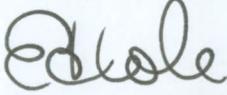
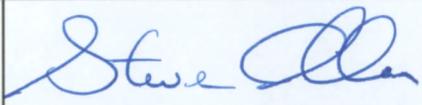


# TRANSPORTATION PLANNING REPORT

INTERSECTION IMPROVEMENT  
STATE ROUTE 160 AT COMMERCE BLVD.  
MORRISTOWN, HAMBLLEN COUNTY  
PIN #107902.00



PREPARED BY  
MATTERN & CRAIG, INC.  
FOR  
TENNESSEE DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION

Recommended by:	Signature	DATE
CHIEF OF ENVIRONMENT AND PLANNING		8/31/07
TRANSPORTATION DIRECTOR PROJECT PLANNING DIVISION		8-7-07
TRANSPORTATION MANAGER 2 PROJECT PLANNING DIVISION		8/7/07

*This document is covered by 23 USC § 409 and its production pursuant to fulfilling public planning requirements does not waive the provisions of § 409.*

## **PROJECT BACKGROUND INFORMATION**

### **Project History**

The Tennessee Department of Transportation (TDOT) is considering a project to improve the intersection of State Route 160 at Commerce Boulevard in Morristown, Tennessee (Hamblen County). Local officials requested that TDOT prepare a Transportation Planning Report (TPR) to detail intersection improvements to alleviate congestion, operational and safety deficiencies at the intersection.

### **Project Study Area**

The proposed project is located in the southwest portion of Morristown, in Hamblen County, in a commercial and industrial area. A large industrial park is located along Commerce Boulevard. The project site is shown on Figure 1 in the Appendix.

### **Existing Transportation Conditions**

State Route 160 in Hamblen County is functionally classified as a four-lane divided minor arterial that serves as a bypass around the southwest edge of the City of Morristown and connects State Route 34 (U.S. 11E), State Route 32 (U.S. 25E), and I-81. The typical section consists of four twelve foot travel lanes and twelve foot shoulders (See Photo No. 1). The existing right-of-way for this segment of State Route 160 is approximately 250 feet. At the intersection, State Route 160 also has a northbound left turn lane and southbound right turn lane for traffic turning onto Commerce Blvd.

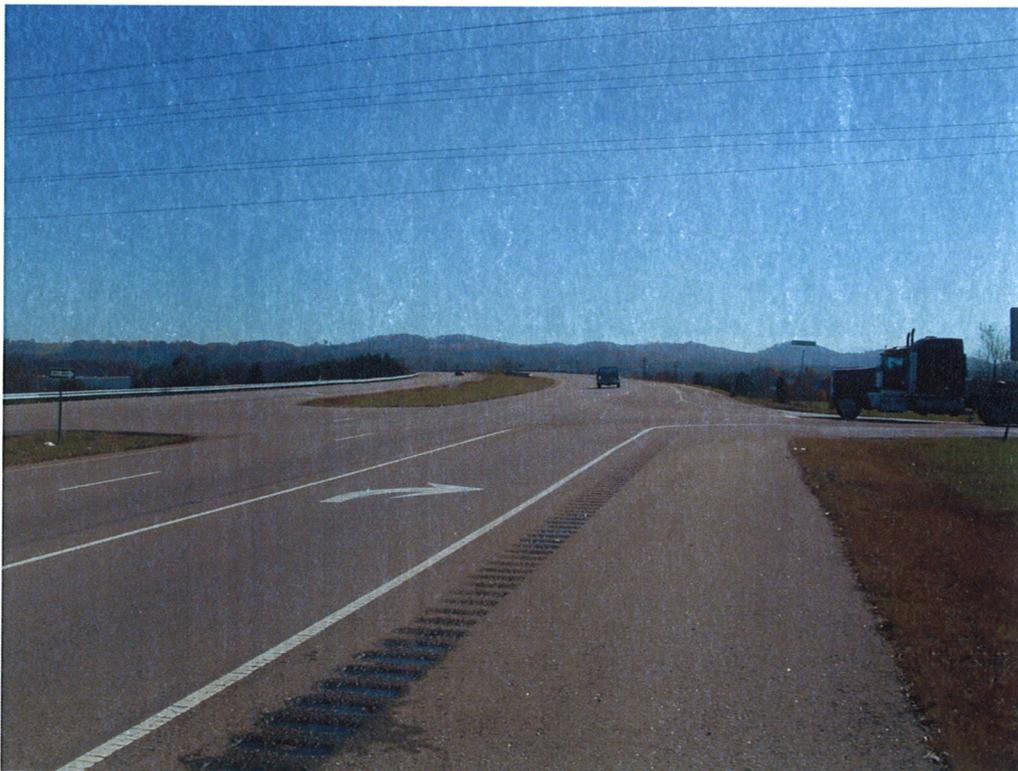


Photo No. 1: Looking southbound along State Route 160.

Commerce Boulevard is functionally classified as a two-lane minor arterial that connects State Route 160 and State Route 34 (U.S. 11E) and provides access to a large industrial park. The typical section consists of two twelve foot travel lanes and twelve foot shoulders (See Photo No. 2). The existing right-of-way for this segment of Commerce Blvd. is approximately 80 feet. At the intersection, Commerce Blvd. also has a widened shoulder which is used as an eastbound right turn lane for traffic turning onto State Route 160. The eastbound traffic along Commerce Blvd. is currently under stop control.



Photo No. 2: Looking westbound along Commerce Blvd.

Traffic volumes in this area have a historic growth rate of approximately 5 percent per year. Truck volumes through this intersection are significant, ranging from 8 to 10 percent of the annual average daily traffic (AADT) on State Route 160 and Commerce Boulevard.

### **Community Profile**

Morristown is the county seat of Hamblen County with an area that comprises a population of 58,128. As the geographic center of East Tennessee, Morristown pulls most of its labor force from Hamblen and seven surrounding counties with a combined population of more than 309,000 people. The area population has grown steadily each decade, and Hamblen County has experienced phenomenal growth in recent years.

Hamblen County is the employment hub, with more than 20,000 people living and working there and around 9,000 commuting in to the county to work. Only 2,700 commute out of Hamblen County for employment, according to the U.S. Department of

Commerce. Residents in eight closest counties drive into Hamblen County in half an hour or less.

According to 2002 data, 32 percent of the Hamblen County population worked in manufacturing and 10 percent worked in retail. In 2006, the unemployment rate in Hamblen County was 5.7%, which is down from 6.8% in 1995 and from an average of 9.5% in the 1980's. There are 29 companies in the Morristown Airport Industrial District that employ over 3,800 people.

## **PURPOSE AND NEED OF PROJECT**

The purpose of the proposed project is to address the capacity, operational, and safety concerns at the intersection of State Route 160 and Commerce Boulevard, by reducing delay time and improving intersection geometry for cars and trucks traveling in the area of the intersection.

Addressing the safety concerns at the intersection, the Tennessee Roadway Information Management System (TRIMS) data indicates that the intersection experienced 31 crashes in the five year period from 2001 to 2005. The total crash rate for the intersection for this period was 0.74 crashes per million entering vehicles, which is higher than the statewide average of 0.26 for this type of intersection. During this time period, there were 11 injury crashes and 1 fatal crash, resulting in a ratio of fatal and injury crashes to total crashes of 0.39 (severity index). The calculations for the above rates are detailed in Figure 2 (Crash Rate Summary), and illustrated in Figure 3 (Crash Summary) diagram in the Appendix.

Addressing the operational and capacity concerns at the intersection, traffic data was provided by TDOT, which consisted of the annual average daily traffic (AADT) and Design Hourly Volume's (DHV's) along both routes for the base (2011) and design (2031) years, as well as a 12-hour full turning movement count from 6:00 AM until 6:00 PM. This count data is contained in the Appendix. The intersection currently operates with Commerce Boulevard under stop control. Capacity analyses of the intersection show that for 2011 peak hour traffic, the Commerce Boulevard eastbound approach and the State Route 160 northbound left approach operate at a level of service "F" during the AM peak hour, and the Commerce Boulevard eastbound approach operates at a level of service "F" during the PM peak hour. The level of service (LOS) methodology is a qualitative measure describing operational conditions within a traffic stream, based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. Descriptions range from LOS A (10 sec. delay) to LOS F (greater than 80 second delay). The volume to capacity (v/c) ratio is the ratio of flow rate (the equivalent hourly rate at which vehicles pass a given point divided by the time interval) to the overall vehicle capacity of the intersection. The LOS and v/c ratio for these approaches continue to worsen for 2031 traffic. This information is summarized below in Table 1. Detailed reports are contained in the Appendix.

TABLE 1  
INTERSECTION CAPACITY ANALYSIS, NO BUILD AND GEOMETRIC  
IMPROVEMENT OPTION

MOVEMENT	2011				2031			
	AM		PM		AM		PM	
	LOS	v/c	LOS	v/c	LOS	v/c	LOS	v/c
Northbound Left	F	1.54	B	0.24	F	3.50	B	0.41
Eastbound Left	F		F	0.87	F		F	2.19
Eastbound Right	F	1.39	D	0.83	F	2.72	F	1.34

## **PROPOSED OPTIONS**

Three options (No-Build, Geometric Improvements, and Traffic Signal) have been investigated for the intersection. Capacity analyses for the intersection were developed for all three options using the projected 2011 and 2031 traffic volumes. For the No-Build and Geometric Improvements options, the results of the capacity analyses are shown above in Table 1. For the Traffic Signal option, the results of the capacity analyses are shown in Table 2, with detailed reports contained in the Appendix.

### **No-Build Option**

As described above, the intersection will operate at an unacceptable level of service for both the 2011 AM and PM peak hours. This level of service will continue to deteriorate with expected increases in traffic volumes. This increase in traffic volumes will likely cause an increase in the number of crashes as well. Figure 4 in the Appendix shows an aerial view of the existing conditions.

No construction costs would be incurred for the No-Build option.

### **Geometric Improvements Option**

The City of Morristown requested that TDOT investigate a proposed option consisting of widening Commerce Boulevard, adding several raised medians, and restriping the intersection. Under this option, the intersection would still operate with Commerce Boulevard under stop control. Thus, the capacity of the intersection will not be affected by this option and will continue to operate at an unacceptable level. Also, even with the addition of raised medians and channelization, the crash rates will likely not be affected by the improvements contained in this option.

This option is shown schematically in Figure 5 in the Appendix. The estimated construction cost for this option is approximately \$782,000 as detailed in the enclosed cost data sheet.

**COST DATA SHEET  
GEOMETRIC IMPROVEMENTS OPTION**

PROJECT: S.R. 160 at Commerce Blvd.  
 TYPE: Intersection Improvement  
 COUNTY: Hamblen

**RIGHT-OF-WAY**

Land, Improvements, & Damages	(# of acres = 0.50 )	\$ 50,000
Incidentals	(# of tracts = 2 )	\$ 10,000
Relocation Payments	(Residences = 0 )	\$ -
	(Businesses = 0 )	\$ -
	(Non-Profits = 0 )	\$ -
<b>TOTAL RIGHT-OF-WAY COST</b>		<b>\$ 60,000</b>

**UTILITY RELOCATION**

Reimbursable	\$ 50,000
Non-reimbursable	\$ -
<b>TOTAL UTILITY ADJUSTMENT COST</b>	<b>\$ 50,000</b>

**CONSTRUCTION**

Clearing & Grubbing	\$ 5,000
Earthwork	\$ 50,000
Pavement Removal	\$ 5,000
Curb	\$ 15,000
Drainage	\$ -
Structures	\$ -
Railroad Crossing	\$ -
Paving	\$ 300,000
Retaining Walls	\$ -
Seeding & Sodding	\$ 30,000
Pavement Marking	\$ 10,000
Signing	\$ 5,000
Signalization	\$ -
Fence	\$ -
Guardrail	\$ -
Erosion Control	\$ 10,000
Maintenance of Traffic	\$ 50,000
SUBTOTAL	\$ 480,000
Other Construction Items ( 10% )	\$ 48,000
Mobilization ( 10% )	\$ 48,000
Contingency ( 10% )	\$ 48,000
Preliminary Engineering ( 10% )	\$ 48,000
<b>TOTAL CONSTRUCTION COST</b>	<b>\$ 672,000</b>

**TOTAL ESTIMATED COST \$ 782,000**

## Traffic Signal Option

The Traffic Signal option consists of installing a traffic signal and restriping the intersection. The results of the capacity analyses for the intersection with this option are shown below in Table 2.

In addition, a signal warrant analysis, contained in the Appendix, was performed to determine if a traffic signal is warranted at the intersection. Based on 2006 traffic data, the intersection meets Warrants 1, 2, 3, and 8 as described in the *Manual on Uniform Traffic Control Devices* (MUTCD).

TABLE 2  
INTERSECTION CAPACITY ANALYSIS, TRAFFIC SIGNAL OPTION

MOVEMENT	2011				2031			
	AM		PM		AM		PM	
	LOS	v/c	LOS	v/c	LOS	v/c	LOS	v/c
Eastbound Left	F	1.13	D	0.75	F	1.53	C	0.47
Eastbound Right	C	0.79	C	0.90	E	1.07	D	0.99
Northbound Left	F	1.17	A	0.39	F	1.58	D	0.92
Northbound Thru	A	0.37	A	0.45	A	0.49	B	0.73
Southbound Thru	D	1.02	B	0.53	F	1.38	C	0.80
Southbound Right	A	0.27	A	0.13	A	0.37	A	0.15
Intersection	D		B		F		C	

As shown above, the intersection will operate at an acceptable level of service during the PM peak hour for both 2011 and 2031 traffic under the control of a traffic signal. Although the AM peak hour will not operate at an acceptable level, traffic data shows that left turn volumes (both ingress and egress) along Commerce Blvd. have a dramatic peak during the AM peak hour. This peak, lasting approximately 30 minutes, is likely due to shift changes at several of the industries located along Commerce Boulevard. Because of this dramatic peak, the signal will likely operate efficiently at all times with the exception of this peak. In addition, the capacity analyses were performed with two assumptions that would negatively impact the level of service: no right turns on red were included for any phase, and the signal was assumed to operate in pre-timed mode. In reality, right turns would occur on red, and the signal would operate in actuated mode; thus, the actual level of service would likely be better than that shown above.

This option is shown schematically in Figure 6 in the Appendix. The estimated construction cost for this option is approximately \$354,200 as detailed in the enclosed cost data sheet.

## DISPOSITION OF EXISTING ROUTE

All proposed improvements are recommended to be along the existing routes with no portions of the roadways to be abandoned.

**COST DATA SHEET  
TRAFFIC SIGNAL OPTION**

PROJECT: S.R. 160 at Commerce Blvd.  
 TYPE: Intersection Improvement  
 COUNTY: Hamblen

**RIGHT-OF-WAY**

Land, Improvements, & Damages	(# of acres = 0.25 )	\$ 25,000
Incidentals	(# of tracts = 2 )	\$ 10,000
Relocation Payments	(Residences = 0 )	\$ -
	(Businesses = 0 )	\$ -
	(Non-Profits = 0 )	\$ -
<b>TOTAL RIGHT-OF-WAY COST</b>		<b>\$ 35,000</b>

**UTILITY RELOCATION**

Reimbursable	\$ -
Non-reimbursable	\$ -
<b>TOTAL UTILITY ADJUSTMENT COST</b>	<b>\$ -</b>

**CONSTRUCTION**

Clearing & Grubbing	\$ 5,000
Earthwork	\$ 5,000
Pavement Removal	\$ 30,000
Curb & Gutter	\$ -
Drainage	\$ -
Structures	\$ -
Railroad Crossing	\$ -
Paving	\$ -
Retaining Walls	\$ -
Seeding & Sodding	\$ 18,000
Pavement Marking	\$ 5,000
Signing	\$ 5,000
Signalization	\$ 130,000
Fence	\$ -
Guardrail	\$ -
Erosion Control	\$ 10,000
Maintenance of Traffic	\$ 20,000
<b>SUBTOTAL</b>	<b>\$ 228,000</b>
Other Construction Items	( 10% ) \$ 22,800
Mobilization	( 10% ) \$ 22,800
Contingency	( 10% ) \$ 22,800
Preliminary Engineering	( 10% ) \$ 22,800
<b>TOTAL CONSTRUCTION COST</b>	<b>\$ 319,200</b>

**TOTAL ESTIMATED COST \$ 354,200**

## CHECK LIST OF DETERMINANTS FOR LOCATION STUDY

If any of the following facilities or ESE categories are located within the project area or corridor, place an "x" in the blank opposite the item. Where more than one alternate is to be considered, place its letter designation in the blank.

1.	Agricultural land usage	X
2.	Airport (existing or proposed)	X
3.	Commercial area, shopping center	
4.	Floodplains	
5.	Forested land	
6.	Historical, cultural, or natural landmark	
7.	Industrial park, factory	X
8.	Institutional usages	
	a. School or other educational institution	
	b. Church or other religious institution	
	c. Hospital or other medical facility	
	d. Public building, e.g., fire station	
	e. Defense installation	
9.	Recreation usages	
	a. Park or recreational area	
	b. Game preserve or wildlife area	
10.	Residential establishment	
11.	Urban area, town, city, or community	X
	(Morristown, Population 26,000)	
12.	Waterway, lake, pond, river, stream, spring	
	(Permit required: Coast Guard	
	Section 404	
	TVA Section 26a review	
	NPDES	
	Aquatic Resource Alteration	
13.	Other	
14.	Location coordinated with local officials	X
15.	Railroad crossings	X
16.	Hazardous materials site	

**TDOT DESIGN CRITERIA FOR LOCATION AND DESIGN PHASE**

**ROUTE:** SR 160/COMMERCE BLVD.      **CONCEPT:** ALL  
**REGION:** 1      **COUNTY:** HAMBLLEN  
**LOCATION:** INTERSECTION OF SR 160 & COMMERCE BLVD.

	SR 160	COMMERCE BLVD.
PRESENT AADT (2006)		
FUTURE AADT (2011)	18,400	8,980
FUTURE AADT (2031)	30,170	14,740
DHV (2031)	3,164	1,598
FUNCTIONAL CLASSIFICATION	URBAN ARTERIAL	URBAN ARTERIAL
MINIMUM DESIGN SPEED (MPH)	60	40
ACCESS CONTROL	N/A	N/A
MINIMUM RADIUS (FT)	1205' (0.08 MAX. S.E.)	565' (0.04 MAX. S.E.)
MAXIMUM GRADE (%)	5	7
MINIMUM STOPPING SIGHT DISTANCE (FT)	570	305
SURFACE WIDTH (FT)	48-72	24-36
NUMBER OF LANES	4-6	2-3
USABLE SHOULDER WIDTH (FT)	12	12
MEDIAN WIDTH (FT)	26	N/A
MINIMUM RIGHT-OF-WAY (FT)	250	80
SIGNALIZATION	NEW SIGNAL	

### SUMMARY DATA TABLE

ITEM	TRAFFIC SIGNAL OPTION (SR 160/COMMERCE BLVD.)	GEOMETRIC IMPROVEMENTS OPTION (SR 160/COMMERCE BLVD.)
FUNCTIONAL CLASS	Urban Arterial	Urban Arterial
SYSTEM CLASS	STP/Local	STP/Local
LENGTH (MILES)	N/A	N/A
CROSS SECTION (FT)	48-72/24	48-72/24-48
PRESENT AADT (2011)	18,400/8,980	18,400/8,980
FUTURE AADT (2031)	30,170/14,740	30,170/14,740
DHV (2031)	3,164/1,598	3,164/1,598
% TRUCKS	7/9	7/9
Estimated Right-of-Way Acquisition (acres)	0.25	0.50
Estimated Right-of-Way Tracts Affected	2	2
Estimated Family Displacements	0	0
Estimated Business Displacements	0	0
Estimated Non-Profit Displacements	0	0
Estimated Right-of-Way Cost	\$35,000	\$60,000
Estimated Reimbursable Utility Cost	\$0	\$50,000
Estimated Non-Reimbursable Utility Cost	\$0	\$0
Estimated Construction Cost	\$319,200	\$672,000
Estimated Preliminary Engineering Cost	\$22,800	\$48,000
Total Estimated Project Cost	\$354,200	\$782,000

## **BICYCLE AND PEDESTRIAN ACCOMODATION**

Due to the location of the project and the surrounding land use, no bicycle or pedestrian accommodations are included in this project.

## **ENVIRONMENTAL REVIEW**

A preliminary review of floodplains, jurisdictional waters, wetlands, threatened and endangered species, historic properties, and hazardous materials located in and around the project site was performed to determine if any and what environmental impacts from the project might be expected. The following segments describe the methods used and the findings of this environmental review.

### **Flood Zone Review**

The Federal Emergency Management Authority (FEMA) Flood Insurance Rate Map (FIRM) for Hamblen County was reviewed to determine if the proposed intersection is located in the base flood zone (Map No. 47063C0120E, revised July 3, 2006). The base flood zone, defined as the area located in the 100-year floodplain, is subject to flooding by the 1 percent chance annual flood. Based on this map, the project area does not fall in the base flood area.

### **Jurisdictional Waters and Wetlands Investigation**

Based on a field investigation and on available mapping data, it is unlikely that any jurisdictional waters or wetlands exist within the project limits. However, a formal investigation has not been performed at this time.

### **Threatened and Endangered Species Review**

Based on a field investigation, it is unlikely that any threatened or endangered species exist within the project limits. However, a formal investigation has not been performed at this time.

### **Historic Properties Review**

Based on a field investigation, and the small footprint of the proposed intersection improvement, it is unlikely that any historic properties exist within the project limits. However, a formal investigation has not been performed at this time.

### **Hazardous Materials**

Based on a field investigation, it is unlikely that any hazardous materials exist within the project limits. However, a formal investigation has not been performed at this time.

## **ASSESSMENT OF OPTIONS**

The Tennessee Department of Transportation has adopted seven guiding principles against which all transportation projects are to be evaluated. These guiding principles address concerns for system management, mobility, economic growth, safety, community, environmental stewardship, and fiscal responsibility. These guiding principles are discussed below as they relate to the options for improving this intersection.

### **Guiding Principle 1: Preserve and Manage the Existing Transportation System**

The intersection of State Route 160 and Commerce Boulevard is currently approaching capacity during the peak hour traffic periods. As traffic volume increases in the area, this condition could extend into off-peak traffic periods. The Traffic Signal alternative should provide a reduction in delay and improve operations at this intersection.

### **Guiding Principle 2: Move a Growing, Diverse, and Active Population**

State Route 160 is a major east-west corridor that serves as both a bypass around the southern side of Morristown, as well as a major connection between Morristown and I-81. Commerce Boulevard serves as the primary access for a large industrial park. As such, the intersection has become congested due to the increase in traffic volumes, and this congestion has contributed to a number of crashes at the intersection.

### **Guiding Principle 3: Support the State's Economy**

Transportation projects such as this intersection improvement help to support Tennessee's economy by providing improved mobility for residents in the general area to live, work, and shop in the area.

### **Guiding Principle 4: Maximize Safety and Security**

The intersection crash rate of 0.74 is greater than the statewide average crash rate of 0.26 for this type of intersection. The Traffic Signal alternative will improve the overall safety of this intersection.

### **Guiding Principle 5: Build Partnerships for Livable Communities**

Although no formal public involvement process has been implemented for the proposed project, there is no known public opposition to the project at this time. The geometric improvements and the traffic signal options are anticipated to have little, if any, negative impacts to the surrounding community. The no-build option could possibly have a negative impact on the future operation of the intersection based on increased traffic volumes.

## **Guiding Principle 6: Promote Stewardship of the Environment**

This report contains results of an environmental review performed on the proposed project site. The results of this review indicated that there are no known environmental impacts to the surrounding area as a result of this project.

## **Guiding Principle 7: Promote Financial Responsibility**

This report follows a comprehensive transportation planning process, promotes coordination among public and private operators of transportation systems, and supports efforts to provide stable funding for the public component of the transportation system.

## **SUMMARY**

State Route 160 in Hamblen County is a four-lane divided minor arterial that serves as a bypass around the southwest edge of the City of Morristown and connects State Route 34 (U.S. 11E), State Route 32 (U.S. 25E), and I-81. Commerce Boulevard is a two-lane minor arterial that connects State Route 160 and State Route 34 (U.S. 11E) and provides access to a large industrial park. Traffic volumes in this area have a historic growth rate of approximately 5 percent per year. Truck volumes through this intersection are significant, ranging from 8 to 10 percent of the annual average daily traffic (AADT) on State Route 160 and Commerce Boulevard.

Addressing the safety concerns at the intersection, the Tennessee Roadway Information Management System (TRIMS) data indicates that the intersection experienced 31 crashes in the five year period from 2001 to 2005. The total crash rate for the intersection for this period was 0.74 crashes per million entering vehicles, which is higher than the statewide average of 0.26 for this type of intersection. During this time period, there were 11 injury crashes and 1 fatal crash, resulting in a ratio of fatal and injury crashes to total crashes of 0.39 (severity index).

Addressing the operational and capacity concerns at the intersection, traffic data consisted of the annual average daily traffic (AADT) and Design Hourly Volume's (DHV's) along both routes for the base (2011) and design (2031) years, as well as a 12-hour full turning movement count from 6:00 AM until 6:00 PM. The intersection currently operates with Commerce Boulevard under stop control. Capacity analyses of the intersection show that for 2011 peak hour traffic, the Commerce Boulevard eastbound approach and the State Route 160 northbound left approach operate at a LOS "F" during the AM peak hour, and the Commerce Boulevard eastbound approach operates at a LOS "F" during the PM peak hour. The LOS and v/c ratio for these approaches continue to worsen for 2031 traffic.

Improvements to the intersection of State Route 160 and Commerce Boulevard are needed to achieve the following criteria:

- Address the capacity, operational, and safety concerns at the intersection.
- Achieve an improved LOS (reduce the average delay) for both roadways.

Three options were considered in addressing the purpose and need of the project. The following is a summary and evaluation of these options:

### **No-Build Option**

- LOS of F in the AM peak for State Route 160 northbound left approach and (2011 projected traffic counts).
- LOS of F in the AM and PM peak for Commerce Boulevard eastbound left approach (2011 projected traffic counts).
- Does not provide an improved LOS for either roadway.
- LOS will continue to deteriorate with expected increases in traffic volumes.
- Provides no additional intersection capacity or improvements to operation and safety.
- Future increase in traffic volumes will likely increase the number of crashes.

### **Geometric Improvements Option**

- LOS of F in the AM peak for State Route 160 northbound left approach and (2011 projected traffic counts).
- LOS of F in the AM and PM for Commerce Boulevard eastbound left approach (2011 projected traffic counts).
- Provides no additional intersection capacity.
- Provides roadway modifications.
- LOS will continue to deteriorate with expected increases in traffic volumes.
- Provides slight measurable improvements to safety operations with offset acceleration lanes and right turn lanes.
- Additional right-of-way may be required.
- Estimated project cost - \$782,000.

### **Traffic Signal Option**

- Intersection meets Traffic Signal Warrants 1, 2, 3 and 8 based on 2006 traffic data.
- LOS of F in the AM peak for State Route 160 northbound left approach and Commerce Boulevard eastbound left approach (2011 projected traffic counts). Peak time is 30 minutes and due to industry shift changes. Overall intersection at LOS of D.
- Provides additional intersection capacity and improvements to operation and safety.
- Additional right-of-way may be required.
- Estimated project cost - \$354,200.

## **FIELD INVESTIGATION**

A field investigation of the project was made by the following individuals on January 24, 2007:

Chris Armstrong	TDOT Project Planning
Gena Gilliam	TDOT Project Planning
Dudley Daniel	TDOT Project Planning
Nathan Vatter	TDOT Region 1 Traffic Engineering
Jeff Turner	TDOT Region 1 Design
Stacy Weaver	TDOT Region 1 Design
Mark Parrish	TDOT Region 1 Design
Bryan Fowler	City of Morristown
Jeff Branham	City of Morristown
Rich DesGroseilliers	Lakeway Area MPO
Randy Dodson	Mattern & Craig
Jason Carder	Mattern & Craig

## **APPENDIX**



**FIGURE 2**  
**CRASH RATE SUMMARY**

County: Hamblen City: Morristown Date: 12/11/06  
 Route: SR 160 Route: Commerce Blvd.  
 Facility Type: Urban 4-lane divided highway  
 Time Period of Accident Data: From: 01/01/01 To: 12/31/05

**Intersection**

Number of accidents: 31  
 Number of years: 5  
 ADT 1: 17,250 ADT 2: 19,540  
 ADT 3: 8,980 ADT 4: \_\_\_\_\_  
 Statewide Average Rate: 0.26  
 Number of Fatal Accidents: 1  
 Number of Injury Accidents: 11

Exposure Rate = **41.77**

Average Accident Rate = **0.74**

Critical Accident Rate = **0.46**

Statewide Average Rate = **0.26**

Severity Index = **0.39**

Ratio = **1.63**

COUNTY: HAMBLEN  
 ROUTE: S.R. 160  
 LOCATION ON ROUTE: INTERSECTION OF  
 AIR PARK BLVD. (S.R. 160) AND COMMERCE BLVD.  
 PERIOD COVERED: 1/25/01-12/08/05  
 PREPARED BY: MATTERN AND CRAIG ENG.  
 DATE: OCT. 10, 2006

CRASH SUMMARY	
19	PROPERTY DAMAGE
11	INJURY
1	FATAL
31	TOTAL CRASHES

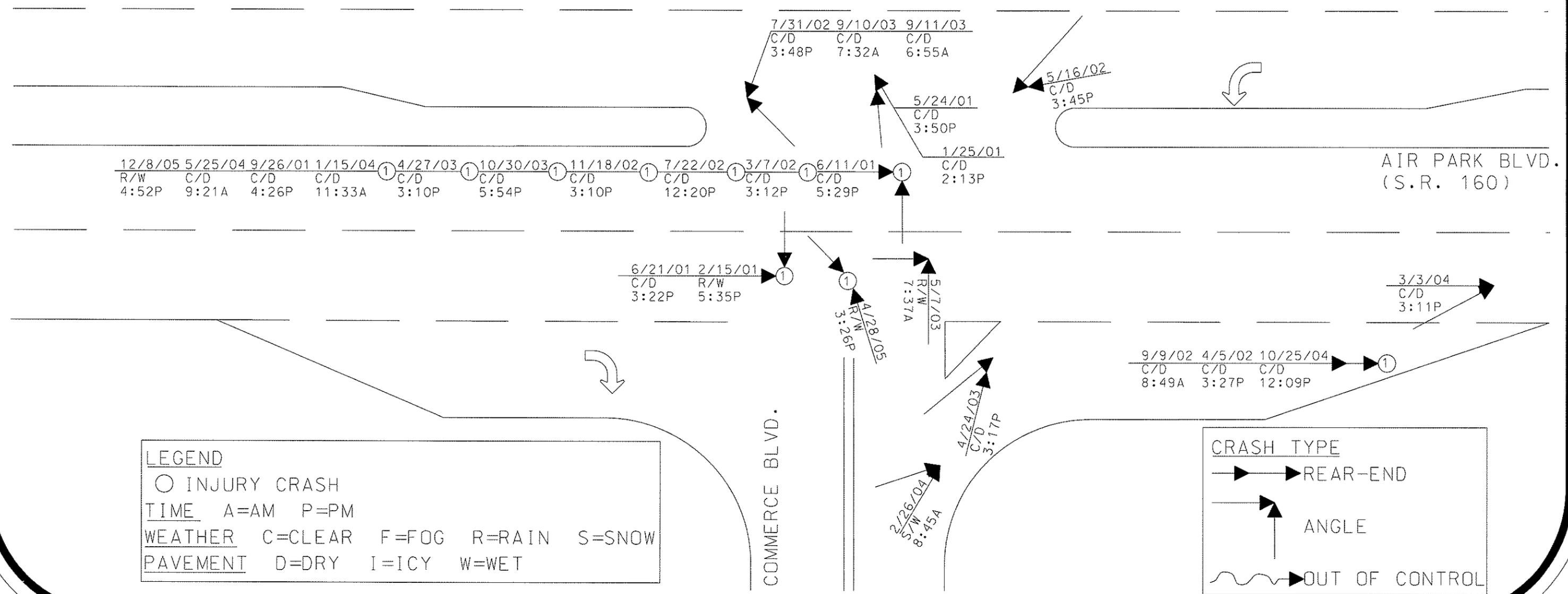
FIGURE 3



SCALE: NTS

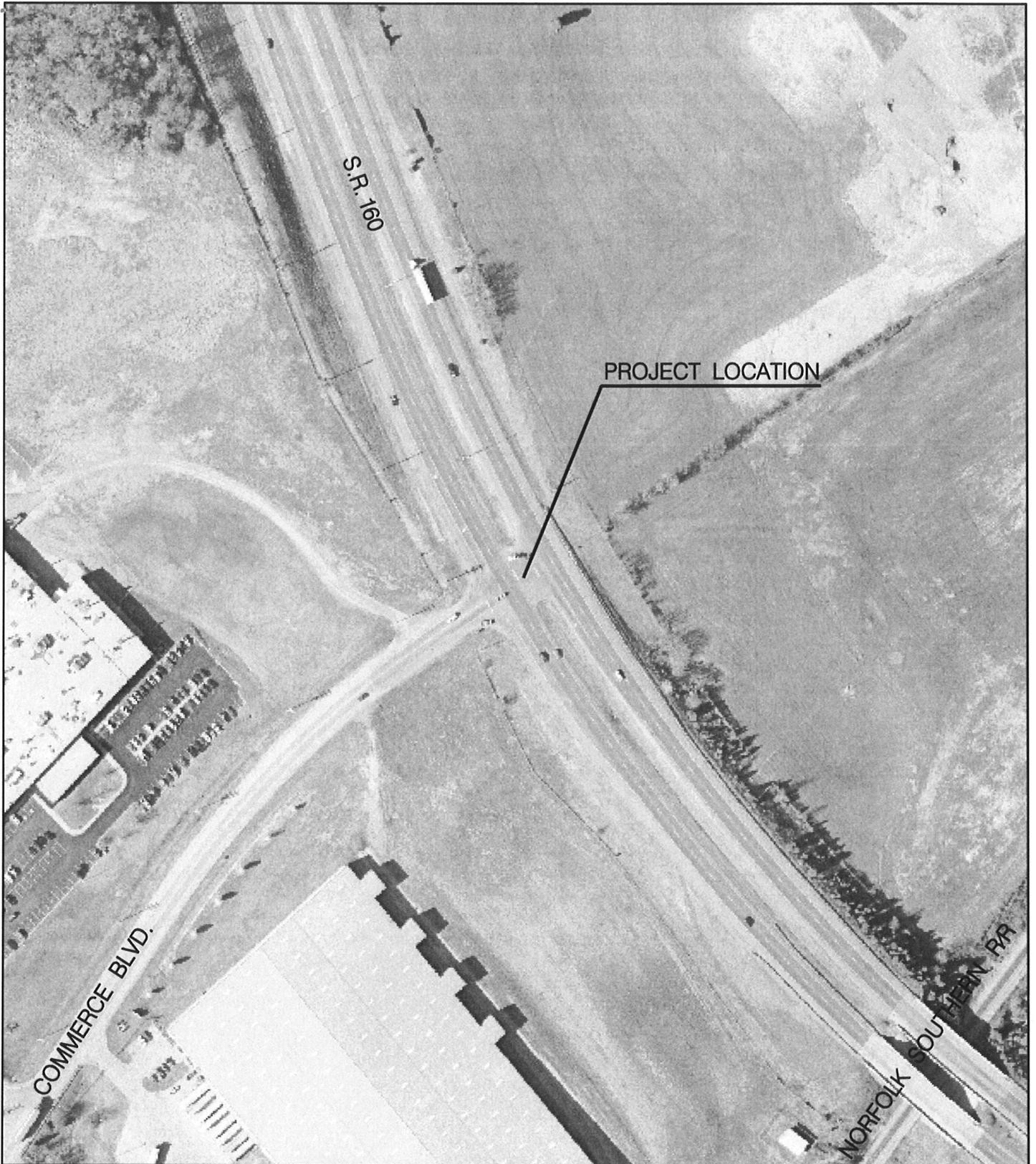
AIR PARK BLVD.  
 (S.R. 160)

3/30/01	11/30/02	12/17/03	2/27/03	12/25/04
R/W	C/D	R/W	R/W	C/D
9:30P	5:42P	1:54A	1:08A	3:25A



LEGEND	
○	INJURY CRASH
TIME	A=AM P=PM
WEATHER	C=CLEAR F=FOG R=RAIN S=SNOW
PAVEMENT	D=DRY I=ICY W=WET

CRASH TYPE	
→→	REAR-END
↗	ANGLE
~→	OUT OF CONTROL



0 100 200 300  
SCALE: 1" = 200'

FIGURE 4

AERIAL MAP  
S.R. 160 AT COMMERCE BLVD.  
HAMBLEN COUNTY



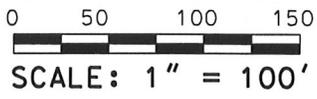
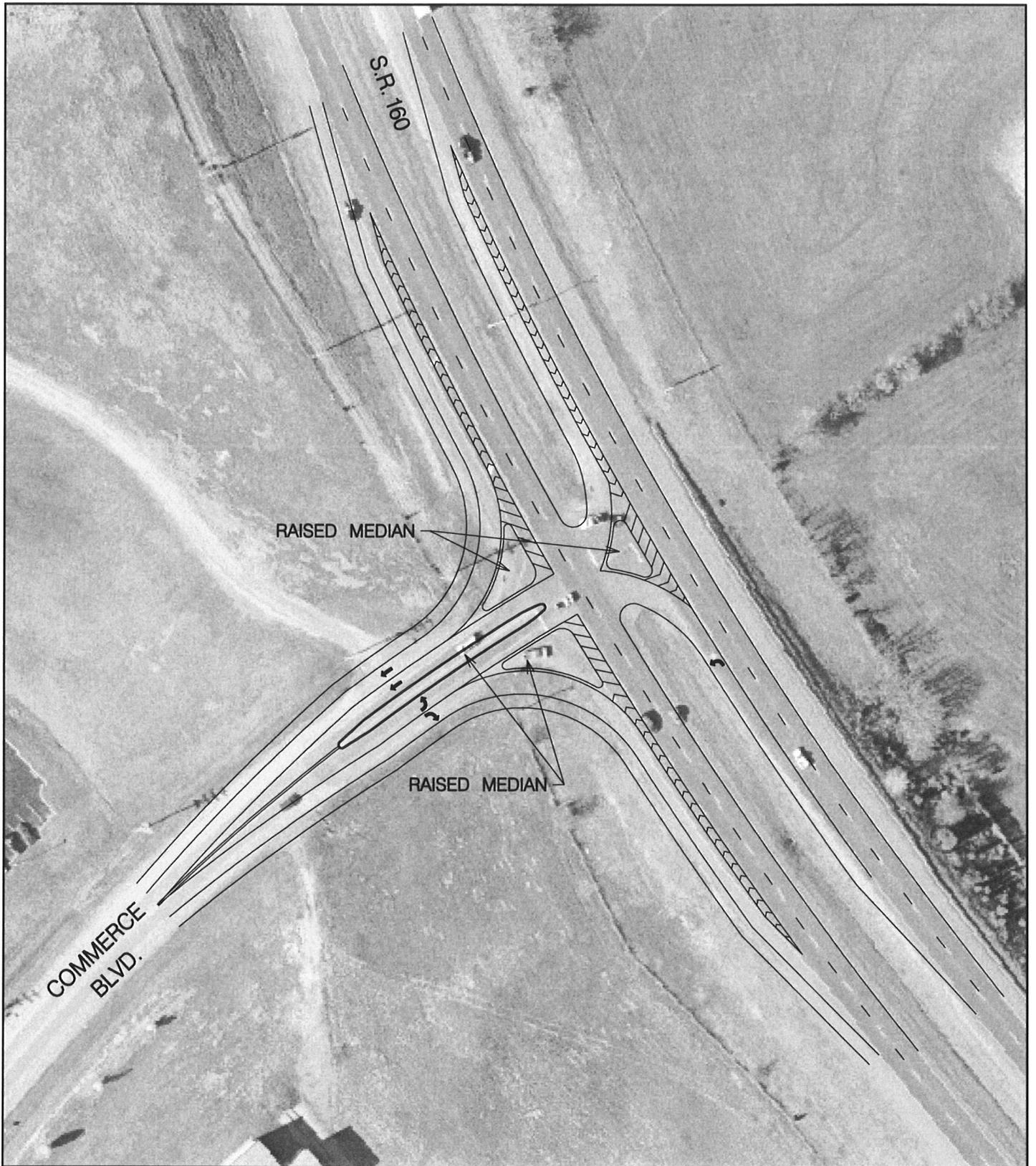
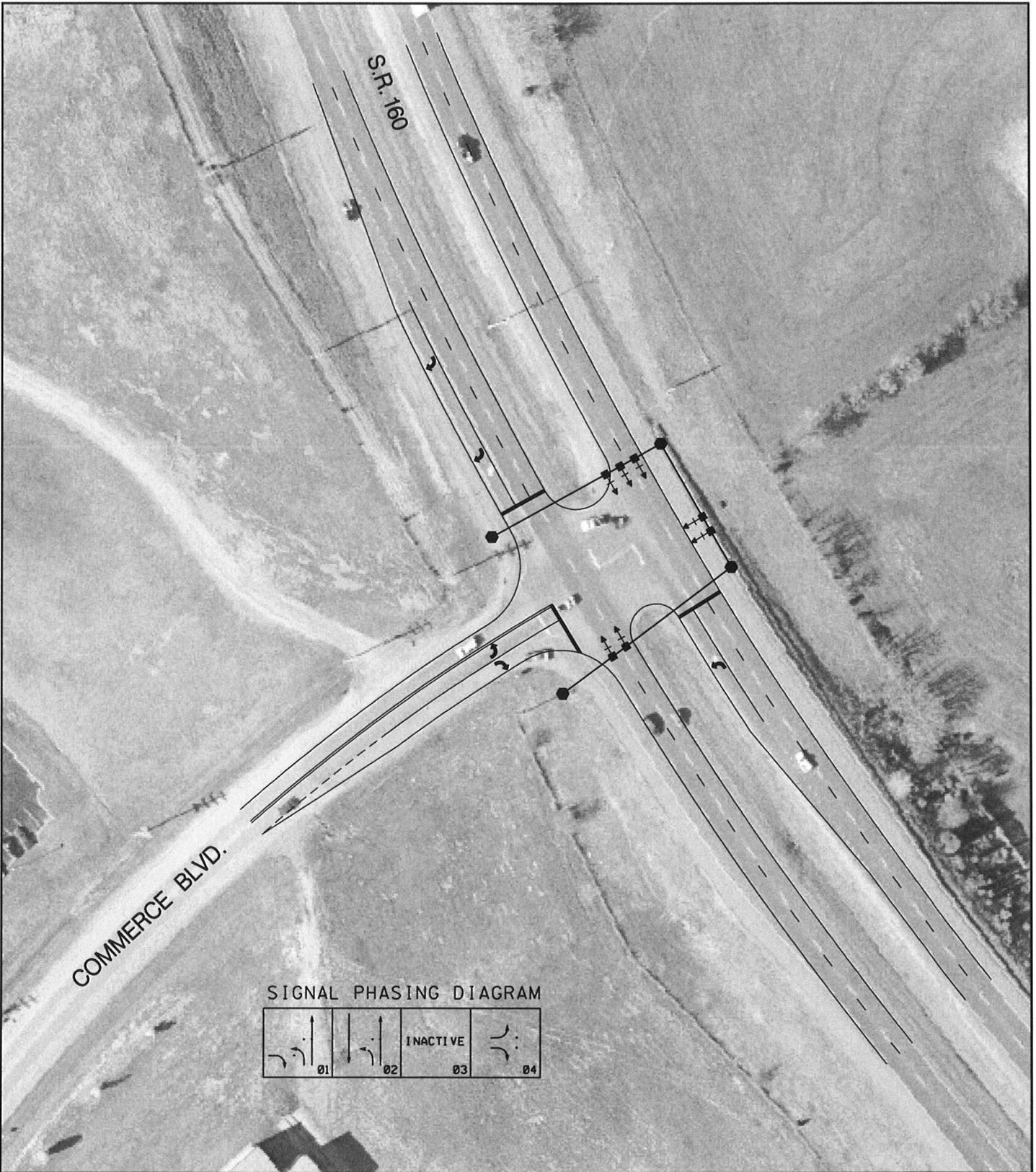


FIGURE 5

GEOMETRIC IMPROVEMENTS ALTERNATIVE  
S.R. 160 AT COMMERCE BLVD.  
HAMBLÉN COUNTY





0 50 100 150  
 SCALE: 1" = 100'

FIGURE 6

TRAFFIC SIGNAL ALTERNATIVE  
 S.R. 160 AT COMMERCE BLVD.  
 HAMBLLEN COUNTY



TENNESSEE DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION

Matthew & Craig

PROJECT NO.: 99106-1084-04 ROUTE: S.R. 160 @ COMMERCE BLVD.  
 COUNTY: HAMBLLEN CITY: \_\_\_\_\_  
 PROJECT PIN NUMBER: 107902.00  
 PROJECT DESCRIPTION: INTERSECTION IMPROVEMENT  
[1] S.R. 160 TRAFFIC DATA  
[2] COMMERCE BLVD. TRAFFIC DATA

**DIVISION REQUESTING:**

MAINTENANCE  PAVEMENT DESIGN   
 PLANNING  STRUCTURES   
 PROG. DEVELOPMENT & ADM.  SURVEY & DESIGN   
 PUBLIC TRANS. & AERO.  TRAFFIC SIGNAL DESIGN   
 OTHER   
 YEAR PROJECT PROGRAMMED FOR CONSTRUCTION: \_\_\_\_\_  
 PROJECTED LETTING DATE: \_\_\_\_\_

**TRAFFIC ASSIGNMENT:**

	BASE YEAR		DESIGN YEAR				DESIGN ROADWAY % TRUCKS		DESIGN AVERAGE DAILY LOADS		
	ADT	YEAR	ADT	DHV	%	YEAR	DIR.DIST.	DHV	ADT	FLEX	RIGID
[1]	18,400	2011	30,170	3,164	10	2031	60-40	5	7		
[2]	8,980	2011	14,740	1,598	11	2031	55-45	6	9		

REQUESTED BY: NAME TERRY GLADDEN DATE 7/28/06  
 DIVISION PLANNING  
 ADDRESS SUITE 900, JAMES K. POLK BLDG.  
NASHVILLE, TN 37243

REVIEWED BY: TONY ARMSTRONG Tony Armstrong DATE 9.29.06  
 TRANSPORTATION MANAGER 1  
 SUITE 1000, JAMES K. POLK BUILDING

APPROVED BY: BILL HART Bill Hart DATE 9.29.06  
 TRANSPORTATION MANAGER 2  
 SUITE 900, JAMES K. POLK BUILDING

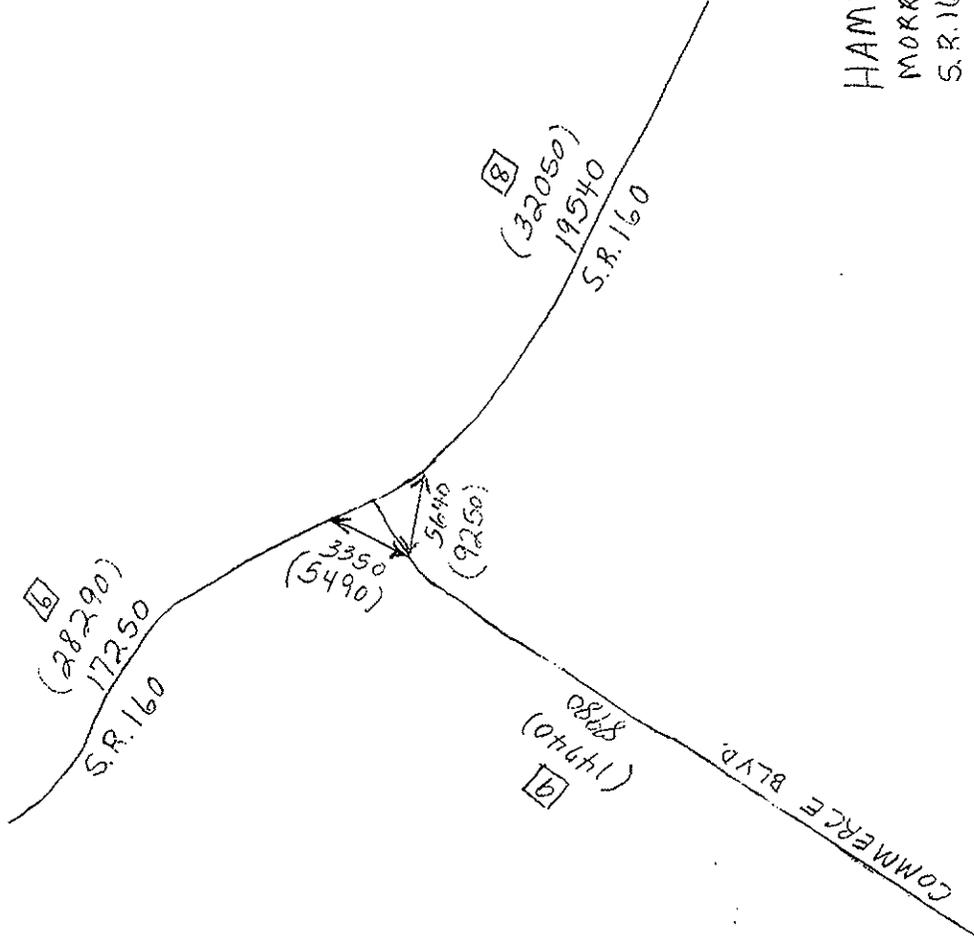
**COMMENTS:**

TRAFFIC IS BASED ON 2006 CYCLE COUNTS NO.'S 90 AND 103 IN HAMBLLEN COUNTY AND A 12-HOUR TURNING MOVEMENT COUNT [SEPT. 2006]. FUTURE TRAFFIC IS BASED ON GROWTH RATE FROM THE ADAM COMPUTER PROGRAM.

**DHV'S ARE NOT REQUIRED FOR SIDE ROADS LESS THAN 1000 ADT.**

NOTE: FOR BRIDGE REPLACEMENT PROJECTS, ADLs ARE NOT REQUIRED FOR ADTs OF 1000 OR LESS AND PERCENTAGE OF TRUCKS OF 7% OR LESS.

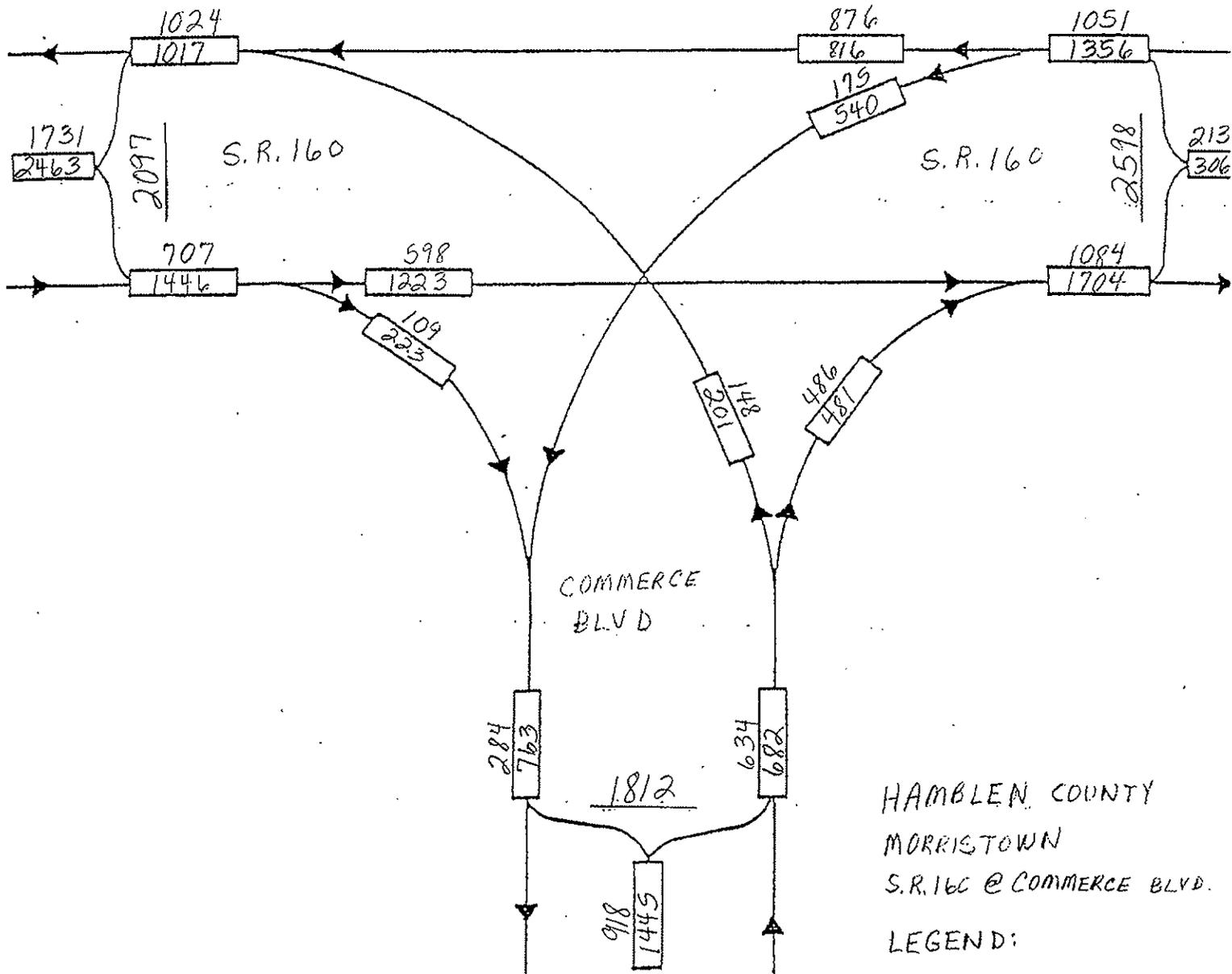
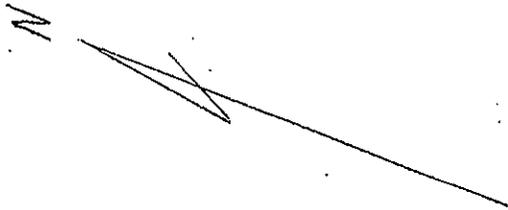
SEE ATTACHMENTS FOR TURNING MOVEMENTS AND/OR OTHER DETAILS.



HAMBLETON COUNTY  
MORRISTOWN  
S.R. 160 @ COMMERCE BLVD.

LEGEND:

2011 ADT - 000  
2051 ADT - (500)  
ADT TRUCK % - 10  
DATE: SEPTEMBER 29, 2006



HAMBLEN COUNTY  
MORRISTOWN  
S.R. 160 @ COMMERCE BLVD.

LEGEND:

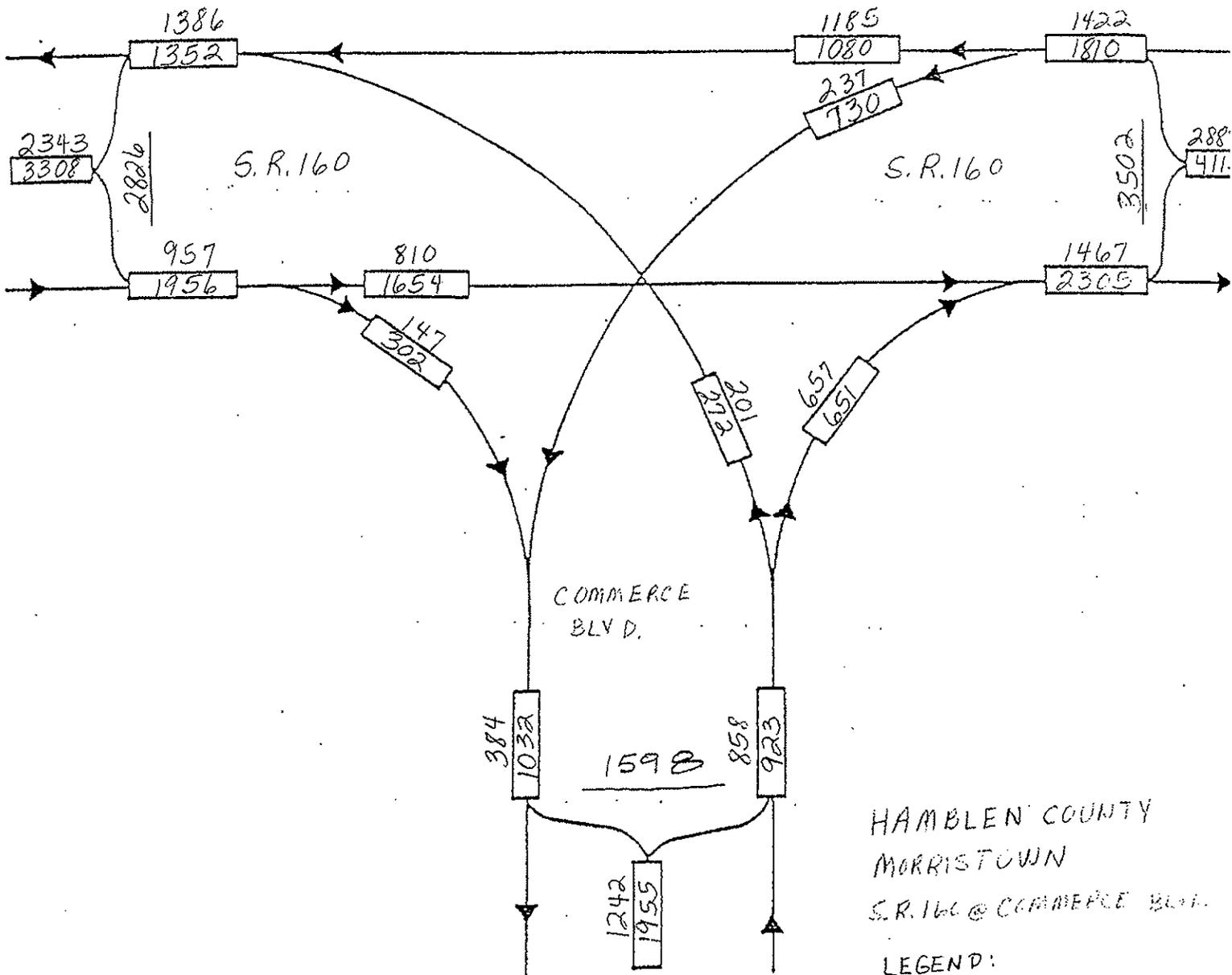
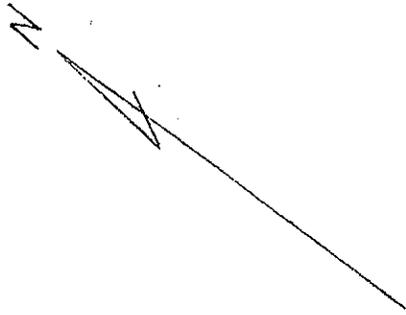
2011 DHV

PM

AM

DATE: SEPTEMBER 29, 2006

P.W.



HAMBLEN COUNTY  
 MORRISTOWN  
 S.R. 160 @ COMMERCE BLVD.

LEGEND:  
2031 DHV  
 PM  
 AM

DATE: SEPTEMBER 29, 2006  
 P.W.

## TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	Jason Carder	Intersection	SR 160 at Commerce Blvd.
Agency/Co.	Mattern & Craig	Jurisdiction	City of Morristown
Date Performed	10/26/2006	Analysis Year	2011
Analysis Time Period	2011 AM		

Project Description SR 160 at Commerce Blvd. Intersection Study

East/West Street: Commerce Blvd.

North/South Street: SR 160

Intersection Orientation: North-South

Study Period (hrs): 0.25

## Vehicle Volumes and Adjustments

Major Street Movement	Northbound			Southbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume (veh/h)	540	816			1223	223
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	223	0	534	0	0	0
Percent Heavy Vehicles	5	--	--	0	--	--
Median Type	Raised curb					
RT Channelized			0			0
Lanes	1	2	0	0	2	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street Movement	Eastbound			Westbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume (veh/h)	201		481			
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	0	1358	247	600	906	0
Percent Heavy Vehicles	6	0	6	0	0	0
Percent Grade (%)		0			0	
Flared Approach		Y			N	
Storage		2			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

## Delay, Queue Length, and Level of Service

Approach Movement	Northbound	Southbound	Westbound			Eastbound		
	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (veh/h)	600					223		534
C (m) (veh/h)	390							385
v/c	1.54							1.39
95% queue length	33.06							26.25
Control Delay (s/veh)	280.5							217.3
LOS	F							F
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

## TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	Jason Garder	Intersection	SR 160 at Commerce Blvd.
Agency/Co.	Mattern & Craig	Jurisdiction	City of Morristown
Date Performed	10/26/2006	Analysis Year	2011
Analysis Time Period	2011 PM		

Project Description SR 160 at Commerce Blvd. Intersection Study

East/West Street: North/South Street: SR 160  
 Intersection Orientation: North-South Study Period (hrs): 0.25

### Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	175	876			598	109
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	164	0	540	0	0	0
Percent Heavy Vehicles	5	—	—	0	—	—
Median Type	Raised curb					
RT Channelized			0			0
Lanes	1	2	0	0	2	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	148		486			
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	0	664	121	194	973	0
Percent Heavy Vehicles	6	0	6	0	0	0
Percent Grade (%)		0			0	
Flared Approach		Y			N	
Storage		2			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

### Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
	1	4	7	8	9	10	11	12
Movement	L					L		R
v (veh/h)	194					164		540
C (m) (veh/h)	810					189		652
v/c	0.24					0.87		0.83
95% queue length	0.93					6.43		8.86
Control Delay (s/veh)	10.8					85.5		31.5
LOS	B					F		D
Approach Delay (s/veh)	—	—				44.1		
Approach LOS	—	—				E		

## TWO-WAY STOP CONTROL SUMMARY

General Information				Site Information				
Analyst	Jason Carder			Intersection	SR 160 at Commerce Blvd.			
Agency/Co.	Mattern & Craig			Jurisdiction	City of Morristown			
Date Performed	10/26/2006			Analysis Year	2031			
Analysis Time Period	2031 AM							
Project Description SR 160 at Commerce Blvd. Intersection Study								
East/West Street: Commerce Blvd.				North/South Street: SR 160				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	730	1080			1654	302		
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90		
Hourly Flow Rate, HFR (veh/h)	302	0	723	0	0	0		
Percent Heavy Vehicles	5	--	--	0	--	--		
Median Type	Raised curb							
RT Channelized			0			0		
Lanes	1	2	0	0	2	1		
Configuration	L	T			T	R		
Upstream Signal		0			0			
Minor Street	Eastbound			Westbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	272		651					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90		
Hourly Flow Rate, HFR (veh/h)	0	1837	335	811	1200	0		
Percent Heavy Vehicles	6	0	6	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		Y			N			
Storage		2			0			
RT Channelized			0			0		
Lanes	1	0	1	0	0	0		
Configuration	L		R					
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (veh/h)	811					302		723
C (m) (veh/h)	232							266
v/c	3.50							2.72
95% queue length	76.36							61.53
Control Delay (s/veh)	1165							812.5
LOS	F							F
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

## TWO-WAY STOP CONTROL SUMMARY

General Information			Site Information					
Analyst	Jason Carder		Intersection	SR 160 at Commerce Blvd.				
Agency/Co.	Mattern & Craig		Jurisdiction	City of Morristown				
Date Performed	10/26/2006		Analysis Year	2031				
Analysis Time Period	2031 PM							
Project Description SR 160 at Commerce Blvd. Intersection Study								
East/West Street:			North/South Street: SR 160					
Intersection Orientation: North-South			Study Period (hrs): 0.25					
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	237	1185			810	147		
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90		
Hourly Flow Rate, HFR (veh/h)	223	0	730	0	0	0		
Percent Heavy Vehicles	5	--	--	0	--	--		
Median Type	Raised curb							
RT Channelized			0			0		
Lanes	1	2	0	0	2	1		
Configuration	L	T			T	R		
Upstream Signal		0			0			
Minor Street	Eastbound			Westbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	201		657					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90		
Hourly Flow Rate, HFR (veh/h)	0	900	163	263	1316	0		
Percent Heavy Vehicles	6	0	6	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		Y			N			
Storage		2			0			
RT Channelized			0			0		
Lanes	1	0	1	0	0	0		
Configuration	L		R					
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (veh/h)	263					223		730
C (m) (veh/h)	634					102		546
v/c	0.41					2.19		1.34
95% queue length	2.04					19.43		31.65
Control Delay (s/veh)	14.6					632.7		186.0
LOS	B					F		F
Approach Delay (s/veh)	--	--				290.5		
Approach LOS	--	--				F		

Warrants Summary												
Information												
Analyst	Jason Carder					Intersection	SR 160 at Commerce Blvd.					
Agency/Co	Mattern & Craig					Jurisdiction	City of Morristown					
Date Performed	12/7/2006					Units	U.S. Customary					
Project ID	Intersection Study					Time Period Analyzed	2011					
East/West Street	Commerce Blvd.					North/South Street	SR 160					
File Name	Signal warrant.xhy					Major Street	North-South					
Project Description <i>Intersection Study</i>												
General						Roadway Network						
Major Street Speed (mph)	55	<input checked="" type="checkbox"/>	Population < 10,000				Two Major Routes				<input checked="" type="checkbox"/>	
Nearest Signal (ft)	3000	<input checked="" type="checkbox"/>	Coordinated Signal System				Weekend Count				<input checked="" type="checkbox"/>	
Crashes (per year)	6	<input checked="" type="checkbox"/>	Adequate Trials of Alternatives				5-yr Growth Factor				0	
Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	1	0	1	0	0	0	1	2	0	0	2	1
Lane usage	L		R				L	T			T	R
Vehicle Volume Averages (vph)	85	0	145	0	0	0	137	370	0	0	366	96
Peds (ped/h) / Gaps (gaps/h)	--	/	--	--	/	--	--	/	--	--	/	--
Delay (s/veh) / (veh-hr)	--	/	--	--	/	--	--	/	--	--	/	--
<b>Warrant 1: Eight-Hour Vehicular Volume</b>												<input checked="" type="checkbox"/>
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--												<input checked="" type="checkbox"/>
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--												<input checked="" type="checkbox"/>
1 80% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)												<input checked="" type="checkbox"/>
<b>Warrant 2: Four-Hour Vehicular Volume</b>												<input checked="" type="checkbox"/>
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)												<input checked="" type="checkbox"/>
<b>Warrant 3: Peak Hour</b>												<input checked="" type="checkbox"/>
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--												<input checked="" type="checkbox"/>
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)												<input checked="" type="checkbox"/>
<b>Warrant 4: Pedestrian Volume</b>												<input checked="" type="checkbox"/>
4 A. Pedestrian Volumes (Four hours --or-- one hour) --and--												<input checked="" type="checkbox"/>
4 B. Gaps Same Period (Four hours --or-- one hour)												<input checked="" type="checkbox"/>
<b>Warrant 5: School Crossing</b>												<input checked="" type="checkbox"/>
5. Student Volumes --and--												<input checked="" type="checkbox"/>
5. Gaps Same Period												<input checked="" type="checkbox"/>
<b>Warrant 6: Coordinated Signal System</b>												<input checked="" type="checkbox"/>
6. Degree of Platooning (Predominant direction or both directions)												<input checked="" type="checkbox"/>
<b>Warrant 7: Crash Experience</b>												<input checked="" type="checkbox"/>
7 A. Adequate trials of alternatives, observance and enforcement failed --and--												<input checked="" type="checkbox"/>
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--												<input checked="" type="checkbox"/>
7 C. 80% Volumes for Warrants 1A, 1B --or-- 4 are satisfied												<input checked="" type="checkbox"/>

<b>Warrant 8: Roadway Network</b>												<input checked="" type="checkbox"/>
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--												

8 B. Weekend Volume (Five hours total)	■
	■

### Warrants Volume

**Information**

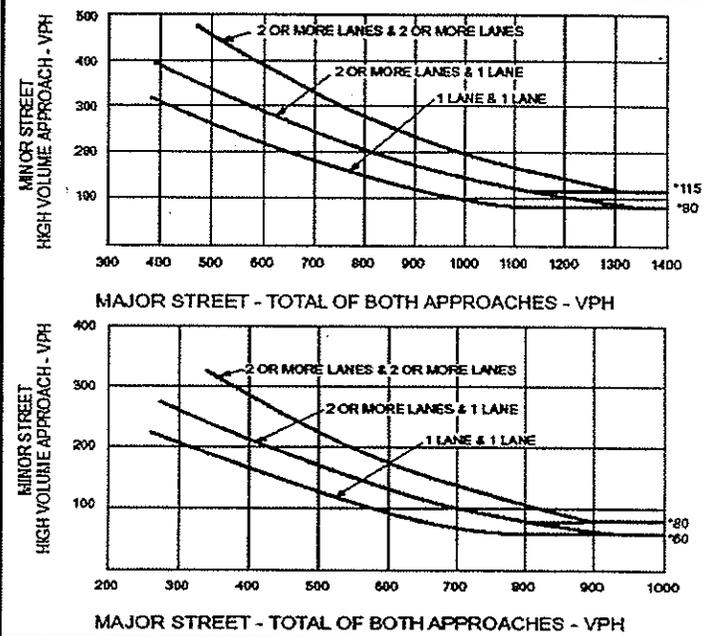
Analyst	Jason Carder	Intersection	SR 160 at Commerce Blvd.
Agency/Co	Mattern & Craig	Jurisdiction	City of Morristown
Date Performed	12/7/2006	Units	U.S. Customary
Project ID	Intersection Study	Time Period Analyzed	2011
East/West Street	Commerce Blvd.	North/South Street	SR 160
File Name	Signal warrantLxhy	Major Street	North-South

Project Description *Intersection Study*

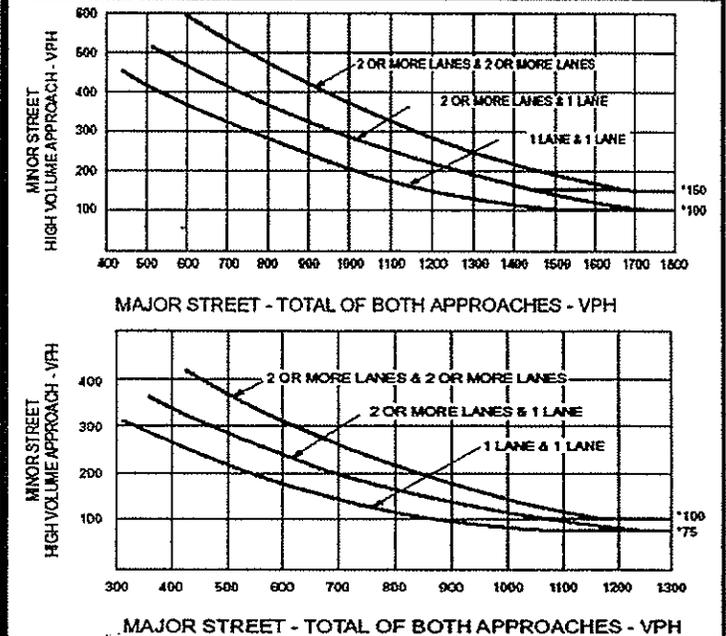
#### Warrant 1

Condition A - Minimum Vehicular Volume							Condition B - Interruption of Continuous Traffic								
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)			Vehicles per hour on higher-volume minor-street approach (one direction only)		Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)			Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%*	80%*	70%*	100%*	80%*	70%*	Major Street	Minor Street	100%*	80%*	70%*	100%*	80%*	70%*
1.....	1.....	500	400	350	150	120	105	1.....	1.....	750	600	525	75	60	53
2 or more...	1.....	600	480	420	150	120	105	2 or more...	1.....	900	720	630	75	60	53
2 or more...	2 or more...	600	480	420	200	160	140	2 or more...	2 or more...	900	720	630	100	80	70
1.....	2 or more...	500	400	350	200	160	140	1.....	2 or more...	750	600	525	100	80	70

#### Warrant 2



#### Warrant 3



#### Volume Summary

Hours	Major Street Lanes 2+			Minor Street Lanes 2+			Speed	55	Population		
	Major Volume	Minor Volume	Total Volume	1A (70%)	1A (56%)	1B (70%)	1B (56%)	2 (70%)	3A (70%)	3B (70%)	
06-07	1475	154	1629	Yes	Yes	Yes	Yes	Yes	No	Yes	
07-08	1988	485	2473	Yes	Yes	Yes	Yes	Yes	No	Yes	
08-09	760	109	869	No	No	Yes	Yes	No	No	No	
09-10	677	95	772	No	No	Yes	Yes	No	No	No	
10-11	478	90	568	No	No	No	No	No	No	No	
11-12	586	219	805	Yes	Yes	No	Yes	Yes	No	No	
12-13	723	160	883	Yes	Yes	Yes	Yes	Yes	No	No	
13-14	681	85	766	No	No	Yes	Yes	No	No	No	
14-15	851	163	1014	Yes	Yes	Yes	Yes	Yes	No	No	
15-16	1213	444	1657	Yes	Yes	Yes	Yes	Yes	No	Yes	
16-17	1037	307	1344	Yes	Yes	Yes	Yes	Yes	No	Yes	

17-18	1179	457	1636	Yes	Yes	Yes	Yes	Yes	No	Yes
Totals	11648	2768	14416	8	8	10	11	8	0	5

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## SHORT REPORT

General Information				Site Information			
Analyst	Jason Carder			Intersection	SR 160 at Commerce Blvd.		
Agency or Co.	Mattern & Craig			Area Type	All other areas		
Date Performed	12/7/2006			Jurisdiction	City of Morristown		
Time Period	2011 AM			Analysis Year			

Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	1		1				1	2			2	1
Lane Group	L		R				L	T			T	R
Volume (vph)	201		481				540	816			1223	223
% Heavy Vehicles	6		6				5	5			5	5
PHF	0.90		0.90				0.90	0.90			0.90	0.90
Pretimed/Actuated (PIA)	P		P				P	P			P	P
Startup Lost Time	2.0		2.0				2.0	2.0			2.0	2.0
Extension of Effective Green	2.0		2.0				2.0	2.0			2.0	2.0
Arrival Type	3		3				3	3			3	3
Unit Extension	3.0		3.0				3.0	3.0			3.0	3.0
Ped/Bike/RTOR Volume	0	0	0				0	0		0	0	0
Lane Width	12.0		12.0				12.0	12.0			12.0	12.0
Parking/Grade/Parking	N	0	N				N	0	N	N	0	N
Parking/Hour												
Bus Stops/Hour	0		0				0	0			0	0
Minimum Pedestrian Time		3.2						3.2			3.2	
Phasing	EB Only	02	03	04	NB Only	NS Perm	07	08				
Timing	G = 9.0	G =	G =	G =	G = 19.0	G = 30.0	G =	G =				
	Y = 6.5	Y =	Y =	Y =	Y = 6.5	Y = 6.5	Y =	Y =				
Duration of Analysis (hrs) = 0.25						Cycle Length C = 77.5						

Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate	223		534				600	907			1359	248
Lane Group Capacity	198		678				514	2467			1334	903
v/c Ratio	1.13		0.79				1.17	0.37			1.02	0.27
Green Ratio	0.12		0.45				0.72	0.72			0.39	0.59
Uniform Delay $d_1$	34.3		18.4				23.0	4.2			23.8	7.9
Delay Factor $k$	0.50		0.50				0.50	0.50			0.50	0.50
Incremental Delay $d_2$	102.0		9.0				94.7	0.4			29.4	0.8
PF Factor	1.000		1.000				1.000	1.000			1.000	1.000
Control Delay	136.2		27.4				117.8	4.7			53.2	8.6
Lane Group LOS	F		C				F	A			D	A
Approach Delay	59.4						49.7			46.3		
Approach LOS	E						D			D		
Intersection Delay	50.2			Intersection LOS						D		

## SHORT REPORT

General Information				Site Information			
Analyst	Jason Carder			Intersection	SR 160 at Commerce Blvd.		
Agency or Co.	Mattern & Craig			Area Type	All other areas		
Date Performed	12/7/2006			Jurisdiction	City of Morristown		
Time Period	2011 PM			Analysis Year			

Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	1		1				1	2			2	1
Lane Group	L		R				L	T			T	R
Volume (vph)	148		486				175	876			598	109
% Heavy Vehicles	6		6				5	5			5	5
PHF	0.90		0.90				0.90	0.90			0.90	0.90
Pretimed/Actuated (P/A)	P		P				P	P			P	P
Startup Lost Time	2.0		2.0				2.0	2.0			2.0	2.0
Extension of Effective Green	2.0		2.0				2.0	2.0			2.0	2.0
Arrival Type	3		3				3	3			3	3
Unit Extension	3.0		3.0				3.0	3.0			3.0	3.0
Ped/Bike/RTOR Volume	0	0	0				0	0		0	0	0
Lane Width	12.0		12.0				12.0	12.0			12.0	12.0
Parking/Grade/Parking	N	0	N				N	0	N	N	0	N
Parking/Hour												
Bus Stops/Hour	0		0				0	0			0	0
Minimum Pedestrian Time		3.2						3.2			3.2	
Phasing	EB Only	02	03	04	NB Only	NS Perm	07	08				
Timing	G = 7.0	G =	G =	G =	G = 8.0	G = 20.0	G =	G =				
	Y = 6.5	Y =	Y =	Y =	Y = 6.5	Y = 6.5	Y =	Y =				
Duration of Analysis (hrs) = 0.25						Cycle Length C = 54.5						

Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	Adjusted Flow Rate	164		540				194	973			664
Lane Group Capacity	219		601				494	2181			1264	945
v/c Ratio	0.75		0.90				0.39	0.45			0.53	0.13
Green Ratio	0.13		0.39				0.63	0.63			0.37	0.61
Uniform Delay $d_1$	22.9		15.5				5.0	5.1			13.5	4.4
Delay Factor k	0.50		0.50				0.50	0.50			0.50	0.50
Incremental Delay $d_2$	20.7		18.8				2.3	0.7			1.6	0.3
PF Factor	1.000		1.000				1.000	1.000			1.000	1.000
Control Delay	43.6		34.3				7.3	5.8			15.1	4.7
Lane Group LOS	D		C				A	A			B	A
Approach Delay	36.4						6.0			13.5		
Approach LOS	D						A			B		
Intersection Delay	16.3			Intersection LOS						B		

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Time Period	2031 AM			Analysis Year			

Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	1		1				1	2			2	1
Lane Group	L		R				L	T			T	R
Volume (vph)	272		651				730	1080			1654	302
% Heavy Vehicles	6		6				5	5			5	5
PHF	0.90		0.90				0.90	0.90			0.90	0.90
Pretimed/Actuated (P/A)	P		P				P	P			P	P
Startup Lost Time	2.0		2.0				2.0	2.0			2.0	2.0
Extension of Effective Green	2.0		2.0				2.0	2.0			2.0	2.0
Arrival Type	3		3				3	3			3	3
Unit Extension	3.0		3.0				3.0	3.0			3.0	3.0
Ped/Bike/RTOR Volume	0	0	0				0	0		0	0	0
Lane Width	12.0		12.0				12.0	12.0			12.0	12.0
Parking/Grade/Parking	N	0	N				N	0	N	N	0	N
Parking/Hour												
Bus Stops/Hour	0		0				0	0			0	0
Minimum Pedestrian Time		3.2						3.2			3.2	
Phasing	EB Only	02	03	04	NB Only	NS Perm	07	08				
Timing	G = 9.0	G =	G =	G =	G = 19.0	G = 30.0	G =	G =				
	Y = 6.5	Y =	Y =	Y =	Y = 6.5	Y = 6.5	Y =	Y =				
Duration of Analysis (hrs) = 0.25						Cycle Length C = 77.5						

Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate	302		723				811	1200			1838	336
Lane Group Capacity	198		678				514	2467			1334	903
v/c Ratio	1.53		1.07				1.58	0.49			1.38	0.37
Green Ratio	0.12		0.45				0.72	0.72			0.39	0.59
Uniform Delay $d_1$	34.3		21.5				23.2	4.8			23.8	8.5
Delay Factor k	0.50		0.50				0.50	0.50			0.50	0.50
Incremental Delay $d_2$	260.3		53.6				269.3	0.7			174.8	1.2
PF Factor	1.000		1.000				1.000	1.000			1.000	1.000
Control Delay	294.6		75.1				292.4	5.5			198.6	9.6
Lane Group LOS	F		E				F	A			F	A
Approach Delay	139.8						121.2			169.4		
Approach LOS	F						F			F		
Intersection Delay	144.9			Intersection LOS						F		

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Time Period	2031 PM			Analysis Year			

Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	1		1				1	2			2	1
Lane Group	L		R				L	T			T	R
Volume (vph)	201		657				237	1185			810	147
% Heavy Vehicles	6		6				5	5			5	5
PHF	0.90		0.90				0.90	0.90			0.90	0.90
Pretimed/Actuated (P/A)	P		P				P	P			P	P
Startup Lost Time	2.0		2.0				2.0	2.0			2.0	2.0
Extension of Effective Green	2.0		2.0				2.0	2.0			2.0	2.0
Arrival Type	3		3				3	3			3	3
Unit Extension	3.0		3.0				3.0	3.0			3.0	3.0
Ped/Bike/RTOR Volume	0	0	0				0	0		0	0	0
Lane Width	12.0		12.0				12.0	12.0			12.0	12.0
Parking/Grade/Parking	N	0	N				N	0	N	N	0	N
Parking/Hour												
Bus Stops/Hour	0		0				0	0			0	0
Minimum Pedestrian Time		3.2						3.2			3.2	
Phasing	EB Only	02	03	04	NB Only	NS Perm	07	08				
Timing	G = 19.0	G =	G =	G =	G = 7.0	G = 22.0	G =	G =				
	Y = 6.5	Y =	Y =	Y =	Y = 6.5	Y = 6.5	Y =	Y =				
Duration of Analysis (hrs) = 0.25						Cycle Length C = 67.5						

Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	Adjusted Flow Rate	223		730				263	1317			900
Lane Group Capacity	479		734				285	1812			1123	1082
v/c Ratio	0.47		0.99				0.92	0.73			0.80	0.15
Green Ratio	0.28		0.48				0.53	0.53			0.33	0.70
Uniform Delay d <sub>1</sub>	20.1		17.4				13.0	12.3			20.8	3.3
Delay Factor k	0.50		0.50				0.50	0.50			0.50	0.50
Incremental Delay d <sub>2</sub>	3.2		31.9				36.7	2.6			6.1	0.3
PF Factor	1.000		1.000				1.000	1.000			1.000	1.000
Control Delay	23.3		49.3				49.7	14.9			26.8	3.6
Lane Group LOS	C		D				D	B			C	A
Approach Delay	43.2						20.7			23.3		
Approach LOS	D						C			C		
Intersection Delay	27.4			Intersection LOS						C		