, I-40 has four basic lanes in each direction. To the west, there is one auxiliary lane in the westbound direction that runs between the Sycamore View interchange and the interchange with I-240. Also to the west, there are two auxiliary lanes that run in the eastbound direction from the I-240 interchange to the Sycamore View interchange. East of the interchange, I-40 is four lanes in each direction, with the inside lane restricted to High Occupancy Vehicle (HOV) use during peak hours.

In the vicinity of the interchange, Sycamore View Road is a six-lane urban arterial with shoulders. Sycamore View Road serves the communities on either side of I-40 and provides access to Summer Avenue. Summer Avenue is designated as State Route 1, and is also designated as U.S. 64, U.S. 70, and U.S. 79. North of Summer Avenue, Sycamore View Road connects with State Route 15 approximately three miles north of I-40.

Shelby Oaks Drive intersects Sycamore View Road approximately 930 feet north of the north ramp terminal.

South of the interchange, Macon Road intersects Sycamore View Road approximately 780 feet south of the south ramp terminal.

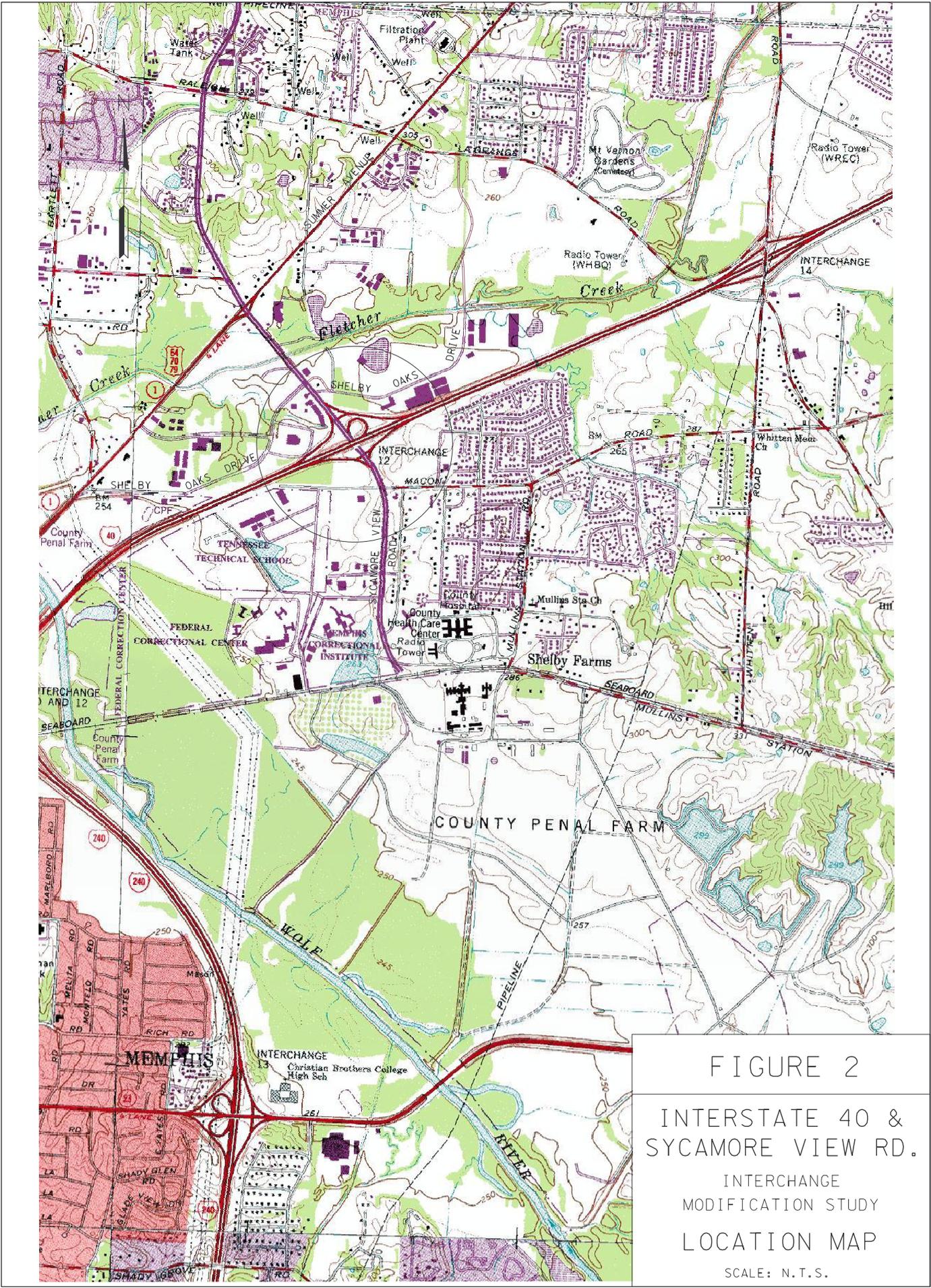


FIGURE 2
 INTERSTATE 40 &
 SYCAMORE VIEW RD.
 INTERCHANGE
 MODIFICATION STUDY
 LOCATION MAP
 SCALE: N.T.S.

Relationship to Other Highway Improvement Plans and Programs

Within the interchange area, I-40 is an urban interstate facility on the National Highway System. The next interchange to the west, with I-240, is currently undergoing a major reconstruction, with construction activity in stages anticipated to continue for several years. On occasion, lane closure tapers may extend as far as the merging/diverging tapers of the west ramps of the Sycamore View Road interchange. There are no other projects currently scheduled by the Tennessee Department of Transportation (TDOT) for the area which would involve the I-40 at Sycamore View Road interchange.

Sycamore View Road is an urban major arterial eligible for Surface Transportation Program funding. The Memphis Area Metropolitan Planning Organization's (MPO) Major Roads Plan, which was last amended in December of 2002, shows Sycamore View Road in the vicinity of the interchange to be a six-lane undivided section with curb and gutter. The Major Roads Plan also shows Macon Road in the future as a six-lane undivided section within an 88-foot wide right-of-way, and I-40 to be an eight-lane divided section.

CHAPTER 2 - PRELIMINARY PLANNING DATA

Land Use

The interchange serves a commercial district that serves residential suburbs to the north and east. Sycamore View Road is the spine of the commercial district. Sycamore View Road is lined with motels, gas stations, strip retail buildings, low-rise office buildings, and grocery store centers. North of the interchange, Shelby Oaks Drive serves suburban office developments on both sides of Sycamore View Road.

South of the interchange, Macon Road serves a retail center on the east side of Sycamore View Road. Further east, the development is single-family residential subdivisions. West of Sycamore View Road is Macon Cove, which serves several small motels, a restaurant, a gas station/convenience market, low-rise office buildings, and a small industrial building. Macon Cove also serves as the primary access route to Southwest Tennessee Community College. Further south on Sycamore View Road are Executive Centre Drive, and Resources Drive, which provide access to office buildings and industrial buildings. Further south on Sycamore View Road are a government office complex and three prisons. To the south of the prisons is Shelby Farms (a very large recreational area), and the Lucius Burch Natural Area.

I-40 and the Wolf River form a barrier to traffic flow in this part of Memphis. For the community that is south of I-40 in this area, there is an access problem. From the Walnut Grove Road interchange on I-240 to the Whitten Road interchange on I-40 is a distance of approximately five miles (measured along the interstate). The only place within this stretch where a motorist can cross the barrier is Sycamore View Road. Thus it may be seen that there is a deficiency in the thoroughfare plan for this area that concentrates a great deal of local traffic through this interchange.

Traffic Served

Traffic data for this study was provided by the Tennessee Department of Transportation, (TDOT). Additional traffic counts were collected by Parsons Transportation Group. Average daily traffic (ADT) and design hourly volumes (DHV) were projected for the years 2005 and 2025. Traffic volume information is contained in Appendix B. The year 2005 ADT on I-40 is projected to be approximately 105,640 vehicles per day (vpd) east of the Sycamore View interchange, and 131,690 vpd west of the interchange. Also, year 2005 ADT on Sycamore View Road is projected to be approximately 54,140 vehicles and 59,550 vehicles south and north of I-40, respectively. By year 2025, the ADT on I-40 east and west of Sycamore View Road is projected to increase to approximately 187,390 vpd and 223,870 vpd, respectively. Year 2025 ADT on Sycamore View Road is projected to reach approximately 80,130 vpd south of I-40 and 87,710 vpd north of I-40.

The concept of Levels-of-Service (LOS) uses qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers. The descriptions of individual levels-of-service characterize these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. There are six (6) levels of service defined and given letter designations, from A to F. LOS A represents the best operating conditions and LOS F represents the worst. LOS E is the value that corresponds to the maximum flow rate, or capacity, on the facility. For most urban planning purposes, LOS D is usually used because it ensures a more acceptable quality of service to facility users. See Appendix C for a description of Levels of Service and notes regarding analysis procedures.

Interstate 40

Based on projected traffic volumes, the current sections on Interstate 40 indicate anticipated traffic congestion. By the year 2025, it is anticipated that the peak-hour peak

direction flow will operate at LOS F for both morning and afternoon peak travel periods. See the summary of I-40 capacity analysis findings in Table 2.1:

Table 2.1 Capacity Analysis Summary for I-40.

I - 40 mainline Levels of Service		Measure of Effectiveness	2005		2025	
Section	Direction		AM	PM	AM	PM
from I-240 to Sycamore View Road	EB	Speed (mph)	63.3	63.3	63.3	*
		Density (veh/ln-mi)	14.7	24.7	25.0	*
		LOS	B	C	C	F
	WB	Speed (mph)	56.7	61.8	*	61.4
Density (veh/ln-mi)		37.7	23.3	*	31.2	
LOS		E	C	F	D	
from Sycamore View Road to Whitten Road	EB	Speed (mph)	61.8	58.1	61.7	*
		Density (veh/ln-mi)	15.7	34.5	27.6	*
		LOS	B	D	D	F
	WB	Speed (mph)	58.4	61.8	*	60.0
Density (veh/ln-mi)		33.9	18.3	*	32.4	
LOS		D	C	F	D	

* Indicates that the value is beyond the range of calibration of the procedure.

The capacity analysis worksheets for this part of the investigation are included in Appendix D.

The peak hour congestion projected for the year 2025 is so severe that the results fall outside the range of calibration for the capacity analysis study methodology that is available to us. The result of the anticipated congestion is a spillover of interstate congestion onto surface streets. Because this anticipated congestion is recognized by the regional travel model, the Macon Road forecast is higher than otherwise might have been expected. This is because travel on I-40 is not expected to be an attractive option for travelers to save time, so some east-west travel that would be expected to divert to I-40 in 2005 will no longer be expected to do so in 2025. The traffic congestion expected on I-40 is not addressed by the interchange improvements proposed in this study. The intent of the study is to review proposed improvements to interchange operations that are intended to prevent cross-street congestion from backing onto the I-40 mainline. However, as

stated above, it is anticipated that, by the year 2025, freeway congestion on I-40 will be such that it will interfere with operations on the intersecting surface streets. None of the analyses reported in this study included analysis of the impacts of I-40 congestion on Sycamore View Road operations.

Sycamore View Road

Sycamore View is a six-lane road that has a median through the interchange area. The key to capacity on Sycamore View is the capacity of the intersections. Within the interchange itself, there are two ramp terminal intersections. The westbound off-ramp terminates at an unsignalized intersection. This intersection currently operates at LOS F for both morning and afternoon peak periods. The delays associated with this intersection are not severe; it is only occasionally that the queue from the left turn lane is long enough to block the right turn lane. When this happens, right-turning motorists generally bypass the queue on the shoulder. Continued traffic growth will eventually lead to westbound off-ramp queues that back onto the mainline. Before the year 2025, this location will require signalization in order to prevent just such queue formation.

The eastbound off-ramp terminates at an intersection on Sycamore View Road with the eastbound on-ramp. This intersection has a deficiency that affects operations on Sycamore View Road. The southbound approach has an auxiliary lane for left turns onto the on-ramp, which is only long enough to store two cars. The limiting factor is the bridge that carries I-40 over Sycamore View Road, which has a center pier and span lengths that are not long enough to accommodate a turn lane for queue storage under the bridge. The queue for the southbound left turn frequently blocks a through lane of southbound traffic. This deficiency is not much noticed since, at the times that the queues are longest, there are queues from the Sycamore View intersection with Macon Road that back through this location.

Discussion of Alternatives

Several alternative interchange configurations were developed and evaluated during this

Two were determined to be feasible and appropriate. These are denoted as Alternate A and Alternate C. Each of the two Alternates considered for this location would maintain provisions for all traffic movements. Functional Plans were developed for the two alternates and are included in Appendix I.

The proposed modifications include the replacement of the structure over Sycamore View Road in order to create storage for left turns for the southbound-to-eastbound movement. Alternate A would reconfigure the eastbound off-ramp to eliminate the eastbound left turn onto Sycamore View Road. Alternate C would reconfigure the entire interchange to create a “single point” interchange (see the description of Alternate C, below). In both Alternate A and Alternate C, it is proposed to reconfigure the I-40 eastbound off-ramp as a collector-distributor (C-D) road with two off-ramps, one to Macon Cove and the other to Sycamore View Road. This C-D road will alleviate traffic congestion on Sycamore View Road by allowing vehicles traveling to Southwest Tennessee Community College (STCC) to use this C-D road to go directly to Macon Cove and hence to the college. Also, traffic congestion on Sycamore View will be lessened further because traffic that presently exits I-40 east to travel east on Macon Road would then be able to use the Macon Cove off-ramp and continue east onto Macon Road. As a result, most of the vehicles using the proposed Sycamore View Road eastbound off-ramp would either travel north or south on Sycamore View Road, thereby significantly diminishing the southbound-to-eastbound and southbound-to-westbound volume at the intersection of Sycamore View Road and Macon

In addition, improvements are proposed as a part of either Alternate at the intersection of Sycamore View Road with Macon Road.

The following is a discussion of alternatives considered in evaluating potential interchange modifications at Interstate 40 and Sycamore View Road:

Alternate A

Alternate A would relocate the eastbound off-ramp to Sycamore View. The ramp would be split into two ramps so that a direct ramp connection to Macon Cove would be created.

The direct ramp connection to Macon Cove is common both to Alternate A and Alternate C, and is discussed in a separate section below. The eastbound off-ramp to Sycamore View would be carried over Sycamore View and over the eastbound on-ramp on separate structures, and then would be extended in a loop alignment to intersect Sycamore View from the east, south of the existing eastbound on-ramp. This would eliminate the eastbound-to-northbound left turn, converting it into a right turn onto northbound Sycamore View. A new traffic signal would need to be installed at this location, to interrupt northbound traffic on Sycamore View and permit the off-ramp to clear. This traffic signal would probably not meet traditional volume warrants, but would likely meet peak hour volume warrants only. The signal would have a simple two-phase operation.

The bridge that carries I-40 over Sycamore View Road would be replaced, in order to permit a widening of Sycamore View Road to provide an auxiliary lane to store southbound vehicles turning left onto the eastbound on-ramp. At the intersection of Sycamore View with the eastbound on-ramp, the traffic signal would no longer have an eastbound approach. The traffic signal would be converted from three-phase to two-phase operation.

The result would be three very closely spaced traffic signals on Sycamore View Road northbound. Operations should be satisfactory, even with the close spacing, since the two downstream signals would be two-phase signals and would have a greater capacity for northbound traffic than the upstream signal.

On the westbound side, the existing ramps would all be retained. The off-ramp would be widened to be a two-lane off ramp.

Off-ramp to Macon Cove

Much of the congestion observed at the interchange is due to congestion at the nearby intersection of Sycamore View Road with Macon Cove/ Macon Road. At peak times, the congestion at the intersection causes long queues of waiting vehicles to form. When a queue forms on southbound Sycamore View, it interferes with operation of the intersection of Sycamore View with the off-ramps. The problem is especially acute in the eastbound direction. During afternoon peaks, the southbound Sycamore View queue backs traffic up onto the eastbound off-ramp. Once this queue converges with the ramp queue of motorists waiting to turn left onto northbound Sycamore View, traffic quickly backs up the ramp and onto the mainline of eastbound I-40. Recent observations confirmed that queues do back up, with several hundred feet of stopped vehicles extending upstream from the ramp gore.

A review of the intersection revealed a very high volume of traffic from eastbound I-40 that turns onto Macon Road at the intersection. These motorists turn right from the ramp, weave across southbound Sycamore View traffic, and then turn left at the intersection. This difficult traffic pattern led to the proposal to create a direct off-ramp connection to Macon Cove.

The direct connection to Macon Cove would be accomplished using a Collector-Distributor roadway, so that I-40 exiting traffic would first exit the I-40 eastbound mainline, and then split into traffic continuing on the existing off-ramp to Sycamore View, or to exit onto Macon Cove. This would allow motorists destined for Macon Cove to avoid Sycamore View altogether. Also, the large contingent of motorists headed for Macon Road could avoid the weave on Sycamore View. This change would make intersection solutions easier to develop, since it would reduce the intersection volume, and would convert many southbound left turns into eastbound through traffic.

It was determined that interchange improvements should be accompanied by geometric improvements at this problem intersection as well. Appendix A contains a review of the investigation into intersection operations. The recommended improvements are for additional lanes for the eastbound and southbound approaches to the intersection.

Macon Cove would require widening to accommodate the additional traffic from the proposed off-ramp. It is proposed to have the transition from interstate ramp to City street occur at the intersection of Macon Road with the main driveway for Southwest Tennessee Community College (STCC).

The proposal to create the off-ramp connection to Macon Cove, and the proposal to improve the intersection of Sycamore View with Macon Road / Macon Cove may be constructed with either Alternate A or Alternate C. Also, these improvements could be constructed independently, so that this work could precede (or follow) other improvements to the interchange.

Alternate C

Alternate C would reconfigure all of the ramps at the interchange in order to create a single point urban interchange (SPUI). This form of interchange has become widely used in recent years because it offers distinct advantages in efficient movement of traffic and avoids the problems of weaving that are associated with interchanges that contain loops. Another highly appreciated attribute of the SPUI interchange is that it generally requires less right-of-way than other interchange configurations.

The existing bridge that carries I-40 over Sycamore View would be replaced to accommodate the SPUI ramp configurations. The replacement structure would have a very long span, since it would not be possible to have a center pier support. (The center pier would occur in the middle of the SPUI intersection.) For Alternate C, all of the ramps are proposed to be two-lane ramps.

Alternate C also features the direct connection to Macon Cove from the eastbound off-ramp.

Phasing Plan

Construction of the off-ramp connection to Macon Cove and improvements to the Sycamore View / Macon Road/ Macon Cove intersection are common features of both Alternate A and Alternate C. These improvements could be constructed independently of the other construction proposed by Alternates A and C. This would allow phasing of the work so that improvements providing the greatest benefit could be made in the initial phase with the remainder of the improvements made in a subsequent phase. With phased construction, the initial and more greatly needed improvements could be made without having to wait for full funding for all of the proposed improvements associated with Alternate A or Alternate C. In the course of our investigation, it was determined that the Macon Cove ramp connection, the Macon Cove improvements, and the Sycamore View / Macon Road / Macon Cove intersection improvements would immediately relieve the queue that backs up on the existing eastbound off-ramp, thus alleviating the choke point on eastbound Interstate 40. The Macon Cove off-ramp would be implemented by first constructing the proposed C-D road diverge from eastbound I-40, and carrying the C-D road east to tie to the existing eastbound off-ramp. The barrier between eastbound I-40 and the C-D road would be included in the initial phase.

By constructing the Macon Cove off-ramp and related improvements first, the choice of interchange type (whether Alternate A or Alternate C) could be postponed and re-evaluated after the traffic flows improve. Also, constructing these elements first would be a benefit to STCC by eliminating uncertainty from their planning process.

Phased construction of improvements associated with Alternate A or C is recommended with Phase 1 consisting of the C-D road and barrier, the Macon Cove ramp connection, associated improvements to Macon Cove, and improvements to the Sycamore View /

Macon Road / Macon Cove intersection. Phase 2 would consist of the remainder of the improvements proposed by either Alternate A or Alternate C. Cost estimates for Phase 1 and Phase 2 are included in a subsequent section of this report.

Other Alternates

Two additional alternates were considered during the progress of the study. Alternate B is the same as Alternate A, except that it does not feature the off-ramp to Macon Cove. It was discarded as not adequate to address the congestion from Sycamore View Road that causes queues to back up onto I-40. Alternate D is a completely different approach, in which a flyover ramp is proposed to carry eastbound-to-northbound left turns over I-40. It was discarded as excessive in need for right-of-way and would have a low limit on the attainable design speed for the flyover, while not addressing Sycamore View Road congestion.

Environmental Concerns

No environmental investigations were made in conjunction with this Interchange Modification Study. One issue that should be reviewed as part of any environmental investigation is the underground storage tanks that are associated with the existing gas station/ convenience store at the corner of Macon Cove with Sycamore View. Another potential environmental concern is the need to enclose a portion the existing roadside ditch located along the south side of Interstate 40 west of the interchange. This would be necessary to minimize right-of-way impacts associated with construction of the C-D Road and off ramp connection to Macon Cove. A third concern would be noise impacts to the residential subdivision located along the south side of Interstate 40 east Sycamore View Road.

There are no other known potential environmental concerns.

CHAPTER 3 - TRAFFIC FLOW INVESTIGATION

Interstate 40

Anticipated mainline freeway operations would not be changed by the proposed interchange modifications. The Levels of Service anticipated on the I-40 through lanes are reported above, in Table 2.1.

The adjacent interchanges at I-240/ Sam Cooper Boulevard and at Whitten Road are beyond the limits of analysis associated with weaving areas. The Whitten Road interchange has no impact on the analyses associated with the interchange of I-40 with Sycamore View Road.

The interchange of I-40 with I-240 and Sam Cooper Blvd. is a more complicated situation and does bear consideration. This interchange is under construction, with future work to take several years. There are very high percentages of ramp traffic that use I-240.

In the eastbound direction, from the new merge gore of I-40 and I-240 to the existing diverge gore at the Sycamore View off-ramp is almost 6800 feet. There are four basic freeway lanes in this segment and two auxiliary lanes, for a total of six lanes in the eastbound direction. The two auxiliary lanes both end onto the Sycamore View off-ramp (two-lane drop). The proposed change to the eastbound off-ramp at Sycamore View would reduce the auxiliary lanes length to approximately 5000 feet. A motorist entering I-40 from Sam Cooper Boulevard would have to change lanes twice in that space in order to exit at Sycamore View. This distance is well beyond the 2600-ft. threshold that would be considered weaving for capacity analysis purposes. 5000 feet seems an adequate distance over which a motorist may be expected to complete two lane changes.

In the westbound direction, the first westbound on-ramp is a lane-add. From this existing gore to the merge gore of the second westbound on-ramp is approximately 1350 feet. From there to the new diverge gore of Sam Cooper Boulevard is a distance of nearly 6000 feet. These distances would be changed only slightly if Alternate A is implemented. Alternate C would replace both of the existing westbound on-ramps from Sycamore View with a single two-lane on-ramp, of which one lane would be a lane-add. The distance between the proposed merge and the I-240 diverge gore would be approximately 5700 feet. Currently, the lane that is added in the westbound direction by the first Sycamore View on-ramp drops as the mainline approaches the bridge over the Wolf River. This bridge currently operates with four lanes in the westbound direction. The bridge and approaches should be re-stripped to accommodate a fifth lane (this is noted in the Major Roads Plan), so that the lane that is added at Sycamore View will continue through to the Sam Cooper diverge gore. The five lanes will diverge, with the two left lanes exiting to Sam Cooper Boulevard and the three right lanes carrying I-40 westbound to the next gore which is the I-240 diverge.

Eastbound Ramp Junctions

Both Alternate A and Alternate C are proposed to feature the off-ramp to Macon Cove. The eastbound off-ramp exit gore would be relocated westward (upstream) by approximately 1800 feet. This diverge location will continue to be a lane-drop exit that drops two lanes. The ramp extension would serve as a two-lane "C-D" road, with an exit ramp to Macon Cove. The gore of the exit to Macon Cove would be approximately 1300 feet east of the gore of the exit from the mainline. Anticipated Levels of Service for these ramp diverge locations are presented in Table 3. The C-D road would continue for approximately 1500 more feet, until a diverge gore that splits with a left lane for northbound Sycamore View and a right lane for southbound Sycamore View. The eastbound on-ramp is proposed to be widened to two lanes, for both Alternate A and Alternate C. This will require at least 1000 additional feet of ramp runout space

along I-40 eastbound.

Westbound Ramp Junctions

The westbound off-ramp to Sycamore View is proposed to be widened into a two-lane off-ramp, which will require improvement along the westbound mainline for approximately 800 feet east of the current ramp. This widening is proposed as part of either Alternate A or Alternate C. Under Alternate C, the ramp would be relocated into the central SPUI traffic signal.

Table 3.1 - Interstate 40 Ramps Levels of Service

Ramp	Measure of Effectiveness	No-build				Alternate A				Alternate C			
		2005		2025		2005		2025		2005		2025	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
I-40 EB Off-Ramp to Sycamore View Road (Note 1)	Speed (mph)	48.8	48.8	*	*	58.8	58.8	53.8	53.8	58.8	58.8	53.8	53.8
	Density (veh/ln-mi)	*	*	*	*	18.8	19.1	*	*	18.8	19.1	*	*
	LOS	F	F	F	F	C	C	F	F	C	C	F	F
EB C-D Road Off-Ramp to Macon Cove	Speed (mph)					48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0
	Density (veh/ln-mi)	NA	NA	NA	NA	19.6	19.9	27.5	28.0	19.6	19.9	27.5	28.0
	LOS					B	B	C	C	B	B	C	C
I-40 EB On-Ramp from Sycamore View Road	Speed (mph)	59.1	57.6	58.0	49.3	63.2	62.7	62.8	60.4	63.2	62.7	62.8	60.4
	Density (veh/ln-mi)	12.9	23.1	21.3	36.0	*	4.1	3.4	14.8	*	4.1	3.4	14.8
	LOS	B	C	C	F	A	A	A	F	A	A	A	F
I-40 WB Off-Ramp to Sycamore View Road	Speed (mph)	54.0	54.0	53.0	53.0	54.0	54.0	53.0	53.0	54.0	54.0	53.0	53.0
	Density (veh/ln-mi)	29.4	17.6	51.8	31.4	19.2	12.5	33.2	21.8	17.4	10.9	31.6	20.2
	LOS	D	B	F	D	B	B	F	C	B	B	F	C
I-40 WB On-Ramp from Sycamore View Road NB (Note 2)	Speed (mph)	63.3	63.3	*	63.3	63.3	63.3	*	63.3				
	Density (veh/ln-mi)	24.8	13.4	*	24.0	24.8	13.4	*	24.0	NA	NA	NA	NA
	LOS	C	B	F	C	C	B	F	C				
I-40 WB On-Ramp from Sycamore View Road SB	Speed (mph)	58.0	58.5	54.3	57.8	61.8	62.0	58.6	61.1	NA	NA	NA	NA
	Density (veh/ln-mi)	20.6	16.2	31.2	21.5	7.3	4.7	19.3	11.5	NA	NA	NA	NA
	LOS	C	B	F	C	A	A	F	B	D**	D**	D**	D**

* : Computed value is beyond the range of calibration of the methodology.

** : From Exhibit 25-7 of HCM 2000, LOS D or better is expected.

Note 1: Freeway segment procedure used to investigate major diverge.

Note 2: Freeway segment procedure used to investigate lane addition.

The existing configuration has a loop ramp for entering westbound traffic from Sycamore View northbound. I-40 widens from four westbound lanes to five at this ramp junction, so the ramp has a lane-add ramp junction. This ramp would remain unchanged in Alternate A, but it would be eliminated in Alternate C.

The existing on-ramp from Sycamore View southbound is proposed to be widened to two lanes in Alternate A. For Alternate C, this ramp would be both widened and relocated. Since the ramp from northbound Sycamore View will be eliminated if Alternate C is implemented, and the northbound-to-westbound traffic added to this ramp, it is proposed to continue the four-lane section on westbound I-40 so that this two-lane ramp could enter the westbound mainline as a one-lane-add.

Macon Cove

Operations on Sycamore Road through the interchange are greatly affected by the signalized intersection with Macon Road. This intersection is congested, and results in queues that interfere with operation of the interchange. The nature of this problem was identified early in the investigation, and was the subject of a separate study. The highlights of that study are presented in Appendix A. The proposed off-ramp to Macon Cove was developed as a way to improve operations at this intersection and to prevent the eastbound off-ramp from backing up onto mainline I-40 in the afternoons. In addition, improvements to the intersection are proposed, which would be the same for either Alternate A or Alternate C.

Sycamore View Road with Alternate A

The proposed change to the eastbound off-ramp to Sycamore View Road is to relocate it onto a new structure over Sycamore View, and then to loop around to intersect Sycamore View on the east side by installing a new structure over the eastbound on-ramp. This would convert the movement that now occurs as an eastbound left turn at the ramp terminal intersection with that traffic becoming a westbound right turn instead. A new intersection

would be created on Sycamore View for this relocated ramp terminal. The very heavy traffic volumes indicate that signal warrants would be met, and signalization would be essential for the ramp to operate. This would result in three closely-spaced intersections on Sycamore View, with this new intersection between the intersection with the eastbound on-ramp to the north and the intersection with Macon Road to the south. Operations are expected to be satisfactory for these reasons: 1) The two signals north of Macon Road both have much greater capacity than the Macon Road intersection, and both can operate at half of the cycle length anticipated for the Macon Road intersection, 2) Neither of the two northern signals would affect southbound traffic on Sycamore View, and 3) Both of the northern traffic signals would be two-phase signals.

Table 3.2 Sycamore View Road Intersections Levels of Service.

Year 2005 Scenario/ Location	Time	Most Congested Lane Group			Overall Intersection		
		Movement	Delay	LOS	Delay	LOS	
No-Build S.V.R. at Macon Road	AM	EB Lt	93.8	F	67.4	E	
	PM	SB Lt	681	F	420	F	
	S.V.R. at Eastbound ramps	AM	NB Th	103	F	73.4	E
		PM	NB Th	88.4	F	56.3	E
Alternate A	S.V.R. at Macon Road	AM	NB Th	77.6	E	48.8	D
		PM	NB Th	104	F	79.2	E
	S.V.R. at Eastbound off-ramp	AM	EB Lt (WB Rt)	37.2	D	27.6	C
		PM	NB Th	49.5	D	49.4	D
	S.V.R. at Eastbound on-ramp	AM	SB Lt	26.2	C	9.8	A
		PM	SB Lt	46.7	D	8.6	A
Alternate C	S.V.R. at Macon Road	AM	NB Th	77.6	E	48.8	D
		PM	NB Th	104	F	79.2	E
	S.V.R. at Single Point	AM	EB Lt	91.3	F	61.8	E
		PM	NB Lt	191	F	103	F

Sycamore View Road with Alternate C

The interchange proposal for Alternate C is to convert the interchange into a single point urban interchange (SPUI). This would eliminate the intersection of Sycamore View with

the eastbound ramps, and replace it with a SPUI intersection that would relocate all of the eastbound and westbound ramps into one signalized intersection. SPUI interchanges have gained favor in the past decade because they combine high capacity with a compact geometry. However, the very high volumes anticipated at this location appear to outpace the reasonable ability to develop auxiliary lanes. Even with triple-left-turns, the intersection is anticipated to operate at LOS F.

Macon Cove Off-Ramp

The proposed off-ramp would terminate at an intersection of Macon Cove with the main driveway for STCC. Because this may be considered an unusual ramp configuration, measures are recommended to make sure that motorists exiting the ramp get the “feel” of leaving the freeway and entering the urban street environment. The ramp is proposed to be fully access-controlled all the way to the STCC main driveway intersection. As the ramp approaches the intersection, curb and gutter should be introduced in place of paved shoulders, with urban street style streetlighting to enhance the visual cue that the driving environment is in transition. Appropriate signing should be either oversized or duplicated in order to catch the attention of the motorist. Rumble strips should be considered, to convey the message that the driving environment is changing.

A traffic signal is proposed at the intersection of the Macon Cove and the main driveway to STCC. On the west approach of this intersection, one through eastbound lane and a through-right lane are proposed. An exclusive right-turn lane to the STCC driveway was considered, but not recommended. The capacity analysis showed that LOS D or better can be achieved without a right-turn lane. Also, the lane will be better utilized as a through-right. In the a.m. when a high volume of right-turn traffic is expected, one lane will be adequate for eastbound through traffic. In the p.m. relatively low right-turn volumes are expected at a time when there will be higher through traffic volumes.

West of this intersection, existing Macon Cove provides access to three small parking areas

on the STCC campus, one of which is for the front entrance to the Farris Administration Building. Also served by Macon Cove are service entrances to the Fulton and Whitehead Buildings. In meetings with STCC officials, it was agreed that STCC could accommodate the development of the ramp by making changes to the STCC internal circulation system, in cooperation with the City and the State. On the north side of the proposed ramp, opposite STCC, is a wedge-shaped parcel that is the home of Celebration Station, an entertainment venue featuring miniature golf, go-carts, and an arcade. There is one driveway that is proposed to be relocated. (Celebration Station is currently closed and for sale.)

The intersection should be signalized, even though it appears that it would only be marginally warranted at first, to impress on motorists leaving I-40 that they have now exited onto local streets. The signalized intersection could operate with a cycle length of half that of the intersection of Sycamore View with Macon Cove/ Macon Road. Macon Cove is three lanes wide at this location, with one through lane in each direction and a center turn lane. A lane would be added for eastbound traffic. The additional eastbound lane would not be needed for traffic flow capacity, but would provide additional storage capacity for queued vehicles, keeping the back of the queue from backing up onto the off-ramp. The intersection would be expected to operate at LOS C in the morning peak period and LOS D in the afternoon peak period.

Because this is an unusual interchange geometry, special measures would be needed to prevent confused motorists from making a wrong-way move onto the ramp.

- There should be a recognizable end of the street in the westbound direction on the west side of the intersection, which could be as simple as a Type III barricade.
- Standard signing to discourage wrong-way travel could be duplicated or made oversize, and should use high-intensity sheeting.
- Street lighting could be installed with a higher than standard illumination level. Street lighting in the intersection could be installed both by the I-40 lighting circuit and by the

City streetlight circuit, so that if one circuit lost power, the intersection would still have some illumination.

- The stop line on the ramp approach should be bordered with raised pavement markers that show red to wrong-way motorists.

The westbound lane could have a geometry that leads the vehicle in a path that curves into the turn.

Cost Estimates

Phase 1

Phase 1 consists of construction of the C-D road, the barrier between eastbound I-40 and the C-D road, the related off-ramp connection to Macon Cove, related improvements to Macon Cove, and improvements to the Sycamore View / Macon Road / Macon Cove intersection. This would be applicable to both Alternate A and Alternate C. The total estimated cost for Phase 1, including construction, right-of-way and utility relocation costs, is \$5,915,000.

Phase 2 – Alternate A

Phase 2 consists of the actual interchange improvements. For Alternate A, the Phase 2 cost estimate, including construction, right-of-way and utility relocation costs, is \$13,904,000.

Phase 2 – Alternate C

For Alternate C, the Phase 2 cost estimate, including construction, right-of-way and utility relocation costs, is \$11,751,000.

Cost data sheets are included in Appendix H.

CHAPTER 4 ACCESS INVESTIGATION

This analysis was undertaken in accordance with the Federal Highway Administration's (FHWA) policy for granting new or revised interstate access. The FHWA policy is described in FHWA Docket No. 98-3460, "Additional Interchanges to the Interstate System," (Federal Register 63, No. 28, February 11, 1998). This analysis was conducted to demonstrate the impacts of a revised access point as opposed to providing a new access point to the interstate system. The FHWA requirements are provided in italics along with responses to those identified items.

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 proposed improvements are to the existing interchange. No additional access points to the interstate system are proposed. The proposed modifications consist of changes to ramps and ramp terminals. The only relevant change to have any effect on I-40 mainline traffic would be the changes proposed for the eastbound off-ramp. It is proposed to relocate this ramp gore upstream to the west in order to accommodate a new off-ramp terminal onto Macon Cove. Improvements to other ramp gores would be limited to reconstruction to comply with current design standards. There are two alternative approaches to the interchange reconfiguration. Alternate A would only change the eastbound ramps configurations. Alternate C would reconstruct all of the ramps in order to install a "single-point urban interchange" (SPUI) configuration. For either Alternate, it is proposed to replace

the bridge that carries I-40 over Sycamore View Road in order to improve the traffic flow capacity of the ramp terminal intersections.

The Alternates both propose to provide additional access to the eastbound off-ramp. This will be done by lengthening the ramp so that downstream of the diverge gore with eastbound I-40, a separate off-ramp can be installed to carry traffic directly to Macon Cove. The primary reason for this is that it appears to be the best strategy to improve traffic capacity of the intersection of Sycamore View Road with Macon Cove/ Macon Road. This intersection is congested now, and queues back up from this intersection onto eastbound I-40. For this reason, it was determined that the intersection must be improved together with interchange improvements in order to alleviate the unsafe situation of traffic congestion backing queues up onto the I-40 mainline.

Without the proposed modifications, the interchange at Interstate 40 and Sycamore View Road will not provide a satisfactory level-of-service in 2005. However, it must be noted that traffic congestion is expected to recur as traffic volumes grow in the corridor. By the year 2025, traffic operations are expected to decline again to LOS F, even with the proposed improvements.

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.*

Interchange modifications are necessary to accommodate projected traffic demands. The deficiencies associated with the existing ramp terminals cannot be adequately addressed through transportation demand management (TDM) strategies such as ramp metering, and improved mass transit. The chief problem is related to off-ramp queues rather than on-ramps. Transit service does exist in the area. Route 53 of the Memphis Area Transit Authority

provides service along Sycamore View Road from Summer Avenue to Mullins Station Road, including a loop to serve the STCC. Park and ride lots are included in the Major Road Plan for locations further east along I-40. These TDM measures could reduce the traffic congestion in the area, although not to the extent that would preclude the need for the proposed improvements. High occupancy vehicle (HOV) lanes exist on I-40 from this location to the east. Expansion of the HOV lane system to the west could potentially reduce the rate of increase in the number of single occupant vehicles entering and exiting I-40 at Sycamore View Road. However, the introduction of HOV lanes, other congestion management systems, or ITS applications on I-40 will not prevent the anticipated congestion on I-40 and will not offset the need to upgrade the ramp terminals on Sycamore View Road.

3. *The proposed access point does not have a significant adverse impact on the safety and operation of the Interstate facility based on an analysis of current and future traffic. The operational analysis for existing conditions shall, particularly in urbanized areas, include an analysis of sections of the 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 adjacent interchanges at I-240/ Sam Cooper Boulevard and at Whitten Road are beyond the limits of analysis associated with weaving areas. The Whitten Road interchange has no impact on the analyses associated with the interchange of I-40 with Sycamore View Road.

The interchange of I-40 with I-240 and Sam Cooper Blvd. is a more complicated situation, and is discussed above, in Chapter 3. Freeway mainline operations on I-40 are reported above, in Chapter 2 (see Table 2.1).

Sycamore View Road is the crossroad of the proposed interchange modifications. Operation of Sycamore View currently experiences such congestion at afternoon peak times that queues

back onto the eastbound mainline of I-40. The operational issues associated with this congestion, and the proposals to address it have been reviewed in depth and are reported in this report. Particular attention is called to the intersection review that is contained in Appendix A.

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 to the interchange will continue to provide for all traffic movements. With Alternate A, the proposed modifications will maintain the existing configuration of ramps with respect to the mainline. With Alternate C, the proposed ramp configuration would appear more like a traditional diamond. In either case, the significant new feature with respect to access would be a new diverge gore on the eastbound off-ramp which would provide the option of exiting to Macon Cove in addition to the option of exiting to Sycamore View Road. Macon Cove is a city street. The intent is to improve traffic operations on Sycamore View Road to prevent or minimize queue spill-back onto I-40. The proposed modifications will continue the "full interchange" status of the location by providing access for all directional movements.

All modifications will be designed to current federal standards for interstate highways, and will meet or exceed all American Association of State Highway and Transportation Officials (AASHTO) criteria.

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.

This study addresses modifications to the interchange of I-40 with Sycamore View Road and is consistent with the local and state transportation plans. The proposed improvements to nearby local streets are also consistent with the Major Roads Plan of the MPO. As such, the proposal is consistent with the most recent conformity determination for the Memphis region.

- 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.*

At this time, there are no plans for additional access points to Interstate 40 in or near the study area. To the west, the existing interchange of I-40 with I-240 and Sam Cooper Boulevard is under reconstruction. To the east, the existing interchange of I-40 with Whitten Road is approximately 1-1/4 miles distant.

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

The request for modification of the interchange was not generated by a specific new or expanding development, but by general growth and development in the area served by Sycamore View Road. There is a significant development that does have an impact on the proposal, which is the Southwest Tennessee Community College (STCC). TDOT and the study team have met with the City of Memphis and the STCC administration at the campus on Macon Cove on two occasions. The investigation of the Sycamore View Road intersection with Macon Cove/ Macon Road was reviewed by STCC and their consultant (see Appendix A, and the discussion of Macon Cove in Chapter 3).

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

Traffic projections for years 2005 and 2025 were the bases of the traffic analyses performed as part of this study. This traffic data is contained in Appendix B. No environmental investigations were included in this study. These will be performed later in the project development process.

CHAPTER 5 – SUMMARY AND CONCLUSIONS

The analyses and recommendations contained in this report support the proposed modifications to the interchange at Interstate 40 and Sycamore View Road. Without these modifications, this facility will not function at an acceptable level-of-service as traffic demands increase due to growth and development in the area. Even with the proposed improvements, traffic congestion is anticipated in future years.

The primary advantage to Alternate A is the improved capacity for traffic flow. The chief disadvantage is cost, since Alternate A requires more right-of-way and more structures. The primary advantage to Alternate C is cost, since very little additional right-of-way would be required. Though Alternate C would increase the interchange capacity, it would not provide as great an increase in interchange capacity as could be realized with Alternate A.

Since the proposed off-ramp to Macon Cove, and improvements to the intersection of Sycamore View Road and Macon Road, are featured in both Alternate A and Alternate C, it would be reasonable to undertake these improvements as a “Phase 1” improvement regardless of the selected alternative.

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix A

**Intersection of Sycamore View Road and Macon Cove/
Macon Road**

Appendix A

Intersection of Sycamore View Road and Macon Cove/ Macon Road

The intersection of Sycamore View Road with Macon Cove/ Macon Road was identified as a problem location that results in severe operational deficiencies for the interchange. The existing intersection geometry is inadequate, providing unacceptable levels of traffic congestion. Resulting queues are expected to increasingly interfere with interchange operations.

It is proposed to create a direct eastbound off-ramp connection from I-40 to Macon Cove. This is proposed as a way to improve the distribution of the off-ramp traffic in order to better manage the traffic flows. This will change the traffic patterns at the intersection of Sycamore View with Macon Cove/ Macon Road. In order to accommodate the additional traffic from the off-ramp, Macon Cove would require widening.

At the intersection of Sycamore View with Macon Cove/ Macon Road, if improvements were considered only for the eastbound approach (Macon Cove), then the resulting operational character would still be unacceptable. With widening assumed for eastbound, but not on any other approaches, a traffic review anticipates volume-to-capacity ratios (v/c) near 1.5, indicating long queues of backed-up traffic on southbound Sycamore View Road. Further intersection improvements would be needed in order to result in improved interchange operations.

With intersection improvements on the southbound Sycamore View and Westbound Macon Road approaches, significant reductions in delays and queues would be possible.

Traffic Flow Investigation

An investigation was conducted to gather additional information about traffic flows in this area. A license tag survey was used to match vehicles on the eastbound off-ramp to vehicles observed entering STCC. It was found that, of the eastbound off-ramp traffic that turned right onto Sycamore View, approximately 19 percent went to STCC in the morning, and approximately 16 percent in the afternoon. Also, the City of Memphis provided videotape that enabled identification of the number of right turns from the ramp that then turned left

onto Macon Road. This was approximately 44 percent in the morning and 53 percent in the afternoon. Of all the vehicles that exit I-40 eastbound and turn right onto southbound Sycamore View, the portion that continues southbound at the Macon Road intersection is only 37 percent in the morning and 31 percent in the afternoon.

Since the traffic congestion for the interchange is dramatically influenced by queues backing up from the intersection, analyses of this location were used for the following review. Year 2005 projections are used throughout. (A preliminary review of year 2025 projections previously found that the entire interchange vicinity would be so highly congested that all capacity computations were beyond the calibrated limits of the methodologies. There are three primary reasons for the projections of such a high level of congestion. One is that the forecast model incorporates significant growth for the STCC campus, a second problem is a deficiency in the thoroughfare plan that concentrates area traffic into the interchange, and a third problem is a projected deficiency in the number of through lanes planned for I-40 in this area.)

Levels of Service

Anticipated year 2005 traffic flow characteristics are a very low Level of Service F for the intersection in the current configuration and geometry. The anticipated year 2005 v/c ratio is 1.06 in the morning but 3.45 in the afternoon.

With development of the proposed off-ramp to Macon Cove, right turns could be nearly eliminated from the existing ramp. It is believed that most of this traffic would relocate to Macon Cove, even though the direct right turn onto Sycamore View is proposed to be retained. At the intersection of Sycamore View with Macon Cove/ Macon Road, this traffic would be shifted from the southbound approach to the eastbound approach. This has the advantage of removing some of the very high southbound left turn traffic and converting it to eastbound through traffic.

Table A.1 includes findings for intersection capacity. These were developed for the existing intersection geometry with revised year 2005 traffic projections. Results are provided in terms of average delay, v/c ratio, Level of Service, and length of the queue of vehicles accumulated on the southbound approach.

The indication from the review using the existing intersection geometry is that the implementation of the proposed new ramp would not improve the capacity of the intersection unless geometric improvements at the intersection are made.

Table A.1 - Capacity Analysis Findings for Macon Rd. Intersection.

		Intersection			Southbound Queue
		Delay	V / C	LOS	
E2 Existing interchange configuration.	AM	68	1.06	E	675
	PM	189	1.58	F	1894
A2 Proposed ramp to Macon Cove.	AM	129	1.42	F	430
	PM	255	1.72	F	1582

Delay is average seconds per vehicle. Queue is in feet.

Eastbound Approach

Because the proposed ramp would include improvements to Macon Cove, intersection geometries were reviewed that would feature added lanes on the eastbound approach to the intersection. It should be noted that a widening of Macon Cove would require substantial additional right-of-way, probably including at least one business relocation.

Results of this review are shown in Table A.2. In the afternoon peak, implementation of the improvements to the eastbound approach while retaining the existing interchange configuration could reduce the overall average delay per entering vehicle from 189 seconds to 167 seconds. If the proposed ramp were implemented, improvements to the eastbound approach would be expected to drop the average delay to 157 seconds.

Table A.2 - Capacity Analysis findings for Improved Eastbound Approach

		Intersection			Southbound Queue
		Delay	V / C	LOS	
E2 Existing interchange configuration.	AM	54	0.93	D	673
	PM	167	1.47	F	1858
A2 Proposed ramp to Macon Cove.	AM	45	0.87	D	366
	PM	157	1.46	F	1453

Delay is average seconds per vehicle. Queue is in feet.

The tables include estimates of the extent of the back of the queue of vehicles waiting on the southbound approach. These queue estimates indicate that, whether or not the proposed

ramp is constructed, the congestion from the Macon Road intersection with Sycamore View will continue to block interchange ramp intersections on Sycamore View. Further geometric improvements would be needed at this intersection in order to prevent street congestion from causing queue back-ups on the I-40 ramps.

Major Intersection Improvements

Because of the anticipated unacceptable Levels of Service, potential improvements were considered in an effort to identify means to increase the capacity of this intersection. The most obvious choice would be to improve the capacity of the southbound left turn, since this is the largest volume movement and the one that causes the greatest trouble in terms of traffic signal efficiency. The southbound left turn currently is made from a left-turn lane and also a lane that is shared between southbound left and through traffic. The volume projected for this turn is so great, however, that much greater capacity is warranted. The potential improvement of triple left-turn lanes was investigated as a part of an effort to identify appropriate enhancements to intersection capacity. These are considered below, approach by approach:

Southbound. A triple-left would greatly reduce the green time needed from the traffic signal, and also would reduce the space required for queuing vehicles. Since the southbound left turn is the greatest traffic flow problem, it is reasonable to consider adding left turn lanes by taking away through lanes. The existing southbound through has three lanes, with the inside lane shared with the left turn, and the outside lane shared with the right turn. A minimum of two lanes is required for through and right-turns southbound. In order to improve operations, at least one added lane seems to be necessary in the southbound direction.

Eastbound. An additional left-turn lane for a double turn was considered. However, with the proposed new off-ramp onto Macon Cove, the left-turn volume would not be the critical approach volume, but the through traffic to Macon Road would be the problem. Up to three through lanes could be efficiently used to serve eastbound through traffic.

Northbound. The northbound approach appears to offer little prospect of increasing capacity by road widening. The left turn volume is not so great as to appear to need a double turn. A right-turn lane is already present. There is a substantial demand of northbound through traffic, but increasing the number of through lanes would lead to other operational problems. The westbound right turn is a "free turn," which is to say that the westbound right turn becomes a lane-add situation for northbound traffic. This allows the very heavy westbound right turn to

run continuously. Since much of this traffic is headed for the two downstream I-40 on-ramps, both of which are configured as channelized right turns, much of the traffic in this lane stays in the outside lane of Sycamore View Road. Northbound through traffic on Sycamore View (and left turns from Macon Cove) must merge into this lane in order to have access to the on-ramps. If the northbound through lanes were to be increased from two lanes to three at Macon Road, then the downstream picture for northbound traffic would become more complicated. The likelihood is that such an additional lane would have a poor utilization. The option of widening the northbound approach to the intersection of Sycamore View with Macon Road was not pursued.

Westbound. The westbound traffic is dominated by the heavy right turn discussed above. There is enough pavement on this approach to allow two through lanes. No improvements (other than re-striping) would be appropriate for this approach.

The intersection geometry discussed above features a triple left-turn for the southbound left. This presents a problem in terms of potential for lane utilization. Macon Road on the east side of Sycamore View is wide enough to receive three lanes, and Macon Road appears as a six-lane road in the Major Road Plan of the Memphis Region Metropolitan Planning Organization. However, approximately 1200 feet east of Sycamore View, Macon Road transitions to a four-lane roadway section. Until Macon Road is widened, the full utility of triple-left-turn lanes cannot be realized. On the Major Roads Plan, Macon Road is listed as Priority 1, which means that the widening should be scheduled within the next ten years. Diminished utility of the proposed triple-left turn was factored into the capacity computations presented in Table A.3.

Table A.3 - Capacity Analysis Findings for Improved Intersection Geometries.

		Intersection			Southbound
		Delay	V / C	LOS	Queue
E2 Existing interchange configuration.	AM	61	1.01	E	777
	PM	119	1.21	F	1175
A2 Proposed ramp to Macon Cove.	AM	75	1.09	E	988
	PM	110	1.19	F	922

Delay is average seconds per vehicle. Queue is in feet.

Widened Macon Road

Table A.4 shows the operational characteristics that would be anticipated if all reasonable improvements were to be made to the intersection of Sycamore View Road with Macon Road. This assumes that Macon Road would be widened so that reasonable utilization would be expected of a triple-left turn for southbound. Also, further widening of the southbound approach was assumed in the computations for Table A.4. This would be the addition of a right-turn lane, resulting in a six-lane approach for southbound Sycamore View at Macon Road.

Table A.4 - Capacity Findings for Proposed Intersection Improvements

		Intersection			Southbound
		Delay	V / C	LOS	Queue
E2 Existing interchange configuration.	AM	40	0.87	D	580
	PM	87	1.11	F	931
A2 Proposed ramp to Macon Cove.	AM	38	0.91	D	431
	PM	86	1.10	F	732

Delay is average seconds per vehicle. Queue is in feet.

Comparison of Alternate A and Alternate C

For the purpose of the intersection investigation presented above, Alternate A2 is Alternate A and is equivalent to conditions proposed in Alternate C as well, since the traffic volumes projected for all three cases are identical at the intersection. The primary difference between the two Alternates from the point of view of intersection traffic flow, is the likelihood that intersection congestion would continue to impair traffic operations of the ramp terminal intersections of the interchange of I-40 with Sycamore View Road.

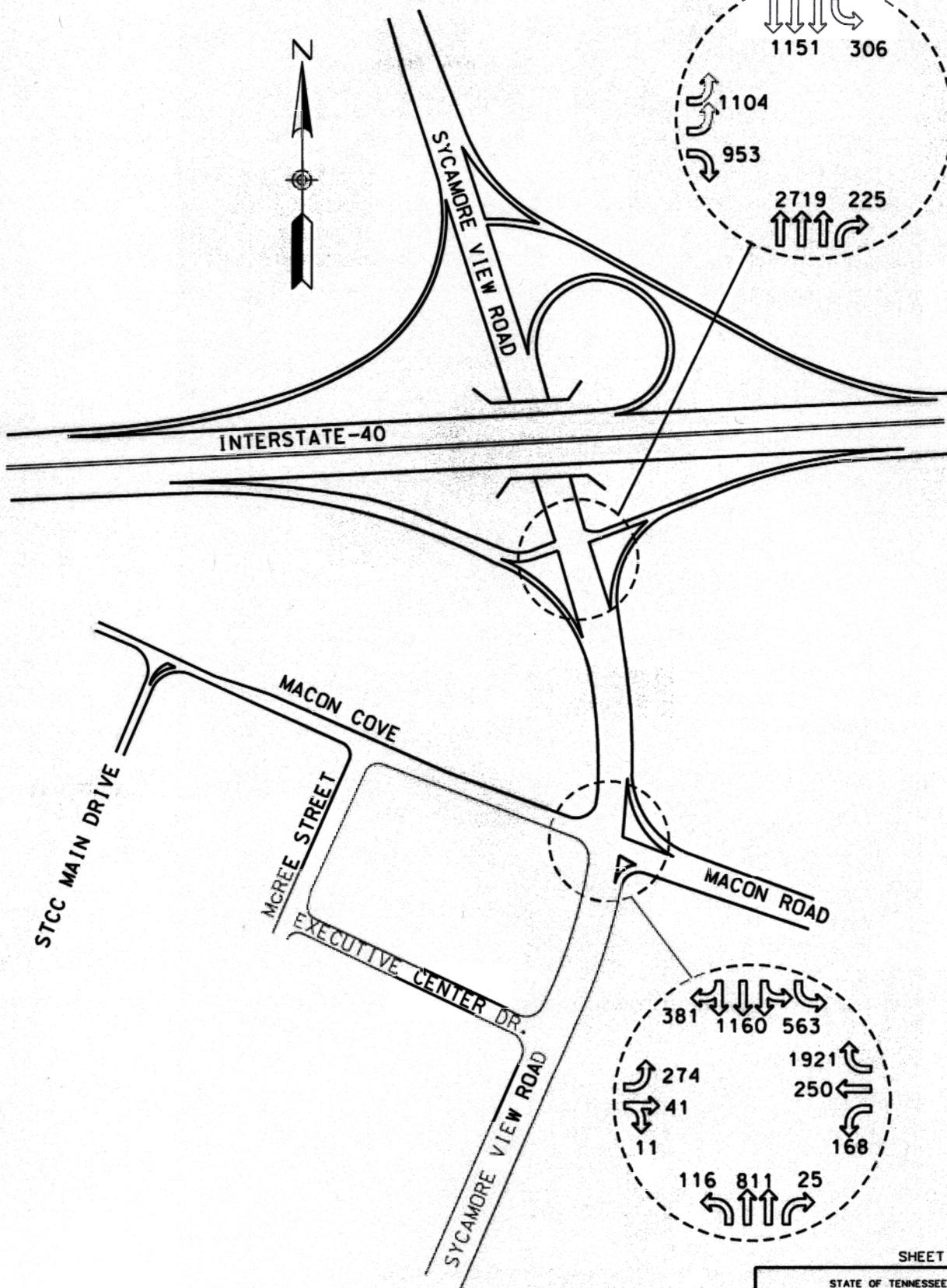
The queue on Sycamore View Road in the southbound direction is the key determinant. The queue currently has three lanes to fill, plus the left-turn auxiliary lane for the first 300 feet north of the intersection stop line. In the existing configuration, there is approximately 400 feet to the channelized right turn from the eastbound off-ramp, with almost 300 feet more to the signalized intersection of Sycamore View with the eastbound ramps, for a total of approximately 700 feet between intersections. At peak times, once this queue reaches 400 feet in length, the queue on the eastbound off-ramp begins to rapidly grow. From the Macon

Road intersection, there is approximately 1550 feet to the intersection of Sycamore View with the westbound off-ramp.

For Alternate A, the intersection with the eastbound on-ramp is proposed to be retained at its existing location. The eastbound left turn from the ramp would be eliminated. The channelized right turn could be retained in its existing location, or it could be relocated northward. Potentially as much as 600 feet could be achieved on Sycamore View between the Macon Road intersection and the channelized right turn. Queues on Sycamore View would have a lessened effect on the interstate, since the queue of eastbound-to-northbound vehicles exiting I-40 would be moved to the east side of Sycamore View, and would be unlikely to combine with the queue of eastbound-to-southbound vehicles. Alternate A is also proposed to feature an added auxiliary lane on Sycamore View Road which would provide additional storage space for queued vehicles. The result is that, at peak travel periods, the back of the queue is anticipated to just reach but not block the intersection with the eastbound on-ramp. Even if the southbound queue spillback did occasionally hamper Sycamore View operations at the intersection with the eastbound on-ramp, this would not affect interchange operations. Alternate A would greatly reduce the impacts on interchange operation due to congestion at the Sycamore View/ Macon Road intersection.

For Alternate C, the SPUI intersection will replace the existing ramp terminal intersections on Sycamore View Road. The channelized right turn would intersect Sycamore View approximately 700 feet north of the Macon Road intersection. There would be approximately 900 feet on Sycamore View Road between the Macon Road intersection and the SPUI intersection.

For Alternate C compared to Alternate A, there would be fewer instances when excessive queues from Macon Road interfered with interchange operations. However, on those few occasions when a queue did reach the SPUI intersection (such as with an incident at the Macon Road intersection), blockage of the intersection would quickly close all of the ramps with queues of their own. For most “everyday” traffic, Alternate C would be slightly better than Alternate A in this aspect of traffic flow. For extraordinary circumstances, such as an incident, Alternate A would be superior to Alternate C.



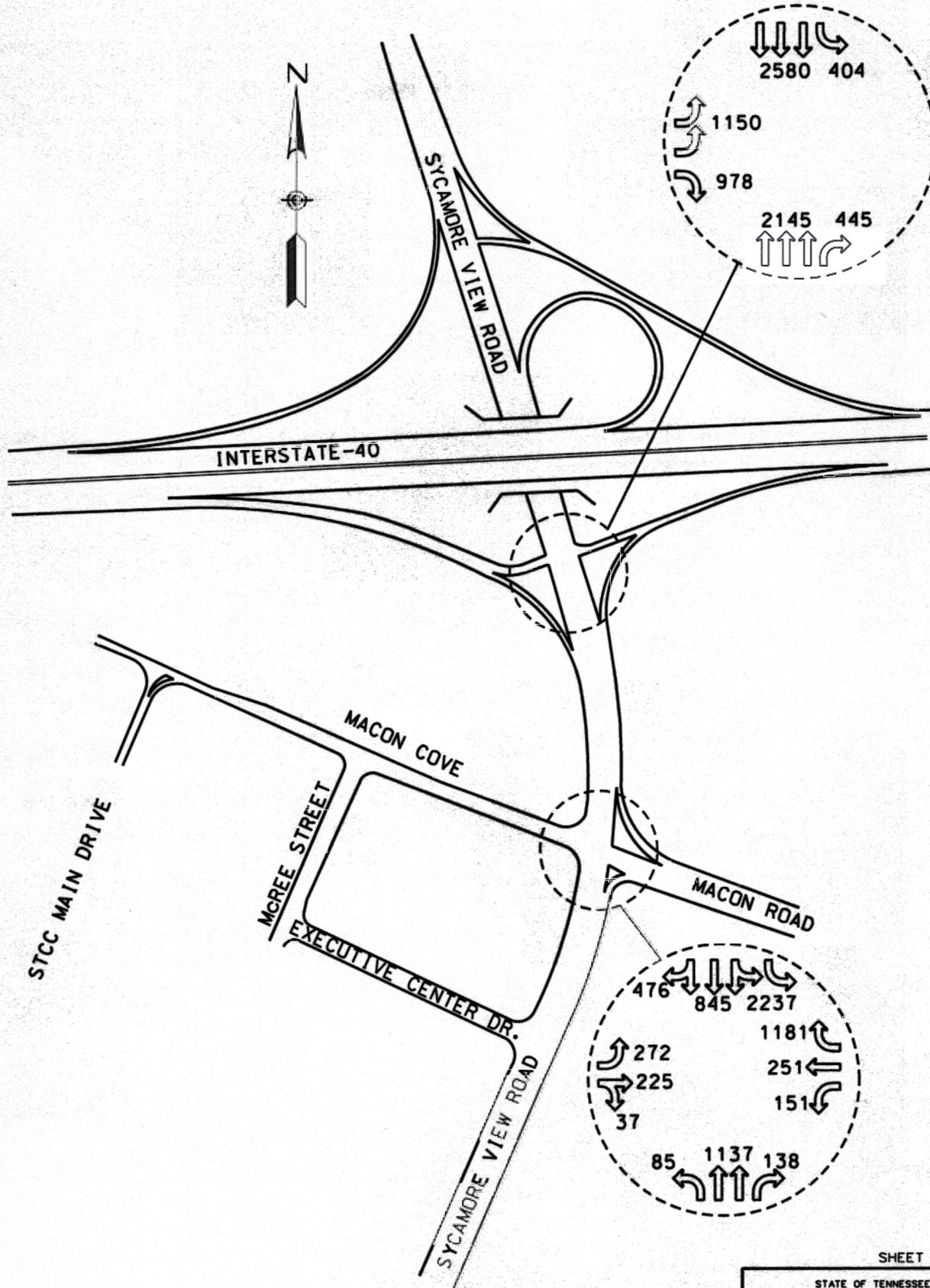
SHEET 1 OF 2

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

AM PEAK

NO BUILD
AM DESIGN HOURLY
VOLUMES FOR
THE YEAR 2005

SCALE: N.T.S.



STCC MAIN DRIVE

MCREE STREET

EXECUTIVE CENTER DR.

SYCAMORE VIEW ROAD

MACON COVE

MACON ROAD

INTERSTATE-40

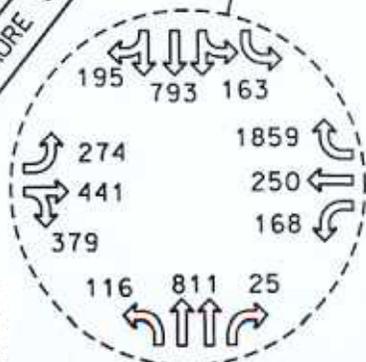
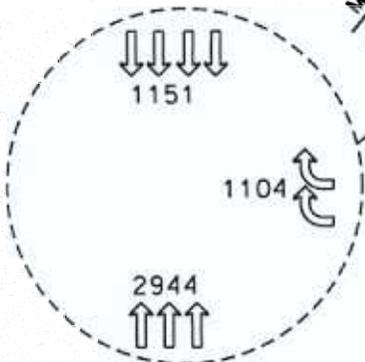
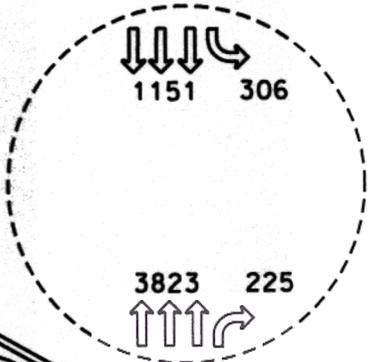
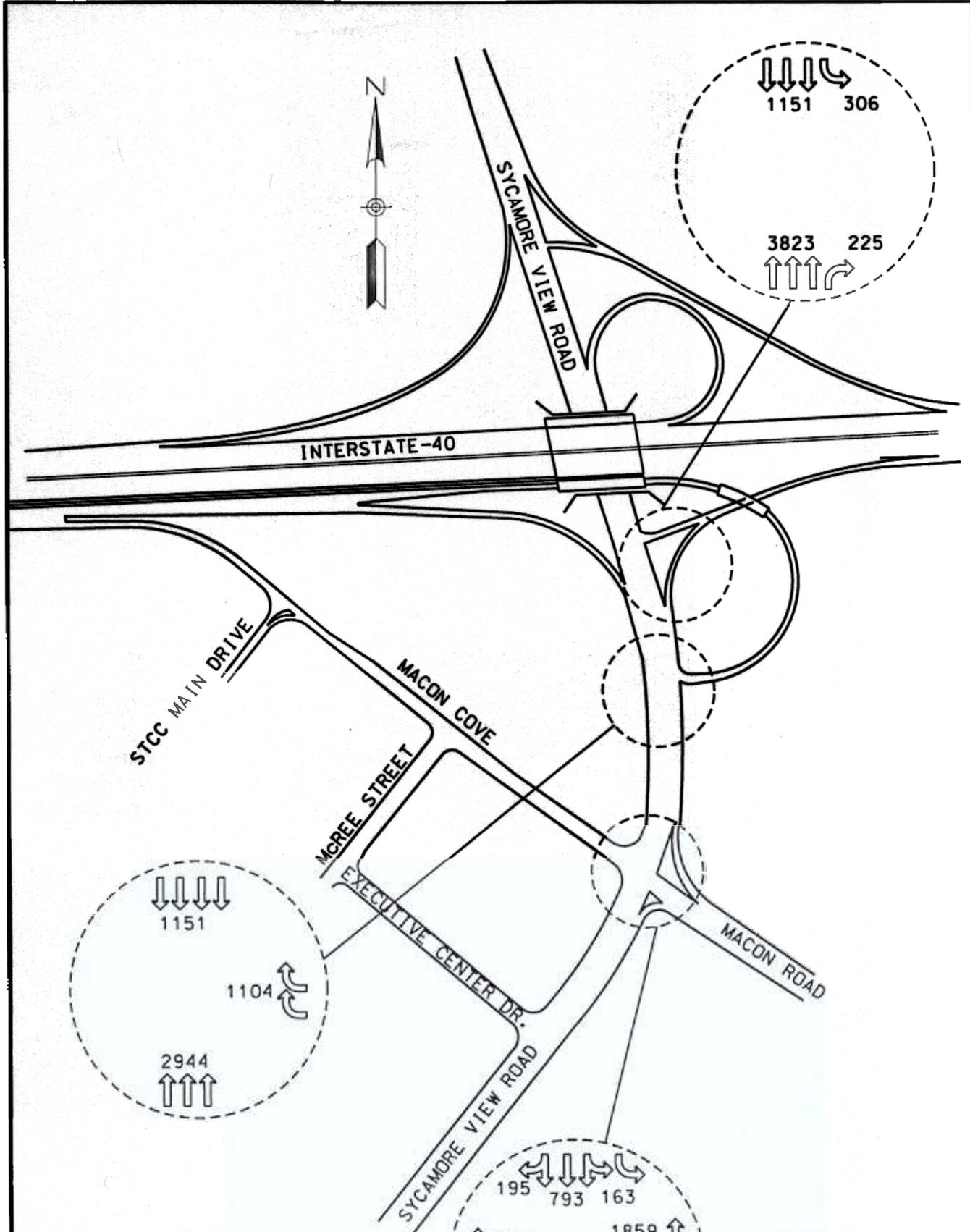
PM PEAK

SHEET 2 OF 2

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

NO BUILD
PM DESIGN HOURLY
VOLUMES FOR
THE YEAR 2005

SCALE: N.T.S.



AM PEAK

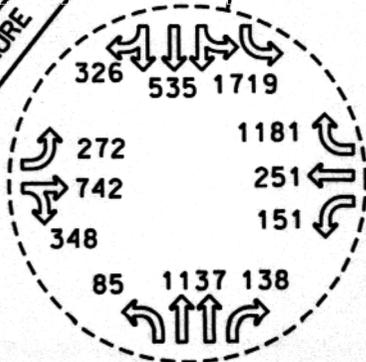
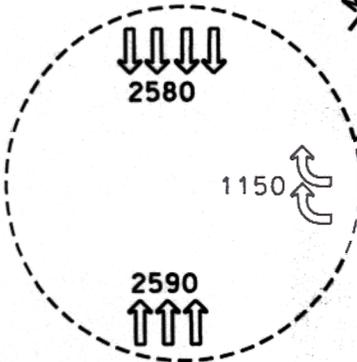
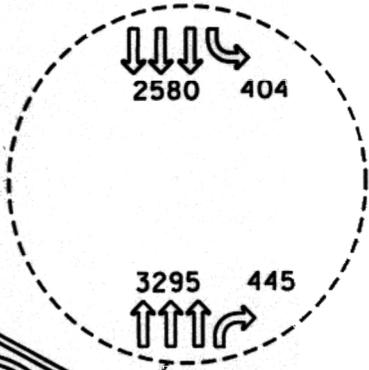
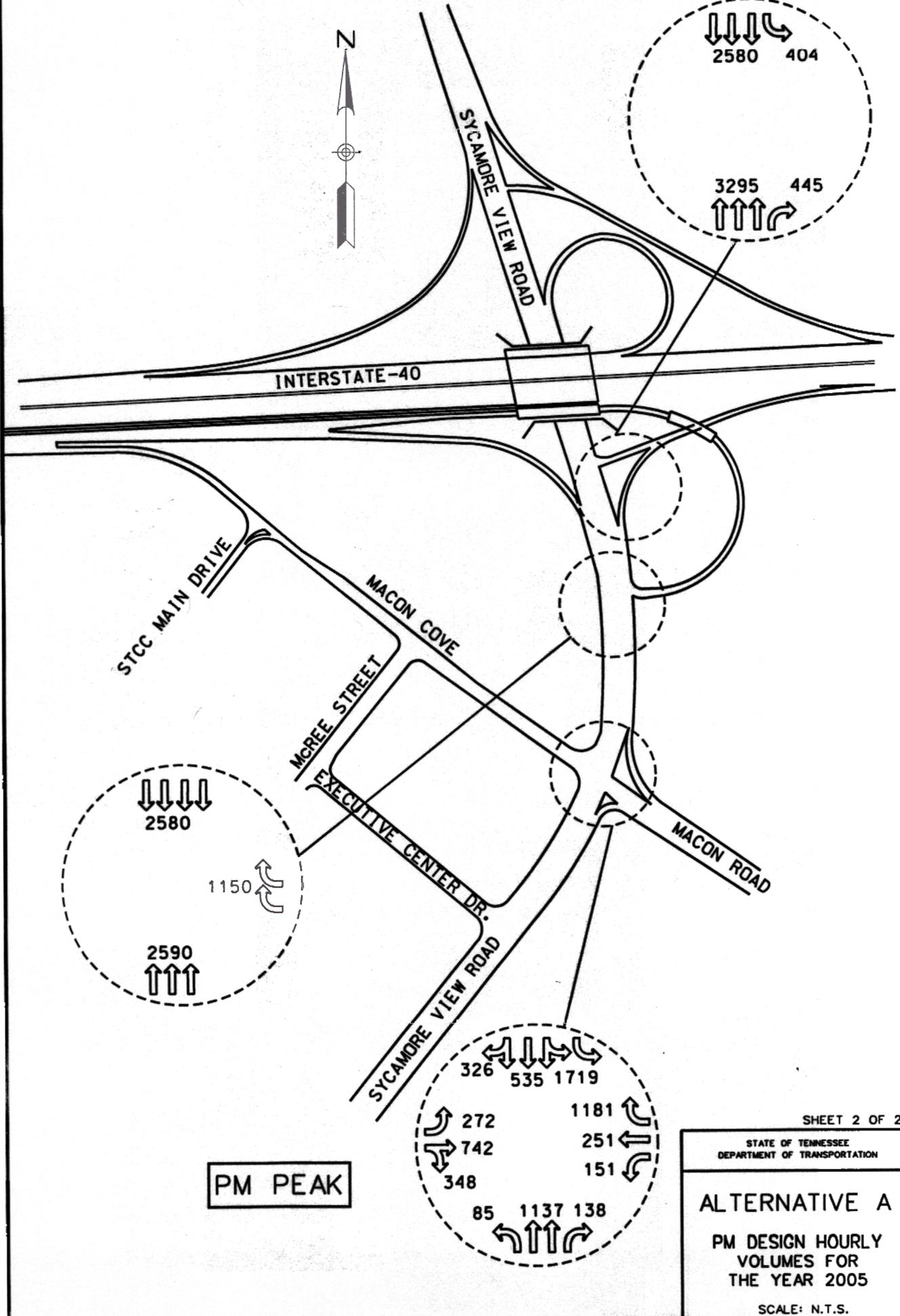
SHEET 1 OF 2

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

ALTERNATIVE A

AM DESIGN HOURLY
VOLUMES FOR
THE YEAR 2005

SCALE: N.T.S.



SHEET 2 OF 2

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

ALTERNATIVE A

PM DESIGN HOURLY
VOLUMES FOR
THE YEAR 2005

SCALE: N.T.S.

Traffic Summary of License Tag Matching

Sycamore View Off-ramp Count (right turns)	
Date:	Time:
4/23/02	7:00 AM - 9:00 AM
Number of cars from video tape =	1059
Number of cars counted from count cards =	1250
Percent of counted cars that were captured on video =	84.7 %

Sycamore View Off-ramp Count (right turns)	
Date:	Time:
4/23/02	4:00 PM - 6:00 PM
Number of cars from video tape =	1068
Number of cars counted from count cards =	1272
Percent of counted cars that were captured on video =	84.0 %

SWTCC Main Entrance Count	
Date:	Time:
4/23/02	7:00 AM - 9:00 AM
Number of cars from video tape =	958
Number of cars counted from count cards =	885
Percent of counted cars that were captured on video =	108.2 %

SWTCC Main Entrance Count	
Date:	Time:
4/23/02	4:00 PM - 6:00 PM
Number of cars from video tape =	762
Number of cars counted from count cards =	703
Percent of counted cars that were captured on video =	108.4 %

Resource Driveway Count	
Date:	Time:
4/23/02	7:00 AM - 9:00 AM
Number of cars from video tape =	69
Number of cars counted from count cards =	75
Percent of counted cars that were captured on video =	92.0 %

Resource Driveway Count	
Date:	Time:
4/23/02	4:00 PM - 6:00 PM
Number of cars from video tape =	80
Number of cars counted from count cards =	77
Percent of counted cars that were captured on video =	103.9 %

Matches from Sycamore Off Ramp to SWTCC Main Entrance	
Date:	Time:
4/23/02	7:00 AM - 9:00 AM
Number of matches =	198
Number of cars from video tape =	1059
Percent of cars from video tape that used main entrance =	18.7 %

Matches from Sycamore Off Ramp to SWTCC Main Entrance	
Date:	Time:
4/23/02	4:00 PM - 6:00 PM
Number of matches =	170
Number of cars from video tape =	1068
Percent of cars from video tape that used main entrance =	15.9 %

Matches from Sycamore Off Ramp to Resource Drive	
Date:	Time:
4/23/02	7:00 AM - 9:00 AM
Number of matches =	37
Number of cars from video tape =	N/A
Percent of cars from EB offramp that used Resource Drive =	3.0 %

Matches from Sycamore Off Ramp to Resource Drive	
Date:	Time:
4/23/02	4:00 PM - 6:00 PM
Number of matches =	30
Number of cars from video tape =	N/A
Percent of cars from EB ramp that used Resource Drive =	2.4 %

Sycamore View Off-Ramp to left-turn onto Macon	
Date:	Time:
4/23/02	7:00 AM - 9:00 AM
Number of left turns in queue before green phase =	381
Number of left turns after green phase started =	80
Number of cars from off-ramp on video tape =	1059
Percent of cars from off-ramp on video tape that turned left onto Macon =	43.53 %

Sycamore View Off-Ramp to left-turn onto Macon	
Date:	Time:
4/23/02	4:30 PM - 6:30 PM
Number of left turns in queue before green phase =	474
Number of left turns after green phase started =	187
Number of cars counted from count cards =	1246 (*)
Percent of cars from off-ramp on video tape that turned left onto Macon =	53.0 %

(*) Used count card data instead of video tape data due to time difference.

SWTCC Main Entrance	
Date:	Time:
4/23/02	7:00 AM - 9:00 AM
Number of cars from SWTCC driveway =	188
Number of cars going westbound (from east of SWTCC driveway) =	15
Number of cars going eastbound =	62

SWTCC Main Entrance	
Date:	Time:
4/23/02	4:30 PM - 6:30 PM
Number of cars from SWTCC driveway =	335
Number of cars going westbound (from east of SWTCC driveway) =	50
Number of cars going eastbound =	85

HCS2000 Signalized Intersections Release 4.1a

Analyst: Alt A mjb 2005 Inter.: Macon Road & Sycamore View R
 Date: 02/03/2003 Jurisd:
 Period: PM peak Year : 2005
 Project ID: New Ramp to Macon Cove - impr. intersection at Sycamore View
 E/W St: Macon Road N/S St: Sycamore View Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	1	1	2	0	1	2	1	3	2	1
LGConfig	L	T	R	L	T		L	T	R	L	T	R
Volume	272	742	348	151	251		85	1137	138	1719	535	326
Lane Width	12.0	15.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
RTOR Vol			0						0			0

Duration	Area Type: All other areas									
Signal Operations										
Phase Combination	1	2	3	4	5	6				
EB Left		A	A		NB Left	A				
Thru			A	P	Thru	A				
Right			A	P	Right	A				
Peds				X	Peds	X				
WB Left		A			SB Left		P			
Thru				P	Thru		P			
Right					Right		P			
Peds				X	Peds		X			
NB Right		P			EB Right	P				
SB Right		P			WB Right					
Green		15.0	2.0	15.0		40.0	44.0			
Yellow		3.5		3.5		3.5	3.5			
All Red		0.5		0.5		0.5	0.5			

Cycle Length: 132.0 sec

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
East bound								
L	294	1761	0.98	0.17	102.5	F		
T	759	5566	1.03	0.14	97.3	F	79.8	E
R	725	1543	0.51	0.47	25.0	C		
West bound								
L	216	1778	0.75	0.12	69.7	E		
T	431	3557	0.62	0.12	61.7	E	64.7	E
Northbound								
L	539	1736	0.17	0.31	33.3	C		
T	1078	3471	1.10	0.31	103.9	F	91.0	F
R	665	1539	0.22	0.43	23.7	C		
Southbound								
L	1615	4738	1.10	0.34	97.4	F		
T	1183	3471	0.48	0.34	35.6	D	75.0	E
R	747	1540	0.46	0.48	24.7	C		
Intersection Delay = 79.2 (sec/veh)					Intersection LOS = E			

OPERATIONAL ANALYSIS

Analyst: Alt A mjb 2005
 Agency/Co.: Sycamore View Road
 Date Performed: 02/03/2003
 Analysis Time Period: PM peak
 Intersection: Macon Road & Sycamore View Road2005
 Area Type: All other areas
 Jurisdiction:
 Analysis Year: 2005
 Project ID: New Ramp to Macon Cove - impr intersection at Sycamore View
 East/West Street North/South Street
 Macon Road Sycamore View Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	272	742	348	151	251		85	1137	138	1719	535	326
% Heavy Veh	2	2	2	2	2		4	4	4	4	4	4
PHF	0.94	0.95	0.94	0.93	0.94		0.92	0.96	0.93	0.97	0.95	0.94
PK 15 Vol	72	195	93	41	67		23	296	37	443	141	87
Hi Ln Vol												
% Grade		1			-1			0			0	
Ideal Sat	1900	1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
ParkExist												
NumPark												
No. Lanes	1	3	1	1	2	0	1	2	1	3	2	1
LGConfig	L	T	R	L	T		L	T	R	L	T	R
Lane Width	12.0	15.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
RTOR Vol			0						0			0
Adj Flow	289	781	370	162	267		92	1184	148	1772	563	347
%InSharedLn												
Prop LTs		0.000			0.000			0.000			0.000	
Prop RTs			1.000		0.000			0.000	1.000		0.000	1.000
Peds Bikes	10		0	10			10		0	10		0
Buses	0	0	0	0	0		0	0	0	0	0	0
%InProtPhase			0.0						0.0			0.0
Duration	0.25											

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Arriv. Type	3	3	3	3	3		3	3	3	3	3	3
Unit Ext.	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext of g	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped Min g												

PHASE DATA

Phase Combination	1	2	4	5	6	7	8
EB Left	A	A		NB Left	A		
Thru		A	P	Thru	A		
Right		A	P	Right	A		
Peds			X	Peds	X		
WB Left	A			SB Left		P	
Thru			P	Thru		P	
Right				Right		P	
Peds			X	Peds		X	
NB Right	P			EB Right	P		
SB Right	P			WB Right			
Green	15.0	2.0	15.0	40.0	44.0		
Yellow	3.5		3.5	3.5	3.5		
All Red	0.5		0.5	0.5	0.5		

Cycle Length: 132.0 sec

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	272	742	348	151	251		95	1137	138	1719	535	326
PHF	0.94	0.95	0.94	0.93	0.94		0.92	0.96	0.93	0.97	0.95	0.94
Adj flow	289	781	370	162	267		92	1184	148	1772	563	347
No. Lanes	1	3	1	1	2	0	1	2	1	3	2	1
Lane group	L	T	R	L	T		L	T	R	L	T	R
Adj flow	289	781	370	162	267		92	1184	148	1772	563	347
Prop LTs		0.000			0.000			0.000			0.000	
Prop RTs			1.000		0.000			0.000	0.000		0.000	1.000

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

LG	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
So	1900	1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
Lanes	1	3	1	1	2	0	1	2	1	3	2	1
fw	1.000	1.100	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.00
fHV	0.980	0.980	0.980	0.980	0.980		0.962	0.962	0.962	0.962	0.962	0.96
fG	0.995	0.995	0.995	1.005	1.005		1.000	1.000	1.000	1.000	1.000	1.00
fP	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.00
fBB	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.00
fA	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
fLU	1.00	0.91	1.00	1.00	0.95		1.00	0.95	1.00	0.91	0.95	1.00
fRT		1.000	0.850		1.000			1.000	0.850		1.000	0.85
fLT	0.950	1.000		0.950	1.000		0.950	1.000		0.950	1.000	
Sec.												
fLpb	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
fRpb		1.000	0.979		1.000			1.000	0.991		1.000	0.99
S	1761	5566	1543	1778	3557		1736	3471	1539	4738	3471	1540
Sec.												

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Left	L	289	1761	0.16	0.17	294	0.98
Thru	T	781	5566	0.14	0.14	759	1.03
Right	R	370	1543	0.24	0.47	725	0.51
Westbound							
Left	L	162	1778	0.09	0.12	216	0.75
Thru	T	267	3557	0.08	0.12	431	0.62
Northbound							
Left	L	92	1736	0.05	0.31	539	0.17
Thru	T	1184	3471	0.34	0.31	1078	1.10
Right	R	148	1539	0.10	0.43	665	0.22
Southbound							
Left	L	1772	4738	0.37	0.34	1615	1.10
Thru	T	563	3471	0.16	0.34	1183	0.48
Right	R	347	1540	0.23	0.48	747	0.46

Sum of flow ratios for critical lane groups, $Yc = \text{Sum (v/s)} = 0.95$
 Total lost time per cycle, $L = 8.00$ sec
 Critical flow rate to capacity ratio, $Xc = Yc \cdot (C) / (C-L)$

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Res Del d2	Res Del d3	Lane Group Delay LOS	Approach Delay LOS
Eastbound									
L	0.98	0.17	54.8	1.000	294	0.49	47.7	0.0	102.5 F
T	1.03	0.14	57.0	1.000	759	0.50	40.3	0.0	97.3 F 79.8 E
R	0.51	0.47	24.4	1.000	725	0.12	0.6	0.0	25.0 C
Westbound									
L	0.75	0.12	56.1	1.000	216	0.31	13.6	0.0	69.7 E
T	0.62	0.12	55.1	1.000	431	0.50	6.5	0.0	61.7 E 64.7 E
Northbound									
L	0.17	0.31	33.1	1.000	539	0.11	0.2	0.0	33.3 C
T	1.10	0.31	45.5	1.000	1078	0.50	58.4	0.0	103.9 F 91.0 E
R	0.22	0.43	23.6	1.000	665	0.11	0.2	0.0	23.7 C
Southbound									
L	1.10	0.34	43.5	1.000	1615	0.50	53.9	0.0	97.4 F
T	0.48	0.34	34.2	1.000	1183	0.50	1.4	0.0	35.6 D 75.0 E
R	0.46	0.48	22.6	1.000	747	0.50	2.1	0.0	24.7 C

Intersection delay = 79.2 (sec/veh) Intersection LOS = E

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns

	EB	WB	NB	SB
Effective pedestrian green time, gp (s)				
Conflicting pedestrian volume, Vped (p/h)				
Pedestrian flow rate, Vpedg (p/h)				
OCCpedg				
Opposing queue clearing green, gq (s)				
Eff. ped. green consumed by opp. veh. queue, gq/gp				
OCCpedu				
Opposing flow rate, Vo (veh/h)	267			
OCCr				
Number of cross-street receiving lanes, Nrec				
Number of turning lanes, Nturn				
ApbT				
Proportion of left turns, PLT				
Proportion of left turns using protected phase, PLTA				
Left-turn adjustment, fLpb				
Permitted Right Turns				
Effective pedestrian green time, gp (s)	19.0		44.0	18.0
Conflicting pedestrian volume, Vped (p/h)	10		10	10
Conflicting bicycle volume, Vbic (bicycles/h)	0		0	0
Vpedg	69		30	27
OCCpedg	0.035		0.015	0.01
Effective green, g (s)	0.0		0.0	0.0
Vbicg	0		0	0
OCCbicg	0.020		0.020	0.02
OCCr	0.035		0.015	0.01
Number of cross-street receiving lanes, Nrec	3		3	2
Number of turning lanes, Nturn	1		1	1
ApbT	0.979		0.991	0.99
Proportion right-turns, PRT	1.000		1.000	1.00
Proportion right-turns using protected phase, PRTA	0.000		0.000	0.00
Right turn adjustment, fRpb	1.000		1.000	1.00

BACK OF QUEUE WORKSHEET

LaneGroup	Eastbound			Westbound		Northbound			Southbound			
	L	T	R	L	T	L	T	R	L	T	R	
Init Queue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Flow Rate	289	260	370	162	133	92	592	148	590	281	347	
So	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
No.Lanes	1	3	1	1	2	0	1	2	1	3	1	
SL	1761	1855	1543	1778	1778		1736	1735	1539	1579	1735	1540
LnCapacity	294	253	725	216	215		539	539	665	538	591	747
Flow Ratio	0.16	0.14	0.24	0.09	0.07		0.05	0.34	0.10	0.37	0.16	0.23
v/c Ratio	0.98	1.03	0.51	0.75	0.62		0.17	1.10	0.22	1.10	0.48	0.46
Grn Ratio	0.17	0.14	0.47	0.12	0.12		0.31	0.31	0.43	0.34	0.34	0.48
I Factor		1.000			1.000			1.000			1.000	
AT or PVG	3	3	3	3	3		3	3	3	3	3	3
Pltn Ratio	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
PF2	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Q1	10.6	9.5	9.5	5.7	4.6		2.5	21.7	3.4	21.6	8.1	8.5
kB	0.4	0.4	0.7	0.3	0.5		0.6	0.6	0.7	1.0	1.0	1.2
Q2	3.6	4.0	0.7	0.9	0.8		0.1	10.7	0.2	12.3	0.9	1.0
Q Average	14.1	13.5	10.2	6.7	5.4		2.6	32.5	3.6	33.9	9.0	9.5
Q Spacing												
Q Storage												
Q S Ratio												
70th Percentile Output:												
fb%	1.2	1.2	1.2	1.2	1.2		1.2	1.1	1.2	1.2	1.2	1.2
BOQ	16.5	15.8	12.0	7.9	6.7		3.1	37.1	4.3	40.7	11.0	11.5
QSRatio												
85th Percentile Output:												
fb%	1.5	1.5	1.5	1.5	1.5		1.6	1.4	1.6	1.4	1.4	1.4
BOQ	21.0	20.2	15.4	10.3	8.1		4.1	45.5	5.6	47.5	13.1	13.7
QSRatio												
90th Percentile Output:												
fb%	1.6	1.6	1.6	1.7	1.7		1.8	1.5	1.7	1.5	1.6	1.6
BOQ	22.6	21.7	16.7	11.2	9.0		4.5	48.0	6.3	50.9	14.3	15.0
QSRatio												
95th Percentile Output:												
fb%	1.8	1.8	1.8	1.9	1.9		2.0	1.6	2.0	1.6	1.8	1.7
BOQ	25.1	24.1	18.8	12.7	10.5		5.2	51.9	7.2	54.3	15.9	16.6
QSRatio												
98th Percentile Output:												
fb%	2.0	2.1	2.2	2.3	2.2		2.5	1.8	2.5	1.7	1.9	1.9
BOQ	28.8	27.8	22.0	15.3	11.9		6.5	57.8	8.9	57.7	17.6	18.3
QSRatio												

ERROR MESSAGES

No errors to report

Sycamore View Road, New Ramp to Macon Cove - impr. geometry
 1: Macon Road & Sycamore View Road

PM Peak
 2/4/2003

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
				↙			↙	↑↑			↑↑	
				1900			1900	1900			1900	
				12			12	12			12	
								0%			0%	
	50		100	379			284		284	0		0
				1			1		1	3		
	3.0	3.0	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0
	50	50	50	50			50	50	50	50	50	50
	0	0	0	0			0	0	0	0	0	0
	15		9	15			15		9	15		9
	1.00	0.91	1.00	1.00			1.00	0.95	1.00	0.90	0.95	1.00
	0.99		0.96	0.99			0.99		0.96	0.99		0.96
			0.850						0.850			0.850
	0.950			0.950			0.950			0.950		
	1761	5566	1575	1778	3557	0	1736	3471	1553	4686	3471	1553
	0.305			0.950			0.950			0.950		
	558	5566	1519	1764	3557	0	1716	347	1497	4649	347	1497
			Yes			Yes			Yes			Yes
			208						119			347
	0.01	0.89	1.01	0.99	0.99	0.99	0.00	1.00	1.00	1.00	1.00	1.00
		40			40			40			40	
		653			379			284			181	
		11.1			6.5			4.8			3.1	
	272	742	348	151	251	0	85	137	138	1719	535	326
	10		10	10		10	10		10	10		10
	0.94	0.95	0.94	0.93	0.94	0.95	0.92	0.96	0.93	0.97	0.95	0.94
	2%	2%	2%	2%	2%	2%	4%	4%	4%	4%	4%	4%
		40%			10%			5%			0%	
	289	781	370	162	267	0	92	1184	148	1772	563	347
	289	781	370	162	267	0	92	1184	148	1772	563	347
pm+pt			Perm	Prot			Split		Perm	Split		Perm
	7	4		3	8		2	2		6	6	
	4		4						2			6
	7	4	4	3	8		2	2	2	6	6	6
	4.0	5.0	5.0	4.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
	8.0	20.0	20.0	8.5	20.0		20.0	20.0	20.0	20.0	20.0	20.0
	19.0	21.0	21.0	17.0	19.0	0.0	44.0	44.0	44.0	48.0	48.0	48.0
	15%	16%	16%	13%	15%	0%	34%	34%	34%	37%	37%	37%
	15.0	17.0	17.0	13.0	15.0		40.0	40.0	40.0	44.0	44.0	44.0
	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5
	Lead	Lag	Lag	Lead	Lag							
				Yes								
	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
	None	None	None	None	None		None	None	None	Coord	Coord	Coord
		5.0	5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0
		11.0	11.0		11.0		11.0	11.0	11.0	11.0	11.0	11.0
		0	0		0		0	0	0	0	0	0
	34.1	17.9	17.9	13.9	15.9		41.0	41.0	41.0	45.1	45.1	45.1

Sycamore View Road, New Ramp to Macon Cove - impr. geometry
 1: Macon Road & Sycamore View Road

PM Peak
 2/4/2003

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
			0.14	0.11				0.32			0.35	
			0.95	0.86				1.08			0.47	
			24.1	57.0				44.5			33.1	
			47.2	76.5				85.9			33.4	
			D	E				F			C	
								74.4			63.6	
								E			E	
	214		146	136			56	-586	17	-622	194	0
	#359		#345	#261			100	#724	68	#720	248	64
								204			101	
								46%		55%	32%	
								53%		57%	39%	
	150		100	379			284		284			
	25%	32%	18%					37%				
	48%	49%	63%					47%				
	95	116	105					38		997	201	

Area Type: Other
 Cycle Length: 130
 Actuated Cycle Length: 130
 Offset: 0 (0%), Referenced to phase 6:SBTL, Start of Green, Master Intersection
 Natural Cycle: 100
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.09
 Intersection Signal Delay: 68.2
 Intersection Capacity Utilization 104.9%
 Intersection LOS: E
 ICU Level of Service F
 * User Entered Value
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Macon Road & Sycamore View Road

 ø2	 ø6	 ø3	 ø4
44 s	48 s	17 s	21 s
		 ø7	 ø8
		19 s	19 s

HCS2000: Signalized Intersections Release 4.1a

Analyst: mjb Alt. A2 2005
 Agency: Parsons
 Date: 02-04-2003
 Period: AM Peak
 E/W St: Macon Road

Inter.:
 Area Type All other areas
 Jurisd:
 Year : 2005 New ramp. - prop. ge
 N/S St: Sycamore View Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	1	1	2	0	1	2	1	3	2	1
LGConfig	L	T	R	L	T		L	T	R	L	T	R
Volume	274	441	379	168	250		116	811	25	163	793	195
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
RTOR Vol			0						0			0

Duration 0:25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A	A		NB Left	A		
Thru			A		Thru	A		
Right			A		Right	A		
Peds			X		Peds	X		
WB Left		A			SB Left		P	
Thru			A		Thru		P	
Right					Right		P	
Peds			X		Peds		X	
NB Right		P			EB Right	P		
SB Right		P			WB Right			
Green		20.0	23.0			31.7	41.0	
Yellow		4.0	3.5			3.5	3.5	
All Red		0.0	0.5			0.5	0.5	

Cycle Length: 131.7 sec

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	428	1746	0.68	0.36	36.7	D		
T	922	5060	0.51	0.18	49.0	D	38.6	D
R	703	1550	0.57	0.45	27.7	C		
Westbound								
L	284	1778	0.64	0.16	56.5	E		
T	648	3557	0.41	0.18	48.0	D	51.5	D
Northbound								
L	431	1736	0.29	0.25	40.5	D		
T	862	3471	0.99	0.25	77.6	E	71.5	E
R	626	1536	0.04	0.41	23.6	C		
Southbound								
L	1511	4738	0.12	0.32	31.9	C		
T	1107	3471	0.75	0.32	45.0	D	38.8	D
R	771	1539	0.27	0.50	19.8	B		
Intersection Delay = 48.8			(sec/veh)		Intersection LOS = D			

HCS2000: Signalized Intersections Release 4.1a
OPERATIONAL ANALYSIS

Analyst: mjb Alt. A2 2005
 Agency/Co.: Parsons
 Date Performed: 02-04-2003
 Analysis Time Period: AM Peak
 Intersection:
 Area Type: All other areas
 Jurisdiction:
 Analysis Year: 2005 New ramp. - prop geom.Parsons
 Project ID: Alternate A2 EB off loop ramp
 East/West Street North/South Street
 Macon Road Sycamore View Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	274	441	379	168	250		116	811	25	163	793	195
% Heavy Veh	2	2	2	2	2		4	4	4	4	4	4
PHF	0.94	0.94	0.94	0.93	0.94		0.93	0.95	0.90	0.93	0.95	0.93
PK 15 Vol	73	117	101	45	66		31	213	7	44	209	52
Hi Ln Vol												
% Grade		1			-1			0			0	
Ideal Sat	1900	1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
ParkExist												
NumPark												
No. Lanes	1		1	1	2	0	1	2	1	3		1
LGConfig	L		R		T		L	T	R	L		R
Lane Width	12.0	12.3	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
RTOR Vol			0						0			0
Adj Flow	291	469	403	181	266		125	854	28	175	6	210
%InSharedLn												
Prop LTs	1.000	0.000			0.000			0.000			0.000	
Prop RTs			1.000		0.000			0.000	1.000		0.000	1.000
Peds Bikes	10		0	10			10	0		10		0
Buses	0	0	0	0	0		0	0	0	0	0	0
%InProtPhase	0.0		0.0						0.0			0.0
Duration	0.25											

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Arriv. Type	3	3	3	3	3		3	3	3	3	3	3
Unit Ext.	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext of g	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped Min g												

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A	A			NB Left	A		
Thru		A			Thru	A		
Right		A			Right	A		
Peds		X			Peds	X		
WB Left	A				SB Left		P	
Thru		A			Thru		P	
Right					Right		P	
Peds		X			Peds		X	
NB Right					EB Right	P		
SB Right	P				WB Right			

Green	20.0	23.0			31.7	41.0
Yellow	4.0	3.5			3.5	3.5
All Red	0.0	0.5			0.5	0.5

Cycle Length: 131.7 se

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	274	441	379	168	250		116	811	25	163	793	195
PHF	0.94	0.94	0.94	0.93	0.94		0.93	0.95	0.90	0.93	0.95	0.93
Adj flow	291	469	403	181	266		125	854	28	175	835	210
No. Lanes	1	3	1	1	2	0	1	2	1	3	2	1
Lane group	L	T	R	L	T		L	T	R	L	T	R
Adj flow	291	469	403	181	266		125	854	28	175	835	210
Prop LTs	1.000	0.000			0.000			0.000			0.000	
Prop RTs			1.000		0.000			0.000	1.000		0.000	1.000

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

LG	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
So	1900	1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
Lanes	1	3	1	1	2	0	1	2	1	3	2	1
fW	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.00
fHV	0.980	0.980	0.980	0.980	0.980		0.962	0.962	0.962	0.962	0.962	0.96
fG	0.995	0.995	0.995	1.005	1.005		1.000	1.000	1.000	1.000	1.000	1.00
fP	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.00
fBB	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.00
fA	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
fLU	1.00	0.91	1.00	1.00	0.95		1.00	0.95	1.00	0.91	0.95	1.00
fRT		1.000	0.850		1.000			1.000	0.850		1.000	0.85
fLT	0.950	1.000		0.950	1.000		0.950	1.000		0.950	1.000	
Sec.	0.386											
fLpb	0.992	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
fRpb		1.000	0.984		1.000			1.000	0.989		1.000	0.99
S	1746	5060	1550	1778	3557		1736	3471	1536	4738	3471	1539
Sec.	710											

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot		285	1746	0.16	0.163	285	1.00
Perm		6	710	0.01	0.201	143	0.04
Left	L	291			0.36	428	0.68
Prot							
Perm							
Thru	T	469	5060	0.09	0.18	922	0.51
Right	R	403	1550	0.26	0.45	703	0.57
Westbound							
Prot							
Perm							
Left	L	181	1778	0.10	0.16	284	0.64
Prot							
Perm							
Thru	T	266	3557	0.07	0.18	648	0.41
Right							
Northbound							
Prot							
Perm							
Left	L	125	1736	0.07	0.25	431	0.29
Prot							
Perm							
Thru	T	854	3471	0.25	0.25	862	0.99
Right	R	28	1536	0.02	0.41	626	0.04
Southbound							
Prot							
Perm							
Left	L	175	4738	0.04	0.32	1511	0.12
Prot							
Perm							
Thru	T	835	3471	0.24	0.32	1107	0.75
Right	R	210	1539	0.14	0.50	771	0.27

Sum of flow ratios for critical lane groups, $Y_c = \text{Sum (v/s)} = 0.74$

Total lost time per cycle, $L = 12.00 \text{ sec}$

Critical flow rate to capacity ratio, $X_c = (Y_c)(C)/(C-L) = 0.82$

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios		Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental		Res Del d3	Lane Group		Approach	
	v/c	g/C				Factor	Del d2		Delay	LOS	Delay	LOS
Eastbound												
L	0.68	0.36	32.3	1.000	428	0.25	4.3	0.0	36.7	D		
T	0.51	0.18	48.5	1.000	922	0.12	0.5	0.0	49.0	D	38.6	D
R	0.57	0.45	26.6	1.000	703	0.17	1.1	0.0	27.7	C		
Westbound												
L	0.64	0.16	51.8	1.000	284	0.22	4.7	0.0	56.5	E		
T	0.41	0.18	47.6	1.000	648	0.11	0.4	0.0	48.0	D	51.5	D
Northbound												
L	0.29	0.25	40.1	1.000	431	0.11	0.4	0.0	40.5	D		
T	0.99	0.25	49.3	1.000	862	0.49	28.3	0.0	77.6	E	71.5	E
R	0.04	0.41	23.5	1.000	626	0.11	0.0	0.0	23.6	C		
Southbound												
L	0.12	0.32	31.7	1.000	1511	0.50	0.2	0.0	31.9	C		
T	0.75	0.32	40.2	1.000	1107	0.50	4.8	0.0	45.0	D	38.8	D
R	0.27	0.50	19.0	1.000	771	0.50	0.9	0.0	19.8	B		

Intersection delay = 48.8 (sec/veh) Intersection LOS = D

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input	EB	WB	NB	SB
Cycle length, C	131.7			
Total actual green time for LT lane group, G (s)	47.0			
Effective permitted green time for LT lane group, g(s)	26.5			
Opposing effective green time, go (s)	24.0			
Number of lanes in LT lane group, N	1			
Number of lanes in opposing approach, No	2			
Adjusted LT flow rate, VLT (veh/h)	291			
Proportion of LT in LT lane group, PLT	1.000			
Proportion of LT in opposing flow, PLTo	0.00			
Adjusted opposing flow rate, Vo (veh/h)	266			
Lost time for LT lane group, tL	3.00			
Computation				
LT volume per cycle, LTC=VLTC/3600	10.65			
Opposing lane util. factor, fLUo	0.95	0.91	0.95	0.9
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)	5.12			
gf=G[exp(- a * (LTC ** b))]-tL, gf<=g	0.0			
Opposing platoon ratio, Rpo (refer Exhibit 16-11)	1.00			
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]	0.82			
gq, (see Exhibit C16-4,5,6,7,8)	9.08			
gu=g-gq if gq>=gf, or = g-gf if gq<gf	17.42			
n=Max(gq-gf)/2,0)	4.54			
PTHo=1-PLTo	1.00			
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]	1.00			
EL1 (refer to Exhibit C16-3)	1.70			
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g	0.15			
gdifff=max(gq-gf,0)	0.00			
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)	0.39			
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdifff/g]/[1+PL(EL2-1)], (fmin<=fm<=1.00)				
or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT	0.386			

For special case of single-lane approach opposed by multilane approach, see text.

* If $Pl \geq 1$ for shared left-turn lanes with $N > 1$, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, $flt = fm$
For special case of multilane approach opposed by single-lane approach or when $gf > gq$, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns

	EB	WB	NB	SB
Effective pedestrian green time, gp (s)	27.0			
Conflicting pedestrian volume, Vped (p/h)	10			
Pedestrian flow rate, Vpedg (p/h)	48			
OCCpedg	0.024			
Opposing queue clearing green, gq (s)	9.08			
Eff. ped. green consumed by opp. veh. queue, gq/gp	0.336			
OCCpedu	0.020			
Opposing flow rate, Vo (veh/h)	266			
OCCr	0.014			
Number of cross-street receiving lanes, Nrec	3			
Number of turning lanes, Nturn	1			
ApbT	0.992			
Proportion of left turns, PLT	1.000			
Proportion of left turns using protected phase, PLTA	0.000			
Left-turn adjustment, fLpb	0.992			
Permitted Right Turns				
Effective pedestrian green time, gp (s)	24.0		35.7	45.0
Conflicting pedestrian volume, Vped (p/h)	10		10	10
Conflicting bicycle volume, Vbic (bicycles/h)	0		0	0
Vpedg	54		36	29
OCCpedg	0.027		0.018	0.01
Effective green, g (s)	26.5		0.0	0.0
Vbicg	0		0	0
OCCbicg	0.020		0.020	0.02
OCCr	0.027		0.018	0.01
Number of cross-street receiving lanes, Nrec	3		3	2
Number of turning lanes, Nturn	1		1	1
ApbT	0.984		0.989	0.99
Proportion right-turns, PRT	1.000		1.000	1.00
Proportion right-turns using protected phase, PRTA	0.000		0.000	0.00
Right turn adjustment, fRpb	1.000		1.000	1.00

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Cycle length, C	131.7			
Adj. LT vol from Vol Adjustment Worksheet, v	291			
v/c ratio from Capacity Worksheet, X	0.68			
Protected phase effective green interval, g (s)	21.5			
Opposing queue effective green interval, gq	9.08			
Unopposed green interval, gu	17.42			
Red time $r = (C - g - gq - gu)$	83.7			
Arrival rate, $qa = v / (3600 \max[X, 1.0])$	0.08			
Protected ph. departure rate, $Sp = s / 3600$	0.485			
Permitted ph. departure rate, $Ss = s(gq + gu) / (gu * 3600)$	0.30			

	EBLT	WBLT	NBLT	SBLT
XPerm	0.41			
XProt	0.82			
Case	1			
Queue at beginning of green arrow, Qa	6.77			
Queue at beginning of unsaturated green, Qu	0.73			
Residual queue, Qr	0.00			
Uniform Delay, d1	32.3			

BACK OF QUEUE WORKSHEET

LaneGroup	Eastbound			Westbound		Northbound			Southbound		
	L	T	R	L	T	L	T	R	L	T	R
Init Queue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate	291	156	403	181	133	125	427	28	58	417	210
So	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
No.Lanes	1	3	1	1	2	0	1	2	1	3	2
SL	1746	1686	1550	1778	1778		1736	1735	1536	1579	1735
LnCapacity	428	307	703	284	324		431	431	626	503	553
Flow Ratio	0.17	0.09	0.26	0.10	0.07		0.07	0.25	0.02	0.04	0.24
v/c Ratio	0.68	0.51	0.57	0.64	0.41		0.29	0.99	0.04	0.12	0.75
Grn Ratio	0.36	0.18	0.45	0.16	0.18		0.25	0.25	0.41	0.32	0.32
I Factor		1.000			1.000			1.000			1.000
AT or PVG	3	3	3	3	3		3	3	3	3	3
Pltn Ratio	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
PF2	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Q1	10.0	5.1	10.9	6.2	4.3		3.7	15.6	0.6	1.5	13.7
kB	0.7	0.4	0.7	0.4	0.4		0.5	0.5	0.7	0.9	1.0
Q2	1.3	0.4	0.9	0.7	0.3		0.2	5.0	0.0	0.1	2.6
Q Average	11.3	5.6	11.8	6.9	4.6		3.9	20.6	0.6	1.6	16.3
Q Spacing											
Q Storage											
Q S Ratio											
70th Percentile Output:											
fB%	1.2	1.2	1.2	1.2	1.2		1.2	1.2	1.2	1.3	1.2
BOQ	13.3	6.6	13.9	8.1	5.5		4.7	23.9	0.8	2.1	19.6
QSRatio											
85th Percentile Output:											
fB%	1.5	1.5	1.5	1.5	1.6		1.6	1.5	1.6	1.6	1.4
BOQ	17.1	8.6	17.7	10.6	7.2		6.1	29.9	1.0	2.6	23.0
QSRatio											
90th Percentile Output:											
fB%	1.6	1.7	1.6	1.7	1.7		1.7	1.5	1.8	1.9	1.5
BOQ	18.4	9.5	19.2	11.6	7.9		6.8	31.8	1.2	3.0	24.8
QSRatio											
95th Percentile Output:											
fB%	1.8	1.9	1.8	1.9	2.0		2.0	1.7	2.1	2.3	1.6
BOQ	20.6	10.8	21.4	13.1	9.0		7.8	34.9	1.3	3.8	26.7
QSRatio											
98th Percentile Output:											
fB%	2.1	2.4	2.1	2.3	2.4		2.4	1.9	2.7	2.8	1.8
BOQ	24.0	13.1	24.8	15.7	11.1		9.6	39.3	1.7	4.5	28.6
QSRatio											

ERROR MESSAGES

No errors to report

Sycamore View Road, 2005 New ramp
1: Sycamore View Road &

prop. geom.

AM Peak
2/4/2003

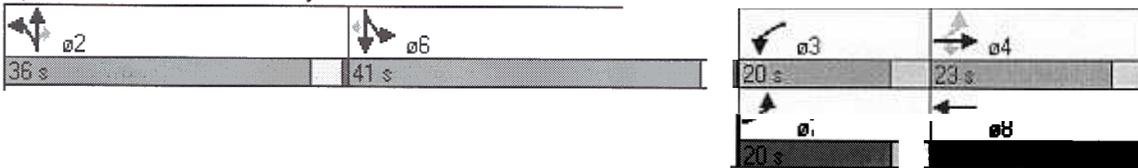
												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			 			 		  	 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		1%			-1%			0%			0%	
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50	50	50	50		50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Turning Speed (mph)	15		12	15		9	15		15	15		12
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	1.00	*0.90	0.95	1.00
Ped Bike Factor	0.99		0.97	0.99			0.99		0.97	0.99		0.97
Frnt			0.850						0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1761	5060	1575	1778	3557	0	1736	3471	1553	4686	3471	1553
Flt Permitted	0.428			0.950			0.950			0.950		
Satd. Flow (perm)	783	5060	1522	1758	3557	0	1723	3471	1500	4632	3471	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			403						28			210
Headway Factor	1.01	1.01	1.01	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		35			35			10			40	
Link Distance (ft)		683			379			284			240	
Travel Time (s)		13.3			7.4			19.4			4.1	
Volume (vph)	274	441	379	168	250	0	116	811	25	163	793	195
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Peak Hour Factor	0.94	0.94	0.94	0.93	0.94	0.92	0.93	0.95	0.90	0.93	0.95	0.93
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	4%	4%	4%
Mid-Block Traffic (%)		40%			10%			5%			0%	
Adj. Flow (vph)	291	469	403	181	266	0	125	854	28	175	835	210
Lane Group Flow (vph)	291	469	403	181	266	0	125	854	28	175	835	210
Turn Type	pm+pt		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases	4		4						2			6
Detector Phases	7	4	4	3	8		2	2	2	6	6	6
Minimum Initial (s)	4.0	5.0	5.0	4.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	20.0	20.0	8.0	20.0		20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	23.0	23.0	20.0	23.0	0.0	36.0	36.0	36.0	41.0	41.0	41.0
Total Split (%)	17%	19%	19%	17%	19%	0%	30%	30%	30%	34%	34%	34%
Maximum Green (s)	16.0	19.0	19.0	16.0	19.0		32.0	32.0	32.0	37.0	37.0	37.0
Yellow Time (s)	4.0	3.5	3.5	4.0	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.0	0.5	0.5	0.0	0.5		0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag							
Lead-Lag Optimize?					Yes							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		None	None	None	Coord	Coord	Coord
Walk Time (s)		5.0	5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)		11.0	11.0		11.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0		0		0	0	0	0	0	0
Act Effct Green (s)	34.9	18.2	18.2	15.9	17.2		32.7	32.7	32.7	41.2	41.2	41.2
Actuated g/C Ratio	0.29	0.15	0.15	0.13	0.14		0.27	0.27	0.27	0.34	0.34	0.34
v/c Ratio	0.80	0.61	0.70	0.77	0.52		0.26	0.90	0.07	0.11	0.70	0.32
Uniform Delay, d1	34.3	47.6	0.0	50.2	47.6		34.2	42.1	0.0	26.9	34.0	0.0

Lane Group	EBL	EBT	BR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay								47.0			35.2	4.1
LOS								D			D	A
Approach Delay								44.5			28.8	
Approach LOS								D			C	
Queue Length 50th (ft)	182	124	0	136			76	335	0	35	301	0
Queue Length 95th (ft)	#288	162	97	#235			129	#447	23	54	382	53
Internal Link Dist (ft)		603						204			160	
50th Up Block Time (%)								29%			33%	
95th Up Block Time (%)								40%			41%	
Turn Bay Length (ft)												
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)											305	

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 0 (0%), Referenced to phase 6:SBTL, Start of Green, Master Intersection
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.90
 Intersection Signal Delay: 35.9
 Intersection Capacity Utilization 69.1%
 * User Entered Value
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

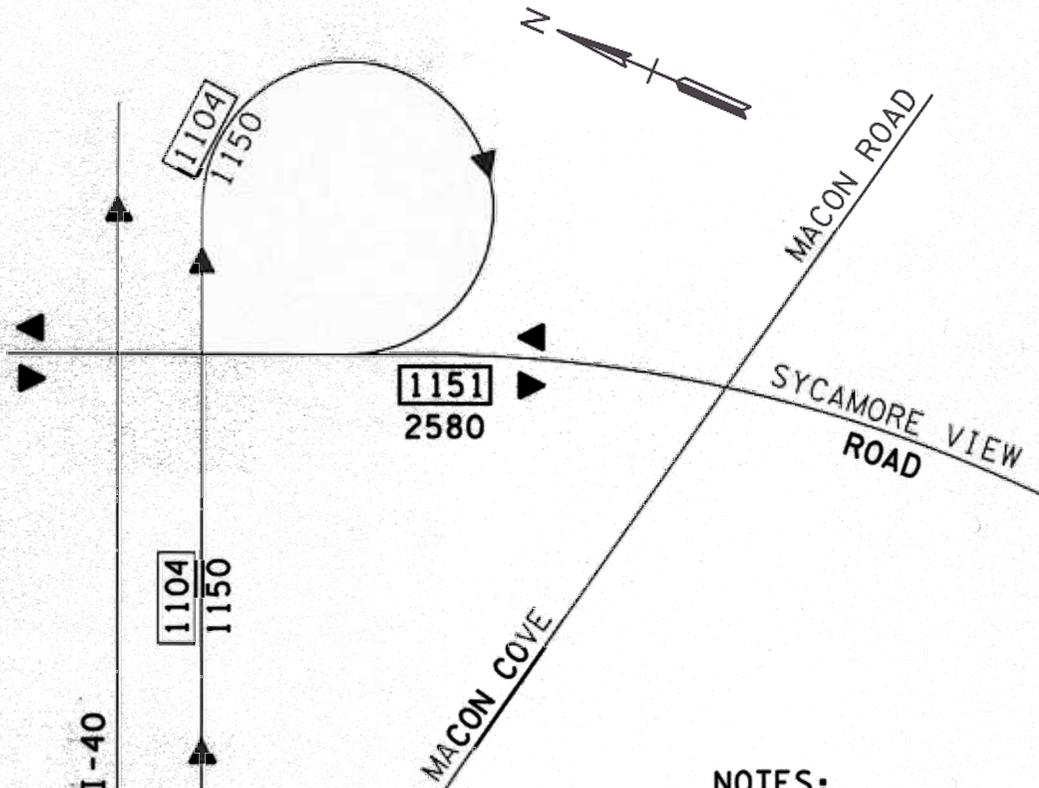
Splits and Phases: 1: Sycamore View Road &



**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix B

Traffic Volume Projections

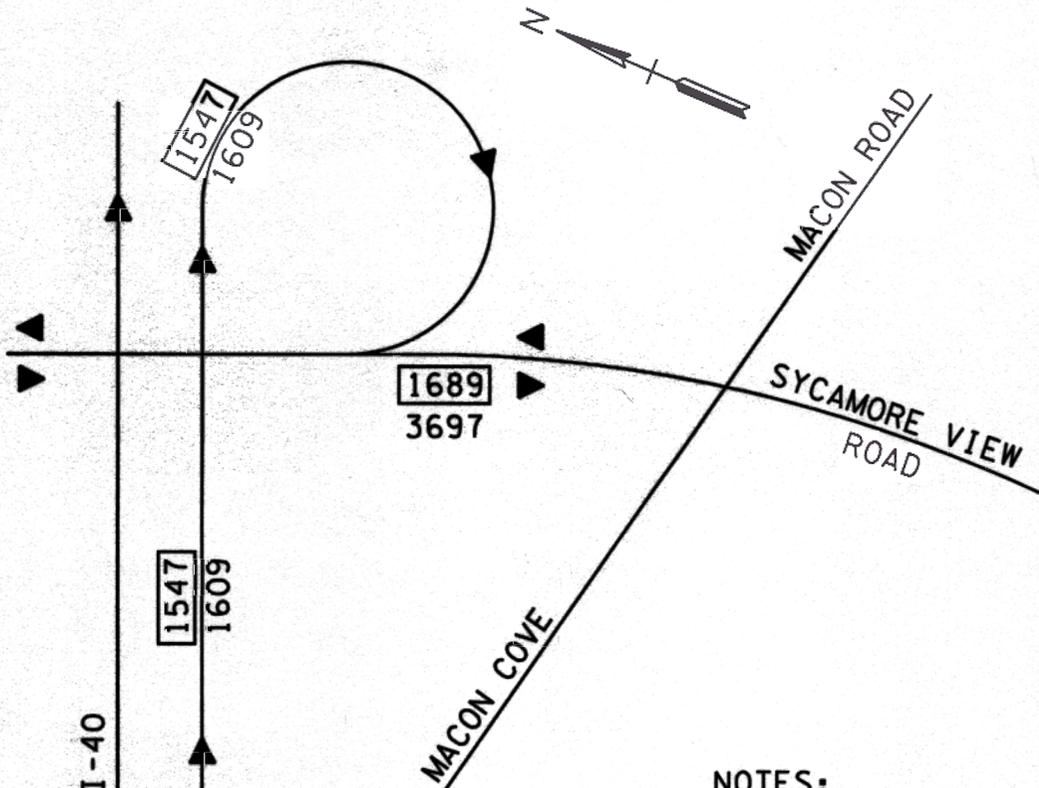


NOTES:

1. ALL OTHER VOLUMES WOULD BE THE SAME AS THE NO-BUILD VOLUMES.
2. VOLUMES SHOWN ON THE PROPOSED C-D ROAD AND ON MACON COVE ALSO APPLY TO ALTERNATE C, IF CONSTRUCTED WITH THE OFF-RAMP TO MACON COVE.

**INTERSTATE 40 &
 SYCAMORE VIEW RD.**
 INTERCHANGE
 MODIFICATION STUDY
2005 DHV
**ALTERNATE A WITH
 C-D ROAD AND OFF-RAMP
 TO MACON COVE**

AM
 PM

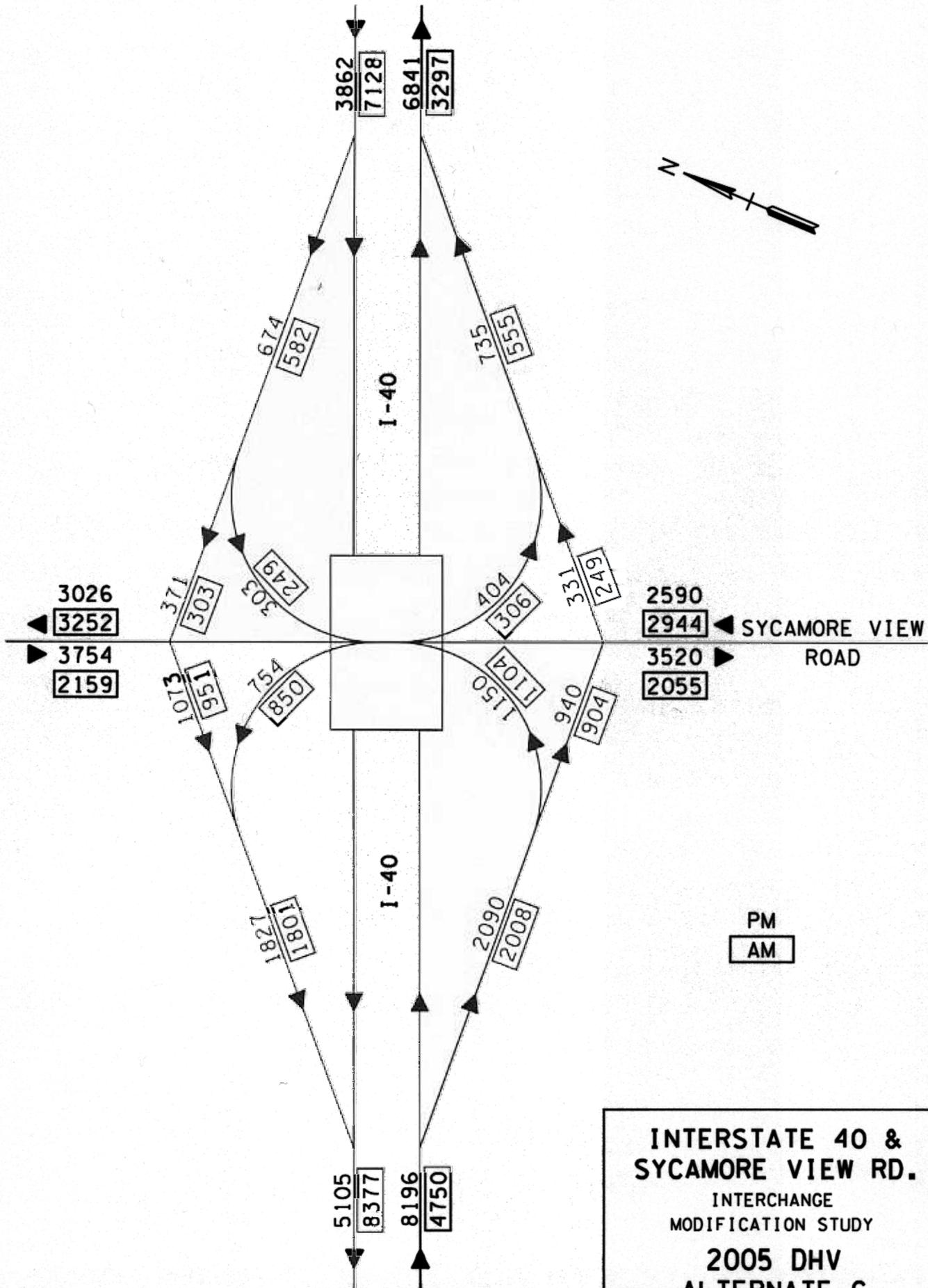


NOTES:

1. ALL OTHER VOLUMES WOULD BE THE SAME AS THE NO-BUILD VOLUMES.
2. VOLUMES SHOWN ON THE PROPOSED C-D ROAD AND ON MACON COVE ALSO APPLY TO ALTERNATE C, IF CONSTRUCTED WITH THE OFF-RAMP TO MACON COVE.

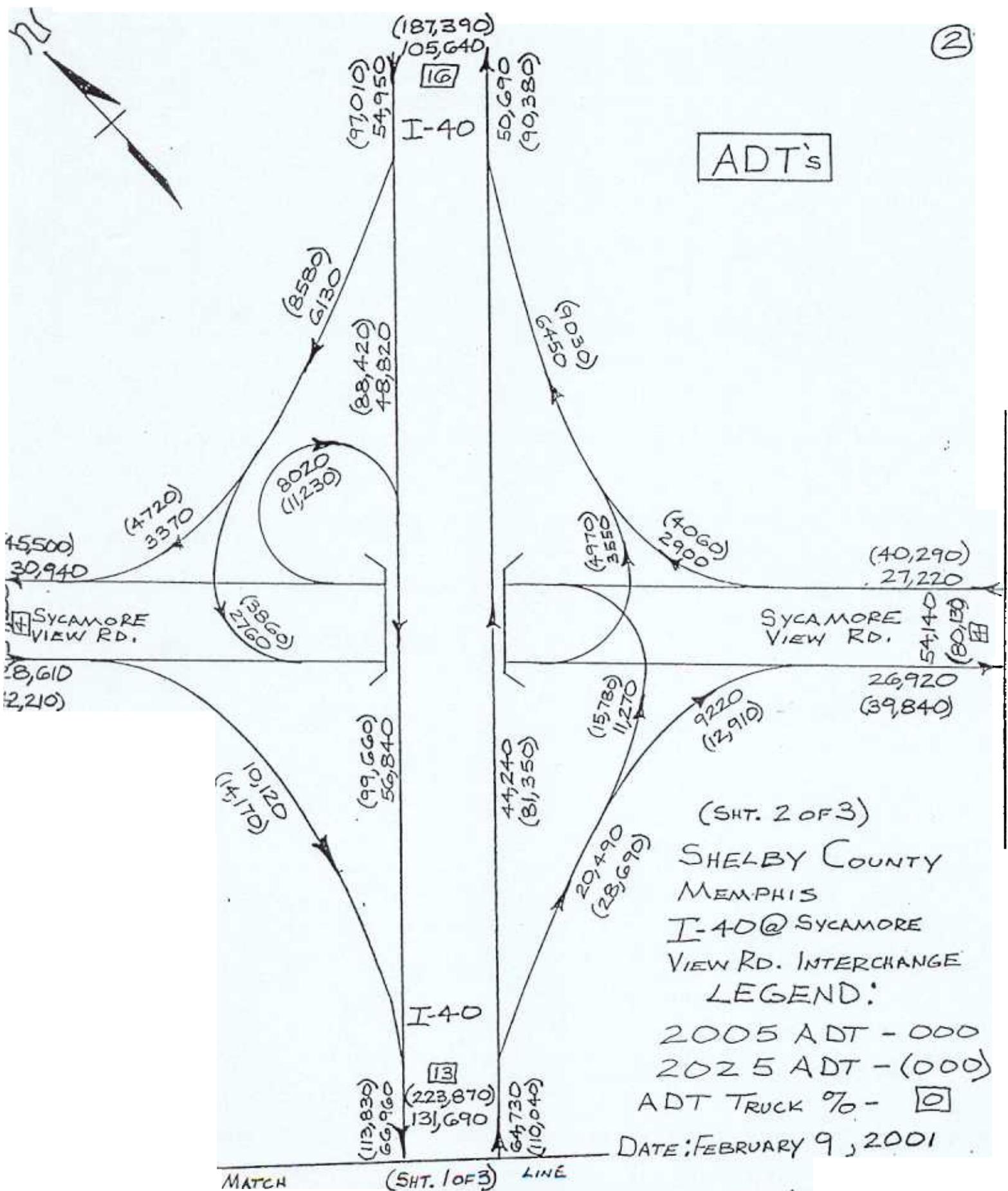
**INTERSTATE 40 &
 SYCAMORE VIEW RD.**
 INTERCHANGE
 MODIFICATION STUDY
2025 DHV
**ALTERNATE A WITH
 C-D ROAD AND OFF-RAMP
 TO MACON COVE**

AM
 PM



**INTERSTATE 40 &
SYCAMORE VIEW RD.**
INTERCHANGE
MODIFICATION STUDY
**2005 DHV
ALTERNATE C**

ADT's



(SHT. 2 OF 3)
 SHELBY COUNTY
 MEMPHIS
 I-40@SYCAMORE
 VIEW RD. INTERCHANGE
 LEGEND:
 2005 ADT - 000
 2025 ADT - (000)
 ADT TRUCK % - []

DATE: FEBRUARY 9, 2001

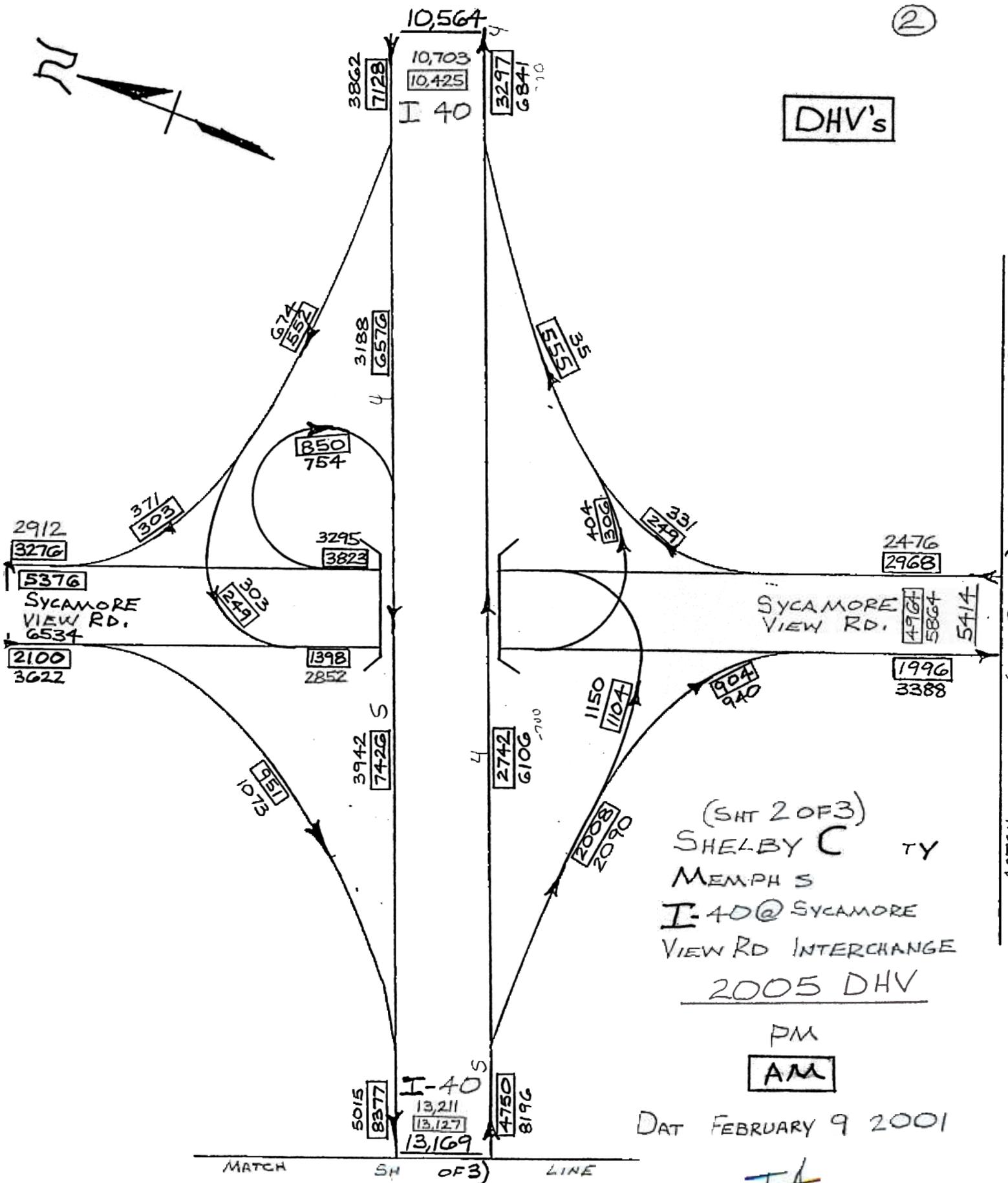
MATCH (SHT. 1 OF 3) LINE

T.A.

2



DHV's



(SHT 2 OF 3)
 SHELBY COUNTY
 MEMPHIS
 I-40@SYCAMORE
 VIEW RD INTERCHANGE
 2005 DHV

PM
 AM

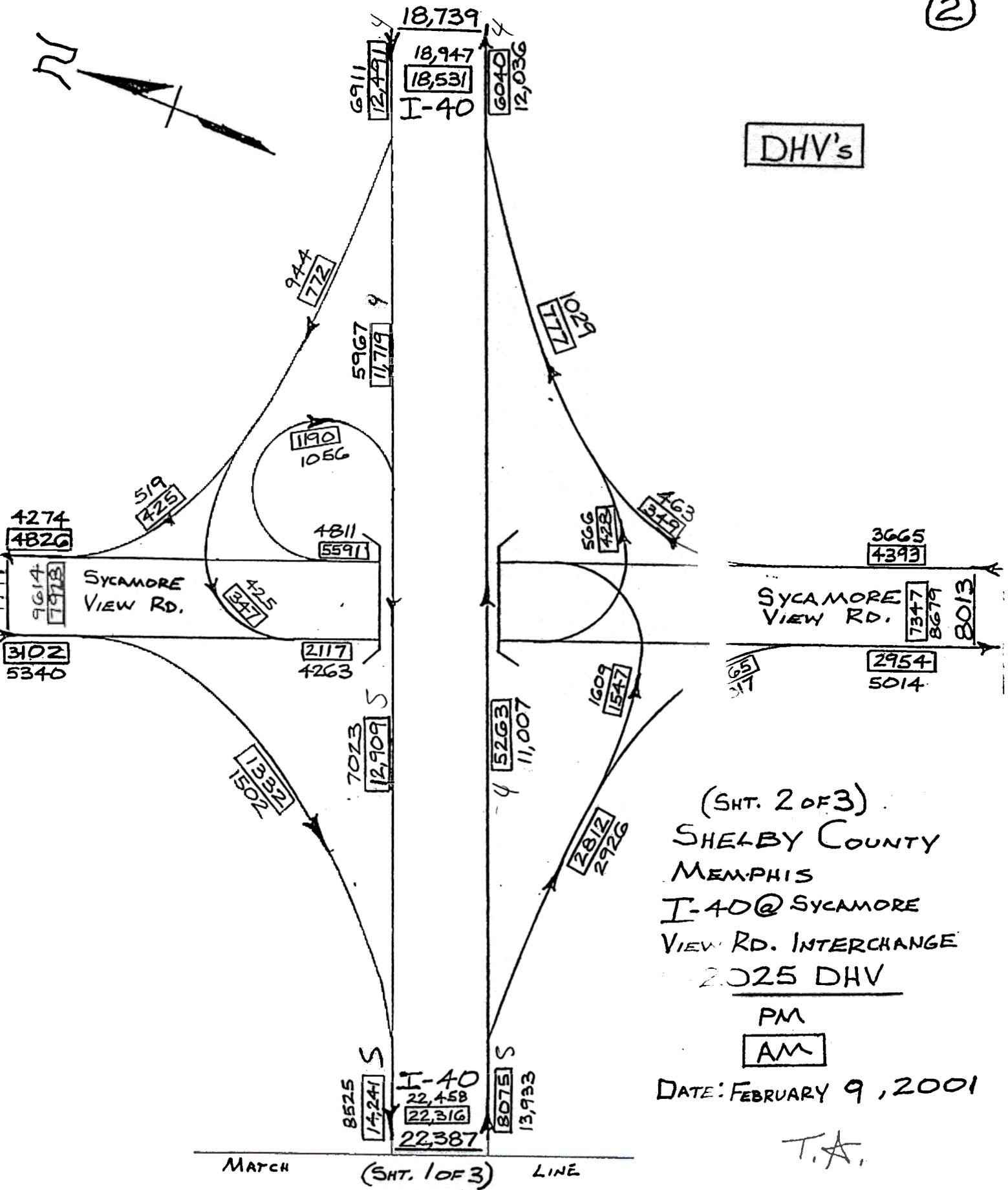
DAT FEBRUARY 9 2001

T.A.

MATCH SH OF 3) LINE



DHV's



(SHT. 2 OF 3)
 SHELBY COUNTY
 MEMPHIS
 I-40@SYCAMORE
 VIEW RD. INTERCHANGE
 2025 DHV
 PM
 AM
 DATE: FEBRUARY 9, 2001

T.A.

MATCH

(SHT. 2 OF 3)

LINE

3



ADT's

SYCAMORE VIEW ROAD

4

MACON ROAD

MACON ROAD

SYCAMORE VIEW ROAD

SHELBY COUNTY
MEMPHIS
SYCAMORE VIEW ROAD
AT MACON ROAD.

LEGEND:

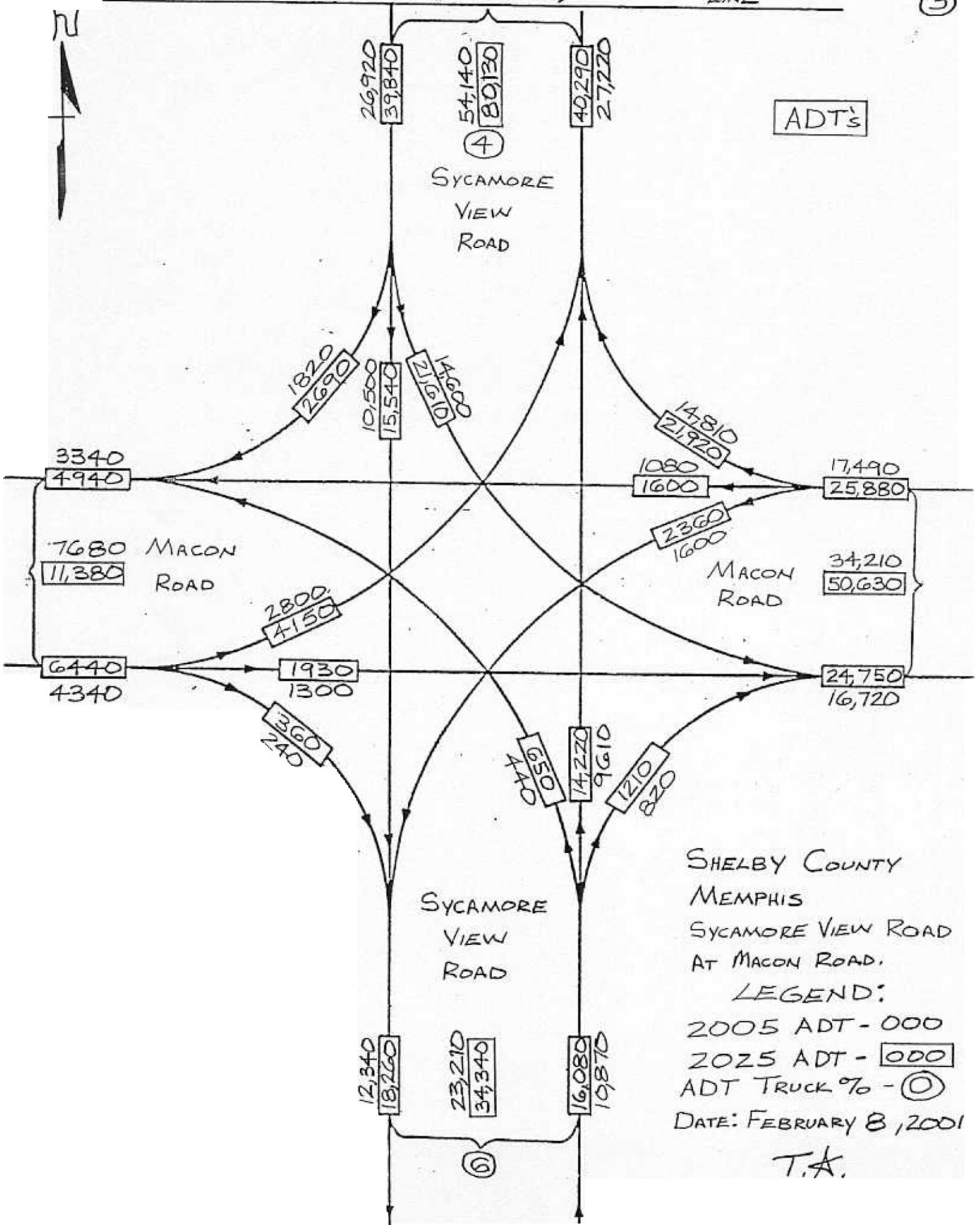
2005 ADT - 000

2025 ADT - 000

ADT TRUCK % - 0

DATE: FEBRUARY 8, 2001

T.A.





3

MATCH (SHT. 2 OF 3) LINE

DHV's

5414
SYCAMORE
VIEW
ROAD

MACON
ROAD

MACON
ROAD

SYCAMORE
VIEW
ROAD

SHELBY COUNTY
MEMPHIS
SYCAMORE VIEW ROAD
AT MACON ROAD

2005 DHV

PM

AM

DATE: FEBRUARY 9, 2001

T.A.

3388
1996

5864
4964

2968
2476

307
361

821
715

354
514

180
184

262
298

12
36

880
1220

515
592

44
216

1068
1400

2350
2292

2321

1103
1859

168
152

25
139

95
121

1350
2148

4033
2809

661
2683

3421

56
32

811
1111

892
1282

MATCH

(SHT. 2 OF 3)

LINE

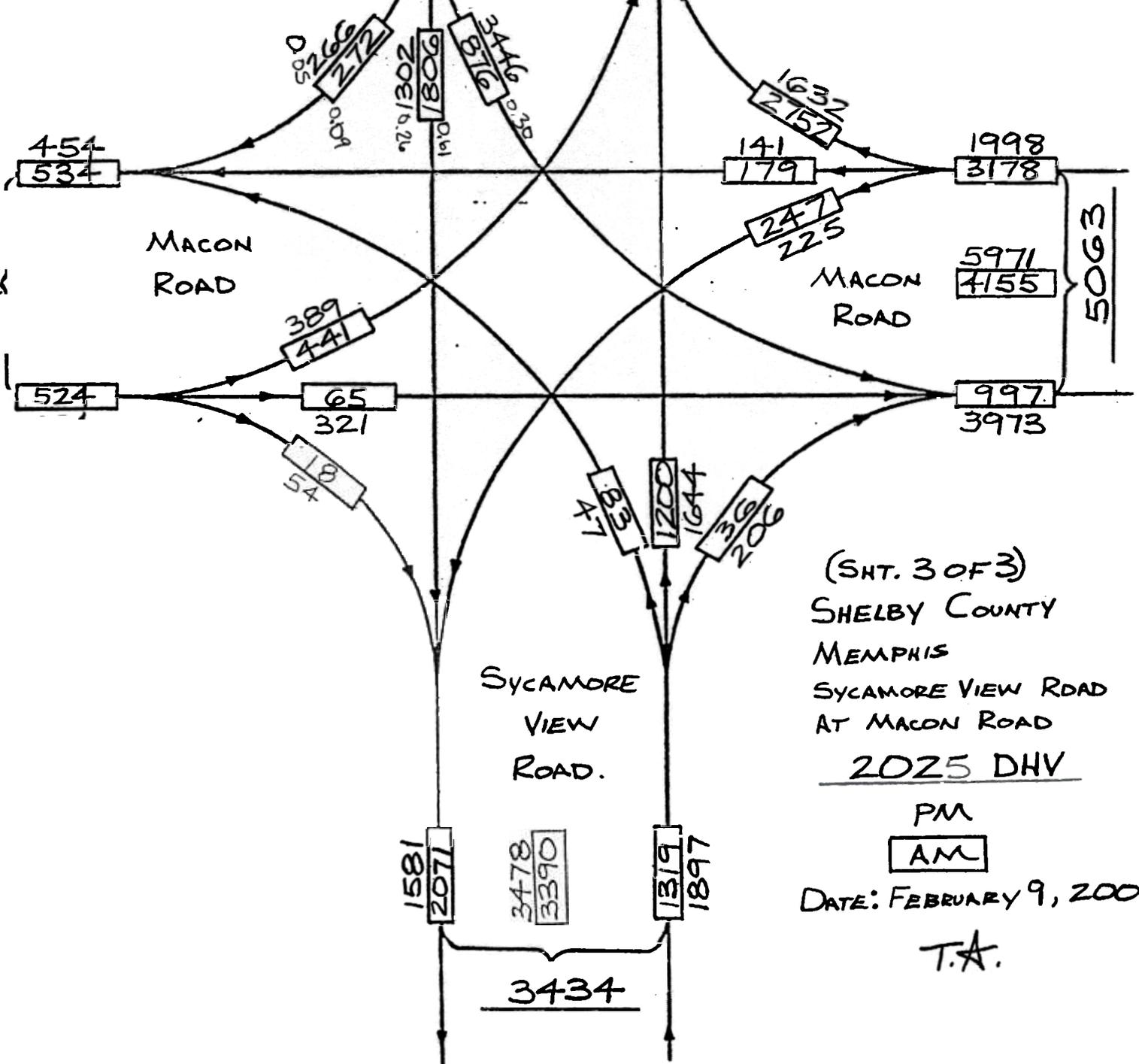
3



DHV's

8013

SYCAMORE VIEW ROAD



1138

MACON ROAD

MACON ROAD

SYCAMORE VIEW ROAD.

(SHT. 3 OF 3)
SHELBY COUNTY
MEMPHIS
SYCAMORE VIEW ROAD
AT MACON ROAD

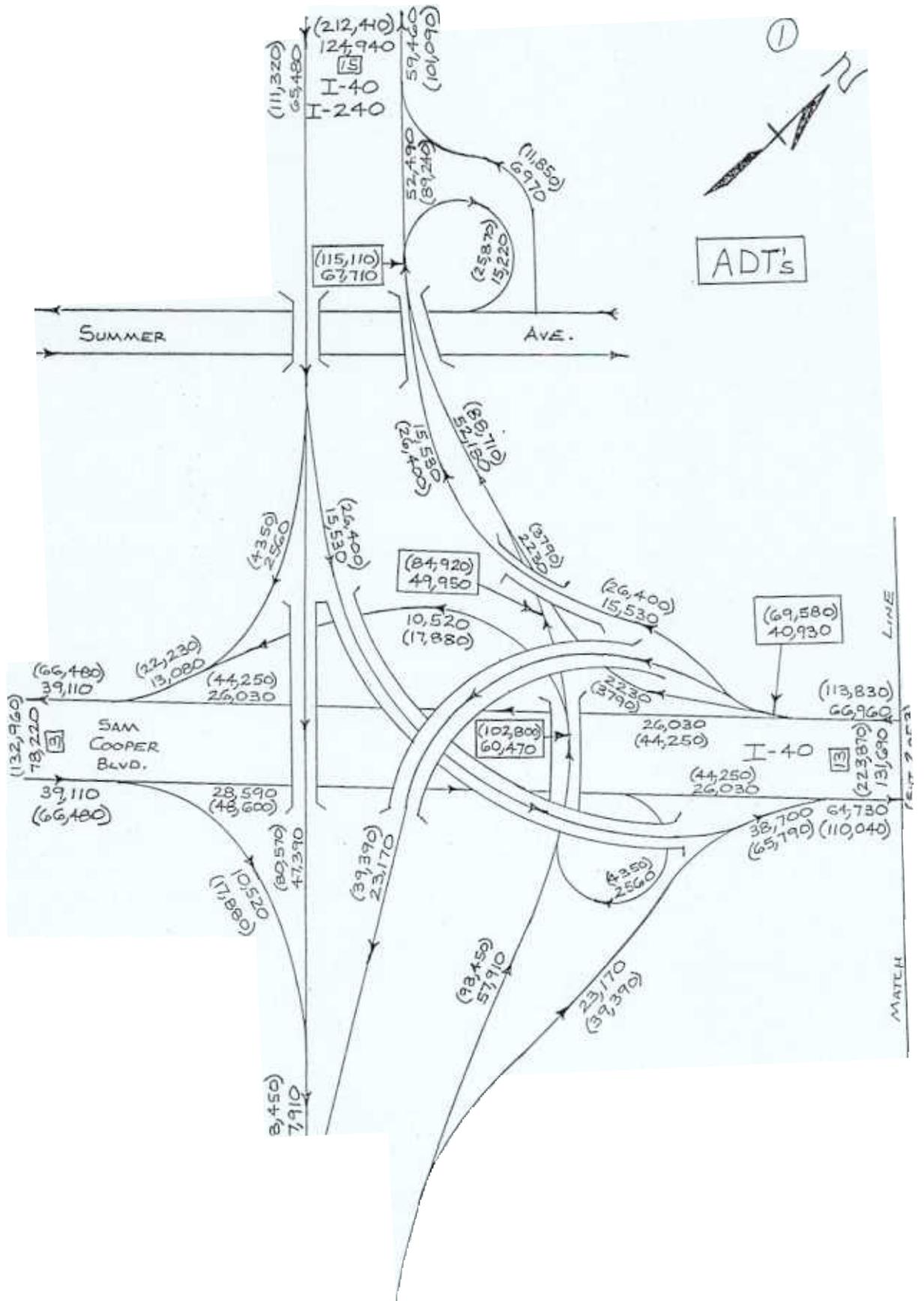
2025 DHV

PM

AM

DATE: FEBRUARY 9, 2000

T.A.



(137,840)

I-240

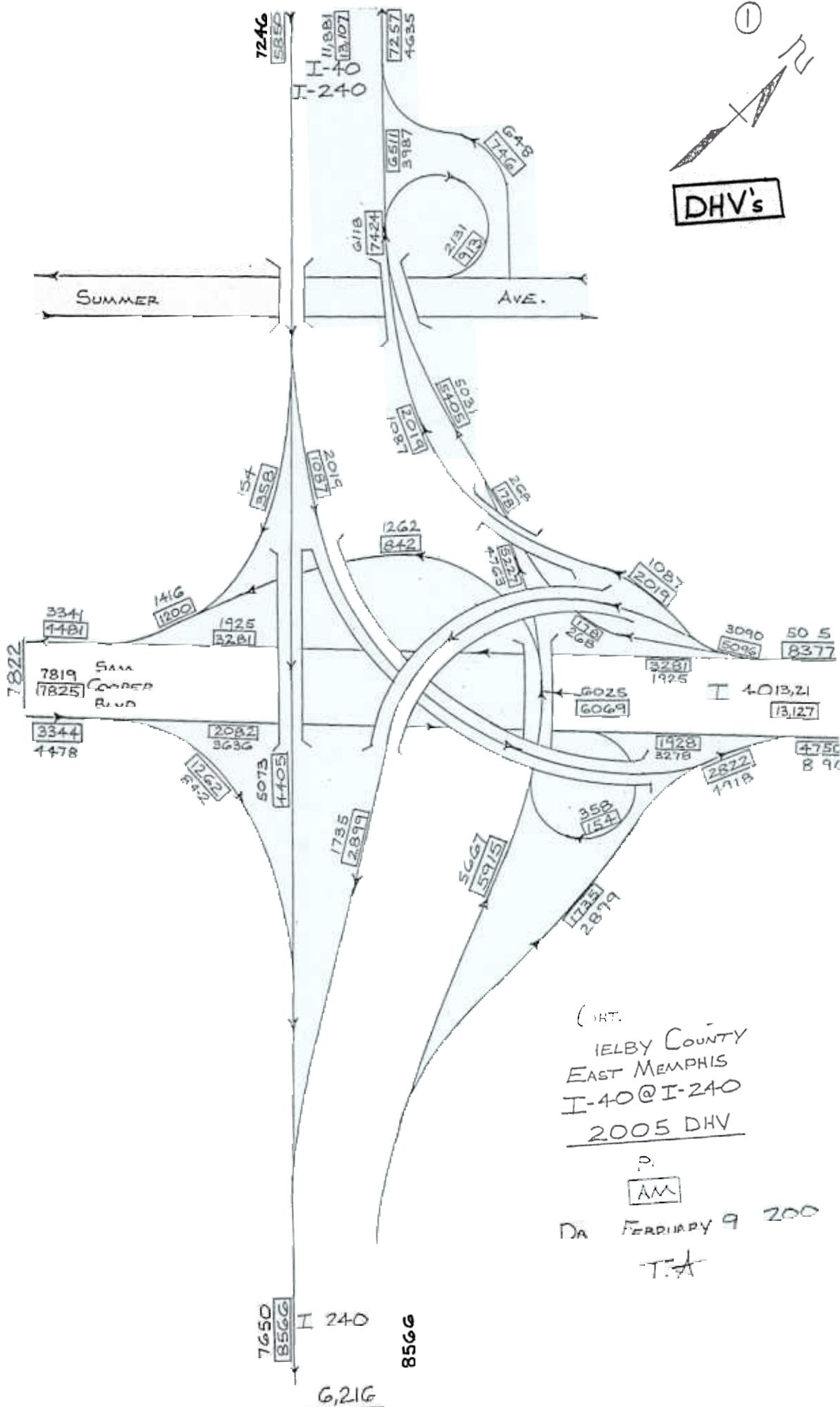
(162,160)

(275,680)

81,080

(137,840)

T.A.



(INT.)
 IELBY COUNTY
 EAST MEMPHIS
 I-40@I-240
 2005 DHV
 P.
 AM
 DA FEBRUARY 9 200
 T.A

①



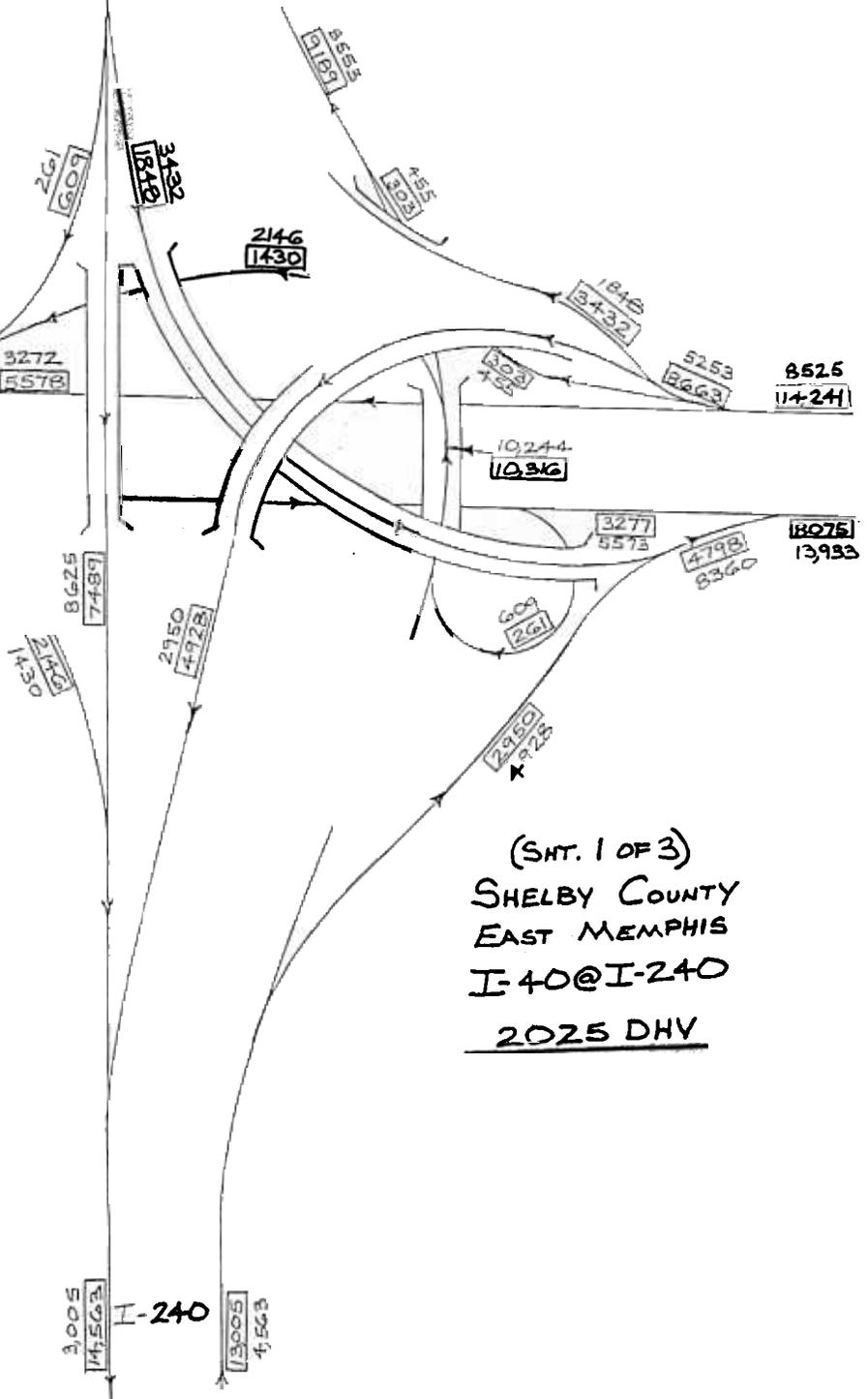
DHV's

1102
1268

AVE.

12,318
9746
20,199
22,283
I-40
I-240
12,337
7881

13,296
13,291
13,301
SAM
COOPER
BLVD.



(SHT. 1 OF 3)
SHELBY COUNTY
EAST MEMPHIS
I-40@I-240
2025 DHV

3,005
14,563
I-240
13,005
4,563

27,568

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix C

**Definitions of Levels of Service, and
Methodological Notes on Capacity Analysis**

Appendix C

Definitions of Levels of Service, and Methodological Notes on Capacity Analysis

Definitions of Levels of Service

Levels of Service are established as a way to indicate the level of operational character that is expected for a segment of roadway. It is very much like giving a school grade to the road, where Level of Service A indicates very low traffic volumes and ease of movement for a motorist traveling through the segment. Level of Service E indicates congestion, and Level of Service F indicates congestion that is at or over a “breakdown” condition of stop-and-go traffic. Level of Service is abbreviated LOS.

The methods and procedures used to determine LOS are established in the *Highway Capacity Manual 2000*, a publication of the Transportation Research Board, which is a branch of the National Academies of Science.

The Levels of Service are:

- A. Free-flow operations.** Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. The general level of physical and psychological comfort provided to the driver is high.
 - B. Reasonably free-flow operations.** The ability to maneuver within the traffic stream is only slightly restricted and the general level of physical, and psychological comfort provided to the driver is still high.
 - C. Flow with speeds at or near free-flow speeds.** Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more vigilance on the part of the driver. The driver notices an increase in tension because of the additional vigilance required for safe operation.
-

- D. Speeds decline with increasing traffic.** Freedom to maneuver within the traffic stream is more noticeably limited. The driver experiences reduced physical and psychological comfort levels.
- E. At lower boundary, the facility is at capacity.** Operations are volatile because there are virtually no gaps in the traffic stream. There is little room to maneuver. The driver experiences poor levels of physical and psychological comfort.
- F. Breakdowns in traffic flow.** The number of vehicles entering the highway section exceeds the capacity or ability of the highway to accommodate the number of vehicles. There is little or no room to maneuver. The driver experiences poor levels of physical and psychological comfort.

Methodological Notes on Capacity Analysis

Freeway and Ramps

The *Highway Capacity Manual 2000* was used to guide capacity analyses for this study. For all freeway and ramp analyses, the Highway Capacity Software (HCS) was used. HCS was originally developed for the Federal Highway Administration, and is now maintained by McTrans. The capacity worksheets that illustrate the capacity computations occur in Appendix D.

Freeway analyses for segments east of Sycamore View Road were adjusted to allow for the effects of High Occupancy Vehicle (HOV) traffic. East of Sycamore View, the inside lane of eastbound I-40 is restricted to HOV use in the afternoon peak, and the inside lane of westbound I-40 is restricted to HOV use in the morning peak. The adjustment was accomplished by reducing the volume and the number of lanes, thereby removing the HOV lane from the computation. The HOV lanes end at Sycamore View.

There are some special ramp cases that were addressed using the procedures for basic freeway segments. These are the Eastbound Off-ramp, and the first of the two westbound on-ramps. The Eastbound Off-ramp is a two-lane ramp that is a two-lane

drop from the I-40 eastbound mainline. That is, the two lanes end onto the ramp. HCM 2000 guidance in such a case is to treat this case as a “Major Diverge,” and so the ramp is considered as a basic freeway segment. The freeway worksheets are included in the section on ramp analyses.

The Westbound-from-Northbound On-ramp is the first of two on-ramps in the westbound direction. This is a lane-add situation. HCM 2000 guidance for this case is to analyze the downstream freeway segment. As above, the freeway worksheets are included in the section on ramp analyses.

Intersections

For intersection analyses, the primary tool was Synchro, a software product of Trafficware. There are minor differences between Synchro and HCS, so both Synchro and HCS files were developed for intersections found to be operating at LOS E or F. Worksheets that illustrate the capacity analyses computations for intersections appear in Appendix A, and in Appendices E, F, and G.

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix D

Capacity Worksheets for Interstate 40:

Mainline Basic Freeway Segments

And

Ramp Analyses

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix D

Section 1

Capacity Worksheets for Interstate 40:

Mainline Basic Freeway Segments

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

 Operational Analysis

Analyst: DKJ/ mjb - 40ebw05am
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/17/03
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: I-240 to Sycamore View Road
 Jurisdiction: City of Memphis
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS

 Flow Inputs and Adjustments

Volume, V	4750	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1291	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	1.00	%
Segment length	1.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	929	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	6	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

 LOS and Performance Measures

Flow rate, vp	929	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	6	
Density, D	14.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40ebw05pm
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 EB
 From/To: I-240 to Sycamore View Road
 Jurisdiction: City of Memphis
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	8196	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	2227	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	1.00	%
Segment length	1.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	1566	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	6	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1566	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	6	
Density, D	24.7	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40wbw05am
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 WB
 From/To: Sycamore View Road to I-240
 Jurisdiction: City of Memphis
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	8377	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	2137	v
Trucks and buses	0	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	-1.00	%
Segment length	2.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	1.000	
Driver population factor, vp	1.00	
Flow rate, vp	2137	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	61.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	2137	pc/h/ln
Free-flow speed, FFS	61.8	mi/h
Average passenger-car speed, S	56.7	mi/h
Number of lanes, N	4	
Density, D	37.7	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40wbw05pm
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 WB
 From/To: Sycamore View Road to I-240
 Jurisdiction: City of Memphis
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	5015	veh/h
Peak-hour factor, PHF	0.94	
Peak 15-min volume, v15	1334	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	-1.00	%
Segment length	2.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1440	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	61.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1440	pc/h/ln
Free-flow speed, FFS	61.8	mi/h
Average passenger-car speed, S	61.8	mi/h
Number of lanes, N	4	
Density, D	23.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb 40ebe05am
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: Sycamore View Rd to Whitten Rd
 Jurisdiction: City of Memphis
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	3297		
Peak-hour factor, PHF	0.92		
Peak 15-min volume, v15	896	v	
Trucks and buses	16	%	
Recreational vehicles	0	%	
Terrain type:	Grade		
Grade	1.00	%	
Segment length	2.00	mi	
Trucks and buses PCE, ET	1.5		
Recreational vehicle PCE, ER	1.2		
Heavy vehicle adjustment, fHV	0.926		
Driver population factor, vp	1.00		
Flow rate, vp	968	pc/h/ln	

Speed Inputs and Adjustments

Lane width	12.0	ft	
Right-shoulder lateral clearance	6.0	ft	
Interchange density	0.83	interchange/mi	
Number of lanes, N	4		
Free-flow speed:	Ideal		
FFS or BFFS	65.0		
Lane width adjustment, fLW	0.0	mi/h	
Lateral clearance adjustment, fLC	0.0	mi/h	
Interchange density adjustment, fID	1.7	mi/h	
Number of lanes adjustment, fN	1.5	mi/h	
Free-flow speed, FFS	61.8	mi/h	

Urban Freeway

LOS and Performance Measures

Flow rate, vp	968	pc/h/ln	
Free-flow speed, FFS	61.8	mi/h	
Average passenger-car speed, S	61.8	mi/h	
Number of lanes, N	4		
Density, D	15.7	pc/mi/ln	
Level of service, LOS	B		

Overall results are not computed when free-flow speed is less than 55 mph.

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

 Operational Analysis

Analyst: DKJ/ mjb - 40ebe05pm
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 EB
 From/To: Sycamore View Rd to Whitten Rd
 Jurisdiction: City of Memphis
 Analysis Year: 2005 - Adjusted for HOV
 Description: I-40 / Sycamore View Road IMS

 Flow Inputs and Adjustments

Volume, V	5473	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1425	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	1.00	%
Segment length	2.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	2005	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.3	mi/h

Urban Freeway

 LOS and Performance Measures

Flow rate, vp	2005	pc/h/ln
Free-flow speed, FFS	60.3	mi/h
Average passenger-car speed, S	58.1	mi/h
Number of lanes, N	3	
Density, D	34.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40wbe05am
 Agency or Company: Parsons Transportation Group
 Date Performed: 04/20/01
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 WB
 From/To: Whitten Rd to Sycamore View Rd
 Jurisdiction: City of Memphis
 Analysis Year: 2005 - Adjusted for HOV
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	5702	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1485	v
Trucks and buses	0	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	-1.00	%
Segment length	1.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	1.000	
Driver population factor, vp	1.00	
Flow rate, vp	1980	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1980	pc/h/ln
Free-flow speed, FFS	60.3	mi/h
Average passenger-car speed, S	58.4	mi/h
Number of lanes, N	3	
Density, D	33.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40wbe05pm
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 WB
 From/To: Whitten Rd to Sycamore View Rd
 Jurisdiction: City of Memphis
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	3862	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1049	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	-1.00	%
Segment length	1.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1133	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	61.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1133	pc/h/ln
Free-flow speed, FFS	61.8	mi/h
Average passenger-car speed, S	61.8	mi/h
Number of lanes, N	4	
Density, D	18.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40ebw25am
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: I-240 to Sycamore View Road
 Jurisdiction: City of Memphis
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	8075	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	2194	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	1.00	%
Segment length	1.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1580	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	6	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1580	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	6	
Density, D	25.0	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40ebw25pm
 Agency or Company: Parsons Transportation Group
 Date Performed: 04/20/01
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 EB
 From/To: I-240 to Sycamore View Road
 Jurisdiction: City of Memphis
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	13933		
Peak-hour factor, PHF	0.98		
Peak 15-min volume, v15	3554	v	
Trucks and buses	11	%	
Recreational vehicles	0	%	
Terrain type:	Grade		
Grade	1.00	%	
Segment length	1.00	mi	
Trucks and buses PCE, ET	1.5		
Recreational vehicle PCE, ER	1.2		
Heavy vehicle adjustment, fHV	0.948		
Driver population factor, vp	1.00		
Flow rate, vp	2500	pc/h/ln	

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	6	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	2500	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	6	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40wbw25am
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 WB
 From/To: Sycamore View Road to I-240
 Jurisdiction: City of Memphis
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	14241	veh/h
Peak-hour factor, PHF	0.99	
Peak 15-min volume, v15	3596	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	-1.00	%
Segment length	2.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	3035	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	3035	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	5	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40wbw25pm
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 WB
 From/To: Sycamore View Road to I-240
 Jurisdiction: City of Memphis
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	8525	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	2220	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	-1.00	%
Segment length	2.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1918	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1918	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S	61.4	mi/h
Number of lanes, N	5	
Density, D	31.2	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40ebe25am
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: Sycamore View Rd to Whitten Rd
 Jurisdiction: City of Memphis
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	6040	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1573	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	1.00	%
Segment length	2.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1699	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	61.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1699	pc/h/ln
Free-flow speed, FFS	61.8	mi/h
Average passenger-car speed, S	61.7	mi/h
Number of lanes, N	4	
Density, D	27.6	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40ebe25pm
 Agency or Company: Parsons Transportation Group
 Date Performed: 04/20/01
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 EB
 From/To: Sycamore View Rd to Whitten Rd
 Jurisdiction: City of Memphis
 Analysis Year: 2025 - Adjusted for HOV
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	9629	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	2408	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	1.00	%
Segment length	2.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	3386	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	3386	pc/h/ln
Free-flow speed, FFS	60.3	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	3	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40wbe25am
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 WB
 From/To: Whitten Rd to Sycamore View Rd
 Jurisdiction: City of Memphis
 Analysis Year: 2025 - Adjusted for HOV
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	9993	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	2499	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	-1.00	%
Segment length	1.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	3514	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	3514	pc/h/ln
Free-flow speed, FFS	60.3	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	3	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

Deborah Kreis Jokisch
 Parsons Transportation Group
 225 East Robinson Street
 Suite 300
 Orlando, Florida 32801
 Phone: 407-316-8600 Fax: 407-316-8837
 E-mail: Deborah.Kreis@parsons.com

Operational Analysis

Analyst: DKJ/mjb - 40wbe25pm
 Agency or Company: Parsons Transportation Group
 Date Performed: 01/20/03
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 WB
 From/To: Whitten Rd to Sycamore View Rd
 Jurisdiction: City of Memphis
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS

Flow Inputs and Adjustments

Volume, V	6911	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1800	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	-1.00	%
Segment length	1.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1944	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	61.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1944	pc/h/ln
Free-flow speed, FFS	61.8	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	4	
Density, D	32.4	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix D

Section 2

Capacity Worksheets for Interstate 40:

Ramp Analyses for No-build Conditions

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/21/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: No Build (EB OFFramp)
 Analysis Year: 2005
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2008	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	512	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1106	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	48.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1106	pc/h/ln
Free-flow speed, FFS	48.8	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	2	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/21/2003
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: No Build (EB OFFramp)
 Analysis Year: 2005
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2090	
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	533	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	1125	

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	48.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1125	pc/h/ln
Free-flow speed, FFS	48.8	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	2	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/21/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: No Build (EB OFFramp)
 Analysis Year: 2025
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2812	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	717	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1549	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	48.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1549	pc/h/ln
Free-flow speed, FFS	48.8	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	2	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/21/2003
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: No Build (EB OFFramp)
 Analysis Year: 2025
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2926	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	746	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	1575	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	48.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1575	pc/h/ln
Free-flow speed, FFS	48.8	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	2	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone:
E-mail:

Fax:

Merge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/22/2003
Analysis time period: AM Peak
Freeway/dir or travel: I-40 EB
Junction: EB on
Jurisdiction: No Build
Analysis Year: 2005
Description: I-40/Sycamore View Road IMS (Anal

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	2742	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	555	vph	
Length of first accel/decel lane	940	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	2008		
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1805	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	2742	555	2008 vph

Peak-hour factor, PHF	0.99	0.95	0.98	
Peak 15-min volume, v ₁₅	692	146	512	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	.00	1.00	1.00	
Flow rate, v _p	2991	631	2213	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.372$ Using Equation 4
 FM
 $v = v (P) = 1112$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	3622	9400	No
v _{R12}	1743	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 12.9$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $M = 0.259$
 S
 Space mean speed in ramp influence area, $S = 59.1$ mph
 R
 Space mean speed in outer lanes, $S = 63.4$ mph
 0
 Space mean speed for all vehicles, $S = 61.2$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: _____ Fax: _____
 E-mail: _____

_____ Merge Analysis _____

Analyst: Gregory Dotson
 Agency/Co.: Parsons Transportation Group
 Date performed: 1/22/2003
 Analysis time period: PM Peak
 Freeway/dir or travel: I-40 EB
 Junction: EB on
 Jurisdiction: No Build
 Analysis Year: 2005
 Description: I-40/Sycamore View Road IMS (Anal

_____ Freeway Data _____

Type of analysis	Merge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	6106	vph	

_____ On Ramp Data _____

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	735	vph	
Length of first accel/decel lane	940	ft	
Length of second accel/decel lane		ft	

_____ Adjacent Ramp Data (if one exists) _____

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	2090	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1805	ft	

_____ Conversion to pc/h Under Base Conditions _____

Junction Components	Freeway	Ramp	Adjacent	
	Ramp			
Volume, V (vph)	6106	735	2090	vph

Peak-hour factor, PHF	1.00	0.95	0.98	
Peak 15-min volume, v ₁₅	1527	193	533	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	6442	816	2250	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = 0.349 Using Equation 4

FM

v = v (P) = 2246 pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	7258	9400	No
FO			
v	3062	4600	No
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 23.1$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M = 0.320

S

Space mean speed in ramp influence area S = 57.6 mph

R

Space mean speed in outer lanes, S = 59.2 mph

O

Space mean speed for all vehicles, S = 58.6 mph

Peak-hour factor, PHF	0.99	0.95	0.98	
Peak 15-min volume, v ₁₅	1329	204	512	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.926	0.926	0.926	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, v _p	5741	883	2213	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.340$ Using Equation 4
 FM
 $v = v(P) = 1954$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	6624	9400	No
v _{R12}	2837	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 21.3$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, S	M = 0.303
Space mean speed in ramp influence area, S _R	S = 58.0 mph
Space mean speed in outer lanes, S _O	S = 60.0 mph
Space mean speed for all vehicles, S	S = 59.1 mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: _____ Fax: _____
 E-mail: _____

Merge Analysis

Analyst: Gregory Dotson
 Agency/Co.: Parsons Transportation Group
 Date performed: 1/22/2003
 Analysis time period: PM Peak
 Freeway/dir or travel: I-40 EB
 Junction: EB on
 Jurisdiction: No Build
 Analysis Year: 2025
 Description: I-40/Sycamore View Road IMS (Anal

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	11007	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1029	vph
Length of first accel/decel lane	940	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2090	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1805	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
	Ramp		
Volume, V (vph)	11007	1029	2090 vph

Peak-hour factor, PHF	1.00	0.95	0.98	
Peak 15-min volume, v ₁₅	2752	271	533	v
Trucks and buses	12	11	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.943	0.948	0.943	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	11667	1143	2261	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.308$ Using Equation 4
 FM
 $v = v (P) = 3592$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	12810	9400	Yes
FO			
v	4735	4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 36.0$ pc/mi/ln
 R R A

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, $M = 0.680$
 S
 Space mean speed in ramp influence area, $S = 49.3$ mph
 R
 Space mean speed in outer lanes, $S = 48.0$ mph
 0
 Space mean speed for all vehicles, $S = 48.5$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Gregory Dotson
 Agency/Co.: Parsons Transportation Group
 Date performed: 1/15/2003
 Analysis time period: AM Peak
 Freeway/dir or travel: I-40 WB
 Junction: WB off (upstream)
 Jurisdiction: No Build
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7128	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	552	vph
Length of first accel/decel lane	673	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	850	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	893	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
	Ramp		
Volume, V (vph)	7128	552	850 vph

Peak-hour factor, PHF	1.00	0.95	0.95	
Peak 15-min volume, v ₁₅	1782	145	224	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	7520	613	944	pcph

Estimation of V₁₂ Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 0.436 Using Equation 8

FD

$v = v + (v - v) P = 3624$

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	7520	9400	No
F _i F			
v	3624	4400	No
12			
v = v - v	6907	9400	No
F _O F R			
v	613	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 29.4$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.483$

S

Space mean speed in ramp influence area, $S = 54$ mph

R

Space mean speed in outer lanes, $S = 67.6$ mph

O

Space mean speed for all vehicles, $S = 60.2$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: _____ Fax: _____
 E-mail: _____

Diverge Analysis

Analyst: Gregory Dotson
 Agency/Co.: Parsons Transportation Group
 Date performed: 1/15/2003
 Analysis time period: PM Peak
 Freeway/dir or travel: I-40 WB
 Junction: WB off (upstream)
 Jurisdiction: No Build
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	3862	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	674	vph	
Length of first accel/decel lane	673	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	754	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	893	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
	Ramp		
Volume, V (vph)	3862	674	754 vph

Peak-hour factor, PHF	1.00	0.95	0.95	
Peak 15-min volume, v ₁₅	966	177	198	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	4171	766	857	pcph

Estimation of V₁₂ Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 0.436 Using Equation 8

FD

$v = v + (v - v) P = 2251$

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	4171	9400	No
F _i F			
v	225	4400	No
12			
$v = v - v$	3405	9400	No
F _O F R			
v	766	2000	
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 17.6$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.497$

S

Space mean speed in ramp influence area, $S = 54$ mph

R

Space mean speed in outer lanes, $S = 71.3$ mph

O

Space mean speed for all vehicles, $S = 60.5$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/15/2003
Analysis time period: AM Peak
Freeway/dir or travel: I-40 WB
Junction: WB off (upstream)
Jurisdiction: No Build
Analysis Year: 2025
Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	12491	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	772	vph	
Length of first accel/decel lane	673	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	850	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	893	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
		Ramp	
Volume, V (vph)	12491	772	850 vph

Peak-hour factor, PHF	1.00	0.95	0.95	
Peak 15-min volume, v15	3123	203	224	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	% 0.00	% 0.00	%
Length	0.00	mi 0.00	mi 0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.948	0.948	0.948	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	13178	857	944	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 0.436 Using Equation 8

FD

$v = v + (v - v) P = 6229$ pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	13178	9400	Yes
Fi F			
v	6229	4400	Yes
12			
$v = v - v$	12321	9400	No
FO F R			
v	857	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 51.8$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, $D = 0.505$

S

Space mean speed in ramp influence area, $S = 53$ mph

R

Space mean speed in outer lanes, $S = 61.7$ mph

0

Space mean speed for all vehicles, $S = 57.4$ mph

Peak-hour factor, PHF	1.00	0.95	0.95	
Peak 15-min volume, v ₁₅	1728	248	198	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	% 0.00	% 0.00	%
Length	0.00	mi 0.00	mi 0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.926	0.926	0.926	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, v _p	7464	1073	857	pcph

Estimation of V₁₂ Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 0.436 Using Equation 8

FD

$v = v + (v - v) P = 3859$ pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	7464	9400	No
Fi F			
v	3859	4400	No
12			
v = v - v	6391	9400	No
FO F R			
v	1073	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 31.4$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.525$

S

Space mean speed in ramp influence area, $S = 53$ mph

R

Space mean speed in outer lanes, $S = 68.2$ mph

0

Space mean speed for all vehicles, $S = 59.3$ mph

Phone _____ Fax _____
 E-mail: _____

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons
 Date Performed: 1/27/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 WB
 From/To: At Sycamore View
 Jurisdiction: Alt A (WB ONramp midstream)
 Analysis Year: 2005
 Description:

Flow Inputs and Adjustments

Volume, V	7426	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1857	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	1567	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1567	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	5	
Density, D	24.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph

Phone: _____ Fax: _____
 E-mail: _____

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons
 Date Performed: 1/27/2003
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 WB
 From/To: From Sycamore View to I-240
 Jurisdiction: NoBuild WB ONramp
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS (Analysis for WB on ramp)

Flow Inputs and Adjustments

Volume, V	3942		
Peak-hour factor, PHF	1.00		
Peak 15-min volume, v15	986		
Trucks and buses	16	%	
Recreational vehicles	0	%	
Terrain type:	Level		
Grade	0.00	%	
Segment length	0.00	mi	
Trucks and buses PCE, ET	1.5		
Recreational vehicle PCE, ER	1.2		
Heavy vehicle adjustment, fHV	0.926		
Driver population factor, vp	1.00		
Flow rate, vp	851	pc/h/ln	

Speed Inputs and Adjustments

Lane width	12.0	ft	
Right-shoulder lateral clearance	6.0	ft	
Interchange density	0.83	interchange/mi	
Number of lanes, N	5		
Free-flow speed:	Ideal		
FFS or BFFS	65.0		
Lane width adjustment, fLW	0.0	mi/h	
Lateral clearance adjustment, fLC	0.0	mi/h	
Interchange density adjustment, fID	1.7	mi/h	
Number of lanes adjustment, fN	0.0	mi/h	
Free-flow speed, FFS	63.3	mi/h	

Urban Freeway

LOS and Performance Measures

Flow rate, vp	851	pc/h/ln	
Free-flow speed, FFS	63.3	mi/h	
Average passenger-car speed, S	63.3	mi/h	
Number of lanes, N	5		
Density, D	13.4	pc/mi/ln	
Level of service, LOS	B		

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson wbon25am mid
 Agency or Company: Parsons
 Date Performed: 1/27/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 WB
 From/To: From Sycamore View to I-240
 Jurisdiction:
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS (Analysis for WB on ramp)

Flow Inputs and Adjustments

Volume, V	12909	
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	3228	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	2724	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	2724	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	5	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Phone: _____ Fax: _____
 E-mail: _____

Operational Analysis

Analyst: Gregory Dotson wbon25pm mid
 Agency or Company: Parsons
 Date Performed: 1/27/2003
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 WB
 From/To: From Sycamore View to I-240
 Jurisdiction:
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS (Analysis for WB on ramp)

Flow Inputs and Adjustments

Volume, V	7023	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1756	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1517	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1517	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	5	
Density, D	24.0	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Ramps and Ramp Junctions Release 4.1a

PARSONS TRANSPORTATION GROUP
PARSONS CORP.

Phone:

Fax:

E-mail:

Merge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/13/03
Analysis time period: AM
Freeway/dir or travel: I-40 WB
Junction: WB on (downstream)
Jurisdiction: No Build
Analysis Year: 2005
Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	5		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	7426	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	951	vph	
Length of first accel/decel lane	788	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	850	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	On		
Distance to adjacent Ramp	1354	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	7426	951	850 vph

Peak-hour factor, PHF	1.00	0.95	0.95	
Peak 15-min volume, v ₁₅	1857	250	224	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.948	0.948	0.948	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, v _p	7834	1056	944	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.281$ Using Equation 4
 FM
 $v = v(P) = 1574$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	6658	11750	No
v _{R12}	2630	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 20.6$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, S	M = 0.304
Space mean speed in ramp influence area, S _R	S = 58.0 mph
Space mean speed in outer lanes, S ₀	S = 59.5 mph
Space mean speed for all vehicles, S	S = 58.9 mph

Peak-hour factor, PHF	1.00	0.96	0.95	
Peak 15-min volume, v ₁₅	986	279	198	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	4257	1207	857	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.262$ Using Equation 4
 FM
 $v = v (P) = 871$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	4528	11750	No
v _{R12}	2078	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 16.2$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	$M = 0.281$
S	
Space mean speed in ramp influence area,	$S = 58.5$ mph
R	
Space mean speed in outer lanes,	$S = 62.4$ mph
O	
Space mean speed for all vehicles,	$S = 60.6$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

PARSONS TRANSPORTATION GROUP
PARSONS CORP.

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/13/03
Analysis time period: AM
Freeway/dir or travel: I-40 WB
Junction: WB on (downstream)
Jurisdiction: No Build
Analysis Year: 2025
Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	12909	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1332	vph
Length of first accel/decel lane	788	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1190	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1354	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	12909	1332	1190 vph

Peak-hour factor, PHF	1.00	0.95	0.95	
Peak 15-min volume, v ₁₅	3228	351	313	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	13619	1479	1322	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.228$ Using Equation 4
 FM
 $v = v (P) = 2537$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	12598	11750	Yes
v _{R12}	4016	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 31.2$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, S	M = 0.466
Space mean speed in ramp influence area, S _R	S = 54.3 mph
Space mean speed in outer lanes, S ₀	S = 46.5 mph
Space mean speed for all vehicles, S	S = 48.7 mph

Peak-hour factor, PHF	1.00	0.96	0.95	
Peak 15-min volume, v ₁₅	1756	391	278	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	7585	1690	1201	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = 0.202 Using Equation 4

FM

$v = v (P) = 1095 \text{ pc/h}$

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	7114	11750	No
FO			
v	2785	4600	No
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 21.5 \text{ pc/mi/ln}$

R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M = 0.313

S

Space mean speed in ramp influence area S = 57.8 mph

R

Space mean speed in outer lanes, S = 59.0 mph

O

Space mean speed for all vehicles, S = 58.5 mph

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix D

Section 3

Capacity Worksheets for Interstate 40:

Ramp Analyses for Alternate A Conditions

Phone:
 E-mail:
 Fax:

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/28/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: Alt A (EB OFFramp)
 Analysis Year: 2005
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2008	
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	512	
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1106	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	58.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1106	pc/h/ln
Free-flow speed, FFS	58.8	mi/h
Average passenger-car speed, S	58.8	mi/h
Number of lanes, N	2	
Density, D	18.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/28/2003
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: Alt A (EB OFFramp)
 Analysis Year: 2005
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2090	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	533	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	1125	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	58.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1125	pc/h/ln
Free-flow speed, FFS	58.8	mi/h
Average passenger-car speed, S	58.8	mi/h
Number of lanes, N	2	
Density, D	19.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson eboff25am.hcf
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/28/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: Alt A (EB OFFramp)
 Analysis Year: 2025
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2812	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	717	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1549	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	53.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1549	pc/h/ln
Free-flow speed, FFS	53.8	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	2	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson eboff25pm.hcf
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/28/2003
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: Alt A (EB OFFramp)
 Analysis Year: 2025
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2926	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	746	
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	1575	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	53.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1575	pc/h/ln
Free-flow speed, FFS	53.8	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	2	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: _____ Fax: _____
 E-mail: _____

Diverge Analysis

Analyst: MJB eb05amCDMC
 Agency/Co.: Parsons
 Date performed: 1/29/2003
 Analysis time period: AM Peak
 Freeway/dir or travel: I-40 EB C-D road
 Junction: off-ramp to Macon Cove
 Jurisdiction:
 Analysis Year: 2005
 Description: Alternate A or Alternate C

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	2008	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	904	vph	
Length of first accel/decel lane	500	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	2742	vph	
Position of adjacent ramp	Upstream		
Type of adjacent ramp	Off		
Distance to adjacent ramp	1300	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	2008	904	2742 vph

Peak-hour factor, PHF	0.94	0.92	0.92	
Peak 15-min volume, v ₁₅	534	246	745	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.926	0.926	0.926	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, v _p	2307	1061	3219	pcph

Estimation of V₁₂ Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)
 EQ
 P = 1.000 Using Equation 0
 FD
 $v = v + (v - v) P = 2307 \text{ pc/h}$
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	2307	4500	No
Fi F			
v	2307	4400	No
12			
v = v - v	1246	4500	No
FO F R			
v	1061	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 19.6 \text{ pc/mi/ln}$
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.523$
 S
 Space mean speed in ramp influence area, $S = 48 \text{ mph}$
 R
 Space mean speed in outer lanes, $S = \text{N/A} \text{ mph}$
 O
 Space mean speed for all vehicles, $S = 48.2 \text{ mph}$

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: MJB eb05amCDMC
Agency/Co.: Parsons
Date performed: 1/29/2003
Analysis time period: PM Peak
Freeway/dir or travel: I-40 EB C-D road
Junction: off-ramp to Macon Cove
Jurisdiction:
Analysis Year: 2005
Description: Alternate A or Alternate C

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	2090	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	940	vph	
Length of first accel/decel lane	500	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	6106	vph	
Position of adjacent ramp	Upstream		
Type of adjacent ramp	Off		
Distance to adjacent ramp	1300	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	2090	940	6106 vph

Peak-hour factor, PHF	0.94	0.92	0.96	
Peak 15-min volume, v ₁₅	556	255	1590	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	% 0.00	% 0.00	%
Length	0.00	mi 0.00	mi 0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	2346	1078	6710	pcph

Estimation of V₁₂ Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 1.000 Using Equation 0

FD

$v = v + (v - v) P = 2346$ pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	2346	4500	No
F _i F			
v	2346	4400	No
12			
v = v - v	1268	4500	No
F _O F R			
v	1078	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 19.9$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.525$

S

Space mean speed in ramp influence area, $S = 48$ mph

R

Space mean speed in outer lanes, $S = N/A$

O

Space mean speed for all vehicles, $S = 48.2$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: _____ Fax: _____
E-mail: _____

Diverge Analysis

Analyst: MJB eb25amCDMC
Agency/Co.: Parsons
Date performed: 1/29/2003 /
Analysis time period: AM Peak
Freeway/dir or travel: I-40 EB C-D road
Junction: off-ramp to Macon Cove
Jurisdiction:
Analysis Year: 2025
Description: Alternate A or Alternate C

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	2812	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	1265	vph	
Length of first accel/decel lane	500	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	5263	vph	
Position of adjacent ramp	Upstream		
Type of adjacent ramp	Off		
Distance to adjacent ramp	1300	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2812	1265	5263	vph

Peak-hour factor, PHF	0.94	0.94	0.94	
Peak 15-min volume, v ₁₅	748	336	1400	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	3231	1453	6047	pcph

Estimation of V12 Diverge Areas

$L = 0.00$ (Equation 25-8 or 25-9)
 EQ
 $P = 1.000$ Using Equation 0
 FD
 $v = v + (v - v) P = 3231$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	3231	4500	No
$F_i F$			
v	3231	4400	No
12			
$v = v - v$	1778	4500	No
$F_O F R$			
v	1453	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 27.5$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.559$
 S
 Space mean speed in ramp influence area, $S = 48$ mph
 R
 Space mean speed in outer lanes, $S = N/A$ mph
 O
 Space mean speed for all vehicles, $S = 47.7$ mph

Peak-hour factor, PHF	0.94	0.94	0.99	
Peak 15-min volume, v ₁₅	778	350	2780	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.948	0.948	0.948	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, v _p	3284	1478	11730	pcph

Estimation of V12 Diverge Areas

$L = 0.00$ (Equation 25-8 or 25-9)
 EQ
 $P = 1.000$ Using Equation 0
 FD
 $v = v + (v - v) P = 3284$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	3284	4500	No
Fi F			
v	3284	4400	No
12			
$v = v - v$	1806	4500	No
FO F R			
v	1478	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 28.0-$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D = 0.561
S	
Space mean speed in ramp influence area,	S = 48 mph
R	
Space mean speed in outer lanes,	S = N/A mph
0	
Space mean speed for all vehicles,	S = 47.7 mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: _____ Fax: _____
E-mail: _____

Merge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/28/2003
Analysis time period: AM Peak
Freeway/dir or travel: I-40 EB
Junction: EB On
Jurisdiction: Alternate A
Analysis Year: 2005
Description: I-40/Sycamore View Road IMS

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	2742	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	2		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	555	vph	
Length of first accel/decel lane	950	ft	
Length of second accel/decel lane	950	ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No		
Volume on adjacent Ramp		vph	
Position of adjacent Ramp			
Type of adjacent Ramp			
Distance to adjacent Ramp		ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	2742	555	vph

Peak-hour factor, PHF	0.99	0.95	
Peak 15-min volume, v15	692	146	v
Trucks and buses	16	16	%
Recreational vehicles	0	0	%
Terrain type:	Level	Level	Level
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	
Heavy vehicle adjustment, fHV	0.926	0.926	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2991	631	

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)
EQ
P = 0.209 Using Equation 0
FM
 $v = v(P) = 625$ pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	3622	9400	No
v R12	1256	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = -2.9$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $M = 0.078$
S
Space mean speed in ramp influence area, $S = 63.2$ mph
R
Space mean speed in outer lanes, $S = 62.5$ mph
0
Space mean speed for all vehicles, $S = 62.8$

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: _____ Fax: _____
 E-mail: _____

Merge Analysis

Analyst: Gregory Dotson
 Agency/Co.: Parsons Transportation Group
 Date performed: 1/28/2003
 Analysis time period: PM Peak
 Freeway/dir or travel: I-40 EB
 Junction: EB On
 Jurisdiction: Alternate A
 Analysis Year: 2005
 Description: I-40/Sycamore View Road IMS

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6106	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	735	vph
Length of first accel/decel lane	950	ft
Length of second accel/decel lane	950	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
	Ramp		
Volume, V (vph)	6106	735	vph

Peak-hour factor, PHF	1.00	0.95	
Peak 15-min volume, v ₁₅	1527	193	v
Trucks and buses	11	11	%
Recreational vehicles	0	0	%
Terrain type:	Level	Level	Level
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	
Driver population factor, f _P	1.00	1.00	
Flow rate, v _p	6442	816	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = 0.209 Using Equation 0

FM

$v = v(P) = 1346$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	7258	9400	No
v _{R12}	2162	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 4.1$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, M = 0.098

Space mean speed in ramp influence area, S = 62.7 mph

Space mean speed in outer lanes, S = 57.0 mph

Space mean speed for all vehicles, S = 58.6 mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Gregory Dotson ebon25am.hcr
Agency/Co.: Parsons Transportation Group
Date performed: 1/28/2003
Analysis time period: AM Peak
Freeway/dir or travel: I-40 EB
Junction: EB On
Jurisdiction: Alternate A
Analysis Year: 2025
Description: I-40/Sycamore View Road IMS

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5263	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	777	vph
Length of first accel/decel lane	950	ft
Length of second accel/decel lane	950	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
	Ramp		
Volume, V (vph)	5263	777	vph

Peak-hour factor, PHF	1.00	0.95	
Peak 15-min volume, v15	1316	204	v
Trucks and buses	16	16	%
Recreational vehicles	0	0	%
Terrain type:	Level	Level	Level
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	
Heavy vehicle adjustment, fHV	0.926	0.926	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5684	883	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)
EQ
P = 0.209 Using Equation 0
FM
 $v = v (P) = 1188 \text{ pc/h}$
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	6567	9400	
FO			
v	2071	4600	
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L = 3.4 \text{ pc/mi/ln}$
R R 12 A

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, M = 0.095
S
Space mean speed in ramp influence area, S = 62.8 mph
R
Space mean speed in outer lanes, S = 58.7 mph
0
Space mean speed for all vehicles, S = 59.9 mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone:

Fax:

E-mail:

Merge Analysis

Analyst: Gregory Dotson ebon25pm.hcr
Agency/Co.: Parsons Transportation Group
Date performed: 1/28/2003
Analysis time period: PM Peak
Freeway/dir or travel: I-40 EB
Junction: EB On
Jurisdiction: Alternate A
Analysis Year: 2025
Description: I-40/Sycamore View Road IMS

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	11007	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1029	vph
Length of first accel/decel lane	950	ft
Length of second accel/decel lane	950	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	11007	1029	vph

Peak-hour factor, PHF	1.00	0.96	
Peak 15-min volume, v ₁₅	2752	268	v
Trucks and buses	11	11	%
Recreational vehicles	0	0	%
Terrain type:	Level	Level	Level
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	
Driver population factor, f _P	1.00	1.00	
Flow rate, v _p	11612	1131	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.209$ Using Equation 0
 FM
 $v = v (P) = 2427$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	12743	9400	Yes
v _{R12}	3558	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 14.8$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, S	M = 0.201
Space mean speed in ramp influence area, S _R	S = 60.4 mph
Space mean speed in outer lanes, S ₀	S = 44.7
Space mean speed for all vehicles, S	S = 48.2

Peak-hour factor, PHF	1.00	0.95	0.95	
Peak 15-min volume, v ₁₅	1782	153	224	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	7520	646	944	pcph

Estimation of V₁₂ Diverge Areas

$L = 0.00$ (Equation 25-8 or 25-9)
 EQ
 $P = 0.260$ Using Equation 0
 FD
 $v = v + (v - v) P = 2433$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v F _i F	7520	9400	No
v 12	2433	4400	No
v = v - v F _O F R	6874	9400	No
v R	646	3800	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 19.2$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D = 0.486
Space mean speed in ramp influence area,	S = 54 mph
Space mean speed in outer lanes,	S = 65.3 mph
Space mean speed for all vehicles,	S = 61.1 mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone:

Fax:

E-mail:

Diverge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/27/2003
Analysis time period: PM Peak
Freeway/dir or travel: I-40 WB
Junction: WB Off
Jurisdiction: Alternative A reconfig
Analysis Year: 2005
Description: I-40/Sycamore View Road IMS

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	3862	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	2		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	674	vph	
Length of first accel/decel lane	220	ft	
Length of second accel/decel lane	220	ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	754	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1202	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	3862	674	754

Peak-hour factor, PHF	1.00	0.95	0.95	
Peak 15-min volume, v ₁₅	966	177	198	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	4171	766	857	pcph

Estimation of V₁₂ Diverge Areas

$L = 0.00$ (Equation 25-8 or 25-9)
 EQ
 $P = 0.260$ Using Equation 0
 FD
 $v = v + (v - v) P = 1651$
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	4171	9400	No
F _i F			
v	1651	4400	No
12			
v = v - v	3405	9400	No
F _O F R			
v	766	3800	
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 12.5$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.497$
 S
 Space mean speed in ramp influence area, $S = 54$ mph
 R
 Space mean speed in outer lanes, $S = 70.3$ mph
 O
 Space mean speed for all vehicles, $S = 62.6$ mph

Peak-hour factor, PHF	1.00	0.95	0.96	
Peak 15-min volume, v ₁₅	3123	203	310	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	13178	857	1308	

Estimation of V₁₂ Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v_{12} = v_{12R} + (v_{12F} - v_{12R}) P = 4060 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{12} = v_{12R}$	13178	9400	Yes
$v_{12} = v_{12F}$	4060	4400	No
$v_{12} = v_{12R} - v_{12F}$	12321	9400	No
v_{12R}	857	3800	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12R} - 0.009 L = 33.2 \text{ pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, $D = 0.505$

Space mean speed in ramp influence area, $S_R = 53$

Space mean speed in outer lanes, $S_0 = 57.4 \text{ mph}$

Space mean speed for all vehicles, $S = 56.1 \text{ mph}$

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: Fax:

E-mail:

Diverge Analysis

Analyst: Gregory Dotson wboff25pm.hcr
 Agency/Co.: Parsons Transportation Group
 Date performed: 1/27/2003
 Analysis time period: PM Peak
 Freeway/dir or travel: I-40 WB
 Junction: WB Off
 Jurisdiction: Alternative A reconfig
 Analysis Year: 2025
 Description: I-40/Sycamore View Road IMS

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6911	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	r
Volume on ramp	944	vph
Length of first accel/decel lane	220	ft
Length of second accel/decel lane	220	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1056	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1202	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	6911	944	1056 vph

Peak-hour factor, PHF	1.00	0.95	0.96	
Peak 15-min volume, v ₁₅	1728	248	275	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	% 0.00	% 0.00	%
Length	0.00	mi 0.00	mi 0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	7464	1073	1188	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v = v + (v - v) P = 2735$ pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	7464	9400	No
F _i F			
v	2735	4400	No
12			
v = v - v	6391	9400	No
F _O F R			
v	1073	3800	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 21.8$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.525$

S

Space mean speed in ramp influence area $S = 53$ mph

R

Space mean speed in outer lanes, $S = 66.0$ mph

O

Space mean speed for all vehicles, $S = 60.5$ mph

HCS2000: Basic Freeway Segments Release 4.1a

Phone: _____ Fax: _____
 E-mail: _____

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons
 Date Performed: 1/27/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 WB
 From/To: At Sycamore View
 Jurisdiction:
 Analysis Year: 2005
 Description: I-40 / Sycamore View IMS (Analysis for 1st WB on ramp)

Flow Inputs and Adjustments

Volume, V	7426	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1857	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	1567	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1567	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	5	
Density, D	24.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons
 Date Performed: 1/27/2003
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 WB
 From/To: From Sycamore View to I-240
 Jurisdiction:
 Analysis Year: 2005
 Description: I-40 / Sycamore View Road IMS (Analysis for WB on ramp)

Flow Inputs and Adjustments

Volume, V	3942	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	986	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	851	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	851	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	5	
Density, D	13.4	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1a

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson wbon25am mid
 Agency or Company: Parsons
 Date Performed: 1/27/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 WB
 From/To: From Sycamore View to I-240
 Jurisdiction: Alt A (WB ONramp midstream)
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS (Analysis for WB on ramp)

Flow Inputs and Adjustments

Volume, V	12909	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	3228	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	2724	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	2724	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	5	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson wbon25pm mid
 Agency or Company: Parsons
 Date Performed: 1/27/2003
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 WB
 From/To: From Sycamore View to I-240
 Jurisdiction:
 Analysis Year: 2025
 Description: I-40 / Sycamore View Road IMS (Analysis for WB on ramp)

Flow Inputs and Adjustments

Volume, V	7023	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1756	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1517	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	63.3	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1517	pc/h/ln
Free-flow speed, FFS	63.3	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	5	
Density, D	24.0	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Peak-hour factor, PHF	1.00	0.95	0.95	
Peak 15-min volume, v ₁₅	1857	250	224	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	7834	1056	944	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.209$ Using Equation 0
 FM
 $v = v(P) = 1171$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	6658	11750	No
v _{R12}	2227	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 7.3$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable	M = 0.141
Space mean speed in ramp influence area, S _R	S = 61.8 mph
Space mean speed in outer lanes, S _O	S = 58.8 mph
Space mean speed for all vehicles, S	S = 59.8 mph

PARSONS TRANSPORTATION GROUP
PARSONS CORP.

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/28/03
Analysis time period: PM Peak
Freeway/dir or travel: I-40 WB
Junction: WB on (downstream)
Jurisdiction: Alternate A
Analysis Year: 2005
Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3942	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1073	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	800	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	754	
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1585	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
	Ramp		
Volume, V (vph)	3942	1073	754 vph

Peak-hour factor, PHF	1.00	0.96	0.95	
Peak 15-min volume, v ₁₅	986	279	198	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	4257	1207	857	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = 0.209 Using Equation 0

FM

$v = v(P) = 694$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	4528	11750	No
FO			
v	1901	4600	No
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 4.7$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $M = 0.131$

Space mean speed in ramp influence area, $S = 62.0$ mph

Space mean speed in outer lanes, $S = 62.1$ mph

Space mean speed for all vehicles, $S = 62.0$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

PARSONS TRANSPORTATION GROUP
PARSONS CORP.

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Gregory Dotson wb2on25am.hcr
Agency/Co.: Parsons Transportation Group
Date performed: 1/28/03
Analysis time period: AM Peak
Freeway/dir or travel: I-40 WB
Junction: WB on (downstream)
Jurisdiction: Alternate A
Analysis Year: 2025
Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	12909	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1332	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	800	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1190	
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1585	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	12909	1332	1190 vph

Peak-hour factor, PHF	1.00	0.96	0.96	
Peak 15-min volume, v15	3228	347	310	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.948	0.948	0.948	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	13619	1464	1308	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = 0.209 Using Equation 0

FM

$v = v(P) = 2324$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	12583	11750	Yes
FO			
v	3788	4600	No
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 19.3$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, $M = 0.277$

Space mean speed in ramp influence area, $S = 58.6$ mph

Space mean speed in outer lanes, $S = 45.9$ mph

Space mean speed for all vehicles, $S = 49.1$ mph

Peak-hour factor, PHF	1.00	0.97	0.96	
Peak 15-min volume, v ₁₅	1756	387	275	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	00	1.00	1.00	
Flow rate, v _p	7585	1672	1188	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.209$ Using Equation 0
 FM
 $v = v(P) = 1134$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	7096	11750	No
v _{R12}	2806	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 11.5$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, S	M = 0.170
Space mean speed in ramp influence area, S	S = 61.1 mph
Space mean speed in outer lanes, S	S = 59.1 mph
Space mean speed for all vehicles, S	S = 59.9 mph

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix D

Section 4

Capacity Worksheets for Interstate 40:

Ramp Analyses for Alternate C Conditions

Phone:
 E-mail:
 Fax:

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/28/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: Alt C (EB OFFramp)
 Analysis Year: 2005
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2008	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	512	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1106	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	58.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1106	pc/h/ln
Free-flow speed, FFS	58.8	mi/h
Average passenger-car speed, S	58.8	mi/h
Number of lanes, N	2	
Density, D	18.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/21/2003
 Analysis Time Period: PM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: SPUI (EB OFFramp)
 Analysis Year: 2005
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2090	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	533	
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	1125	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	58.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1125	pc/h/ln
Free-flow speed, FFS	58.8	mi/h
Average passenger-car speed, S	58.8	mi/h
Number of lanes, N	2	
Density, D	19.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: _____ Fax: _____
 E-mail: _____

Operational Analysis

Analyst: Gregory Dotson
 Agency or Company: Parsons Transportation Group
 Date Performed: 1/22/2003
 Analysis Time Period: AM Peak
 Freeway/Direction: I-40 EB
 From/To: From Sycamore View to I-240
 Jurisdiction: SPUI (EB OFFramp)
 Analysis Year: 2025
 Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2812	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	717	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhV	0.926	
Driver population factor, vp	1.00	
Flow rate, vp	1549	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	53.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1549	pc/h/ln
Free-flow speed, FFS	53.8	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	2	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: _____ Fax: _____
 E-mail: _____

Operational Analysis

Analyst: Gregory Dotson
Agency or Company: Parsons Transportation Group
Date Performed: 1/21/2003
Analysis Time Period: PM Peak
Freeway/Direction: I-40 EB
From/To: From Sycamore View to I-240
Jurisdiction: SPUI (EB OFFramp)
Analysis Year: 2025
Description: I-40/Sycamore View Road IMS (Analysis on EB off ramp)

Flow Inputs and Adjustments

Volume, V	2926	veh/h
Peak-hour factor, PHF	0.98	
Peak 15-min volume, v15	746	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, vp	1.00	
Flow rate, vp	1575	

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.83	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Ideal	
FFS or BFFS	60.0	
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	1.7	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	53.8	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1575	pc/h/ln
Free-flow speed, FFS	53.8	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	2	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: MJB eb05amCDMC
Agency/Co.: Parsons
Date performed: 1/29/2003
Analysis time period: AM Peak
Freeway/dir or travel: I-40 EB C-D road
Junction: off-ramp to Macon Cove
Jurisdiction:
Analysis Year: 2005
Description: Alternate A or Alternate C

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	
Volume on freeway	2008	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	904	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	2742	
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	2008	904	2742 vph

Peak-hour factor, PHF	0.94	0.92	0.92	
Peak 15-min volume, v ₁₅	534	246	745	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	2307	1061	3219	pcph

_____ Estimation of V12 Diverge Areas _____

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 1.000 Using Equation 0

FD

$v = v + (v - v) P = 2307$

$12 \quad R \quad F \quad R \quad FD$

_____ Capacity Checks _____

	Actual	Maximum	LOS F?
$v = v$	2307	4500	No
$F_i \quad F$			
v	2307	4400	No
12			
$v = v - v$	1246	4500	No
$F_O \quad F \quad R$			
v	1061	2000	No
R			

_____ Level of Service Determination (if not F) _____

Density, $D = 4.252 + 0.0086 v - 0.009 L = 19.6 \text{ pc/mi/ln}$

$R \quad 12 \quad D$

Level of service for ramp-freeway junction areas of influence B

_____ Speed Estimation _____

Intermediate speed variable, $D = 0.523$

S

Space mean speed in ramp influence area, $S = 48 \text{ mph}$

R

Space mean speed in outer lanes, $S = \text{N/A} \text{ mph}$

O

Space mean speed for all vehicles, $S = 48.2 \text{ mph}$

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone:
E-mail:

Fax:

Diverge Analysis

Analyst: MJB eb05amCDMC
 Agency/Co.: Parsons
 Date performed: 1/29/2003
 Analysis time period: PM Peak
 Freeway/dir or travel: I-40 EB C-D road
 Junction: off-ramp to Macon Cove
 Jurisdiction:
 Analysis Year: 2005
 Description: Alternate A or Alternate C

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2090	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	
Volume on ramp	940	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	6106	
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	2090	940	6106 vph

Peak-hour factor, PHF	0.94	0.92	0.96	
Peak 15-min volume, v15	556	255	1590	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.948	0.948	0.948	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2346	1078	6710	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 1.000 Using Equation 0

FD

$v = v + (v - v) P = 2346$

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	2346	4500	No
Fi F			
v	2346	4400	No
12			
$v = v - v$	1268	4500	No
FO F R			
v	1078	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 19.9$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.525$

S

Space mean speed in ramp influence area, $S = 48$ mph

R

Space mean speed in outer lanes, $S = N/A$ mph

0

Space mean speed for all vehicles, $S = 48.2$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone:
E-mail:

Fax:

Diverge Analysis

Analyst: MJB eb25amCDMC
 Agency/Co.: Parsons
 Date performed: 1/29/2003 /
 Analysis time period: AM Peak
 Freeway/dir or travel: I-40 EB C-D road
 Junction: off-ramp to Macon Cove
 Jurisdiction:
 Analysis Year: 2025
 Description: Alternate A or Alternate C

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2812	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1265	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	5263	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	2812	1265	5263 vph

Peak-hour factor, PHF	0.94	0.94	0.94	
Peak 15-min volume, v ₁₅	748	336	1400	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	3231	1453	6047	pcph

Estimation of V₁₂ Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 1.000 Using Equation 0

FD

$v = v + (v - v) P = 3231 \text{ pc/h}$

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	3231	4500	No
F _i F			
v	3231	4400	No
12			
v = v - v	1778	4500	No
F _O F R			
v	1453	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 27.5 \text{ pc/mi/ln}$

R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.559$

S

Space mean speed in ramp influence area, $S = 48 \text{ mph}$

R

Space mean speed in outer lanes, $S = \text{N/A} \text{ mph}$

O

Space mean speed for all vehicles, $S = 47.7 \text{ mph}$

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone:
E-mail:

Fax:

Diverge Analysis

Analyst: MJB eb25pmCDMC
 Agency/Co.: Parsons
 Date performed: 1/29/2003
 Analysis time period: PM Peak
 Freeway/dir or travel: I-40 EB C-D road
 Junction: off-ramp to Macon Cove
 Jurisdiction:
 Analysis Year: 2025
 Description: Alternate A or Alternate C

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2926	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1317	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	11007	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
	Ramp			
Volume, V (vph)	2926	1317	11007	vph

Peak-hour factor, PHF	0.94	0.94	0.99	
Peak 15-min volume, v ₁₅	778	350	2780	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	3284	1478	11730	pcph

Estimation of V₁₂ Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 1.000 Using Equation 0

FD

$v = v + (v - v) P = 3284$ pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	3284	4500	No
F _i F			
v	3284	4400	No
12			
v = v - v	1806	4500	No
F _O F R			
v	1478	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 28.0$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.561$

S

Space mean speed in ramp influence area, $S = 48$ mph

R

Space mean speed in outer lanes, $S = N/A$ mph

0

Space mean speed for all vehicles, $S = 47.7$ mph

Peak-hour factor, PHF	0.99	0.95	0.98	
Peak 15-min volume, v ₁₅	692	146	512	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	2991	631	2213	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.209$ Using Equation 0
 FM
 $v = v (P) = 625$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	3622	9400	No
v R12	1256	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L = -2.9$ pc/mi/ln
 R R 12 A

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, S	M = 0.078
Space mean speed in ramp influence area, S	S = 63.2 mph
R	
Space mean speed in outer lanes, S	S = 62.5 mph
0	
Space mean speed for all vehicles, S	S = 62.8 mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: Fax:

E-mail:

Merge Analysis

Analyst: Gregory Dotson
 Agency/Co.: Parsons Transportation Group
 Date performed: 1/22/2003
 Analysis time period: PM Peak
 Freeway/dir or travel: I-40 EB
 Junction: EB On
 Jurisdiction: SPUI
 Analysis Year: 2005
 Description: I-40/Sycamore View Road IMS

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6106	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	735	vph
Length of first accel/decel lane	950	ft
Length of second accel/decel lane	950	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2090	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1931	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	6106	735	2090 vph

Peak-hour factor, PHF	1.00	0.95	0.98	
Peak 15-min volume, v15	1527	193	533	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.948	0.948	0.948	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6442	816	2250	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.209$ Using Equation 0
 FM
 $v = v (P) = 1346$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	7258	9400	
v R12	2162	4600	

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 4.1$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, S	M = 0.098
Space mean speed in ramp influence area, S	S = 62.7 mph
Space mean speed in outer lanes, S	S = 57.0 mph
Space mean speed for all vehicles, S	S = 58.6 mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone:
E-mail:

Fax:

Merge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/22/2003
Analysis time period: AM Peak
Freeway/dir or travel: I-40 EB
Junction: EB On
Jurisdiction: SPUI
Analysis Year: 2025
Description: I-40/Sycamore View Road IMS

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	5263	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	2		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	777	vph	
Length of first accel/decel lane	950	ft	
Length of second accel/decel lane	950	ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	2812	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1931	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	5263	777	2812 vph

Peak-hour factor, PHF	1.00	0.95	0.98	
Peak 15-min volume, v ₁₅	1316	204	717	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	5684	883	3099	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.209$ Using Equation 0
 FM
 $v = v(P) = 1188$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	6567	9400	No
FO			
v	2071	4600	No
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 3.4$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $M = 0.095$
 Space mean speed in ramp influence area, $S = 62.8$ mph
 Space mean speed in outer lanes, $S = 58.7$ mph
 Space mean speed for all vehicles, $S = 59.9$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: _____ Fax: _____
 E-mail: _____

Merge Analysis

Analyst: Gregory Dotson
 Agency/Co.: Parsons Transportation Group
 Date performed: 1/22/2003
 Analysis time period: PM Peak
 Freeway/dir or travel: I-40 EB
 Junction: EB On
 Jurisdiction: SPUI
 Analysis Year: 2025
 Description: I-40/Sycamore View Road IMS

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	11007	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	2		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	1029	vph	
Length of first accel/decel lane	950	ft	
Length of second accel/decel lane	950	ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	2926	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1931	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway Ramp	Ramp	Adjacent	
Volume, V (vph)	11007	1029	2926	vph

Peak-hour factor, PHF	1.00	0.96	0.98	
Peak 15-min volume, v ₁₅	2752	268	746	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	11612	1131	3150	pcph

Estimation of V₁₂ Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.209$ Using Equation 0
 FM
 $v = v (P) = 2427$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	12743	9400	Yes
v _{R12}	3558	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 14.8$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, S	M = 0.201
Space mean speed in ramp influence area, S _R	S = 60.4 mph
Space mean speed in outer lanes, S ₀	S = 44.7 mph
Space mean speed for all vehicles, S	S = 48.2 mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone: _____ Fax: _____
E-mail: _____

Diverge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/15/2003
Analysis time period: AM Peak
Freeway/dir or travel: I-40 WB
Junction: WB off
Jurisdiction: SPUI
Analysis Year: 2005
Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	7128	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	2		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	582	vph	
Length of first accel/decel lane	280	ft	
Length of second accel/decel lane	280	ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	1801		
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	2851	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	7128	582	1801 vph

Peak-hour factor, PHF	1.00	0.95	0.97	
Peak 15-min volume, v ₁₅	1782	153	464	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	% 0.00	% 0.00	%
Length	0.00	mi 0.00	mi 0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.948	0.948	0.948	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	7520	646	1959	

Estimation of V12 Diverge Areas

$L = 0.00$ (Equation 25-8 or 25-9)
 EQ
 $P = 0.260$ Using Equation 0
 FD
 $v = v + (v - v) P = 2433$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	7520	9400	No
Fi F			
v	2433	4400	No
12			
v = v - v	6874	9400	No
FO F R			
v	646	3800	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 17.6$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D = 0.486
S	
Space mean speed in ramp influence area,	S = 54
R	
Space mean speed in outer lanes,	S = 65.3 mph
0	
Space mean speed for all vehicles,	S = 61.1 mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone:
E-mail:

Fax:

Diverge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/15/2003
Analysis time period: PM Peak
Freeway/dir or travel: I-40 WB
Junction: WB off
Jurisdiction: SPUI
Analysis Year: 2005
Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	3862	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	2		
Free-Flow speed on ramp	35.0		
Volume on ramp	674	vph	
Length of first accel/decel lane	280	ft	
Length of second accel/decel lane	280	ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	1827		
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	2851	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	3862	674	1827 vph

Peak-hour factor, PHF	1.00	0.95	0.97	
Peak 15-min volume, v ₁₅	966	177	471	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	4171	766	2034	

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v = v + (v - v) P = 1651$ pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	4171	9400	No
F _i F			
v	1651	4400	No
12			
v = v - v	3405	9400	No
F _O F R			
v	766	3800	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 10.9$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.497$

S

Space mean speed in ramp influence area, $S = 54$

R

Space mean speed in outer lanes, $S = 70.3$ mph

0

Space mean speed for all vehicles, $S = 62.6$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1a

Phone:
E-mail:

Fax:

Diverge Analysis

Analyst: Gregory Dotson
Agency/Co.: Parsons Transportation Group
Date performed: 1/21/2003
Analysis time period: AM Peak
Freeway/dir or travel: I-40 WB
Junction: WB off
Jurisdiction: SPUI
Analysis Year: 2025
Description: I-40 / Sycamore View Road IMS

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	4		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	12491	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	2		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	772	vph	
Length of first accel/decel lane	280	ft	
Length of second accel/decel lane	280	ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	2522	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	2851	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
Volume, V (vph)	12491	772	2522 vph

Peak-hour factor, PHF	1.00	0.95	0.98	
Peak 15-min volume, v15	3123	203	643	v
Trucks and buses	11	11	11	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	% 0.00	% 0.00	%
Length	0.00	mi 0.00	mi 0.00	mi
Trucks and buses PCE, ET		1.5	1.5	1.5
Recreational vehicle PCE, ER		1.2	1.2	1.2
Heavy vehicle adjustment, fHV		0.948	0.948	0.948
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	13178	857	2715	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v = v + (v - v) P = 4060$ pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	13178	9400	Yes
Fi F			
v	4060	4400	No
12			
$v = v - v$	12321	9400	No
FO F R			
v	857	3800	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 31.6$ pc/mi/ln

R 12 D

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, $D = 0.505$

S

Space mean speed in ramp influence area, $S = 53$ mph

R

Space mean speed in outer lanes, $S = 57.4$ mph

0

Space mean speed for all vehicles, $S = 56.1$ mph

Peak-hour factor, PHF	1.00	0.95	0.98	
Peak 15-min volume, v ₁₅	1728	248	653	v
Trucks and buses	16	16	16	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.926	0.926	0.926	
Driver population factor, f _P	1.00	1.00	1.00	
Flow rate, v _p	7464	1073	2819	pcph

Estimation of V₁₂ Diverge Areas

$L = 0.00$ (Equation 25-8 or 25-9)
 EQ
 $P = 0.260$ Using Equation 0
 FD
 $v = v + (v - v) P = 2735$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	7464	9400	No
$F_i F$			
v	2735	4400	No
12			
$v = v - v$	6391	9400	No
$F_O F R$			
v	1073	3800	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 20.2$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.525$
 S
 Space mean speed in ramp influence area, $S = 53$ mph
 R
 Space mean speed in outer lanes, $S = 66.0$
 O
 Space mean speed for all vehicles, $S = 60.5$ mph

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix E

Intersection Capacity Worksheets for Alternate A

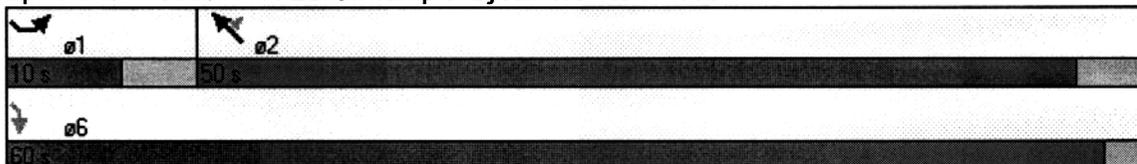
Lane Group	NBL	NBR	SEL	SET	SER	NWL	NWT	NWR	SWL	SWR
			↖↗		↖↖↗		↖↖↖	↖		
	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
	0%			0%			0%		2%	
	0	0	100		0	0		0	0	0
	0	0	2		3	0		1	0	0
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
			50		50		50	50		
			0		0		0	0		
	15	10	15		25	15		10	15	10
	1.00	1.00	0.97	0.91	*0.91	1.00	0.91	1.00	1.00	1.00
					0.850			0.850		
			0.950							
	0	0	3433	0	4322	0	5085	1583	0	0
			0.950							
	0	0	3433	0	4322	0	5085	1583	0	0
					Yes	Yes		Yes		Yes
								25		
	1.00	.00	.00	1.00	1.00	1.00	1.00	1.00	1.01	
	40			40			40		10	
	286			816			264		193	
	4.9			13.9			4.5		13.2	
	0	0	306	0	1151	0	3823	225	0	0
	0.90	0.90	0.94	0.96	0.96	0.90	1.00	0.94	0.90	0.90
	0	0	326	0	1199	0	3823	239	0	0
	0	0	326	0	1199	0	3823	239	0	0
			custom		custom			Perm		
							2			
			1		6			2		
			1		6		2	2		
			4.0		4.0		4.0	4.0		
			8.0		20.0		20.0	20.0		
	0.0	0.0	10.0	0.0	60.0	0.0	50.0	50.0	0.0	0.0
	0%	0%	17%	0%	100%	0%	83%	83%	0%	0%
			6.0		57.5		46.0	46.0		
			4.0		2.0		4.0	4.0		
			0.0		0.5		0.0	0.0		
			Lead				Lag	Lag		
			3.0		3.0		3.0	3.0		
			None		Coord		Coord	Coord		
					5.0		5.0	5.0		
					11.0		11.0	11.0		
					0		0	0		
			7.0		60.0		47.0	47.0		
			0.12		1.00		0.78	0.78		
			0.81		0.28		0.96	0.19		
			25.8		0.0		5.7	1.5		
			37.3		0.0		6.5	1.0		
			D		A		A	A		

Lane Group	NBL	NBR	SEL	SET	SER	NWL	NWT	NWR	SWL	SWR
Approach Delay				8.0			6.1			
Approach LOS				A			A			
90th %ile Green (s)			6.0		57.5		46.0	46.0		
90th %ile Term Code			Max		Coord		Coord	Coord		
70th %ile Green (s)			6.0		57.5		46.0	46.0		
70th %ile Term Code			Max		Coord		Coord	Coord		
50th %ile Green (s)			6.0		57.5		46.0	46.0		
50th %ile Term Code			Max		Coord		Coord	Coord		
30th %ile Green (s)			6.0		57.5		46.0	46.0		
30th %ile Term Code			Max		Coord		Coord	Coord		
10th %ile Green (s)			6.0		57.5		46.0	46.0		
10th %ile Term Code			Max		Coord		Coord	Coord		
Queue Length 50th (ft)			62		0		513	8		
Queue Length 95th (ft)			#123		0		m536	m8		
Internal Link Dist (ft)	206			736			184		113	
50th Up Block Time (%)							7%			
95th Up Block Time (%)							7%			
Turn Bay Length (ft)			100							
50th Bay Block Time %										
95th Bay Block Time %			32%							
Queuing Penalty (veh)			64				264			

Intersection Summary

Area Type: Other
 Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NWT and 6:SER, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.96
 Intersection Signal Delay: 6.6
 Intersection Capacity Utilization 89.8%
 Intersection LOS: A
 ICU Level of Service D
 * User Entered Value
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: EB On-ramp & Sycamore View Road



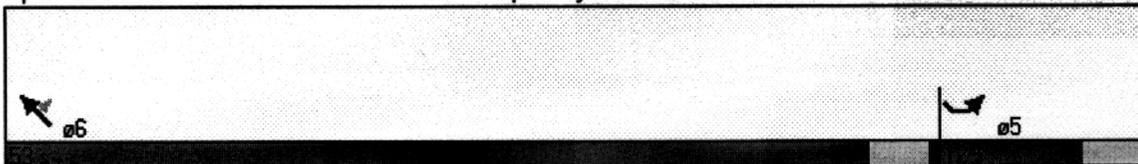
Lane Group	NBL	NBR	SEL	SET	SER	NWL	NWT	NWR	SWL	SWR
			↖↖		↗↗↗		↕↕↕	↗		
	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
	0%			0%			0%		2%	
	0	0	100		0	0		0	0	0
	0	0	2		3	0		1	0	0
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
			50		50		50	50		
			0		0		0	0		
	15	10	15		10	15		10	15	10
	1.00	1.00	0.97	0.91	0.76	1.00	0.91	1.00	1.00	1.00
			1.00					0.98		
					0.850			0.850		
			0.950							
	0	0	3367	0	3610	0	4988	1553	0	0
			0.950							
	0	0	3366	0	3610	0	4988	1516	0	0
					Yes	No		Yes		Yes
					2487			16		
	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01
	10			40			40		40	
	328			765			295		188	
	22.4			13.0			5.0		3.2	
	0	0	404	0	2580	0	3295	445	0	0
			10					10		10
	0.90	0.90	0.94	0.99	0.99	0.90	1.00	0.95	0.90	0.92
	2%	2%	4%	4%	2%	2%	4%	4%	2%	2%
	0	0	430	0	2606	0	3295	468	0	0
	0	0	430	0	2606	0	3295	468	0	0
			custom		Free			Perm		
			5					6		
			5		Free			6		
			5					6		6
			4.0					4.0		4.0
			8.0					20.0		20.0
	0.0	0.0	12.0	0.0	0.0	0.0	53.0	53.0	0.0	0.0
	0%	0%	18%	0%	0%	0%	82%	82%	0%	0%
			8.0					49.0		49.0
			4.0					3.5		3.5
			0.0					0.5		0.5
			Lag					Lead		Lead
			Yes					Yes		Yes
			3.0					3.0		3.0
			None					Coord		Coord
								5.0		5.0
								11.0		11.0
								0		0
			9.0		65.0			50.0		50.0
			0.14		1.00			0.77		0.77
			0.92		0.72			0.86		0.40

Lane Group	NBL	NBR	SEL	SET	SER	NWL	NWT	NWR	SWL	SWR
Uniform Delay, d1			27.6		0.0		5.1	2.4		
Delay			46.8		0.7		10.7	4.4		
LOS			D		A		B	A		
Approach Delay				7.2			9.9			
Approach LOS				A			A			
90th %ile Green (s)			8.0				49.0	49.0		
90th %ile Term Code			Max				Coord	Coord		
70th %ile Green (s)			8.0				49.0	49.0		
70th %ile Term Code			Max				Coord	Coord		
50th %ile Green (s)			8.0				49.0	49.0		
50th %ile Term Code			Max				Coord	Coord		
30th %ile Green (s)			8.0				49.0	49.0		
30th %ile Term Code			Max				Coord	Coord		
10th %ile Green (s)			8.0				49.0	49.0		
10th %ile Term Code			Max				Coord	Coord		
Queue Length 50th (ft)			89		0		407	69		
Queue Length 95th (ft)			#170		20		m367	m62		
Internal Link Dist (ft)	248			685			215		108	
50th Up Block Time (%)							21%			
95th Up Block Time (%)							19%			
Turn Bay Length (ft)			100							
50th Bay Block Time %										
95th Bay Block Time %			50%		1%					
Queuing Penalty (veh)			215				651			

Intersection Summary

Area Type: Other
 Cycle Length: 65
 Actuated Cycle Length: 65
 Offset: 52 (80%), Referenced to phase 2: and 6:NWT, Start of Green
 Natural Cycle: 40
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.92
 Intersection Signal Delay: 8.7
 Intersection Capacity Utilization 92.1%
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Eastbound On-ramp & Sycamore View Road



						
Lane Group	NBL	NBR	SEL	SER	SWL	SWR
Lane Configurations	TTTT					TT
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50					50
Trailing Detector (ft)	0					0
Turning Speed (mph)	25	10	15	10	15	15
Lane Util. Factor	*0.89	1.00	1.00	1.00	1.00	0.88
Fr						0.850
Flt Protected	0.950					
Satd. Flow (prot)	6300	0	0	0	0	
Flt Permitted	0.950					
Satd. Flow (perm)	6300	0	0	0	0	2787
Right Turn on Red	No	No		No		No
Satd. Flow (RTOR)						
Headway Factor	1.00	1.00	1.00	.00	1.00	
Link Speed (mph)	40		40		40	
Link Distance (ft)	230		264		235	
Travel Time (s)	3.9		4.5		4.0	
Volume (vph)	2944	0	0	0	0	1104
Peak Hour Factor	0.99	0.94	0.90	0.90	0.90	0.96
Adj. Flow (vph)	2974	0	0	0	0	1150
Lane Group Flow (vph)	2974	0	0	0	0	1150
Turn Type						custom
Protected Phases	2					
Permitted Phases						8
Detector Phases	2					8
Minimum Initial (s)	4.0					4.0
Minimum Split (s)	20.0					20.0
Total Split (s)	33.0	0.0	0.0	0.0	0.0	27.0
Total Split (%)	55%	0%	0%	0%	0%	45%
Maximum Green (s)	29.0					23.0
Yellow Time (s)	4.0					4.0
All-Red Time (s)	0.0					0.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0					3.0
Recall Mode	Coord					None
Walk Time (s)	5.0					5.0
Flash Dont Walk (s)	11.0					11.0
Pedestrian Calls (#/hr)	0					0
Act Effct Green (s)	30.0					24.0
Actuated g/C Ratio	0.50					0.40
v/c Ratio	0.94					1.03
Uniform Delay, d1	14.2					18.0
Delay	18.8					48.3
LOS	B					D
Approach Delay	18.8				48.3	
Approach LOS	B				D	
90th %ile Green (s)	29.0					23.0



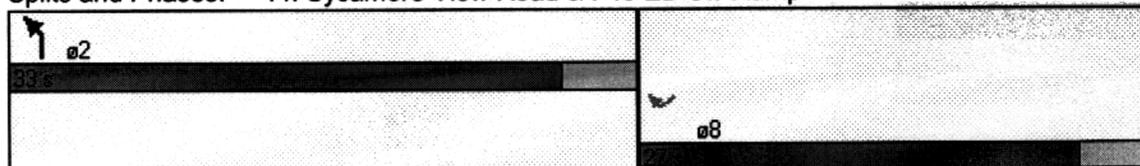
Lane Group	NBL	NBR	SEL	SER	SWL	SWR
90th %ile Term Code	Coord					Max
70th %ile Green (s)	29.0					23.0
70th %ile Term Code	Coord					Max
50th %ile Green (s)	29.0					23.0
50th %ile Term Code	Coord					Max
30th %ile Green (s)	29.0					23.0
30th %ile Term Code	Coord					Max
10th %ile Green (s)	29.0					23.0
10th %ile Term Code	Coord					Max
Queue Length 50th (ft)	264					~244
Queue Length 95th (ft)	#377					#383
Internal Link Dist (ft)	150		184		155	
50th Up Block Time (%)	24%					24%
95th Up Block Time (%)	31%					44%
Turn Bay Length (ft)						
50th Bay Block Time %						
95th Bay Block Time %						
Queuing Penalty (veh)	825					388

Intersection Summary

Area Type: Other
 Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.03
 Intersection Signal Delay: 27.0
 Intersection Capacity Utilization 89.3%
 * User Entered Value
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Intersection LOS: C
 ICU Level of Service D

Splits and Phases: 44: Sycamore View Road & I-40 EB Off-Ramp



New Ramp to Macon Cove - impr. geometry 46: Sycamore View Road & Eastbound Off-ramp
 I-40/Sycamore View Alternate A, 4/30/2003 PM Peak

Lane Group	NBL	NBR	SEL	SER	SWL	SWR
	↑↑↑					↑↑
	1900	1900	1900	1900	1900	1900
	3.0	3.0	3.0	3.0	3.0	3.0
	50					50
	0					0
	15	10	15	10	15	15
	0.94	1.00	1.00	*0.89	1.00	0.88
						0.850
	0.950					
	4990	0	0	0	0	
	0.950					
	4990	0	0	0	0	2787
	No	No		No		No
	1.00	1.00	1.00	1.00	1.00	
	40		40		40	
	251		295		245	
	4.3		5.0		4.2	
	2590	0	0	0	0	1150
	0.99	0.90	0.90	0.99	0.90	0.96
	2616	0	0	0	0	1198
	2616	0	0	0	0	1198
						custom
	2					
						8
	2					8
	4.0					4.0
	20.0					20.0
	35.0	0.0	0.0	0.0	0.0	30.0
	54%	0%	0%	0%	0%	46%
	31.0					26.0
	4.0					4.0
	0.0					0.0
	3.0					3.0
	Coord					None
	5.0					5.0
	11.0					11.0
	0					0
	32.0					27.0
	0.49					0.42
	1.06					1.03
	16.5					19.0
	53.1					49.1
	D					D
	53.1				49.1	
	D				D	
	31.0					26.0

New Ramp to Macon Cove - impr. geometry 46: Sycamore View Road & Eastbound Off-ramp
 I-40/Sycamore View Alternate A, 4/30/2003 PM Peak



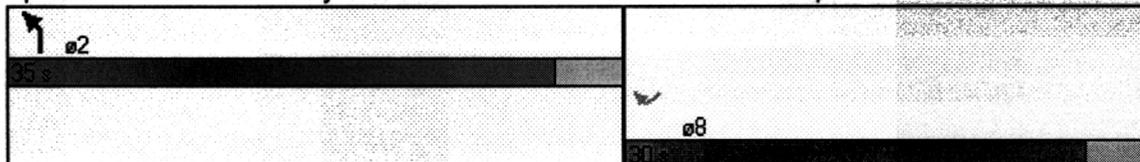
Lane Group	NBL	NBR	SEL	SER	SWL	SWR
90th %ile Term Code	Coord					
70th %ile Green (s)	31.0					
70th %ile Term Code	Coord					
50th %ile Green (s)	31.0					
50th %ile Term Code	Coord					
30th %ile Green (s)	31.0					
30th %ile Term Code	Coord					
10th %ile Green (s)	31.0					
10th %ile Term Code	Coord					
Queue Length 50th (ft)	~725					
Queue Length 95th (ft) m#713						
Internal Link Dist (ft)	171		215		165	
50th Up Block Time (%)	51%					26%
95th Up Block Time (%)	50%					43%
Turn Bay Length (ft)						
50th Bay Block Time %						
95th Bay Block Time %						
Queuing Penalty (veh)	1315					

Intersection Summary

Area Type: Other
 Cycle Length: 65
 Actuated Cycle Length: 65
 Offset: 31 (48%), Referenced to phase 2:NBL and 6:, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.06
 Intersection Signal Delay: 51.8
 Intersection Capacity Utilization 98.3%
 Intersection LOS: D
 ICU Level of Service E

* User Entered Value
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal

Splits and Phases: 46: Sycamore View Road & Eastbound Off-ramp



**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix F

Intersection Capacity Worksheets for Alternate C

Sycamore View at Macon, 2025 Alternate C
7: I-40 WB Ramps & I-40 EB Ramps

PM Peak
2/1/2003

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT	SEL	SET	NWL	NWT
Lane Configurations			↖↖↖		↖↖		↖↖	↑↑↑	↖↖↖	↑↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)	0%	2%		-2%		0%		0%		0%
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)			50		50		50	50	50	50
Trailing Detector (ft)			0		0		0	0	0	0
Turning Speed (mph)			15		15		15	15	15	15
Lane Util. Factor	1.00	1.00	0.94	.00	0.97	.00	0.97	0.86	0.94	0.91
Ped Bike Factor			0.99				1.00			
Frnt										
Flt Protected			0.950		0.950		0.950		0.950	
Satd. Flow (prot)	0	0	5040	0	3433	0	3367	6285	4990	4988
Flt Permitted			0.950		0.950		0.950		0.950	
Satd. Flow (perm)	0	0	4990	0	3433	0	3360	6285	4990	4988
Right Turn on Red										
Satd. Flow (RTOR)										
Headway Factor	1.00	1.01	0.99	0.99	.00	1.00	.00	1.00	1.00	1.00
Link Speed (mph)	40	40		40		40		40		40
Link Distance (ft)	374	352		332		364		1383		609
Travel Time (s)	6.4	6.0		5.7		6.2		23.6		10.4
Volume (vph)	0	0	1700	0	425	0	566	3272	1056	2146
Confl. Peds. (#/hr)			10				10			
Peak Hour Factor	0.92	0.92	0.97	0.92	0.94	0.92	0.95	1.00	0.96	0.98
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	2%	4%
Adj. Flow (vph)	0	0	1753	0	452	0	596	3272	1100	2190
Lane Group Flow (vph)	0	0	1753	0	452	0	596	3272	1100	2190
Turn Type			custom		custom		Prot		Prot	
Protected Phases			4		8		5	2	1	6
Permitted Phases			4		8					
Detector Phases			4		8		5	2	1	6
Minimum Initial (s)			4.0		4.0		4.0	4.0	4.0	4.0
Minimum Split (s)			8.0		8.0		8.0	20.0	8.0	20.0
Total Split (s)	0.0	0.0	42.0	0.0	42.0	0.0	29.0	61.0	27.0	59.0
Total Split (%)	0%	0%	32%	0%	32%	0%	22%	47%	21%	45%
Maximum Green (s)			38.0		38.0		25.0	57.0	23.0	55.0
Yellow Time (s)			3.5		3.5		3.5	3.5	3.5	3.5
All-Red Time (s)			0.5		0.5		0.5	0.5	0.5	0.5
Lead/Lag							Lead	Lag	Lead	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes
Vehicle Extension (s)			3.0		3.0		3.0	3.0	3.0	3.0
Recall Mode			None		None		None	Coord	None	Coord
Walk Time (s)								5.0		5.0
Flash Dont Walk (s)								11.0		11.0
Pedestrian Calls (#/hr)								0		0
Act Effct Green (s)			39.0		39.0		25.5	58.0	24.1	56.6
Actuated g/C Ratio			0.30		0.30		0.20	0.45	0.19	0.44
v/c Ratio			1.16		0.44		0.90	1.17	1.19	1.01
Uniform Delay, d1			45.5		36.6		51.0	36.0	53.0	36.8
Delay			10.2		37.0		57.5	105.5	127.9	55.2

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT	SEL	SET	NWL	NWT
			F	10.2	D	37.0	E	F		
				F		D		F		
			~618		158		254	~951		
			#712		208		#351	#1011		
	294	272		252		284		1303		
			45%							
			50%							

392

Summary

Area Type: Other
 Cycle Length: 130
 Actuated Cycle Length: 130
 Offset: 16 (12%), Referenced to phase 2:SET and 6:NWT, Start of Green
 Natural Cycle: 100
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.19
 Intersection Signal Delay: 90.9 Intersection LOS: F
 Intersection Capacity Utilization 111.7% ICU Level of Service G
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 7: I-40 WB Ramps & I-40 EB Ramps

 ø1 27 s	 ø2 51 s	 ø4 42 s
 ø5 29 s	 ø6 59 s	 ø8 42 s

HCS2000: Signalized Intersections Release 4.1a

Analyst: mjb
 Agency: Parsons
 Date: 2/4/2003
 Period: PM Peak
 Project ID: Alternate C
 E/W St: I-40 Ramps

Inter.: Sycamore View SPUI
 Area Type: All other areas
 Jurisd:
 Year : 2005
 N/S St: Sycamore View

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	3	0	0	2	0	0	3	3	0	2	4	0
LGConfig	L			L			L	T		L	T	
Volume	1700			425			1056	2146		566	3272	
Lane Width	12.0			12.0			12.0	12.0		12.0	12.0	
RTOR Vol												

Duration	0.25	Area Type	All other areas			
Signal Operations						
Phase Combination	1	2	3	4	5	6
EB Left	P				P	
Thru						P
Right						
Peds						
WB Left		P				
Thru						
Right						
Peds						
NB Right						
SB Right						
Green		38.0			23.0	2.0
Yellow		3.5			3.5	0.0
All Red		0.5			0.5	0.5
Cycle Length: 130.0 sec						

Intersection Performance Summary							
Appr/Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group Delay LOS	Approach Delay LOS	
			v/c	g/c			
Eastbound							
L	1412	4831	1.24	0.29	160.9 F	160.9	F
Westbound							
L	1003	3433	0.45	0.29	39.0 D		D
Northbound							
L	855	4831	1.29	0.18	191.3 F		
T	2151	5085	1.02	0.42	61.6 E	104.9	F
Southbound							
L	766	3433	0.78	0.22	55.1 E		
T	2973	6780	1.10	0.44	87.6 F	82.6	F

Intersection Delay = 103.0 (sec/veh) Intersection LOS = F

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left Thru Right Peds	P							
NB Left Thru Right Peds					P		P	
WB Left Thru Right Peds	P					P		P
SB Left Thru Right Peds					P	P	P	
NB Right								
EB Right								
SB Right								
WB Right								
Green	38.0				23.0	2.0	55.0	
Yellow	3.5				3.5	0.0	3.5	
All Red	0.5				0.5	0.0	0.5	

Cycle Length: 130.0 se

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	1700			1425			1056	2146		566	3272	
PHF	0.97			0.94			0.96	0.98		0.95	1.00	
Adj flow	1753			1452			1100	2190		596	3272	
No. Lanes	3	0	0	2	0	0	3	3	0	2	4	0
Lane group	L			L			L	T		L	T	
Adj flow	1753			452			1100	2190		596	3272	
Prop LTs								0.000			0.000	
Prop RTs								0.000			0.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

LG	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
So	1900			1900			1900	1900		1900	1900	
Lanes	3	0	0	2	0	0	3	3	0	2	4	0
fw	1.000			1.000			1.000	1.000		1.000	1.000	
fHV	0.980			0.980			0.980	0.980		0.980	0.980	
fG	1.000			1.000			1.000	1.000		1.000	1.000	
fP	1.000			1.000			1.000	1.000		1.000	1.000	
fBB	1.000			1.000			1.000	1.000		1.000	1.000	
fA	1.00			1.00			1.00	1.00		1.00	1.00	
fLU	0.91			0.97			0.91	0.91		0.97	0.91	
fRT								1.000			1.000	
fLT	0.950			0.950			0.950	1.000		0.950	1.000	
Sec.												
fLpb	1.000			1.000			1.000	1.000		1.000	1.000	
fRpb								1.000			1.000	
S	4831			3433			4831	5085		3433	6780	
Sec.												

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Capaci (c)	roup-- v/c Ratio
Eastbound							
Left	L	1753	4831	0.36	0.29	1412	1.24
Westbound							
Left	L	452	3433	0.13	0.29	1003	0.45
Northbound							
Left	L	1100	4831	0.23	0.18	855	1.29
Thru	T	2190	5085	0.43	0.42	2151	1.02
Right							
Southbound							
Left	L	596	3433	0.17	0.22	766	0.78
Thru	T	3272	6780	0.48	0.44	2973	1.10
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 1.07
 Total lost time per cycle, L = 12.00 sec
 Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 1.18

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Res Del d2	Del d3	Lane Group Delay LOS	Approach Delay LOS
Eastbound									
L	1.24	0.29	46.0	1.000	1412	0.50	114.9	0.0	160.9 F
Westbound									
L	0.45	0.29	37.5	1.000	1003	0.50	1.5	0.0	39.0
Northbound									
L	0.29	0.18	53.5	1.000	855	0.50	137.8	0.0	191.3 F
T	0.02	0.42	37.5	1.000	2151	0.50	24.1	0.0	61.6 E
Southbound									
L	0.78	0.22	47.5	1.000	766	0.50	7.7	0.0	55.1 E
T	1.10	0.44	36.5	1.000	2973	0.50	51.1	0.0	87.6 F

Intersection delay = 103.0 (sec/veh) Intersection LOS = F

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

	Eastbound		Westbound		Northbound		Southbound	
LaneGroup	L		L		L	T	L	T
Init Queue	0.0		0.0		0.0	0.0	0.0	0.0
Flow Rate	584		226		366	730	298	818
So	1900		1900		1900	1900	1900	1900
No.Lanes	3	0	2	0	3	3	2	4
SL	1610		1716		1610	1695	1716	1695
LnCapacity	470		501		285	717	383	743

Flow Ratio	0.36	0.13	0.23	0.43	0.17	0.48
v/c Ratio	1.24	0.45	1.28	1.02	0.78	1.10
Grn Ratio	0.29	0.29	0.18	0.42	0.22	0.44
I Factor	1.000	1.000	1.000	1.000	1.000	1.000
AT or PVG	3	3	3	3	3	3
Pltn Ratio	1.00	1.00	1.00	1.00	1.00	1.00
PF2	1.00	1.00	1.00	1.00	1.00	1.00
Q1	21.1	6.7	13.2	26.4	10.1	29.5
kB	0.9	0.9	0.6	1.2	0.8	1.2
Q2	17.8	0.7	12.4	11.2	2.2	16.7
Q Average	38.9	7.4	25.6	37.5	12.3	46.3
Q Spacing	24.9	24.9	24.9	24.9	24.9	24.9
Q Storage	500	500	400	900	400	900
Q S Ratio	1.9	0.4	1.6	1.0	0.8	1.3
70th Percentile Output:						
FB%	1.2	1.2	1.2	1.2	1.2	1.2
BOQ	46.7	9.0	30.7	45.1	14.9	55.5
QSRatio	2.3	0.4	1.9	1.2	0.9	1.5
85th Percentile Output:						
FB%	1.4	1.5	1.4	1.4	1.4	1.4
BOQ	54.5	10.8	35.9	52.6	17.5	64.8
QSRatio	2.7	0.5	2.2	1.5	1.1	1.8
90th Percentile Output:						
FB%	1.5	1.6	1.5	1.5	1.5	1.5
BOQ	58.4	11.9	38.5	56.3	19.0	69.4
QSRatio	2.9	0.6	2.4	1.6	1.2	1.9
95th Percentile Output:						
FB%	1.6	1.8	1.6	1.6	1.7	1.6
BOQ	62.3	13.5	41.1	60.1	20.7	74.0
QSRatio	3.1	0.7	2.6	1.7	1.3	2.0
98th Percentile Output:						
FB%	1.7	2.0	1.7	1.7	1.8	1.7
BOQ	66.2	15.1	43.8	63.9	22.5	78.6
QSRatio	3.3	0.8	2.7	1.8	1.4	2.2

ERROR MESSAGES

No errors to report.

Sycamore View Road, 2025 Alternate C
7: I-40 WB Ramps & I-40 EB Ramps

AM Peak
2/1/2003



Lane Group	EBT	WBT	NBL	NBT	SBL	SBT	SEL	SET	NWL	NWT
Lane Configurations			↔↔↔		↔↔		↔↔	↑↑↑	↔↔↔	↑↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)	0%	2%		-2%		0%		0%		0%
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)			50		50		50	50	50	50
Trailing Detector (ft)			0		0		0	0	0	0
Turning Speed (mph)			15		15		15		15	
Lane Util. Factor	1.00	1.00	0.94	1.00	0.97	1.00	0.97	0.91	0.94	0.91
Ped Bike Factor			0.99				1.00			
Frt										
Flt Protected			0.950		0.950		0.950		0.950	
Satd. Flow (prot)	0	0	5040	0	3433	0	3367	4988	4990	
Flt Permitted			0.950		0.950		0.950		0.950	
Satd. Flow (perm)	0	0	4988	0	3433	0	3365	4988	4990	
Right Turn on Red										
Satd. Flow (RTOR)										
Headway Factor	1.00	1.01	0.99	0.99	.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)	40	40		40		40		40		40
Link Distance (ft)	374	352		332		364		1383		609
Travel Time (s)	6.4	6.0		5.7		6.2		23.6		10.4
Volume (vph)	0	0	1547	0	347	0	428	1342	1190	2854
Confl. Peds. (#/hr)			10				10			
Peak Hour Factor	0.92	0.92	0.97	0.92	0.94	0.92	0.94	0.96	0.96	0.99
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	2%	4%
Adj. Flow (vph)	0	0	1595	0	369	0	455	1398	1240	2883
Lane Group Flow (vph)	0	0	1595	0	369	0	455	1398	1240	2883
Turn Type			custom		custom		Prot		Prot	
Protected Phases			4		8		5	2	1	6
Permitted Phases			4		8					
Detector Phases			4		8		5	2	1	6
Minimum Initial (s)			4.0		4.0		4.0	4.0	4.0	4.0
Minimum Split (s)			8.0		8.0		8.0	20.0	8.0	20.0
Total Split (s)	0.0	0.0	29.0	0.0	29.0	0.0	15.0	33.0	28.0	46.0
Total Split (%)	0%	0%	32%	0%	32%	0%	17%	37%	31%	51%
Maximum Green (s)			25.0		25.0		11.0	29.0	24.0	42.0
Yellow Time (s)			3.5		3.5		3.5	3.5	3.5	3.5
All-Red Time (s)			0.5		0.5		0.5	0.5	0.5	0.5
Lead/Lag							Lead	Lag	Lead	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes
Vehicle Extension (s)			3.0		3.0		3.0	3.0	3.0	3.0
Recall Mode			None		None		None	Coord	None	Coord
Walk Time (s)								5.0		5.0
Flash Dont Walk (s)								11.0		11.0
Pedestrian Calls (#/hr)								0		0
Act Effct Green (s)			26.0		26.0		12.0	30.3	24.7	43.0
Actuated g/C Ratio			0.29		0.29		0.13	0.34	0.27	0.48
v/c Ratio			1.10		0.37		1.01	0.83	0.91	1.21
Uniform Delay, d1			32.0		25.5		39.0	27.5	31.5	23.5
Delay			79.3		25.8		77.5	28.6	37.0	72.5



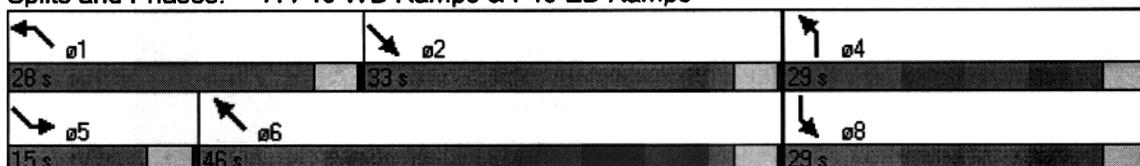
Lane Group	EBT	WBT	NBL	NBT	SBL	SBT	SEL	SET	NWL	NWT
LOS			E		C		E	C	D	E
Approach Delay				79.3		25.8		40.6		61.8
Approach LOS				E		C		D		E
Queue Length 50th (ft)			~367		86		~137	267	246	~722
Queue Length 95th (ft)			#458		125		#237	326	m234	m#603
Internal Link Dist (ft)	294	272		252		284		1303		529
50th Up Block Time (%)			25%							24%
95th Up Block Time (%)			39%							9%
Turn Bay Length (ft)										
50th Bay Block Time %										
95th Bay Block Time %										
Queuing Penalty (veh)										469

Intersection Summary

Area Type: Other
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 72 (80%), Referenced to phase 2:SET and 6:NWT, Start of Green
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.21
 Intersection Signal Delay: 58.7
 Intersection LOS: E
 Intersection Capacity Utilization 109.0%
 ICU Level of Service F

- Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: I-40 WB Ramps & I-40 EB Ramps



HCS2000 Signalized Intersections Release 4.1a

Analyst: mjb
 Agency: Parsons
 Date: 2/4/2003
 Period: AM Peak
 Project ID: Alternate C
 E/W St: I-40 Ramps

Inter.: Sycamore View SPUI
 Area Type: All other areas
 Jurisd:
 Year : 2005
 N/S St: Sycamore View

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	3	0	0	2	0	0	3	3	0	2	4	0
LGConfig	L			L			L	T		L	T	
Volume	1547			347			428	1342		1190	2854	
Lane Width	12.0			12.0			12.0	12.0		12.0	12.0	
RTOR Vol												

Duration	0.25	Area Type:	All other areas					
Signal Operations								
Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru					Thru		P	
Right					Right			
Peds					Peds			
WB Left	P				SB Left	P	P	
Thru					Thru		P	P
Right					Right			
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	30.0					16.0	14.0	28.0
Yellow	3.5					3.5	0.0	3.5
All Red	0.5					0.5	0.0	0.5
Cycle Length: 100.0 sec								

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	1449	4831	1.10	0.30	91.3	F		F
Westbound								
L	1030	3433	0.36	0.30	28.4	C	28	C
Northbound								
L	773	4831	0.59	0.16	42.2	D		
T	1424	5085	0.98	0.28	55.6	E	52.3	D
Southbound								
L	1167	3433	1.06	0.34	77.7	E		
T	2848	6780	1.01	0.42	49.0	D	57.6	E

Intersection Delay = 61.8 (sec/veh) Intersection LOS = E

HCS2000: Signalized Intersections Release 4.1a

OPERATIONAL ANALYSIS

Analyst: mjb
 Agency/Co.: Parsons
 Date Performed: 2/4/2003
 Analysis Time Period: AM Peak
 Intersection: Sycamore View SPUI
 Area Type: All other areas
 Jurisdiction:
 Analysis Year: 2005
 Project ID: Alternate C
 East/West Street North/South Street
 I-40 Ramps Sycamore View

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	1547			347			428	1342		1190	2854	
% Heavy Veh	2			2			2	2		2	2	
PHF	0.97			0.94			0.94	0.96		0.96	0.99	
PK 15 Vol	399			92			114	349		310	721	
Hi Ln Vol												
% Grade	0			0			0			0		
Ideal Sat	1900			1900			1900	1900		1900	1900	
ParkExist												
NumPark												
No. Lanes	3	0	0	2	0	0	3	3	0	2	4	0
LGConfig	L			L			L	T		L	T	
Lane Width	12.0			12.0			12.0	12.0		12.0	12.0	
RTOR Vol												
Adj Flow	1595			369			455	1398		1240	2883	
%InSharedLn												
Prop LTs								0.000			0.000	
Prop RTs								0.000			0.000	
Peds Bikes	0			0			0			0		
Buses	0			0			0	0		0	0	
%InProtPhase												
Duration	0.25											

Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0			0.0			0.0	0.0		0.0	0.0	
Arriv. Type	3			3			3	3		3	3	
Unit Ext.	3.0			3.0			3.0	3.0		3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0			2.0			2.0	2.0		2.0	2.0	
Ext of g	2.0			2.0			2.0	2.0		2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left Thru Right Peds		P						
NB Left Thru Right Peds					P		P	
WB Left Thru Right Peds		P				P		P
SB Left Thru Right Peds					P	P	P	
NB Right								
EB Right								
SB Right								
WB Right								

Green	30.0				16.0	14.0	28.0
Yellow	3.5				3.5	0.0	3.5
All Red	0.5				0.5	0.0	0.5

Cycle Length: 100.0 se

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	1547			347			428	1342		1190	2854	
PHF	0.97			0.94			0.94	0.96		0.96	0.99	
Adj flow	1595			369			455	1398		1240	2883	
No. Lanes	3	0	0	2	0	0	3	3	0	2	4	0
Lane group	L			L			L	T		L	T	
Adj flow	1595			369			455	1398		1240	2883	
Prop LTs								0.000			0.000	
Prop RTs							0.000			0.000		

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

LG	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
So	1900			1900			1900	1900		1900	1900	
Lanes	3	0	0	2	0	0	3	3	0	2	4	0
fW	1.000			1.000			1.000	1.000		1.000	1.000	
fHV	0.980			0.980			0.980	0.980		0.980	0.980	
fG	1.000			1.000			1.000	1.000		1.000	1.000	
fP	1.000			1.000			1.000	1.000		1.000	1.000	
fBB	1.000			1.000			1.000	1.000		1.000	1.000	
fA	1.00			1.00			1.00	1.00		1.00	1.00	
fLU	0.91			0.97			0.91	0.91		0.97	0.91	
fRT								1.000			1.000	
fLT	0.950			0.950			0.950	1.000		0.950	1.000	
Sec.												
fLpb	1.000			1.000			1.000	1.000		1.000	1.000	
fRpb								1.000			1.000	
S	4831			3433			4831	5085		3433	6780	
Sec.												

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Left	L	1595	4831	0.33	0.30	1449	1.10
Thru							
Westbound							
Left	L	369	3433	0.11	0.30	1030	
Thru							
Northbound							
Left	L	455	4831	0.09	0.16	773	0.59
Thru	T	1398	5085	0.27	0.28	1424	0.98
Right							
Southbound							
Left	L	1240	3433	0.36	0.34	1167	1.06
Thru	T	2883	6780	0.43	0.42	2848	1.01
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.97

Total lost time per cycle, L = 8.00 sec

Critical flow rate to capacity ratio, Xc = Yc(C)/(C-L)

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Res Del d2	Res Del d3	Lane Group Delay LOS	Approach Delay LOS
Eastbound									
L	1.10 0.30	35.0	1.000	1449	0.50	56.3	0.0	91.3 F	F
Westbound									
L	0.36 0.30	27.5	1.000	1030	0.50	1.0	0.0	28.4 C	28.4 C
Northbound									
L	0.59 0.16	38.9	1.000	773	0.50	3.3	0.0	42.2 D	
T	0.98 0.28	35.7	1.000	1424	0.50	19.9	0.0	55.6 E	52.3 D
Southbound									
L	1.06 0.34	33.0	1.000	1167	0.50	44.7	0.0	77.7 E	
T	1.01 0.42	29.0	1.000	2848	0.50	20.0	0.0	49.0 D	57.6 E

Intersection delay = 61.8 (sec/veh) Intersection LOS = E

BACK OF QUEUE WORKSHEET

	Eastbound	Westbound	Northbound	Southbound
LaneGroup	L	L	L T	L T
Init Queue	0.0	0.0	0.0 0.0	0.0 0.0
Flow Rate	531	184	151 466	620 720

So	1900	1900	1900	1900	1900	1900
No.Lanes	3 0 0	2 0 0	3 3 0		2 4 0	
SL	1610	1716	1610	1695	1716	1695
LnCapacity	483	515	257	474	583	712
Flow Ratio	0.33	0.11	0.09	0.27	0.36	0.42
v/c Ratio	1.10	0.36	0.59	0.98	1.06	1.01
Grn Ratio	0.30	0.30	0.16	0.28	0.34	0.42
I Factor	1.000	1.000	1.000		1.000	
AT or PVG	3	3	3	3	3	3
Pltn Ratio	1.00	1.00	1.00	1.00	1.00	1.00
PF2	1.00	1.00	1.00	1.00	1.00	1.00
Q1	14.8	4.0	3.9	12.9	17.2	20.0
kB	0.7	0.8	0.5	0.7	0.8	1.0
Q2	10.6	0.4	0.6	6.0	10.7	9.9
Q Average	25.4	4.4	4.5	18.9	27.9	29.9
Q Spacing	24.9	24.9	24.9	24.9	24.9	24.9
Q Storage	500	500	400	900	400	900
Q S Ratio	1.3	0.2	0.3	0.5	1.7	0.8
70th Percentile Output:						
fb%	1.2	1.2	1.2	1.2	1.2	1.2
BOQ	30.5	5.5	5.6	22.7	33.5	35.8
QSRatio	1.5	0.3	0.4	0.6	2.1	1.0
85th Percentile Output:						
fb%	1.4	1.5	1.5	1.4	1.4	1.4
BOQ	35.6	6.8	6.9	26.6	39.2	41.8
QSRatio	1.8	0.3	0.4	0.7	2.4	1.2
90th Percentile Output:						
fb%	1.5	1.7	1.7	1.5	1.5	1.5
BOQ	38.1	7.6	7.7	28.6	42.0	44.8
QSRatio	1.9	0.4	0.5	0.8	2.6	1.2
95th Percentile Output:						
fb%	1.6	2.0	2.0	1.6	1.6	1.6
BOQ	40.7	8.9	9.1	30.7	44.8	47.8
QSRatio	2.0	0.4	0.6	0.8	2.8	1.3
98th Percentile Output:						
fb%	1.7	2.3	2.3	1.7	1.7	1.7
BOQ	43.4	10.3	10.5	32.8	47.7	50.9
QSRatio	2.2	0.5	0.7	0.9	3.0	1.4

ERROR MESSAGES

No errors to report

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix G

Intersection Capacity Worksheets for Macon Cove Ramp

HCS2000: Signalized Intersections Release 4.1a

Analyst: Alt A mjb 2005
 Agency: Sycamore View Road
 Date: 02/03/2003
 Period: AM Peak
 Project ID: New Ramp to Macon Cove
 E/W St: Macon Cove

Inter.: Macon Cove & STCC
 Area Type: All other areas
 Jurisd:
 Year : 2005
 N/S St: STCC Drive

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	0	1	0	1	0	0	1	0
LGConfig	L	TR		L		R		TR			LT	
Volume	20	767	186	403		20		10	106	120	10	
Lane Width	12.0	12.0		12.0		12.0		12.0			13.0	
RTOR Vol			21			0				0		

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left			
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds			
WB Left		A			SB Left	A		
Thru		A			Thru	A		
Right		A			Right			
Peds		X			Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	21.0	18.0			14.0			
Yellow	4.0	4.0			4.0			
All Red	0.0	0.0			0.0			

Cycle Length: 65.0 sec

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	599	1770	0.04	0.34	14.4	B		
TR	1166	3444	0.84	0.34	25.7	C	25.5	C
Westbound								
L	517	1770	0.83	0.29	32.4	C		C
R	463	1583	0.05	0.29	16.5	B		
Northbound								
TR	377	1634	0.33	0.23	21.3	C	21.3	C
Southbound								
LT	368	1595	0.09	0.23	19.7	B	19.7	B

Intersection Delay = 26.8 (sec/veh) Intersection LOS = C

HCS2000 Signalized Intersections Release 4.1a

OPERATIONAL ANALYSIS

Analyst: Alt A mjb 2005
 Agency/Co.: Sycamore View Road
 Date Performed: 02/03/2003
 Analysis Time Period: AM Peak
 Intersection: Macon Cove & STCC
 Area Type: All other areas
 Jurisdiction:
 Analysis Year: 2005
 Project ID: New Ramp to Macon Cove
 East/West Street North/South Street
 Macon Cove STCC Drive

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	20	767	186	403		20	10	106		20	10	
% Heavy Veh	2	2	2	2		2	2	2		2	2	
PHF	0.90	0.95	0.93	0.94		0.90	0.90	0.94		0.90	0.90	
PK 15 Vol	6	202	50	107		6	3	28		6	3	
Hi Ln Vol												
% Grade		0		0			0			0		
Ideal Sat	1900	1900		1900		1900	1900			1900		
ParkExist												
NumPark												
No. Lanes	1	2	0	1	0	1	0	1	0	0	1	0
LGConfig	L	TR		L		R	TR			LT		
Lane Width	12.0	12.0		12.0		12.0	12.0			13.0		
RTOR Vol			21			0		0				
Adj Flow	22	984		429		22	124			33		
%InSharedLn												
Prop LTs		0.000					0.000			0.667		
Prop RTs		0.180				1.000	0.911			0.000		
Peds Bikes	0	0		0	0		0			0		
Buses	0	0		0	0		0			0		
%InProtPhase												
Duration	0.25											

Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0		0.0	0.0			0.0		0.0
Arriv. Type	3	3		3		3	3			3		3
Unit Ext.	3.0	3.0		3.0		3.0	3.0			3.0		3.0
I Factor		1.000			1.000		1.000			1.000		1.000
Lost Time	2.0	2.0		2.0		2.0	2.0			2.0		2.0
Ext of g	3.0	3.0		3.0		3.0	3.0			3.0		3.0
Ped Min g												

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left			
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds			
WB Left		A			SB Left	A		
Thru		A			Thru	A		
Right		A			Right			
Peds		X			Peds	X		
NB Right					EB Right			
SB Right					WB Right			

Green	21.0	18.0			14.0			
Yellow	4.0	4.0			4.0			
All Red	0.0	0.0			0.0			

Cycle Length: 65.0 se

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	20	767	186	403		20	10	106		20	10	
PHF	0.90	0.95	0.93	0.94		0.90	0.90	0.94		0.90	0.90	
Adj flow	22	807	177	429		22	11	113		22	11	
No. Lanes	1	2	0	1	0	1	0	1	0	0	1	0
Lane group	L	TR		L	R		TR			LT		
Adj flow	22	984		429	22		124			33		
Prop LTs		0.000					0.000			0.667		
Prop RTs		0.180			1.000		0.911			0.000		

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

LG	Eastbound			Westbound			Northbound			Southbound		
	L	TR		L	R		TR			LT		
So	1900	1900		1900	1900		1900			1900		
Lanes	1	2	0	1	0	1	0	1	0	0	1	0
fW	1.000	1.000		1.000	1.000		1.000			1.033		
fHV	0.980	0.980		0.980	0.980		0.980			0.980		
fG	1.000	1.000		1.000	1.000		1.000			1.000		
fP	1.000	1.000		1.000	1.000		1.000			1.000		
fBB	1.000	1.000		1.000	1.000		1.000			1.000		
fA	1.00	1.00		1.00	1.00		1.00			1.00		
fLU	1.00	0.95		1.00	1.00		1.00			1.00		
fRT		0.973			0.850		0.877			1.000		
fLT	0.950	1.000		0.950			1.000			0.829		
Sec.												
fLpb	1.000	1.000		1.000			1.000			1.000		
fRpb		1.000			1.000		1.000			1.000		
S	1770	3444		1770	1583		1634			1595		
Sec.												

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left	L	22	1770	0.01	0.34	599	0.04
Prot							
Perm							
Thru	TR	984	3444	# 0.29	0.34	1166	0.84
Right							
Westbound							
Prot							
Perm							
Left	L	429	1770	# 0.24	0.29	517	0.83
Prot							
Perm							
Thru							
Right	R	22	1583	0.01	0.29	463	0.05
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	124	1634	# 0.08	0.23	377	0.33
Right							
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	LT	33	1595	0.02	0.23	368	0.09
Right							

Sum of flow ratios for critical lane groups, $Y_c = \text{Sum (v/s)} = 0.60$
 Total lost time per cycle, $L = 9.00 \text{ sec}$
 Critical flow rate to capacity ratio, $X_c = (Y_c)(C)/(C-L) = 0.70$

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios		Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group		Approach	
	v/c	g/C							Delay	LOS	Delay	LOS
Eastbound												
L	0.04	0.34	14.4	1.000	599	0.11	0.0	0.0	14.4	B		
TR	0.84	0.34	19.9	1.000	1166	0.38	5.8	0.0	25.7	C	25.5	C
Westbound												
L	0.83	0.29	21.5	1.000	517	0.37	10.9	0.0	32.4	C		C
R	0.05	0.29	16.5	1.000	463	0.11	0.0	0.0	16.5	B		
Northbound												
TR	0.33	0.23	20.8	1.000	377	0.11	0.5	0.0	21.3	C	21	
Southbound												
LT	0.09	0.23	19.6	1.000	368	0.11	0.1	0.0	19.7	B	19.7	B

Intersection delay = 26.8 (sec/veh) Intersection LOS = C
 Errors exist. See bottom of text report.

SUPPLEMENTAL PERMITTED LT WORKSHEET
 for shared lefts

Input	EB	WB	NB	SB
Cycle length, C				65.0 sec
Total actual green time for LT lane group, G (s)				14.
Effective permitted green time for LT lane group, g(s)				15.
Opposing effective green time, go (s)				15.
Number of lanes in LT lane group, N				
Number of lanes in opposing approach, No				1
Adjusted LT flow rate, VLT (veh/h)				22
Proportion of LT in LT lane group, PLT	0.000		0.000	0.6
Proportion of LT in opposing flow, PLTo				0.0
Adjusted opposing flow rate, Vo (veh/h)				124
Lost time for LT lane group, tL				3.0
Computation				
LT volume per cycle, LTC=VLT/3600				0.4
Opposing lane util. factor, fLUo		0.95	1.00	1.0
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)				2.2
gf=G[exp(- a * (LTC ** b))]-tL, gf<=g				5.7
Opposing platoon ratio, Rpo (refer Exhibit 16-11)				1.0
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]				0.7
gq, (see Exhibit C16-4,5,6,7,8)				3.9
gu=g-gq if gq>=gf, or = g-gf if gq<gf				9.3
n=Max(gq-gf)/2,0)				0.0
PTHo=1-PLTo				1.0
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]				0.6
EL1 (refer to Exhibit C16-3)				1.5
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g				0.2
gdifff=max(gq-gf, 0)				0.0
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)				0.8

$$flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1 + [gdiff/g]/[1+PL(EL2-1)]), (fmin \leq fm \leq 1.00)$$
 or $flt=[fm+0.91(N-1)]/N^{**}$
 Left-turn adjustment, fLT 0.8

For special case of single-lane approach opposed by multilane approach, see text.

* If $PL \geq 1$ for shared left-turn lanes with $N > 1$, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, $flt=fm$
 For special case of multilane approach opposed by single-lane approach or when $gf > gq$, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns

	EB	WB	NB	SB
Effective pedestrian green time, gp (s)				
Conflicting pedestrian volume, Vped (p/h)				
Pedestrian flow rate, Vpedg (p/h)				
OCCpedg				
Opposing queue clearing green, gq (s)				
Eff. ped. green consumed by opp. veh. queue, gq/gp				
OCCpedu				
Opposing flow rate, Vo (veh/h)				332
OCCr				
Number of cross-street receiving lanes, Nrec				
Number of turning lanes, Nturn				
ApbT				
Proportion of left turns, PLT				
Proportion of left turns using protected phase, PLTA				
Left-turn adjustment, fLpb				
Permitted Right Turns				
Effective pedestrian green time, gp (s)	22.0	19.0		
Conflicting pedestrian volume, Vped (p/h)	0	0		
Conflicting bicycle volume, Vbic (bicycles/h)	0	0		
Vpedg	0	0		
OCCpedg	0.000	0.000		
Effective green, g (s)	22.0	19.0		
Vbicg	0	0		
OCCbicg	0.020	0.020		
OCCr	0.000	0.000		
Number of cross-street receiving lanes, Nrec	1	1		
Number of turning lanes, Nturn	1	1		
ApbT	1.000	1.000		
Proportion right-turns, PRT	0.180	1.000		
Proportion right-turns using protected phase, PRTA	0.000	0.000		
Right turn adjustment, fRpb	1.000	1.000		

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound		Northbound			Southbound	
LaneGroup	L	TR		L	R		TR		LT	
Init Queue	0.0	0.0		0.0	0.0		0.0		0.0	
Flow Rate	22	492		429	22		124		33	
So	1900	1900		1900	1900		1900		190	
No.Lanes	1	2	0	1	0	1	0	1	0	0
SL	1770	1722		1770	1583		1634		159	
LnCapacity	599	583		517	463		377		368	
Flow Ratio	0.01	0.29		0.24	0.01		0.08		0.0	
v/c Ratio	0.04	0.84		0.83	0.05		0.33		0.0	
Grn Ratio	0.34	0.34		0.29	0.29		0.23		0.2	
I Factor		1.000			1.000		1.000		1.0	0
AT or PVG	3	3		3	3		3		3	
Pltn Ratio	1.00	1.00		1.00	1.00		1.00		1.0	
PF2	1.00	1.00		1.00	1.00		1.00		1.0	
Q1	0.3	8.2		7.2	0.3		1.9		0.5	
kB	0.4	0.4		0.4	0.4		0.3		0.3	
Q2	0.0	1.9		1.6	0.0		0.2		0.0	
Q Average	0.3	10.1		8.9	0.3		2.0		0.5	
Q Spacing										
Q Storage										
Q S Ratio										
70th Percentile Output:										
FB%	1.2	1.2		1.2	1.2		1.2		1.2	
BOQ	0.3	11.9		10.5	0.4		2.4		0.6	
QSRatio										
85th Percentile Output:										
FB%	1.6	1.5		1.5	1.6		1.6		1.6	
BOQ	0.5	15.3		13.5	0.5		3.2		0.8	
QSRatio										
90th Percentile Output:										
FB%	1.8	1.6		1.7	1.8		1.8		1.8	
BOQ	0.5	16.6		14.7	0.5		3.6		0.9	
QSRatio										
95th Percentile Output:										
FB%	2.1	1.8		1.9	2.1		2.0		2.1	
BOQ	0.6	18.7		16.5	0.6		4.1		1.0	
QSRatio										
98th Percentile Output:										
FB%	2.7	2.2		2.2	2.7		2.6		2.7	
BOQ	0.8	21.9		19.5	0.8		5.2		1.3	
QSRatio										

ERROR MESSAGES

West bound thru does not exist but has green time

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↓		↘			↗
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50		50			50
Trailing Detector (ft)	0		0			0
Turning Speed (mph)		10	15		15	10
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00
Frt	0.970					0.865
Flt Protected			0.950			
Satd. Flow (prot)	3433	0	1770	0	0	1611
Flt Permitted			0.950			
Satd. Flow (perm)	3433	0	1770	0	0	1611
Right Turn on Red		Yes				No
Satd. Flow (RTOR)	47					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)	35			35	40	
Link Distance (ft)	710			486	466	
Travel Time (s)	48.4			9.5	7.9	
Volume (vph)	767	186	403	0	0	106
Peak Hour Factor	0.95	0.93	0.94	0.90	0.90	0.93
Adj. Flow (vph)	807	200	429	0	0	114
Lane Group Flow (vph)	1007	0	429	0	0	114
Turn Type			custom			custom
Protected Phases	4		3			3
Permitted Phases			3			3
Detector Phases	4		3			3
Minimum Initial (s)	4.0		4.0			4.0
Minimum Split (s)	20.0		8.0			8.0
Total Split (s)	46.0	0.0	14.0	0.0	0.0	14.0
Total Split (%)	77%	0%	23%	0%	0%	23%
Maximum Green (s)	42.0		10.0			10.0
Yellow Time (s)	4.0		4.0			4.0
All-Red Time (s)	0.0		0.0			0.0
Lead/Lag	Lag		Lead			Lead
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0			3.0
Recall Mode	None		None			None
Walk Time (s)	5.0					
Flash Dont Walk (s)	11.0					
Pedestrian Calls (#/hr)	0					
Act Effct Green (s)	17.0		11.2			11.2
Actuated g/C Ratio	0.50		0.33			0.33
v/c Ratio	0.58		0.74			0.22
Uniform Delay, d1	5.8		10.2			8.3
Delay	5.6		21.3			10.7
LOS	A		C			B
Approach Delay	5.6			21.3	10.7	
Approach LOS	A			C	B	
90th %ile Green (s)	24.0		10.0			10.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
			Max			Max
			10.0			10.0
			Max			Max
			10.0			10.0
			Max			Max
			10.0			10.0
			Max			Max
			10.0			10.0
			Max			Max
			65			14
			#232			51
				406	386	

Area Type: Other
 Cycle Length: 60
 Actuated Cycle Length: 34.3
 Natural Cycle: 40
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.74
 Intersection Signal Delay: 10.3
 Intersection Capacity Utilization 59.1%
 90th %ile Actuated Cycle: 42
 70th %ile Actuated Cycle: 36.6
 50th %ile Actuated Cycle: 33.6
 30th %ile Actuated Cycle: 30.8
 10th %ile Actuated Cycle: 28.6
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Macon Cove & STCC Drive



HCS2000: Signalized Intersections Release 4.1a

Analyst: Alt A mjb 2005
 Agency: Sycamore View Road
 Date: 02/03/2003
 Period: PM Peak
 Project ID: New Ramp to Macon Cove
 E/W St: Macon Cove

Inter.: Macon Cove & STCC
 Area Type: All other areas
 Jurisd:
 Year : 2005
 N/S St: STCC Drive

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	0	1	0	1	0	0	1	0
LGConfig	L	TR		L		R		TR			LT	
Volume	20	828	150	497		20		10	302	20	10	
Lane Width	12.0	12.0		12.0		12.0		12.0			13.0	
RTOR Vol			21			0			0			

Duration	0.25	Area Type:	All other areas					
Signal Operations								
Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left			
Thru		A			Thru	A		
Right		A			Right	A		
Peds		X			Peds			
WB Left			A		SB Left	A		
Thru			A		Thru	A		
Right			A		Right			
Peds			X		Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green		20.0	19.0			14.0		
Yellow		4.0	4.0			4.0		
All Red		0.0	0.0			0.0		
Cycle Length: 65.0 sec								

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	572	1770	0.04	0.32	15.1	B		
TR	1120	3466	0.90	0.32	31.3	C	30.9	C
Westbound								
L	545	1770	0.97	0.31	53.3	D	51.8	D
R	487	1583	0.05	0.31	15.8	B		
Northbound								
TR	374	1620	0.89	0.23	46.1	D	46.1	D
Southbound								
LT	240	1040	0.14	0.23	20.1	C	20.1	C

Intersection Delay = 39.2 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1a

OPERATIONAL ANALYSIS

Analyst: Alt A mjb 2005
 Agency/Co.: Sycamore View Road
 Date Performed: 02/03/2003
 Analysis Time Period: PM Peak
 Intersection: Macon Cove & STCC
 Area Type: All other areas
 Jurisdiction:
 Analysis Year: 2005
 Project ID: New Ramp to Macon Cove
 East/West Street North/South Street
 Macon Cove STCC Drive

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	20	828	150	497	20		10	302		20	10	
% Heavy Veh	2	2	2	2	2		2	2		2	2	
PHF	0.90	0.95	0.93	0.94	0.90		0.90	0.94		0.90	0.90	
PK 15 Vol	6	218	40	132	6		3	80		6	3	
Hi Ln Vol												
% Grade		0			0						0	
Ideal Sat	1900	1900		1900	1900		1900				1900	
ParkExist												
NumPark												
No. Lanes		1	2	0		1	0	1	0		0	1
LGConfig	L		TR		L			R			TR	
Lane Width	12.0	12.0		12.0	12.0		12.0				13.0	
RTOR Vol			21		0			0				
Adj Flow	22	1011		529	22		332				33	
%InSharedLn												
Prop LTs			0.000					0.000				0.667
Prop RTs		0.137			1.000		0.967				0.000	
Peds Bikes	0	0	0	0	0		0				0	
Buses	0	0		0	0		0				0	
%InProtPhase												
Duration	0.25											
				Area Type: All other areas								

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0		0.0		0.0			0.0	
Arriv. Type	3	3		3		3		3			3	
Unit Ext.	3.0	3.0		3.0		3.0		3.0			3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0		2.0		2.0			2.0	
Ext of g	3.0	3.0		3.0		3.0		3.0			3.0	
Ped Min g												

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left			
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds			
WB Left		A			SB Left	A		
Thru		A			Thru	A		
Right		A			Right			
Peds		X			Peds	X		
NB Right					EB Right			
SB Right					WB Right			

Green	20.0	19.0			14.0			
Yellow	4.0	4.0			4.0			
All Red	0.0	0.0			0.0			

Cycle Length: 65.0 se

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	20	828	150	497		20	10	302		20	10	
PHF	0.90	0.95	0.93	0.94		0.90	0.90	0.94		0.90	0.90	
Adj flow	22	872	139	529		22	11	321		22	11	
No. Lanes	1	2	0	1	0	1	0	1	0	0	1	0
Lane group	L	TR		L		R		TR			LT	
Adj flow	22	1011		529		22		332			33	
Prop LTs		0.000						0.000			0.667	
Prop RTs		0.137				1.000		0.967			0.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

LG	Eastbound			Westbound			Northbound			Southbound		
	L	TR		L		R		TR			LT	
So	1900	1900		1900		1900		1900			1900	
Lanes	1	2	0	1	0	1	0	1	0	0	1	0
fw	1.000	1.000		1.000		1.000		1.000			1.033	
fHV	0.980	0.980		0.980		0.980		0.980			0.980	
fG	1.000	1.000		1.000		1.000		1.000			1.000	
fP	1.000	1.000		1.000		1.000		1.000			1.000	
fBB	1.000	1.000		1.000		1.000		1.000			1.000	
fA	1.00	1.00		1.00		1.00		1.00			1.00	
fLU	1.00	0.95		1.00		1.00		1.00			1.00	
fRT		0.979				0.850		0.869			1.000	
fLT	0.950	1.000		0.950				1.000			0.541	
Sec.												
fLpb	1.000	1.000		1.000				1.000			1.000	
fRpb		1.000				1.000		1.000			1.000	
S	1770	3466		1770		1583		1620			1040	
Sec.												

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Gro Capacity (c)	-- /c Ratio
Eastbound							
Prot							
Perm							
Left	L	22	1770	0.01	0.32	572	0.04
Prot							
Perm							
Thru	TR	1011	3466	0.29	0.32	1120	0.90
Right							
Westbound							
Prot							
Perm							
Left	L	529	1770	0.30	0.31	545	0.97
Prot							
Perm							
Thru							
Right	R	22	1563	0.01	0.31	487	0.05
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	332	1620	0.20	0.23	374	0.89
Right							
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	LT	33	1040	0.03	0.23	240	0.14
Right							

Sum of flow ratios for critical lane groups, $Y_c = \text{Sum (v/s)} = 0.80$
 Total lost time per cycle, $L = 9.00 \text{ sec}$
 Critical flow rate to capacity ratio, $X_c = (Y_c)(C)/(C-L) = 0.92$

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios		Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental			Lane Group		Approach	
	v/c	g/C				Factor	Del d2	Del d3	Delay	LOS	Delay	LOS
Eastbound												
L	0.04	0.32	15.1	1.000	572	0.11	0.0	0.0	15.1	B		
TR	0.90	0.32	21.0	1.000	1120	0.42	10.2	0.0	31.3	C	30.9	C
Westbound												
L	0.97	0.31	22.2	1.000	545	0.48	31.1	0.0	53.3	D	51.8	D
R	0.05	0.31	15.8	1.000	487	0.11	0.0	0.0	15.8	B		
Northbound												
TR	0.89	0.23	24.2	1.000	374	0.41	21.9	0.0	46.1	D	46.1	D
Southbound												
LT	0.14	0.23	19.9	1.000	240	0.11	0.3	0.0	20.1	C	20.1	C

Intersection delay = 39.2 (sec/veh) Intersection LOS = D
 Errors exist. See bottom of text report.

SUPPLEMENTAL PERMITTED LT WORKSHEET
 for shared lefts

Input	EB	WB	NB	SB
Cycle length, C				65.0 sec
Total actual green time for LT lane group, G (s)				14.
Effective permitted green time for LT lane group, g(s)				15.
Opposing effective green time, go (s)				15.
Number of lanes in LT lane group, N				1
Number of lanes in opposing approach, No				1
Adjusted LT flow rate, VLT (veh/h)				22
Proportion of LT in LT lane group, PLT	0.000		0.000	0.6
Proportion of LT in opposing flow, PLTo				0.0
Adjusted opposing flow rate, Vo (veh/h)				332
Lost time for LT lane group, tL				3.0
Computation				
LT volume per cycle, LTC=VLTC/3600				0.4
Opposing lane util. factor, fLUo		0.95	1.00	1.0
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)				5.9
gf=G[exp(- a * (LTC ** b))]-tL, gf<=g				5.7
Opposing platoon ratio, Rpo (refer Exhibit 16-11)				1.0
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]				0.7
gq, (see Exhibit C16-4,5,6,7,8)				11.
gu=g-gq if gq>=gf, or = g-gf if gq<gf				4.0
n=Max(gq-gf)/2,0)				2.6
PTHo=1-PLTo				1.0
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]				0.6
EL1 (refer to Exhibit C16-3)				1.0
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+PL)/g				0.2
gdiff=max(gq-gf,0)				0.0
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)				0.5
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)], (fmin<=fm<=1.00)				

EB WB NB SB

or $flt = [fm + 0.91(N-1)]/N^{**}$
 Left-turn adjustment, *FLT* 0.5
 For special case of single-lane approach opposed by multilane approach,
 see text.
 * If $Pl \geq 1$ for shared left-turn lanes with $N > 1$, then assume de-facto
 left-turn lane and redo calculations.
 ** For permitted left-turns with multiple exclusive left-turn lanes, $flt = fm$.
 For special case of multilane approach opposed by single-lane approach
 or when $gf > gq$, see text.

BACK OF QUEUE WORKSHEET

LaneGroup	Eastbound			Westbound		Northbound		Southbound	
	L	TR		L	R	TR		LT	
Init Queue	0.0	0.0		0.0	0.0	0.0		0.0	
Flow Rate	22	505		529	22	332		33	
So	1900	1900		1900	1900	1900		1900	
No.Lanes	1	2	0	1	0	1	0	1	0
SL	1770	1733		1770	1583	1620		1040	
LnCapacity	572	560		545	487	374		240	
Flow Ratio	0.01	0.29		0.30	0.01	0.20		0.03	
v/c Ratio	0.04	0.90		0.97	0.05	0.89		0.14	
Grn Ratio	0.32	0.32		0.31	0.31	0.23		0.23	
I Factor		1.000			1.000	1.000		1.000	
AT or PVG	3	3		3	3	3		3	
Pltn Ratio	1.00	1.00		1.00	1.00	1.00		1.00	
PF2	1.00	1.00		1.00	1.00	1.00		1.00	
Q1	0.3	8.7		9.4	0.3	5.8		0.5	
kB	0.4	0.4		0.4	0.4	0.3		0.2	
Q2	0.0	2.7		4.2	0.0	1.8		0.0	
Q Average	0.3	11.4		13.6	0.3	7.6		0.5	
Q Spacing									
Q Storage									
70th Percentile Output:									
FB%	1.2	1.2		1.2	1.2	1.2		1.2	
BOQ	0.3	13.4		16.0	0.4	9.0		0.6	
QSRatio									
85th Percentile Output:									
FB%	1.6	1.5		1.5	1.6	1.5		1.6	
BOQ	0.5	17.1		20.3	0.5	11.7		0.8	
QSRatio									
90th Percentile Output:									
FB%	1.8	1.6		1.6	1.8	1.7		1.8	
BOQ	0.5	18.5		21.8	0.5	12.8		0.9	
QSRatio									
95th Percentile Output:									
FB%	2.1	1.8		1.8	2.1	1.9		2.1	
BOQ	0.6	20.7		24.3	0.6	14.5		1.1	
QSRatio									
98th Percentile Output:									
FB%	2.7	2.1		2.1	2.7	2.3		2.7	
BOQ	0.8	24.1		27.9	0.8	17.2		1.4	
QSRatio									

ERROR MESSAGES

West bound thru does not exist but has green time

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix H

Estimates of Cost

COST DATA SHEET

Project: Phase 1 I-40/Sycamore View Interchange Modifications

Length: mi **Cross Section:** N/A

Right-of-Way

Land, Improvements, and Damages	2.8 Acres)	\$ 1,104,000
Incidentals (10 Tracts)		<u>\$ 27,500</u>
Relocation Payments(0 Residences)	<u>-</u>
	0 Businesses)	<u>-</u>
	0 Non-Profits)	<u>-</u>

Total Right-of-Way Cost \$ 1,131,500

Utility Relocation

Reimbursable		\$ 54,000
Non-Reimbursable		<u>\$ 47,000</u>

Total Utility Cost \$ 101,000

Construction

Clearing & Grubbing		\$ 6,000
Earthwork		<u>\$ 253,000</u>
Pavement Removal		<u>\$ 31,000</u>
Drainage (\$ 1,894,000		<u>\$ 2,008,000</u>
Structures		<u>-</u>
Railroad Crossing		<u>\$ -</u>
Paving		<u>\$ 649,000</u>
Retaining Walls		<u>\$ -</u>
Maintenance of Traffic		<u>\$ 100,000</u>
Topsoil		<u>\$ 8,000</u>
Seeding		<u>\$ 2,200</u>
Sodding		<u>-</u>
Signing		<u>\$ 153,000</u>
Signalization		<u>\$ 110,000</u>
Fence		<u>\$ 42,000</u>
Guardrail		<u>\$ 47,000</u>
Rip Rap or Slope Protection		<u>\$ -</u>
Other Construction Items (8.5%)		<u>\$ 292,000</u>
Mobilization		<u>-</u>

Construction Cost \$ 3,902,200

10% Eng. & Contingencies \$ 390,000

Total Constuction Cost \$ 4,292,200

Preliminary Engineering (10%) \$ 390,000

TOTAL PHASE 1 COST \$ 5,915,000

**COST ESTIMATE
I-40 / SYCAMORE VIEW ROAD IMS
PHASE 1**

	Quantity		Unit Price	Cost
Clearing and Grubbing	6	ac	\$1,000	\$6,000
Pavement Removal	6,200	In-ft	\$5	\$31,000
Signalization				
Macon Cove/end Ramp	1	ea	\$40,000	\$40,000
Sycamore View/Macon Cove	1	ea	\$70,000	\$70,000
Total				\$110,000
Signing	1	mi	\$2,500	\$2,500
Approach I-40	1	ea	\$100,000	\$100,000
Approach Macon Cove	1	ea	\$50,000	\$50,000
Total				\$152,500
Fencing	4200	lf	\$10	\$42,000
Paving				
C-D Road (2 lanes)	2500	lf	\$61	\$152,500
One lane ramp	1520	lf	\$83	\$126,160
Two lane ramp	460	lf	\$111	\$51,060
City street (4 lanes)	1300	lf	\$162	\$210,600
Ramp @ Macon Cove/STCC	500	lf	\$107	\$53,500
Barrier Rail	1850	lf	\$30	\$55,500
Total				\$649,320
Seeding	130	unit	\$17	\$2,200
Sod	7000	sy	\$4	\$28,000
Topsoil	2000	cy	\$4	\$8,000
Guardrail	3000	lf	\$15	\$45,000
Guardrail End	2	ea	\$1,000	\$2,000
Total				\$47,000
Earthwork (Borrow)	41000	cy	\$6	\$246,000
Earthwork (Cut)	2200	cy	\$3	\$6,600
Total				\$252,600
Maintenance of Traffic	1	ls	\$100,000	\$100,000
Drainage				
Inlets	22	ea	\$2,500	\$55,000
18-inch R.C.P.	1,200	lf	\$35	\$42,000
24-inch R.C.P.	1,300	lf	\$45	\$58,500
30-inch R.C.P.	400	lf	\$55	\$22,000
36-inch R.C.P.	400	lf	\$70	\$28,000
42-inch R.C.P.	200	lf	\$80	\$16,000
15-foot x 10-foot R.C.B.C.	2,500	lf	\$600	\$1,500,000
Subtotal				\$1,721,500
Plus 10 Percent				\$172,000
Total				\$1,893,500

**COST ESTIMATE
I-40 / SYCAMORE VIEW ROAD IMS
PHASE 1**

	Quantity		Unit Price	Cost
Right-of-Way Costs				
Land Cost				
Tract 1	1.3	ac	\$200,000	\$260,000
Tract 2	0.8	ac	\$200,000	\$160,000
Tracts 3-5	0.12	ac	\$300,000	\$36,000
Tracts 6-8	0.14	ac	\$300,000	\$42,000
Tract 9	0.21	ac	\$400,000	\$84,000
Tract 10	0.2	ac	\$200,000	\$40,000
	Subtotal			\$622,000
Damages				
Tract 2	1	ls	\$25,000	\$25,000
Tracts 4 and 5	1	ls	\$5,000	\$5,000
Tract 6	1	ls	\$5,000	\$5,000
Tract 7	1	ls	\$35,000	\$35,000
Tract 8	1	ls	\$10,000	\$10,000
Tract 9	1	ls	\$50,000	\$50,000
Tract 10	1	ls	\$20,000	\$20,000
	Subtotal			\$150,000
Subtotal Land and Damages Costs				\$772,000
Plus 43 Percent				\$332,000
Total Land and Damages Costs				\$1,104,000
Incidentals 10 Tracts @ \$2,750 Per Tract				\$27,500
Utility Relocations				
Reimbursable				
O/H Electric Poles	10	ea	\$2,800	\$28,000
12-inch Water Line	800	lf	\$25	\$20,000
Adjust Meters/Valves	20	ea	\$300	\$6,000
	Total Reimbursable			\$54,000
Non-Reimbursable				
O/H Electric Poles	13	ea	\$2,800	\$36,400
U/G Telephone	1,200	lf	\$8	\$9,600
Relocate Fire Hydrants	2	ea	\$600	\$1,200
	Total Non-Reimbursable			\$47,200

COST DATA SHEET

Project: Phase 2 Alternate A I-40/Sycamore View Interchange Modifications

Length: mi Cross Section: N/A

Right-of-Way

Land, Improvements, and Damages	2.8 Acres)	\$ 2,740,000
Incidentals (2 Tracts)		<u>\$ 5,440</u>
Relocation Payments(0 Residences)	<u>\$ 200,000</u>
	10 Businesses)	
	0 Non-Profits)	

Total Right-of-Way Cost \$ 2,945,440

Utility Relocation

Reimbursable	\$ 6,000
Non-Reimbursable	<u>\$ 28,000</u>

Total Utility Cost \$ 34,000

Construction

Clearing & Grubbing	\$ 10,600
Earthwork	<u>\$ 769,000</u>
Pavement Removal	<u>\$ 26,500</u>
Drainage (\$ 433,000)	<u>\$ 559,000</u>
Structures	<u>-----</u>
Railroad Crossing	<u>-----</u>
Paving	<u>\$ 1,408,000</u>
Retaining Walls	<u>\$ 342,000</u>
Maintenance of Traffic	<u>\$ 200,000</u>
Topsoil	<u>\$ 28,000</u>
Seeding	<u>\$ 10,200</u>
Sodding	<u>\$ 32,800</u>
Signing	<u>\$ 105,000</u>
Signalization	<u>\$ 120,000</u>
Fence	<u>\$ 20,500</u>
Guardrail	<u>\$ 84,000</u>
Rip Rap or Slope Protection	<u>\$ -</u>
Other Construction Items (8.5%)	<u>\$ 684,000</u>
Mobilization	<u>\$ 379,000</u>
Construction Cost	<u>\$ 9,104,600</u>
10% Eng. & Contingencies	<u>\$ 910,000</u>

Total Constuction Cost \$ 10,014,600

Preliminary Engineering (10%) \$ 910,000

TOTAL PHASE 1 COST \$ 13,904,000

**COST ESTIMATE
I-40 / SYCAMORE VIEW ROAD IMS
PHASE 2 ALTERNATE A**

	Quantity		Unit Price	Cost
Clearing and Grubbing	10.6	ac	\$1,000	\$10,600
Pavement Removal	5,300	ln-ft	\$5	\$26,500
Signalization				
EB Off-Ramp/S.V. Rd.	1	ea	\$60,000	\$60,000
Replace South Terminal Signal	1	ea	\$60,000	\$60,000
Total				\$120,000
Signing	2	mi	\$2,500	\$5,000
Replace East Approach on I-40	1	ea	\$100,000	\$100,000
				\$105,000
Fencing	2050	lf	\$10	\$20,500
Paving				
C-D Road (2 lanes)	400	lf	\$61	\$24,400
One lane ramp	4950	lf	\$83	\$410,850
Two lane ramp	7200	lf	\$111	\$799,200
Widen S.V. Rd. 2 Lanes	1600	lf	\$90	\$144,000
Barrier Rail	1000	lf	\$30	\$30,000
				\$1,408,450
Seeding	600	unit	\$17	\$10,200
Sod	8,200	sy	\$4	\$32,800
Topsoil	7000	cy	\$4	\$28,000
Guardrail	4400	lf	\$15	\$66,000
Guardrail End	18	ea	\$1,000	\$18,000
Total				\$84,000
Earthwork (Borrow)	116000	cy	\$6	\$696,000
Earthwork (Cut)	24400	cy	\$3	\$73,200
Total				\$769,200
Maintenance of Traffic	1	ls	\$200,000	\$200,000
Drainage				
Inlets	12	ea	\$2,500	\$30,000
18-inch R.C.P.	200	lf	\$35	\$7,000
24-inch R.C.P.	1,100	lf	\$45	\$49,500
24-inch Endwalls	12	ea	\$600	\$7,200
15-foot x 10-foot R.C.B.C.	500	lf	\$600	\$300,000
Subtotal				\$393,700
Plus 10 Percent				\$39,000
Total				\$432,700
Structures				
I-40 Over S.V. Rd.	47,400	sf	\$70	\$3,318,000
EB Off Ramp	14,400	sf	\$70	\$1,008,000
				\$4,326,000
Retaining Walls	11,400	sf	\$30	\$342,000

**COST ESTIMATE
I-40 / SYCAMORE VIEW ROAD IMS
PAHSE 2 Alternate A**

	Quantity		Unit Price	Cost
Right-of-Way Costs				
Land Cost				
Tract 1	0.14	ac	\$400,000	\$56,000
Tract 2	2.7	ac	\$200,000	\$540,000
	Subtotal			\$596,000
Damages				
Tract 1	1	ls	\$20,000	\$20,000
Tract 2	1	ls	\$0	\$0
	Subtotal			\$20,000
Buildings				
Tract 2	1	ls	\$1,300,000	\$1,300,000
Subtotal Land, Buildings and Damages Costs				\$1,916,000
Pluse 43 Percent				\$824,000
Total Land and Damages Costs				\$2,740,000
Incidentals	2 Tracts @ \$2,750 Per Tract			\$5,440
Business Relocations 10 @ \$20,000=				\$200,000
Utility Relocations				
Reimbursable				
Adjust Meters and Valves	20	ea	\$300	\$6,000
	Total Reimbursable			\$6,000
Non-Reimbursable				
O/H Electric Poles	10	ea	\$2,800	\$28,000
	Total Non-Reimbursable			\$28,000

COST DATA SHEET

Project: Phase 2 Alternate C I-40/Sycamore View Interchange Modifications

Length: mi Cross Section: N/A

Right-of-Way

Land, Improvements, and Damages	0.44 Acres)	\$ 230,000
Incidentals (4 Tracts)		
Relocation Payments(0 Residences)	
	0 Businesses)	
	0 Non-Profits)	

Total Right-of-Way Cost \$ 241,000

Utility Relocation

Reimbursable		\$ 6,000
Non-Reimbursable		<u>\$ 28,000</u>

Total Utility Cost \$ 34,000

Construction

Clearing & Grubbing		\$ 6,000
Earthwork		<u>\$ 1,800,000</u>
Pavement Removal		<u>\$ 30,500</u>
Drainage (\$ 498,000)		<u>\$ 663,000</u>
Structures		<u>\$ 3,577,000</u>
Railroad Crossing		<u>\$ -</u>
Paving		<u>\$ 1,555,000</u>
Retaining Walls		<u>\$ 339,000</u>
Maintenance of Traffic		<u>\$ 100,000</u>
Topsoil		<u>\$ 32,000</u>
Seeding		<u>-</u>
Sodding		<u>\$ 37,600</u>
Signing		<u>\$ 105,000</u>
Signalization		<u>\$ 80,000</u>
Fence		<u>\$ 18,000</u>
Guardrail		<u>\$ 95,000</u>
Rip Rap or Slope Protection		<u>\$ -</u>
Other Construction Items (8.5%)		<u>\$ 718,000</u>
Mobilization		<u>-</u>

Construction Cost
10% Eng. & Contingencies

Total Constuction Cost \$ 10,520,200

Preliminary Engineering (10%) \$ 956,000

TOTAL PHASE 1 COST \$ 11,751,000

**COST ESTIMATE
I-40 / SYCAMORE VIEW ROAD IMS
PHASE 2 ALTERNATE C**

	Quantity		Unit Price	Cost
Clearing and Grubbing	6	ac	\$1,000	\$6,000
Pavement Removal	6,100	ln-ft	\$5	\$30,500
Signalization SPUI Signals	1	ls	\$80,000	\$80,000
				\$80,000
Signing	2	mi	\$2,500	\$5,000
Replace East Approach on I-40	1	ea	\$100,000	\$100,000
				\$105,000
Fencing	1800	lf	\$10	\$18,000
Paving				
C-D Road (2 lanes)	400	lf	\$61	\$24,400
One-Lane Ramp	2250	lf	\$83	\$186,750
Two-Lane Ramp	6900	lf	\$111	\$765,900
Widen S.V. Rd. 2 Lanes	1500	lf	\$90	\$135,000
Widen S.V. Rd. 4 Lanes	450	lf	\$150	\$67,500
Three-Lane Ramp	2500	lf	\$150	\$375,000
Total				\$1,554,550
Seeding	650	unit	\$17	\$11,100
Sod	9,400	sy	\$4	\$37,600
Topsoil	8000	cy	\$4	\$32,000
Guardrail	5000	lf	\$15	\$75,000
Guardrail End	20	ea	\$1,000	\$20,000
Total				\$95,000
Earthwork (Borrow)	239,000	cy	\$6	\$1,434,000
Earthwork (Cut)	122,000	cy	\$3	\$366,000
Total				\$1,800,000
Maintenance of Traffic	1	ls	\$100,000	\$100,000
Drainage				
Inlets	18	ea	\$2,500	\$45,000
18-inch R.C.P.	500	lf	\$35	\$17,500
24-inch R.C.P.	1,800	lf	\$45	\$81,000
24-inch Endwalls	16	ea	\$600	\$9,600
15-foot x 10-foot R.C.B.C.	500	lf	\$600	\$300,000
Subtotal				\$453,100
Plus 10 Percent				\$45,000
Total				\$498,100
Structures				
I-40 Over S.V. Rd.	51,100	sf	\$70	\$3,577,000
				\$3,577,000
Retaining Walls	11,300	sf	\$30	\$339,000

**COST ESTIMATE
I-40 / SYCAMORE VIEW ROAD IMS
PHASE 2 ALTERNATE C**

	Quantity		Unit Price	Cost
Right-of-Way Costs				
Land Cost				
Tract 1	0.1	ac	\$200,000	\$20,000
Tract 2	0.09	ac	\$200,000	\$18,000
Tract 3	0.11	ac	\$200,000	\$22,000
Tract 4	0.14	ac	\$400,000	\$56,000
	Subtotal			\$116,000
Damages				
Tract 1	1	ls	\$5,000	\$5,000
Tract 2	1	ls	\$10,000	\$10,000
Tract 3	1	ls	\$10,000	\$10,000
Tract 4	1	ls	\$20,000	\$20,000
	Subtotal			\$45,000
Buildings				
				\$0
Subtotal Land, Buildings and Damages Costs				\$161,000
Plus 43 Percent				\$69,000
Total Land and Damages Costs				\$230,000
Incidentals	4 Tracts @ \$2,750 Per Tract			\$11,000
Business Relocations - None				
Utility Relocations				
Reimbursable				
Adjust Meters and Valves	20	ea	\$300	\$6,000
	Total Reimbursable			\$6,000
Non-Reimbursable				
O/H Electric Poles	10	ea	\$2,800	\$28,000
	Total Non-Reimbursable			\$28,000

**I-40 at Sycamore View Road
Interchange Modification Study**

Appendix I

Functional Plans

TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

Index Of Sheets

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2-4	TYPICAL SECTIONS
5-7	PROPOSED LAYOUT SHEETS (ALTERNATE A)
8-10	PROPOSED LAYOUT SHEETS (ALTERNATE C)
11	MACON COVE DETAIL SHEET

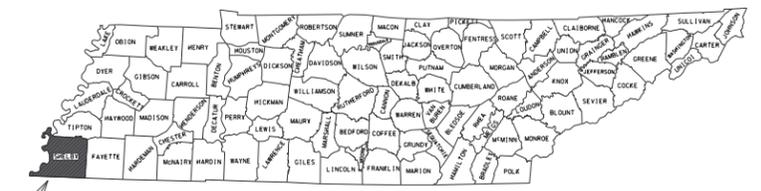
STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION BUREAU OF PLANNING AND DEVELOPMENT

TENN.	YEAR	SHEET NO.
	2004	1
FED. AID PROJ. NO.		
STATE PROJ. NO.		

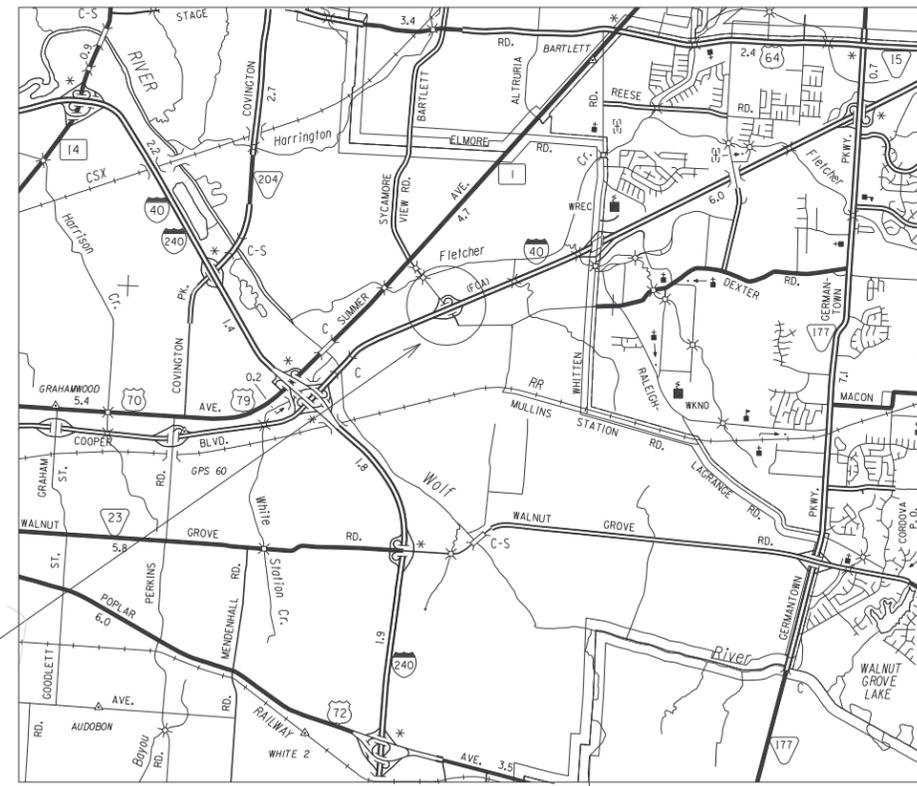
SHELBY COUNTY

INTERSTATE 40 AT SYCAMORE VIEW ROAD

STATE HIGHWAY NO. 40 F.A.H.S. NO. 40



PROJECT LOCATION



PROJECT LOCATION



SPECIAL NOTES

PROPOSALS MAY BE REJECTED BY THE COMMISSIONER IF ANY OF THE UNIT PRICES CONTAINED THEREIN ARE OBVIOUSLY UNBALANCED, EITHER EXCESSIVE OR BELOW THE REASONABLE COST ANALYSIS VALUE.

THIS PROJECT TO BE CONSTRUCTED UNDER THE STANDARD SPECIFICATIONS OF THE TENNESSEE DEPARTMENT OF TRANSPORTATION DATED MARCH 1, 1995 AND ADDITIONAL SPECIFICATIONS AND SPECIAL PROVISIONS CONTAINED IN THE PLANS AND IN THE PROPOSAL CONTRACT

DESIGNED BY PARSONS TRANSPORTATION GROUP INC.

DESIGNER EDWARD CAIN, P.E. CHECKED BY _____

P.E. NO. _____

SCALE: 1" = 1 MILE

APPROVED: _____
DIRECTOR, DESIGN DIVISION

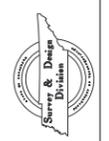
DATE: _____

APPROVED: _____
COMMISSIONER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

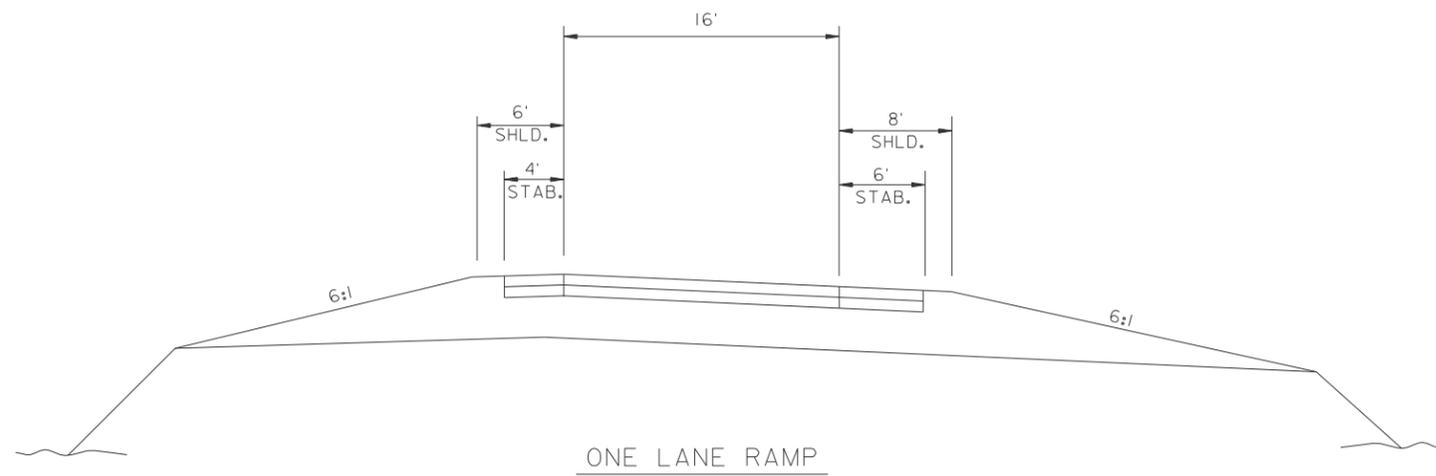
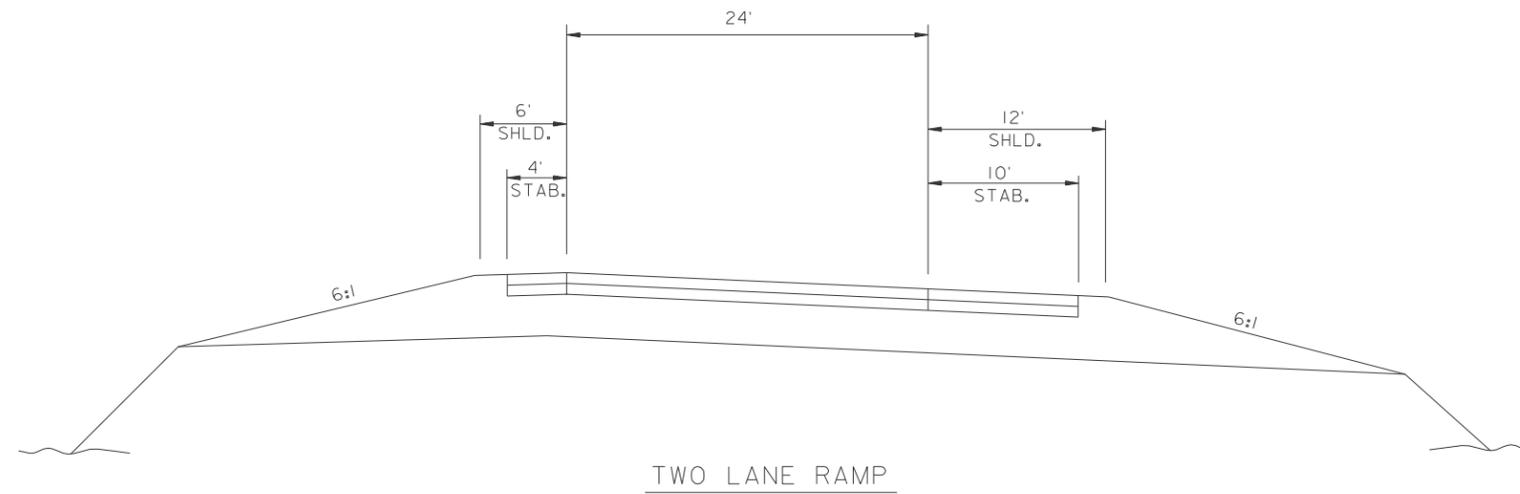
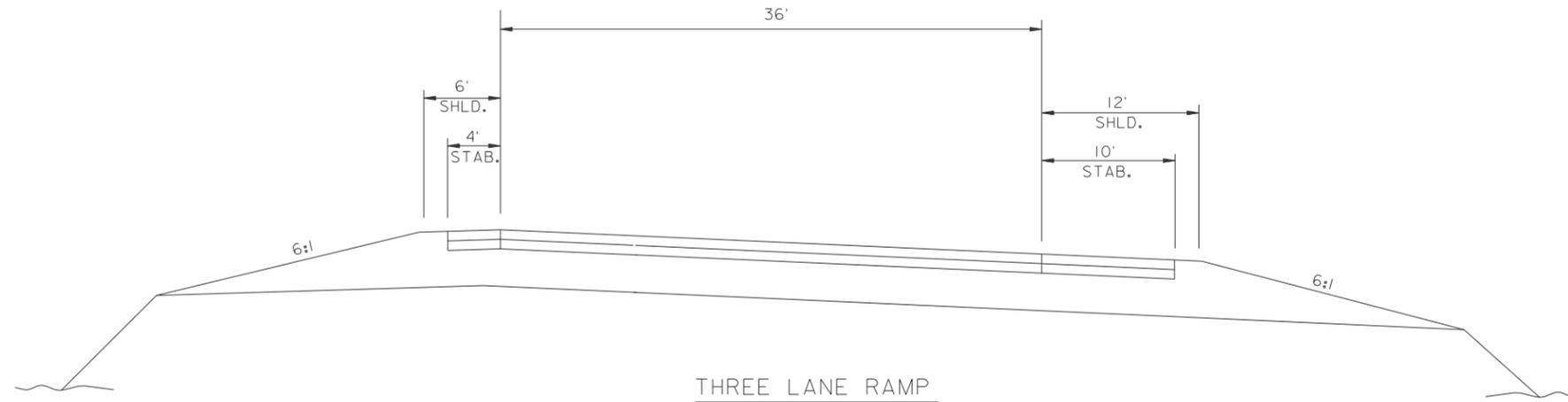
APPROVED: _____
DIVISION ADMINISTRATOR

DATE: _____



TENN.	YEAR	SHEET NO.
	2004	2
FED. AID PROJ. NO.		
STATE PROJ. NO.		

TENNESSEE D.O.T.
 DESIGN DIVISION
 FILE NO.



STATE OF TENNESSEE
 DEPARTMENT OF TRANSPORTATION
 BUREAU OF PLANNING & DEVELOPMENT

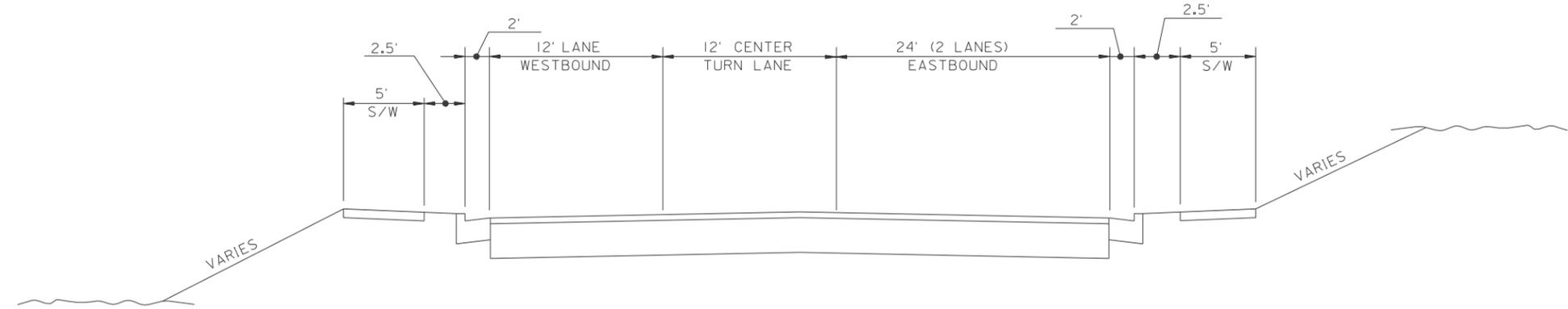
INTERSTATE 40 &
 SYCAMORE VIEW RD.

INTERCHANGE
 MODIFICATION STUDY
 TYPICAL SECTIONS

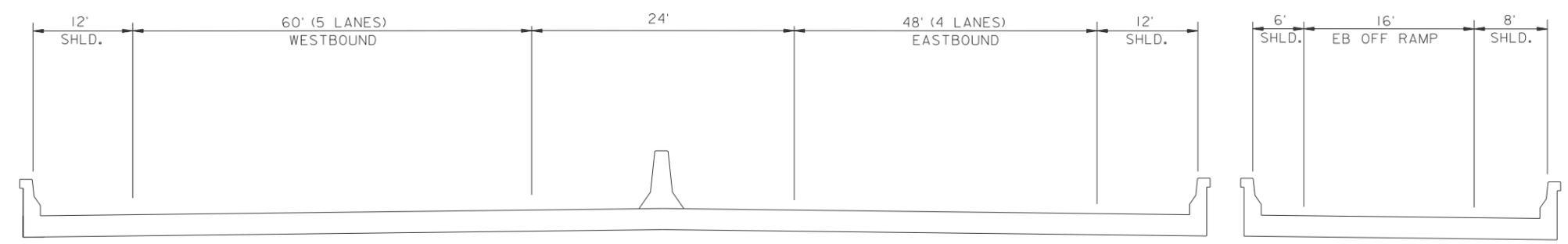
SCALE: N.T.S.

TENN.	YEAR	SHEET NO.
	2004	3
FED. AID PROJ. NO.		
STATE PROJ. NO.		

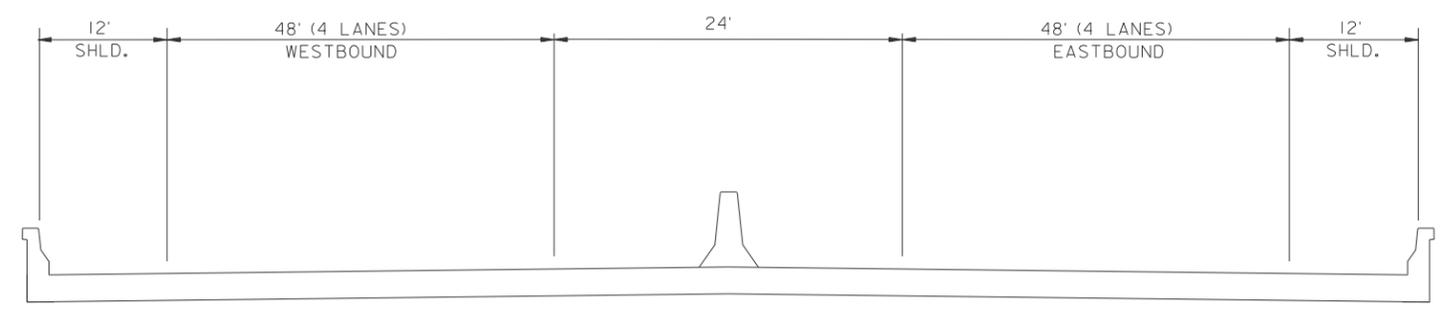
TENNESSEE D.O.T.
 DESIGN DIVISION
 FILE NO.



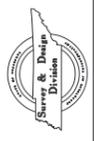
PROPOSED MACON COVE
(WEST OF MCREE STREET)



I-40 PROPOSED OVER SYCAMORE VIEW RD.
FOR ALTERNATE A



I-40 PROPOSED OVER SYCAMORE VIEW RD.
FOR ALTERNATE C



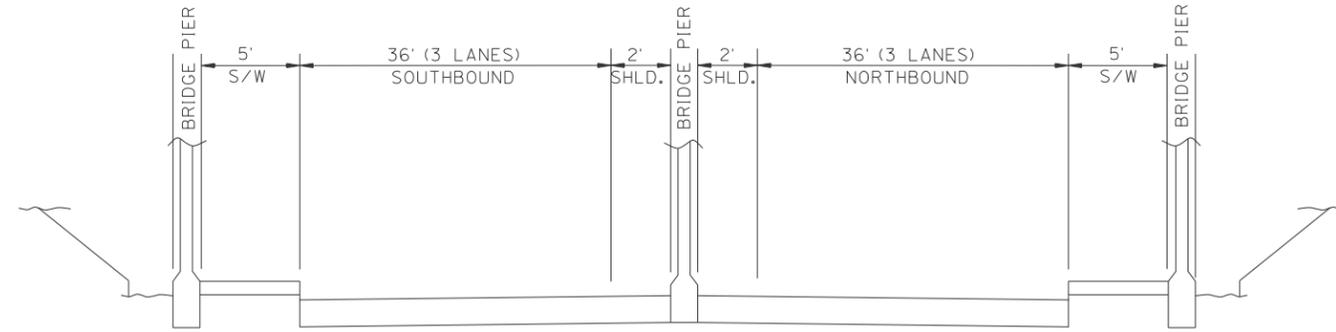
STATE OF TENNESSEE
 DEPARTMENT OF TRANSPORTATION
 BUREAU OF PLANNING & DEVELOPMENT

 INTERSTATE 40 &
 SYCAMORE VIEW RD.

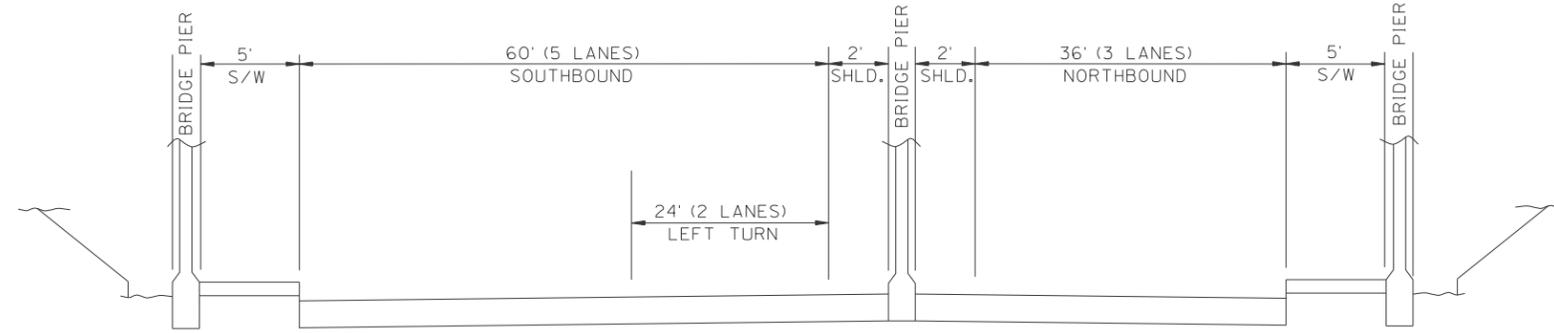
 INTERCHANGE
 MODIFICATION STUDY
 TYPICAL SECTIONS
 SCALE: N.T.S.

TENN.	YEAR	SHEET NO.
	2004	4
FED. AID PROJ. NO.		
STATE PROJ. NO.		

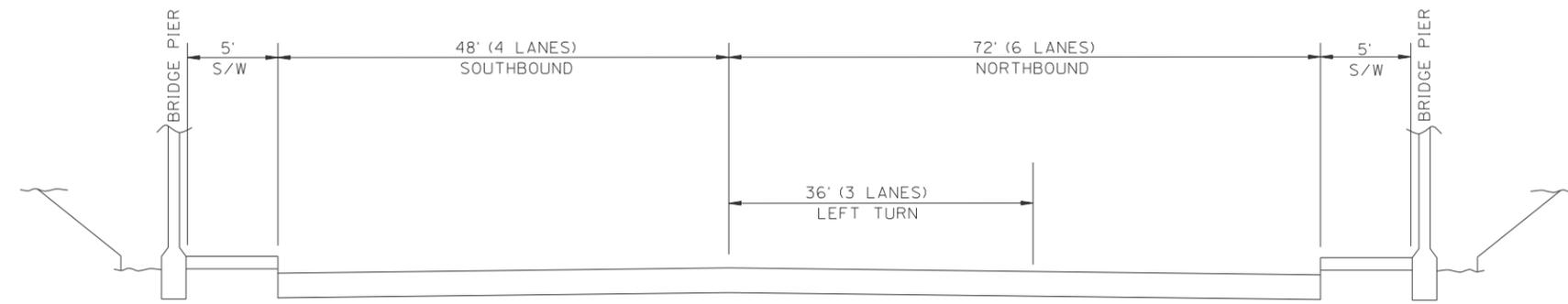
TENNESSEE D.O.T.
 DESIGN DIVISION
 FILE NO.



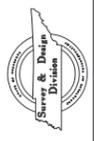
SYCAMORE VIEW RD. UNDER I-40 BRIDGE
(EXISTING)



SYCAMORE VIEW RD. UNDER I-40 BRIDGE
(PROPOSED FOR ALTERNATE A)



SYCAMORE VIEW RD. UNDER I-40 BRIDGE
(PROPOSED FOR ALTERNATE C)



STATE OF TENNESSEE
 DEPARTMENT OF TRANSPORTATION
 BUREAU OF PLANNING & DEVELOPMENT

 INTERSTATE 40 &
 SYCAMORE VIEW RD.

 INTERCHANGE
 MODIFICATION STUDY
 TYPICAL SECTIONS

 SCALE: N.T.S.

TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

TENN.	YEAR 2004	SHEET NO. 5
FED. AID PROJ. NO.		
STATE PROJ. NO.		



STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
BUREAU OF PLANNING & DEVELOPMENT

INTERSTATE 40 & SYCAMORE VIEW RD.

INTERCHANGE
MODIFICATION STUDY

ALTERNATE A

TENN.	YEAR 2004	SHEET NO. 6
FED. AID PROJ. NO.		
STATE PROJ. NO.		



MATCHLINE SHEET 5

MATCHLINE SHEET 7

FOR DETAILS ON MACON COVE,
SEE SHEET 11.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
BUREAU OF PLANNING & DEVELOPMENT

INTERSTATE 40 & SYCAMORE VIEW RD.
INTERCHANGE
MODIFICATION STUDY
ALTERNATE A



TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

TENN.	YEAR 2004	SHEET NO. 7
FED. AID PROJ. NO.		
STATE PROJ. NO.		



STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
BUREAU OF PLANNING & DEVELOPMENT

INTERSTATE 40 &
SYCAMORE VIEW RD.

INTERCHANGE
MODIFICATION STUDY

ALTERNATE A



TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

TENN.	YEAR 2004	SHEET NO. 8
FED. AID PROJ. NO.		
STATE PROJ. NO.		



VERTICAL CURVE SHEET 9



STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
BUREAU OF PLANNING & DEVELOPMENT

INTERSTATE 40 & SYCAMORE VIEW RD.
INTERCHANGE
MODIFICATION STUDY
ALTERNATE C



TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

TENN.	YEAR 2004	SHEET NO. 9
FED. AID PROJ. NO.		
STATE PROJ. NO.		

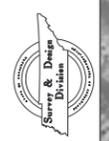


FOR DETAILS ON MACON COVE,
SEE SHEET 11.



STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
BUREAU OF PLANNING & DEVELOPMENT

INTERSTATE 40 & SYCAMORE VIEW RD.
INTERCHANGE
MODIFICATION STUDY
ALTERNATE C



TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

TENN.	YEAR 2004	SHEET NO. 10
FED. AID PROJ. NO.		
STATE PROJ. NO.		

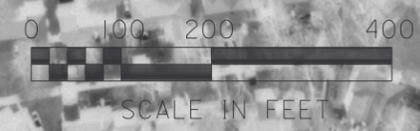


STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
BUREAU OF PLANNING & DEVELOPMENT

INTERSTATE 40 & SYCAMORE VIEW RD.

INTERCHANGE
MODIFICATION STUDY

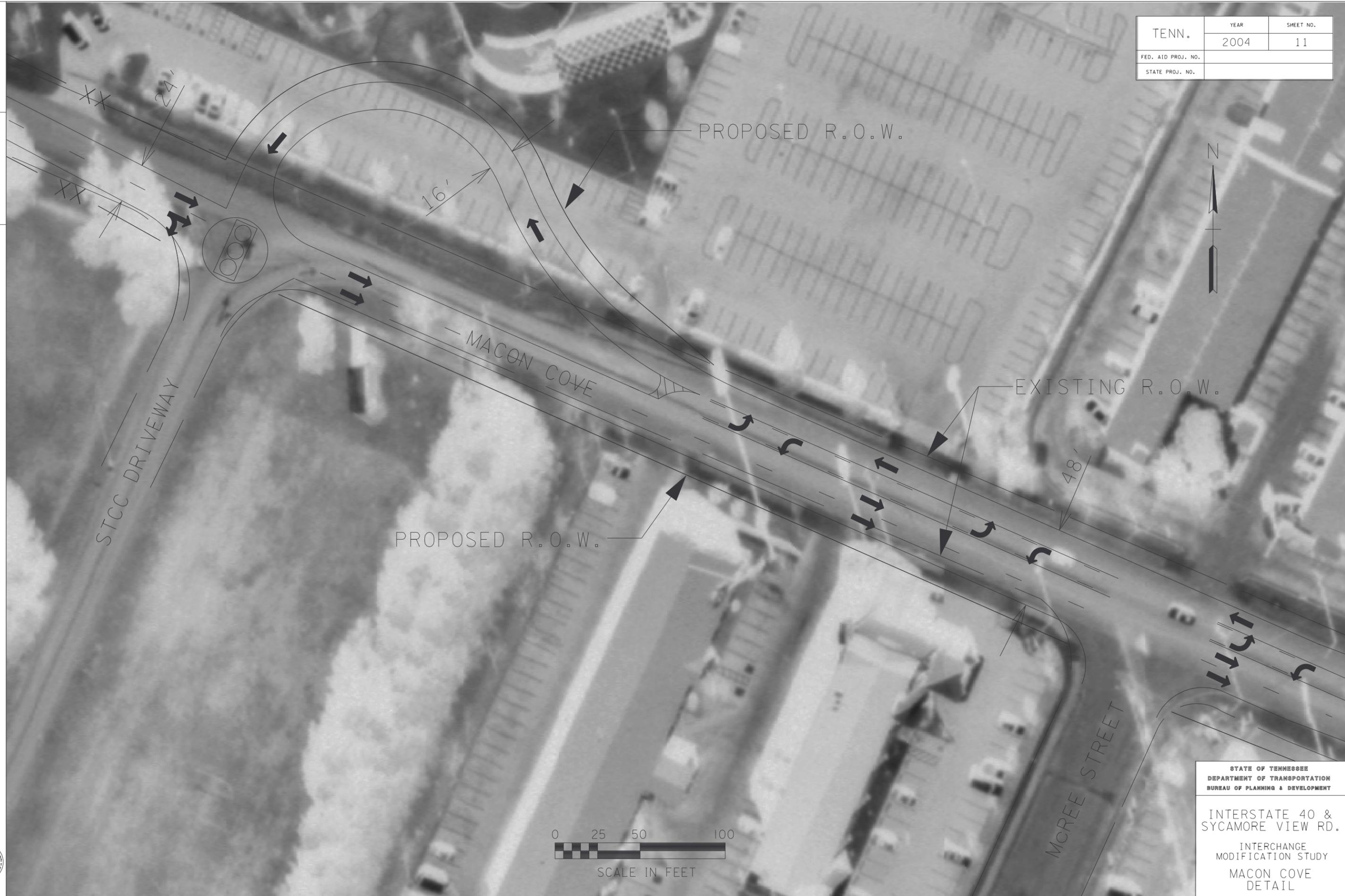
ALTERNATE C



TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

TENN.	YEAR 2004	SHEET NO. 11
FED. AID PROJ. NO.		
STATE PROJ. NO.		



STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
BUREAU OF PLANNING & DEVELOPMENT

INTERSTATE 40 & SYCAMORE VIEW RD.
INTERCHANGE
MODIFICATION STUDY
MACON COVE
DETAIL