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US 11E Corridor Study
Jefferson and Hamblen Counties

FINAL REPORT
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Lakeway Area Metropolitan Transportation Planning Organization

TABLE OF CONTENTS

US 11E CORRIDOR STUDY
Lakeway Area Metropolitan
Transportation Planning Organization

CHAPTER 1

Introduction

Background

US 11E (State Route 34) is a major east Tennessee corridor extending from Knoxville to Bristol. Much of the route is a divided four-lane facility with limited adjacent development (largely due to its rural nature) and associated access points. These accesses range from single right in, right out (RIRO) driveways with no median opening to fully directional, signalized intersections.

The focus of this study is limited to the roughly 13-mile segment of US 11E between Jefferson City in Jefferson County and Morristown in Hamblen County. While the majority of this segment is as described above, a portion within the Morristown City Limits is characterized as a five-lane urban section having a continuous two-way left-turn lane.

Local engineering and planning officials in conjunction with the Lakeway Area Metropolitan Transportation Planning Organization (LAMTPO) have undertaken this study to work towards the improvement of this corridor in several areas. These include: (1) improved signal operation through heavily developed segments in Jefferson City and Morristown, (2) improvement of access at specific spot locations along the route, (3) access management considerations, particularly in relatively undeveloped portions of the route, and (4) environmental considerations of improvements.

Objectives

This study will provide recommendations toward the improvement of the corridor in the movement of current and future traffic volumes through assessment of current operational conditions. Operational objectives include: understanding current signal capabilities and limitations at each intersection, recognition of the traffic patterns and likely growth in each area of the corridor, and prioritized solution suggestions to allow staged implementation, if desired.

In providing the basic tenants of an access improvement strategy, several key components should be addressed. These include feasible improvements to existing intersections, the provision of guidelines and policy considerations for the creation of access at new developments, alterations of existing median openings, engineering and planning considerations such as the requirement of traffic impact studies, traffic operations along segments already having multiple signals, and the implementation of specific geometric design standards with respect to access points.

The goal of this study is to raise these issues and provide considerations and recommendations toward the completion of a defendable operation and access control policy, if so desired. These issues will be formulated specifically for the US 11E corridor and may not be applicable for other routes outside of the study area.

Current Operations

Currently, traffic operation through this corridor can be described as ranging from good to moderately congested depending on location and time of day. Typically, the level of service (LOS) methodology is used to describe traffic operations. This method is defined in the Transportation Research Board's publication, *Highway Capacity Manual 2000*. All procedures used in this study were completed in accordance with this manual. This method assigns roadway components with a LOS ranging from A (optimal conditions) to F (gridlock). Most jurisdictions in the state of Tennessee consider a LOS C or D to be a minimally acceptable service level.

In developing existing traffic operational characteristics, current traffic volumes have been increased using a standard linear regression (consistent with TDOT methods) to forecast future year volumes. For this study, the year 2010 is defined as the future base year and 2030 is the future design year.

For this facility, two types of operations have been analyzed: mainline flow and intersection operation. Each is described in the following paragraphs:

Mainline Traffic

Using existing TDOT-maintained traffic counting stations along US 11E and adjacent roadways, existing traffic counts have been forecast for the future years (see Figure 1-1). Given the roadway cross-sections and access needs in the vicinity of these count stations, coupled with the projected volumes, the following current and future levels of service are given in the chart below.

Mainline Capacity Analysis Summary
US 11E Corridor Study

Location	Jurisdiction	Time Period	Base ADT	DHF	Directional Split	Level of Service
Between SR 92 intersections	Jefferson City	AM 2003	19,300	10.30%	70 / 30	B
		AM 2010	22,300	10.30%	70 / 30	C
		AM 2030	30,800	10.30%	70 / 30	D
Between SR 92 and Chucky Pike	Jefferson City	PM 2003	25,800	9.30%	50 / 50	B
		PM 2010	29,300	9.30%	50 / 50	B
		PM 2030	39,400	9.30%	50 / 50	C
Between County Line and SR 160	Morristown	PM 2003	36,700	8.50%	65 / 35	B
		PM 2010	32,000	8.50%	65 / 35	B
		PM 2030	46,900	8.50%	65 / 35	C
Between SR 342 and Morris Blvd.	Morristown	PM 2003	29,100	9.10%	50 / 50	B
		PM 2010	30,700	9.10%	50 / 50	B
		PM 2030	35,200	9.10%	50 / 50	B
East of Morris Blvd.	Morristown	AM 2003	22,200	9.70%	50 / 50	B
		AM 2010	23,300	9.70%	50 / 50	B
		AM 2030	26,500	9.70%	50 / 50	B

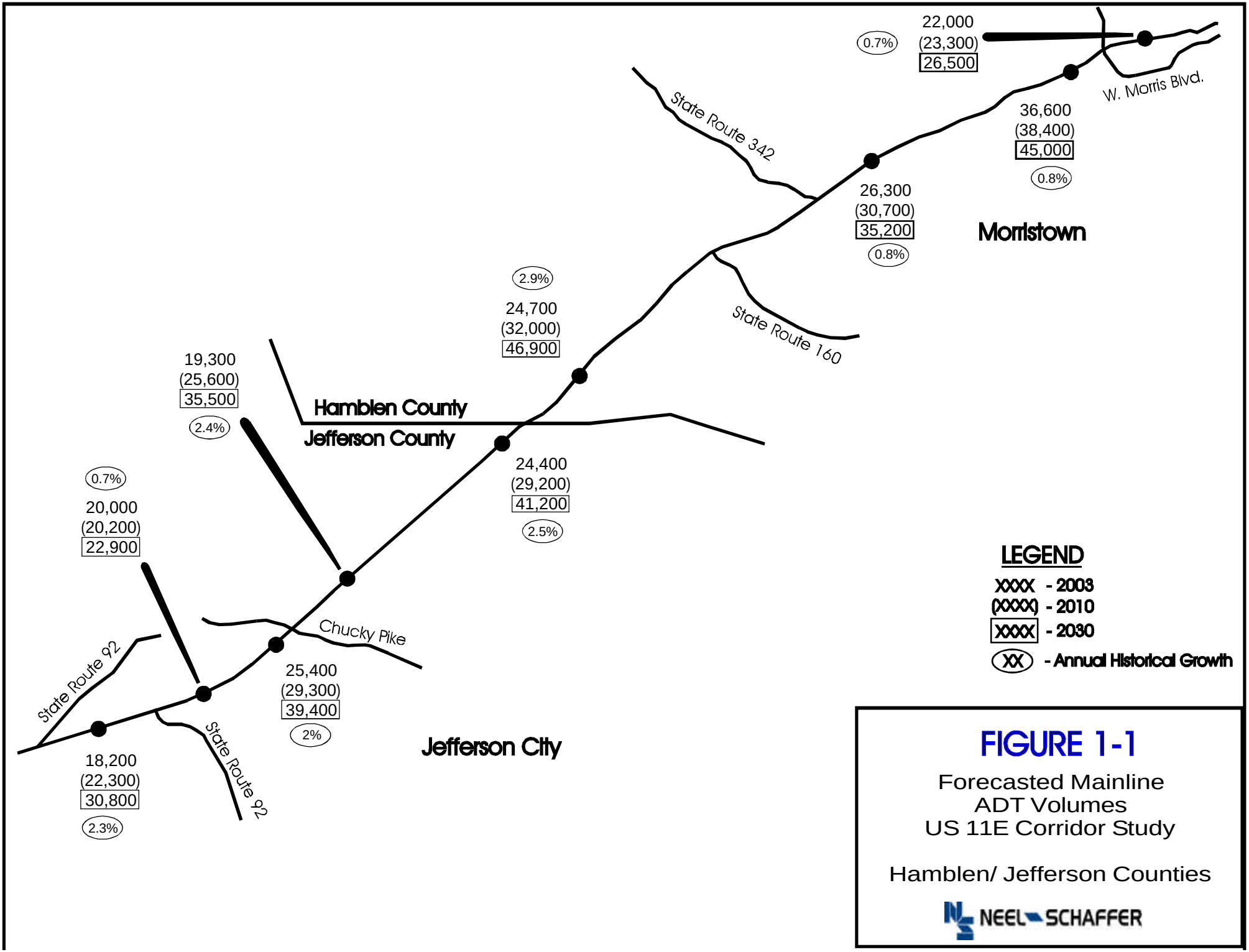

FIGURE 1-1

Forecasted Mainline
ADT Volumes
US 11E Corridor Study

Hamblen/ Jefferson Counties

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The analyses have shown that all segments of the study route are operating with very good levels of service currently, and are expected to be adequate through the 2030 design year.

Intersections

Two kinds of at-grade intersections exist along this route – signalized and two-way stop-controlled. No grade-separated intersections currently exist nor are any planned. Using current and forecasted turning movement counts (TMC), analysis has been completed in classifying the intersections' operational level of service (LOS). The LOS ranges from "A" describing an ideal, free-flow condition to "F", characterized by unacceptable congestion resulting in excessive user delays. In most areas, a LOS of "D" or better is generally considered acceptable. Procedures from the *Highway Capacity Manual (HCM)* 2000 (TRB Special Report 209) were used in determining levels of service. The *HCM* quantifies level-of-service in terms of average travel delay (control delay) per vehicle at signalized and stop-controlled intersections, in seconds.

Intersection operational levels are presented in each individual chapter.

Level of Service Thresholds
Signalized Intersections
Highway Capacity Manual

LOS	Control Delay (sec)
A	**< 10.0**
B	**10.0-20.0**
C	**20.0-35.0**
D	**35.0-55.0**
E	**55.0-80.0**
F	**>80.0**

Level of Service Thresholds
Stop-Controlled Intersections
Highway Capacity Manual

LOS	Control Delay (sec)
A	**< 10**
B	**10 - 15**
C	**15 - 25**
D	**25 - 35**
E	**35 - 50**
F	**> 50**

Travel Time

In addition to the level of service analyses, another methodology of measuring the corridor's efficiency was used. A travel time study is a good way to determine not only overall speeds and delays but specifically where the congestion points are occurring and the severity of them. Measured during AM and PM peak hours, the study used the "floating car" method in which the test vehicle follows the average flow of traffic through the corridor according to prevailing traffic conditions. A computer program was used in collection and analysis of the travel time data. This application, created by Neel-Schaffer, allows the traffic data to be efficiently and accurately measured. Using an electronic distance measuring device and a laptop computer, the software package records the distance between nodes (signalized intersections, approaches controlled by stop signs, interchange bridges, etc.). By distinguishing between the time the vehicle was stationary and when it was in motion, values for travel time, delay, average speed, and running speed can be calculated. Overall travel speeds as well as incremental speeds can be determined with this method. Two study runs were conducted in both directions of the subject route during peak travel periods, then averaged. Data was collected under typical weekday conditions; this excludes holidays, Monday morning peak periods, Friday afternoon peak periods, and atypical events such as crashes, severe inclement weather, etc. Using the computer-synchronized time and distance collection method, the following data is gathered:

- Average overall speed for the route and between intersections
- Average stop delay for the route and between intersections
- Average running speeds (overall speed minus stop delay)

For this corridor, current travel time data is presented on the following pages.

Route Name: US 11E *Peak Period:* AM Peak
Starting At: E Economy Dr *Ending At:* SR 92 South
Direction: WB

2 run(s) 18 links

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Speed (MPH) Average	Speed (MPH) Running
W Morris Blvd	0.15	67.0	44.0	0.5	8.3	24.2
Pearce Dr	0.25	26.5	0.0	0.0	34.1	34.1
Lowe's	0.43	37.5	0.0	0.0	41.0	41.0
W Economy Rd	0.27	39.0	10.0	0.5	25.2	33.9
White Ave	0.15	16.5	0.0	0.0	32.0	32.0
Central Church Rd	0.18	26.5	3.0	0.5	24.8	28.0
Mccrary Dr	0.25	26.0	0.0	0.0	34.6	34.6
Kidwell Ridge Rd	0.53	46.0	0.0	0.0	41.8	41.8
Panther Creek Rd (SR 342)	1.35	101.0	0.0	0.0	48.1	48.1
Collinson Rd (SR 160)	1.17	111.5	22.0	0.5	37.9	47.2
Talbott Kansas Rd (SR 341)	2.13	150.0	0.0	0.0	51.1	51.1
Odssey Rd	3.10	210.0	0.0	0.0	53.2	53.2
Chucky Pike	0.36	48.5	17.0	0.5	26.6	40.9
Hicks Rd	0.87	76.0	2.0	0.5	41.0	42.1
Odell St	0.30	27.5	0.0	0.0	39.8	39.8
George Ave	0.21	20.0	0.0	0.0	37.4	37.4
Russell Ave	0.20	27.5	5.0	0.5	25.5	31.2
Sr 92 South	0.17	26.5	3.0	0.5	23.6	26.6
Total	12.08	1083.5	106.0	4.0	34.8	38.2

Route Name: US 11E *Peak Period:* PM Peak
Starting At: E Economy Dr *Ending At:* SR 92 South
Direction: WB

2 run(s) 18 links

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Speed (MPH) Average	Speed (MPH) Running
W Morris Blvd	0.15	80.5	59.0	1.0	6.9	25.8
Pearce Dr	0.26	26.0	0.0	0.0	36.0	36.0
Lowe's	0.41	39.0	2.5	0.5	38.1	40.7
W Economy Rd	0.28	26.0	0.0	0.0	38.6	38.6
White Ave	0.15	13.0	0.0	0.0	40.9	40.9
Central Church Rd	0.18	16.0	0.0	0.0	40.4	40.4
Mccrary Dr	0.26	23.5	0.0	0.0	39.2	39.2
Kidwell Ridge Rd	0.53	65.5	14.5	0.5	29.2	37.5
Panther Creek Rd (SR 342)	1.34	105.5	7.0	0.5	45.9	49.1
Collinson Rd (SR 160)	1.17	133.5	40.0	1.0	31.6	45.2
Talbott Kansas Rd (SR 341)	2.13	148.0	0.0	0.0	51.8	51.8
Odssey Rd	3.10	210.0	2.5	0.5	53.1	53.8
Chucky Pike	0.36	44.5	8.5	0.5	29.3	36.3
Hicks Rd	0.86	87.0	9.0	0.5	35.7	39.8
Odell St	0.31	50.5	17.0	0.5	21.8	32.8
George Ave	0.21	27.5	3.5	0.5	26.9	30.9
Russell Ave	0.19	29.5	1.5	1.0	23.5	24.7
Sr 92 South	0.18	22.5	0.0	0.0	28.2	28.2
Total	12.07	1148.0	165.0	7.0	34.3	38.4

Route Name: US 11E *Peak Period:* AM Peak
Starting At: SR 92 South *Ending At:* E Economy Dr
Direction: EB

2 run(s) 18 links

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Speed (MPH) Average	Speed (MPH) Running
Russell Ave	0.17	29.5	6.0	0.5	21.3	26.7
George Ave	0.20	23.5	0.0	0.0	30.0	30.0
Odell St	0.21	38.0	8.5	1.0	19.7	25.4
Hicks Rd	0.30	28.5	0.0	0.0	38.5	38.5
Chucky Pike	0.88	88.5	17.0	0.5	35.7	44.2
Odssey Rd	0.35	35.0	1.5	0.5	36.2	37.9
Talbott Kansas Rd (SR 341)	3.10	218.0	0.0	0.0	51.3	51.3
Collinson Rd (SR 160)	2.13	177.5	20.5	0.5	43.2	48.8
Panther Creek Rd (SR 342)	1.17	88.0	0.0	0.0	48.0	48.0
Kidwell Ridge Rd	1.35	110.0	0.0	0.0	44.2	44.2
Mccrary Dr	0.53	52.0	0.0	0.0	36.8	36.8
Central Church Rd	0.25	46.0	18.5	0.5	19.8	33.2
White Ave	0.18	22.5	0.0	0.0	28.3	28.3
W Economy Rd	0.15	16.0	0.0	0.0	33.8	33.8
Lowe's	0.28	25.5	0.0	0.0	39.0	39.0
Pearce Dr	0.42	36.5	0.0	0.0	41.1	41.1
W Morris Blvd	0.26	45.5	16.0	0.5	20.6	31.8
E Economy Dr	0.15	25.0	4.5	0.5	22.1	26.9
Total	12.09	1105.5	92.5	4.5	33.9	37.0

Route Name: US 11E *Peak Period:* PM Peak
Starting At: Sr 92 South *Ending At:* E Economy Dr
Direction: EB

3 run(s) 18 links

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Speed (MPH) Average	Speed (MPH) Running
Russell Ave	0.17	29.3	8.0	0.3	21.4	29.4
George Ave	0.19	29.0	6.3	0.3	24.1	30.8
Odell St	0.21	30.3	4.3	0.7	24.5	28.5
Hicks Rd	0.30	36.7	6.7	0.3	29.8	36.5
Chucky Pike	0.88	71.0	0.0	0.0	44.5	44.5
Odssey Rd	0.35	33.3	2.3	0.3	38.0	40.9
Talbott Kansas Rd (SR 341)	3.10	208.3	0.0	0.0	53.6	53.6
Collinson Rd (SR 160)	2.13	158.3	4.7	1.0	48.4	49.9
Panther Creek Rd (SR 342)	1.17	88.3	0.0	0.0	47.7	47.7
Kidwell Ridge Rd	1.36	99.7	0.0	0.0	49.2	49.2
Mccrary Dr	0.52	51.7	5.0	0.3	36.2	40.0
Central Church Rd	0.25	33.0	4.7	0.3	27.5	32.0
White Ave	0.18	24.7	5.3	0.3	26.4	33.6
W Economy Rd	0.15	13.7	0.0	0.0	38.5	38.5
Lowe's	0.28	33.0	6.0	0.3	30.2	36.9
Pearce Dr	0.42	54.0	11.3	0.7	27.7	35.0
W Morris Blvd	0.26	49.0	14.7	0.7	19.3	27.5
E Economy Dr	0.15	29.7	10.0	0.3	18.6	28.1
Total	12.08	1073.0	89.3	6.0	33.6	37.9

Air Quality

In April 2004, Jefferson County, approximately 25% of which is within the Morristown urbanized area, was designated as an area failing to meet the Environmental Protection Agency's (EPA) current 8-hour ozone standard. This "non-attainment" status has, for this study, initiated documentation of the US 11E corridor's mobile source emissions as well as predictions for air quality improvements with implementation of certain projects.

This emissions data is presented based on analysis performed using the EPA's most current mobile source emissions model, Mobile 6.2. Using data specific to each subarea (see *Study Methodology*), the composite amount of volatile organic compounds (VOC), carbon monoxide (CO), and nitrous oxides (NOx) were determined as a rate of kilograms per day. This data is presented in each chapter.

Using computations of fuel consumption provided in the Synchro software, standard element emissions for each intersection are also provided. Where applicable, this specific air quality data is estimated based on peak hour data multiplied by a standard 10% peak hour factor to obtain a daily emissions rate.

These environmental rates are best used as relative indicators of corridor enhancement. In other words, rates from one intersection should not be compared to those of another intersection to determine which intersection has higher or lower rates. Instead, rates from each intersection should only be compared in a "before-after" scenario to determine likely air quality improvements. This is because the estimations in Synchro are based partly upon travel distance. While the travel distances between intersections along the US 11E corridor are accurate, travel distances on minor cross-street links are not, simply due to the nature of a corridor study as opposed to a network study.

Where significant decreases in emissions are expected with a recommended improvement, this is noted. In looking at the US 11E corridor (and with study limited to this corridor), the most practical way to shrink the emissions level is through improved traffic operations along the route. This usually manifests itself in improvements such as improved signal coordination.

Other Existing Roadway Conditions

In addition to the current operational characteristics, several other important features of the corridor have been analyzed. These characteristics generally have significant bearing on traffic operations. The following paragraphs describe each of these components – traffic signals and associated components, roadway geometrics, and signs and pavement markings.

Traffic Signals

Currently, there are 18 signalized intersections within the study area. The intersecting roads are:

- State Route 92 south
- Russell Avenue
- George Avenue
- Odell Avenue
- Hicks Road
- Chucky Pike

- Odyssey Road
- State Route 160
- State Route 342
- Kidwell Ridge Road
- McCrary Drive
- Central Church Road
- White Avenue
- W. Economy Road
- Barker Road (Lowe's Entrance)
- Pearce Drive
- West Morris Boulevard
- E. Economy Road

One additional signal is under design and is to be located at the intersection of US 11E and Merchants Green Road (under construction) in Morristown.

Roadway Geometrics

Overall, the roadway facility has been shown to fill the current needs of this area and functions well in most locations. Most problem areas occur as a result of intersection issues and/or access and driveway complications.

The five-lane segment that exists at the eastern project terminus at E. Economy Drive continues through the most heavily developed segment of the route, ending at McCrary Drive. From here, the route continues west through the project limits as a four-lane divided highway with occasional median openings.

Along mainline portions of the route, little or no problem exists with substandard horizontal or vertical curvature or sight distances.

Study Methodology

For a simplified and more meaningful analysis of the US 11E corridor, the project study area has been separated into five (5) subareas (see Figure 1-2). These subareas are defined based on prevailing characteristics including land use, density of development, roadway cross-section, traffic volume, speed limit, and development potential. These subareas should not be considered isolated study sections, but unique segments with differing improvement needs and possibilities. The goal for each should be to build off of the existing positive characteristics found in the subarea and move toward the improvement of deficiencies therein. The subareas are named and presented based only on their geographic position, from west to east. The five study subareas, their limits, and their lengths are as follow:

Subarea JC1 – From State Route 92 North to State Route 92 South (1.18± miles)
Subarea JC2 – From State Route 92 South to Hicks Road (1.13± miles)
Subarea R (Rural) – From Hicks Road to Howell Road (8.36± miles)
Subarea M1 – From Howell Road to McCrary Road (1.16± miles)
Subarea M2 – From McCrary Road to E. Economy Road (1.68± miles)

This document is arranged such that each subsequent chapter (2 through 6) contains information and recommendations pertaining to one of the subareas. Inside of each chapter, major headings present a broad characteristic of the subarea, defined in more detail in minor headings (for example, under the major heading land use falls the minor

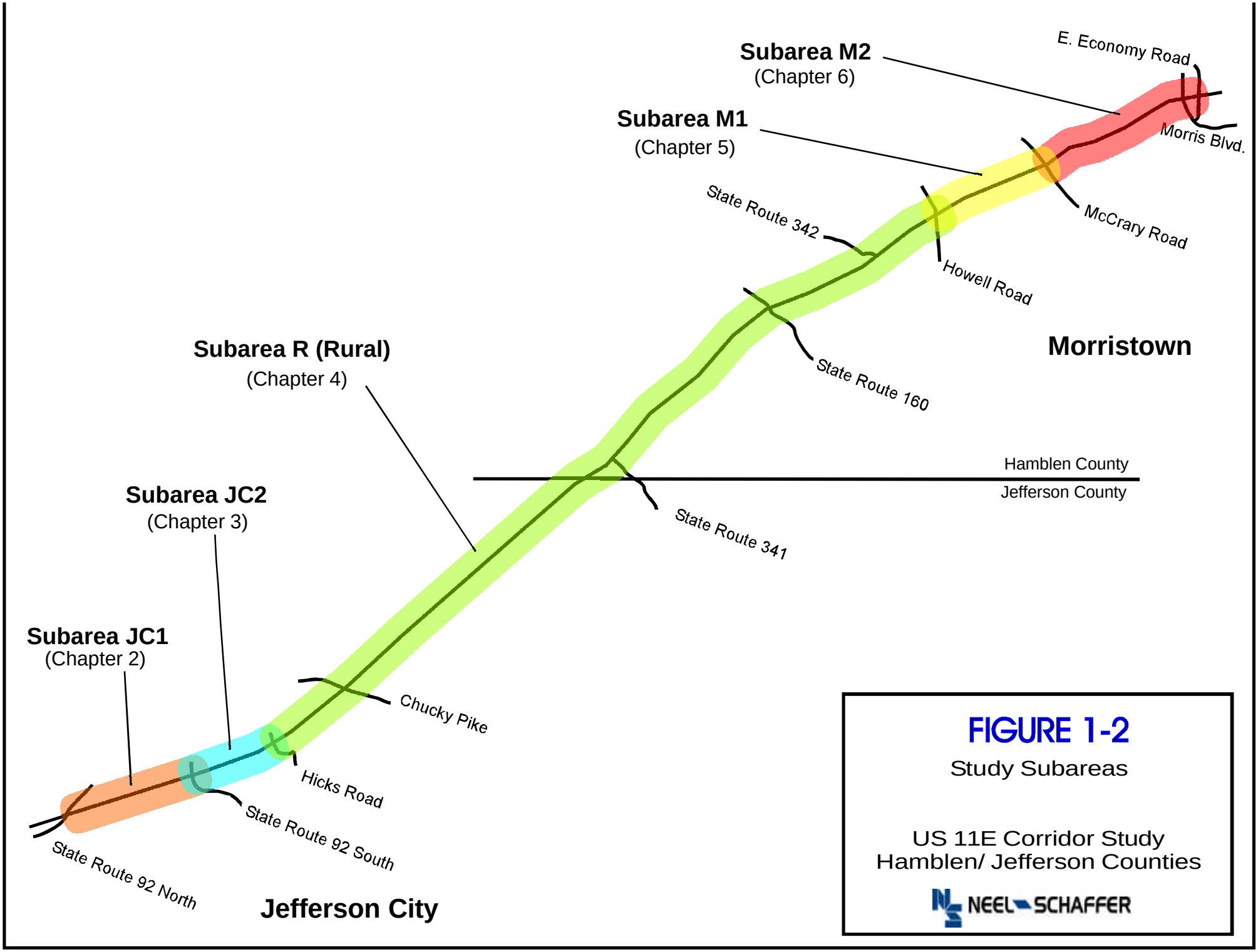

FIGURE 1-2

Study Subareas

US 11E Corridor Study
Hamblen/ Jefferson Counties

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headings of zoning, generators, etc.) Recommendations are summarized at the end of each chapter.

For many minor headings, graphics are given to clarify and/or visually represent the text. All schematics in plan view are meant for reference only and should not be used as design tools. Also, road widths, turning lane lengths, building footprints, property lines, and other relevant features are approximations and should not be regarded as official or legal maps. Figures may, however, be used to identify specific locations at which individual recommendations are made.

Paragraphs describing each major heading to be covered for the subareas follow.

Land Use

This major topic is presented to give a general overview of the type of subarea it is being described. The prevailing type of development will often be a major factor dictating the access needs of that area. Land use policies and goals may define some constraints or opportunities for access along US 11E. Minor headings include a general land use description, current zoning, parcel characteristics, major generators, and potential for future growth.

Traffic Analyses

The ability of the corridor to sustain growing traffic volumes should be determined before allowing significant additional access points. The purpose of this section is to describe the traffic analyses undertaken within each subarea and document existing traffic patterns. Use of this data is then used to promote or justify specific intersection improvements and plan for future corridor operation. Specifics found under the major heading include average daily traffic, turning movement counts (including peak periods and directional splits), signal properties including coordination, average speed and delay data, crash data, future traffic, levels of operational service, and air quality factors.

Much of the mainline and intersection analysis including levels of service, average delay, air quality, and progression benefits are made based on a model built in Trafficware's Synchro (Version 5) software. The model is based on current data from the US 11E corridor including link distances, lane configurations, traffic volumes, and traffic control. Using mathematical algorithms, the software estimates the traffic flow in the corridor and allows efficient and accurate analysis of various traffic characteristics.

Roadway Design and Access

Real improvements can only be made on the basis of solid roadway design principles. A recommendation of a right-turn lane from US 11E, for example, may carry with it right-of-way implications and these must be considered in the design of the improvement. For this example, it would not generally be prudent to design an 8' right turn lane to avoid the acquisition of additional right-of-way. At the same time, it should be understood that design guidelines carry a certain amount of flexibility and this may be exercised in the provision of practical operational or access solutions. Design specifics include right-of-

way, geometry of the mainline and intersections, shoulders, the type and location of curb, sidewalks and utility strips, intersection spacing, and medians and median openings.

Site Access and Circulation

Trips between some destinations within the study areas do not always require access to US 11E; traveling from a supermarket to a site outparcel located on the same property, for example. The use of driveways to maximize efficiency along this corridor and structuring access and egress of sites should be strongly considered. This section contains minor headings such as site layout for major generators, driveway design, parking layouts, the number and density of driveways, access to cross-streets, and supporting street networks.

Recommendations

This section contains the improvement suggestions and/or possibilities based on analysis of the above sections. Each improvement is given basic planning-level cost estimates. In these estimates, costs are only given to include construction and preliminary engineering costs, where applicable. Other costs such as utility relocation and right-of-way acquisition are not included.

Recommendations are also summarized at the end of each chapter. In this summary table, a suggested relative importance factor is offered. This number is meant to represent only the expected improvement likely to be experienced on the US 11E corridor with implementation of that recommendation. This list is not meant as a project priority listing, but may be used as a factor in the completion of one. Project scheduling should be set separately based on factors such as availability of funds and other site-specific opportunities (right-of-way availability, for example).

CHAPTER 2

Subarea JC1 – State Route 92 North to State Route 92 South *(1.18± miles)*

The western study limit is characterized by large-tract institutional uses, consistent access needs, and a rural setting.

Land Use

Description

Roughly 90% of the length of this section is currently defined by just four major trip generators. They are (from west to east): Jefferson Memorial Hospital, Farrar Funeral Home, the Jefferson school complex (containing a middle and an elementary school), and the Jefferson County Rehab Center. All of these generators are located on the south side of US 11E; the north side of the mainline is open pastureland with a few residences. The easternmost portion of this subarea is the beginning of the Jefferson City urban area and contains some smaller developments (more residences, two banks, a professional office, and a small restaurant).

Zoning

Four types of zoning are found along this segment. From SR 92 north to Peck Avenue on the south side of the corridor is a Professional and Civic District (P-1). Highway Business zoning (B-3) describes the north side of the highway from SR 92 north to approximately 600' west of Peck Avenue and on the south side from Peck Avenue through SR 92 south. Roughly 600' of frontage west from Peck Avenue is Single Family Residential District (R-1) and 900'± east from Peck Avenue is defined as Neighborhood Business District (B-1).

Generators

By far the largest generators in this area are the hospital and the school complex (these entities are also the two largest employers in Jefferson County). Currently, enrollments for Jefferson Middle School and Jefferson Elementary School are approximately 750 and 800 students, respectively. Jefferson Memorial Hospital is a new 58-bed facility built in 2001.

Parcels

Subarea JC1 currently describes 23 individual parcels with frontage to US 11E. Of this number, only 9 would require direct access to the corridor because of a lack of frontage to a minor cross-street, if developed. The area currently has 6 driveway openings onto US 11E. On the western end of this subarea, frontage lengths tend to be greater than on the eastern, more heavily developed end.

Growth Potential

Large open parcels immediately adjacent to the relatively high traffic volumes of US 11E and good access to Interstate 81 make this area attractive for future potential commercial

and/or residential development. However, with the opening of several new retail establishments in the Chucky Pike area, immediate growth seems more likely on the opposite end of Jefferson City (see Subarea R).

Traffic Analyses

Average Daily Traffic (ADT)

TDOT maintains one counting station within this subarea. Located roughly midway between State Routes 92 north and south, the station's 2003 ADT was 18,220 vehicles per day (counted as a total of both directions). Using a growth factor of approximately 2.3%, based on 17-year TDOT data, the projected ADT level here ranges from 22,300 in 2010 to almost 31,000 by the 2030 design year (see Figure 1-1). The growth rate here is indicative of healthy growth patterns for this region, though likely not directly attributed to activity within this area itself.

Turning Movement Counts

Turning movement counts at public streets were also made during AM and PM peak hours; generally, 11:45 AM – 12:45 PM and 3:00 – 4:00 PM in this subarea (additional counts were made at State Route 92 north, see *Signalization*). Using standard traffic growth procedures based on historical counts, movements for 2010 and 2030 have also been estimated. These are given in Chapter 3 as Figures 3-1 through 3-3.

Signalization

No signalized intersections exist in Subarea JC1 (analysis of the signal at SR 92 south is presented in Chapter 3). However, a request for specific study of the intersection of State Route 92 north at US 11E prompted additional analysis of this intersection. This analysis included a full 8-hour traffic turning movement count and evaluation and application of signal warrant procedures.

The eight heaviest hours of operation here are 7-8 AM and 12 PM-5 PM. From procedures outlined in the Manual on Uniform Traffic Control Devices (MUTCD), this intersection meets the following signal warrants:

- Warrant 1, 8-Hour Vehicular Volume: Often considered the most compelling warrant, this one demonstrates a possible need for signalization continuously throughout the day. The 70% factor of Condition B (Interruption of Continuous Traffic) is met (see MUTCD p. 4C-5).
- Warrant 2, 4-Hour Vehicular Volume: This warrant demonstrates a possible need for signalization due to the volume of intersecting minor-street traffic. The 100% and 70% factors are met in the 7:00, 3:00, 4:00, and 5:00 hours (see MUTCD p. 4C-7).
- Warrant 3, Peak Hour: Generally applicable for large origin/destination sites such as office complexes, this warrant checks undue delay for minor street traffic during 1 peak hour. Jefferson Memorial Hospital may be a large-generator site, but would generally not condense its trips to such short periods of the day. The 100% and 70% factors are met, however, during the 7:00, 8:00, 3:00, 4:00 and 5:00 hours (see MUTCD p. 4C-9).

If signalization is considered here (see *Recommendations*), the signal would likely operate without subsystem progression. Located more than 1 mile west of the SR 92 south intersection, the interval is too great to efficiently accommodate coordination without additional signals between this interval.

Speed and Delay

Due to the absence of signals or other delay factors, travel time and delay studies are not applicable in this section. School zones appear to slow traffic to an acceptable level and do not cause undue delay to mainline motorists.

Level of Service

As outlined in Chapter 1, procedures from the Highway Capacity Manual 2000 have been used to evaluate existing intersection operating conditions. In this section, the only notable intersection is that of SR 92 north (SR 92 south is covered in Subarea JC2). Analysis of this two-way stop-controlled intersection predicts operation at a minimum LOS "C" through the year 2010. By the 2030 design year, delays are likely to become excessive in turning left onto the mainline.

Air Quality

Estimates of mobile source emissions inside of Subarea JC1 reveal the following 2004 levels:

Composite VOC:	31.7 kg/day
Composite CO:	320 kg/day
Composite NOx:	43.6 kg/day

And in 2010:

Composite VOC:	22.8 kg/day
Composite CO:	233 kg/day
Composite NOx:	31.1 kg/day

Roadway Design and Access

Right-of-Way

Most of the route is characterized by a consistent 180' right-of-way. Toward the eastern end of the section, however, this tapers to 150' then to 100'. Most cross-streets have a minimum 50' right-of-way; the approaches of SR 92 north are situated inside of a 100' right-of-way.

Geometry

The mainline is a four lane section containing 4 @ 12' travel lanes separated by a non-traversable grass median. Only a few of the intersections have separate turn lanes, though all can adequately accommodate the existing traffic volumes. The relatively high speeds and rural nature of this section make separated left turn lanes from the mainline desirable.

Median Openings
Throughout the section limits, median openings are provided at various locations. Typically, these should be located at intersections with public streets and at a spacing consistent with TDOT's rural design criteria (880' preferred with 660' – 1760' being acceptable). The grass median through this section is a benefit to the mobility and integrity of US 11E and should be maintained.

Only one median opening does not conform to the TDOT criteria. This opening is located approximately 400' east of Universal Drive. Because this opening does not directly serve any driveway and other openings are nearby, this median opening should be closed. Overall, openings in the median have been controlled and well maintained.

Shoulders and Curb
Ditch drainage exists through this section. The 5' sidewalk and utility strip that exists through most of Jefferson City end in the vicinity of Sizer Avenue. A variable width paved outside shoulder exists through the remainder of the area which is dropped for separated right turn lanes at some locations. Standard width inside shoulders buffer the median on both sides.

The eastern limit of this area transitions into a more urban section.

Intersection Spacing
Through Subarea JC1, a total of six public street intersections exist. Except for SR 92 south, all are presently two-way stop controlled. All are located an appropriate distance from each other.

Site Access and Circulation

Site Layout
This subarea has two major generators for which site circulation is notable. The first, Jefferson Memorial Hospital is setback a significant distance from US 11E. This position ensures that traffic entering and leaving the site does not impede or complicate movements at the intersection. Site circulation here appears to be adequate.

The second site, the Jefferson Schools complex, has a higher concentration of trips, primarily during school dismissal in the early afternoon. Dismissal queues were noted to be encroaching on the mainline with some taking place on the shoulder or left turn lane of the mainline. This is of short duration, however, and does not appear to cause significant disruption to the mainline. Safety, of course, is paramount and this situation may be given attention.

Driveways
As stated in Land Use, the number of driveways is extremely limited, mainly due to the small number of developments. Also, entities such as the funeral home and the rehab center maintain access only from side streets. This type of access is exemplary and

should be continued to as great an extent possible in Subarea JC1. All other driveways accessing US 11E appear to be necessary and should be maintained.

Access to Cross-Streets

As mentioned above, minor cross-streets in this area allow connection to several relatively large generators. As development continues, connections to side roads should be encouraged.

Supporting Streets

By using State Route 92, connection to downstream eastern portions of the corridor could be accessed via Mountcastle Road and, ultimately, E. Old AJ Highway. The distance of these alternate routes from the mainline, however make the routes impractical and do not encourage significant alternate accesses to US 11E. In reality, a supporting street network is presently not available and is not needed through this area without significant new development.

Recommendations

Signalization

(1) Having fulfilled the warrants prescribed for consideration of installation of a signal and with observation of the amount and characteristics of the traffic, it is recommended that a signal be installed at the intersection of US 11E and State Route 92 north.

Due to the distance from every other signal (the closest is at SR 92 south, over 1 mile away), this intersection should operate independently. The signal should be fully actuated and designed to accommodate full eight-phase operation, though current side street geometrics would prohibit all phases from being used. Because the through and left turn lanes are shared, northbound and southbound side street movement could be accommodated simultaneously. Future traffic, however, may warrant the addition of separate left turn lanes from these approaches. This geometric improvement should be considered in signal planning; split phase operation should be avoided. *Estimated Costs: $85,000 (signal), $130,000 for lane improvements*

Another consideration is sight distance to the signal. Vertical curvature for eastbound traffic appears to be restricted at the proposed signal location. The need for active advance signal warning signs and beacons should be investigated during the signal design.

(2) Improvements to the signalized intersection at SR 92 south are presented in Subarea JC2.

Roadway Geometrics

To reduce driver conflict and structure turning movements from the mainline, the construction of separate left turn lanes at all median openings should be

considered. Whether at public streets, driveways, or for U-turns, this refuge will improve traffic flow along the corridor and increase the safety of left turns. Improvement should be considered at the following locations. *Estimated Costs: $22,000 (per turn lane), $10,000 (median closure)*

Median Improvement Recommendations
US 11E Corridor Study ~ Subarea JC1

Median Opening Location	Left Turn Lane EB	Left Turn Lane WB	Improvement*	Comments
1240' E of SR 92N (W entrance of Jefferson Middle School)	No	No	Add 200' WB and 50' EB left turn lanes.	If this is a school exit only, construct directional median opening.
2020' E of SR 92N (E entrance of Jefferson Middle School)	No	Yes	Add 50' EB left turn lane.	
At Universal Dr.	No	No	Add 50' EB and WB left turn lanes.	
390' E of Universal Dr.	No	No	Close median opening.	
1045' E of Universal Dr.	No	No	Add 50' EB and WB left turn lanes.	
At Peck Ave.	No	No	Add 50' EB and WB left turn lanes.	
At Sizer Ave.	No	Yes	Add 50' EB left turn lane.	
At Cedar Ave.	No	No	Add 50' EB and WB left turn lanes.	

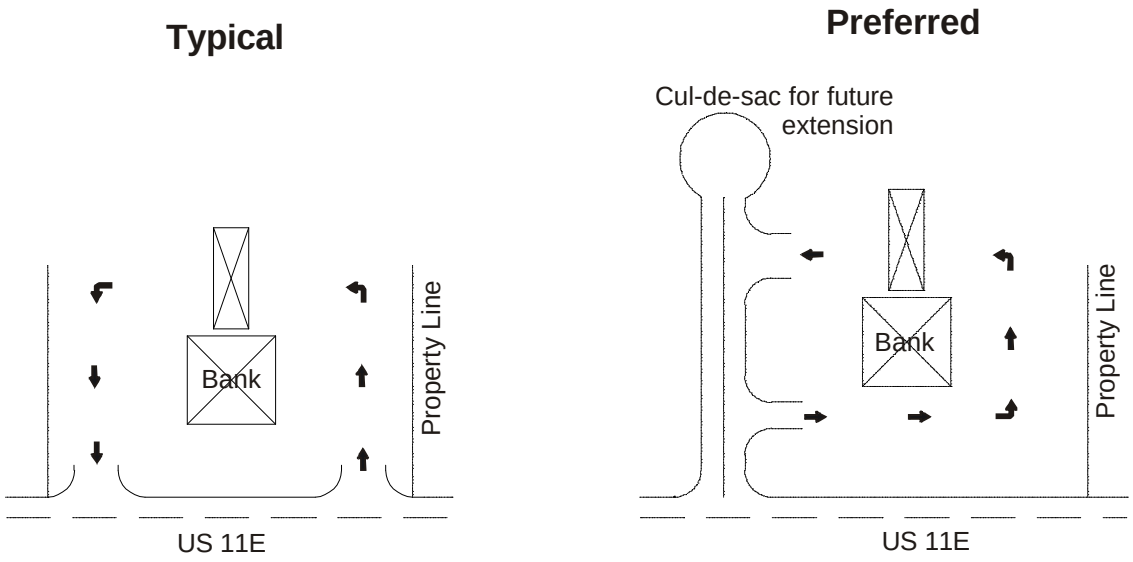
*NOTE: Distances shown are recommended queue storage lengths and do not reflect the total turn lane length.

Site Access

Because of limited development activity occurring in this area in the past, no retrofit recommendations are required. Instead, focus should be on the responsible planning of potential future growth of the area.

General guidelines for future development access in this area are as follow:

A. The number of driveway openings should be kept at a minimum. This is the easiest segment to drive, and likely the safest, due to the lack of driveway openings. While development of some parcels would require driveways, they should be constructed in such a way to allow future expansion, if possible. An example of this type of layout for a new bank with drive-through service is given on the next page.



B. Requests for new driveways onto US 11E in Subarea JC1 should only be considered if the following criteria are met:
   1. Reasonable access cannot be provided through an existing shared driveway arrangement or by connection to a minor cross-street (new or existing).
   2. The proposed driveway will be located outside of any existing intersection influence area.

C. Proposals for the construction of new public street intersections to US 11E in this area should be carefully considered. Preferred street characteristics include:
   1. Extended connectivity to streets other than US 11E. Dead-end streets should be discouraged.
   2. Location of intersections outside of the influence areas of existing intersections. The influence areas of the two intersections (existing and proposed) should not overlap.
   3. Additional signalization may be considered where established warrants are met and consideration of several related factors is satisfied. These include:
      i. Will the signal be beneficial for ongoing or future development activity and can it continue to operate efficiently into the future? A signalized intersection should not be approved for a subdivision containing a small number of houses if no additional growth can occur there, for example.
      ii. Is the spacing such that coordination can be achieved in the future? While communication between traffic control devices west of Jefferson City is likely only many years in the future, consideration of appropriate spacing should begin now.
      iii. What are the roles of the developer, the city, the county, TDOT, and others? Consideration must be made and necessary permits issued by appropriate parties.

4. Alignment across from existing streets, driveways, or median cuts is preferred.
5. Properties immediately adjacent to the proposed street should move access to the proposed street and off of US 11E, if possible.
6. New development should exclusively access adjacent minor streets, to as great an extent possible.

Summarized Improvement Recommendations
US 11E Corridor Study ~ Subarea JC1

Location	Improvement	Estimated Costs	Completion Rating (1=High, 5=Low)
US 11E at SR 92 north	Intersection improvement including signalization	$215,000	3
Various	Addition of separate left turn lanes	$22,000 per turn lane ($264,000 total)	3
East of Universal Dr	Median closure	$10,000	4

CHAPTER 3

Subarea JC2 – State Route 92 South to Hicks Road *(1.13± miles)*

The heart of Jefferson City's retail activity, Subarea JC2 is an urban corridor with many access demands in a small area.

Land Use

Description

Land use varies in this area from assorted commercial uses fronting US 11E, to residential just one block off of it, to institutional uses (churches, Carson Newman College) in close proximity. The US 11E corridor primarily serves many small individual businesses with little on-site connectivity between them.

Zoning

This section of the corridor lies wholly within the Highway Business District (B-3). Some Single Family (R-1), Multiple Family (R-2), and Neighborhood Business (B-1) zoning exists immediately north and south of the strip B-3 zone.

Generators

Subarea JC2 is made up of various types of retail properties, but none individually has an obvious significant impact on traffic patterns. Three supermarkets with associated retail are likely the biggest generators in this subarea. One of these properties, the Food Lion shopping center, also once housed a Wal-Mart which has relocated to a bigger site (see Subarea R).

Parcels

Subarea JC2 currently describes 49 individual parcels with frontage to US 11E. Of this number, 25 require direct access to the corridor because of a lack of frontage to a minor cross-street. The area currently has 46 driveway openings onto US 11E. Between Odell and Russell Avenues, frontage lengths are small, roughly averaging 100' but with some being 50' or less.

Growth Potential

Because of the small parcel size and the already dense use of existing land, major growth in this area is not expected. Several properties already posses multiple access points along US 11E and additional driveway openings are unlikely. The largest site currently available for redevelopment is the old Wal-Mart building, mentioned as part of the Food Lion shopping center. Access here is well defined, however, and should prove adequate even with the establishment of a new tenant.

The largest tracts of open land that could affect this portion of the corridor are located south of US 11E between Hicks Road and Odell Avenue. Significant commercial or

residential development could create a need for improvements to Hicks Road and its intersection with US 11E.

Traffic Analyses

Average Daily Traffic (ADT)

TDOT maintains one counting station within this subarea. Located between Russell and George Avenues, the station's 2003 ADT was 19,970 vehicles per day (counted as a total of both directions). Using a growth factor of just under 1%, based on 17-year TDOT data, the projected ADT level here ranges from 20,200 in 2010 to almost 23,000 by the 2030 design year (see Figure 1-1). The lower growth rates compared to Subareas JC1 and R on either side of this segment reinforces the fact that this urban area has slowed its growth due to a higher level of buildout. The growth rate here is comparable to that seen in the urban parts of Morristown (see Subareas M1 and M2).

Turning Movement Counts

Turning movement counts at public streets were also made during AM and PM peak hours; generally, 11:45 AM – 12:45 PM and 3:00 – 4:00 PM in this subarea. Using standard traffic growth procedures based on historical counts, movements for 2010 and 2030 have also been estimated. These are given as Figures 3-1 through 3-3.

Signalization

Five signalized intersections exist in Subarea JC2. A summary of an inventory of the signal equipment at each of these locations is presented below. None of the signals contain the necessary equipment to operate in any type of coordinated pattern, though traffic would benefit from coordination due to the spacing of the signals. All equipment, including signal heads, was found to be in good condition, but the corridor as a whole is not operating as efficiently as is possible. Signal improvement recommendations are given at the end of this chapter.

TRAFFIC SIGNAL EQUIPMENT INVENTORY

Intersection	Signal Controller	Signal Cabinet	Signal Phasing and Operation	Master Controller	Existing Signal Interconnect	Communications Equipment	Preemption Detection
US 11E at							
State Route 92 South	Transyt 3000	Pole	Isolated, Semi-Actuated, 4 Phase	None	None	None	No
Russell Avenue	Transyt 3000	Base	Isolated, Actuated, 3 Phase	None	None	None	No
George Avenue	Transyt 3000	Base	Isolated, Actuated, 4 Phase	None	None	None	No
Odell Avenue	Transyt 3000	Pole	Isolated, Semi-Actuated, 3 Phase	None	None	None	No
Hicks Road	Transyt 3000	Pole	Isolated, Semi-Actuated, 3 Phase	None	None	None	No

Speed and Delay

As outlined in Chapter 1, speed and delay data has been gathered through the entire length of the corridor. The results for Subarea JC2 follow.

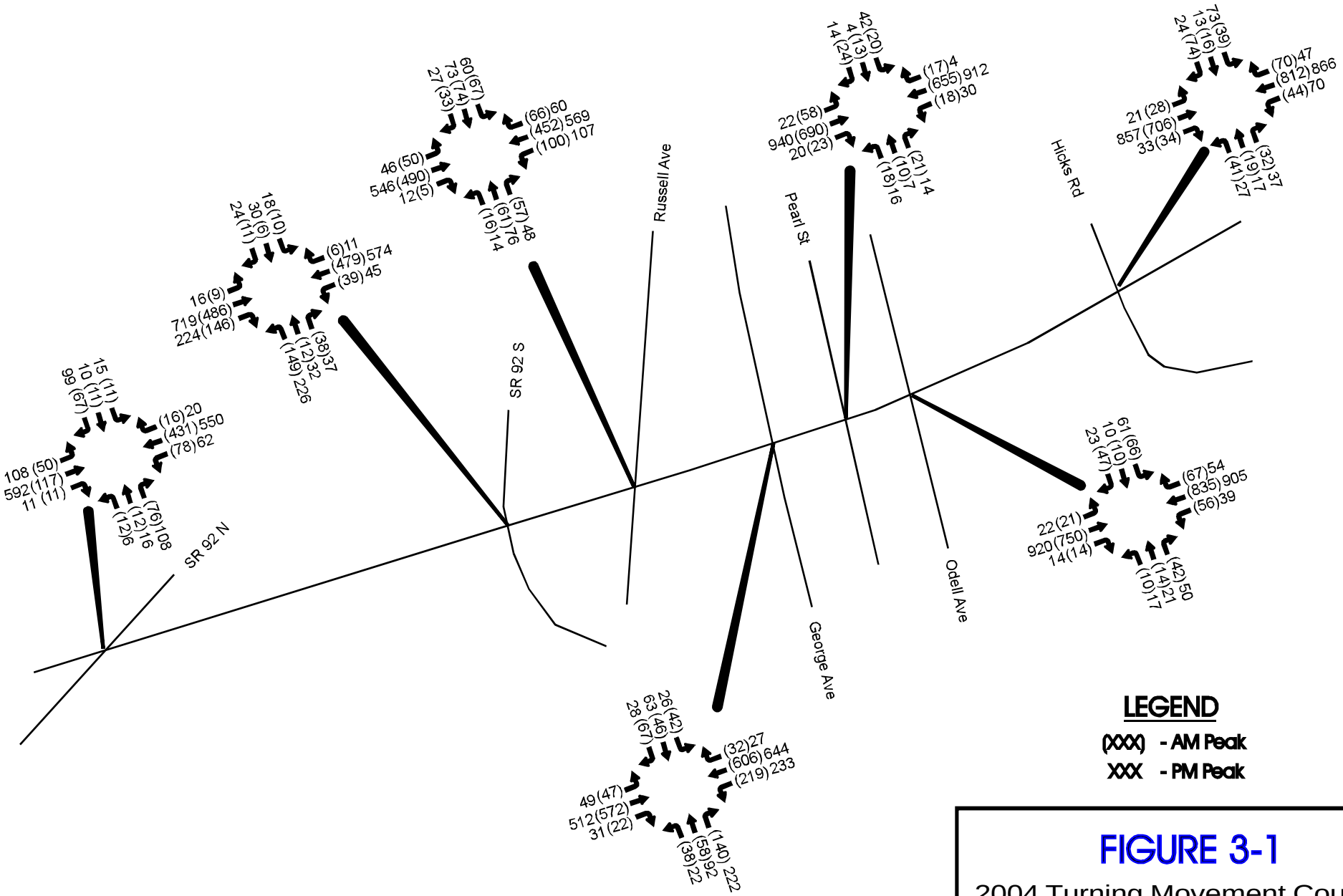


FIGURE 3-1

2004 Turning Movement Counts
US 11E Corridor Study

Subareas JC1, JC2

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

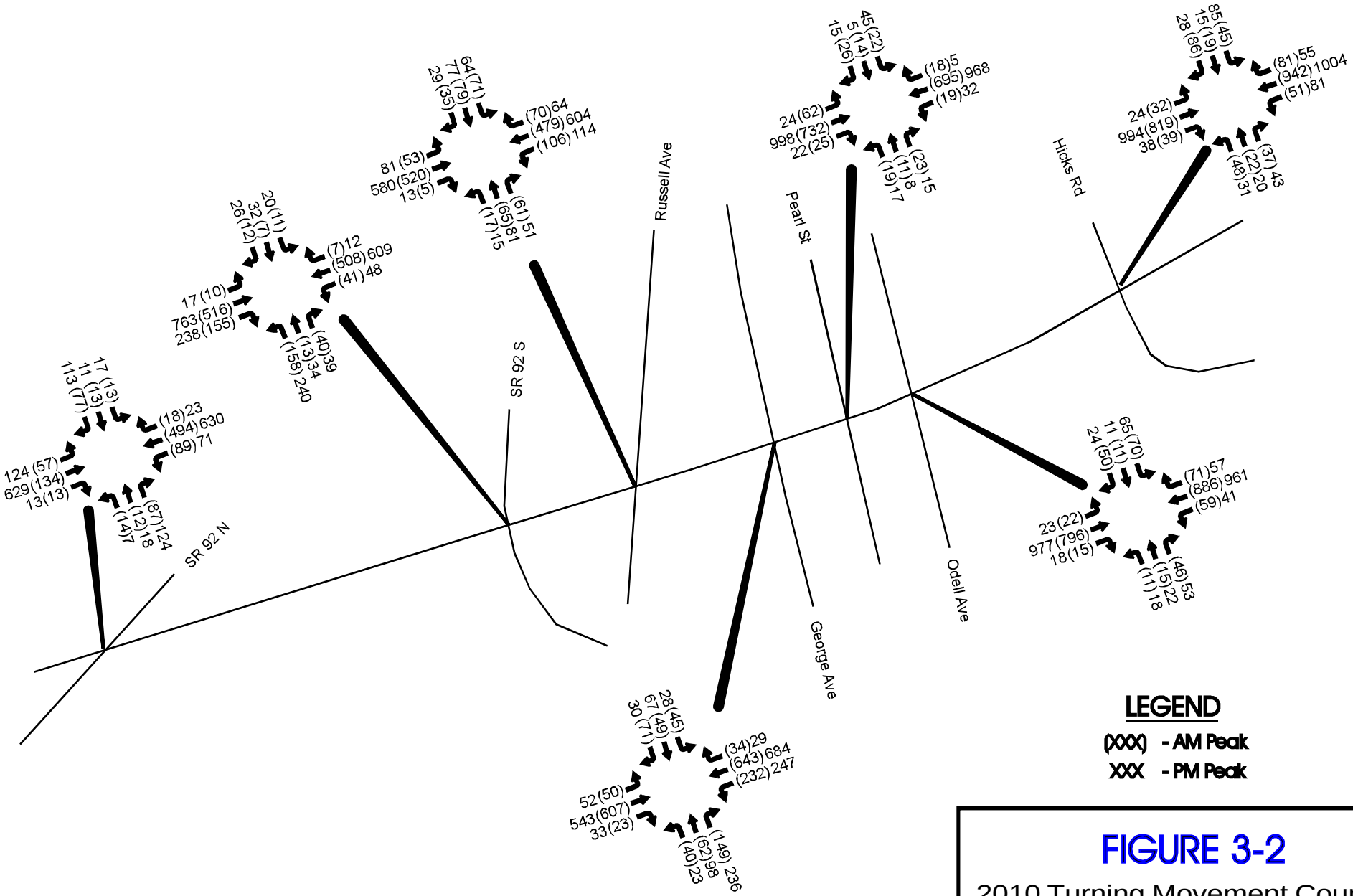


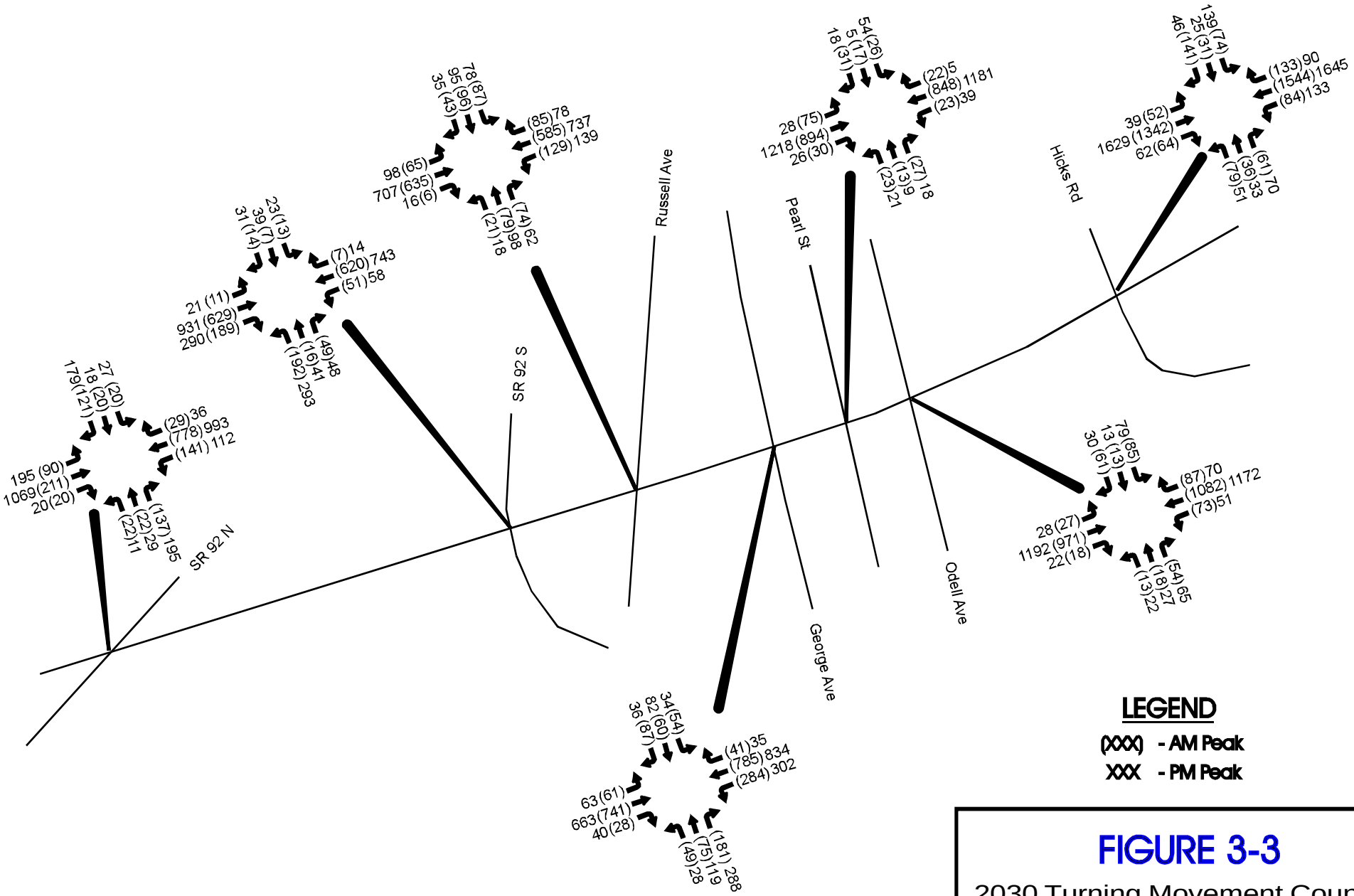
FIGURE 3-2

2010 Turning Movement Counts
US 11E Corridor Study

Subareas JC1, JC2

Hamblen/ Jefferson Counties

NEEL-SCHAFFER



LEGEND

(XXX) - AM Peak

XXX - PM Peak

FIGURE 3-3

2030 Turning Movement Counts
US 11E Corridor Study

Subareas JC1, JC2

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
SR 92 South							
Russell Ave	0.17	29.5	6.0	0.5	40	21.3	26.7
George Ave	0.20	23.5	0.0	0.0	40	30.0	30.0
Odell St	0.21	38.0	8.5	1.0	40	19.7	25.4
Hicks Rd	0.30	28.5	0.0	0.0	40	38.5	38.5
Total	0.88	119.5	14.5	1.5		27.4	30.1

Leaving Jefferson City (EB) during the AM peak.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
Hicks Rd							
Odell St	0.30	27.5	0.0	0.0	40	39.8	39.8
George Ave	0.21	20.0	0.0	0.0	40	37.4	37.4
Russell Ave	0.20	27.5	5.0	0.5	40	25.5	31.2
Sr 92 South	0.17	26.5	3.0	0.5	40	23.6	26.6
Total	0.88	101.5	8.0	1.0		31.6	33.8

Entering Jefferson City (WB) during the AM peak.

During the AM peak, stops were noted on every link except between Hicks Road and Odell Avenue. Delays at these signals were not excessive, but the deceleration, stop, and acceleration times contributed to an average travel speed as low as 20 mph on some occasions.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
SR 92 South							
Russell Ave	0.17	29.3	8.0	0.3	40	21.4	29.4
George Ave	0.19	29.0	6.3	0.3	40	24.1	30.8
Odell St	0.21	30.3	4.3	0.7	40	24.5	28.5
Hicks Rd	0.30	36.7	6.7	0.3	40	29.8	36.5
Total	0.88	125.3	25.3	1.7		24.9	31.3

Leaving Jefferson City (EB) during the PM peak.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
Hicks Rd							
Odell St	0.31	50.5	17.0	0.5	40	21.8	32.8
George Ave	0.21	27.5	3.5	0.5	40	26.9	30.9
Russell Ave	0.19	29.5	1.5	1.0	40	23.5	24.7
Sr 92 South	0.18	22.5	0.0	0.0	40	28.2	28.2
Total	0.88	130.0	22.0	2.0		25.1	29.1

Entering Jefferson City (WB) during the PM peak.

The PM peak here experiences a lower level of operations as stops at many of the signals may be expected (data showed that out of three trips through this segment, at least one stop was incurred at each intersection). Delays due to stops may also be higher and could range from as little as two seconds to as much as twenty. Average travel speeds are also lower (about 25 mph).

Level of Service

As outlined in Chapter 1, procedures from the *Highway Capacity Manual 2000* have been used to summarize intersection operation in base and future years. The table below presents the current and future LOS of each signalized intersection, assuming no improvements are made.

Signalized Intersection Capacity Analysis Summary
US 11E Corridor Study ~ Subarea JC2

Intersection Cross-Street	Time Period	Avg. Intersection Delay (sec.)	Level of Service	Time Period	Avg. Intersection Delay (sec.)	Level of Service
State Route 92 S	AM 2004	12.2	B	PM 2004	15.7	B
	AM 2010	13.4	B	PM 2010	16	B
	AM 2030	14.4	B	PM 2030	19.4	B
Russell Avenue	AM 2004	12.6	B	PM 2004	12.5	B
	AM 2010	12.9	B	PM 2010	12.7	B
	AM 2030	15.7	B	PM 2030	15.2	B
George Avenue	AM 2004	12.1	B	PM 2004	14	B
	AM 2010	12.6	B	PM 2010	15	B
	AM 2030	15.9	B	PM 2030	21.8	C
Odell Avenue	AM 2004	9.6	A	PM 2004	9.6	A
	AM 2010	9.9	A	PM 2010	10	A
	AM 2030	12.5	B	PM 2030	11.6	B
Hicks Road	AM 2004	8.7	A	PM 2004	10.5	B
	AM 2010	10.7	B	PM 2010	11.6	B
	AM 2030	30.7	C	PM 2030	56.9	E

From the results above, all intersections are expected to operate acceptably through the 2030 design year with the exception of Hicks Road. Here, the high number of eastbound and westbound through movements cause operations to reach unacceptable levels of service by the 2030 design year. It is possible, however, that improvement to the signal timings here could offset the high volumes and return operations to an acceptable service level.

Air Quality

Analysis of the Subarea JC2 segment yields the following emissions estimates for 2004 and 2010:

Air Quality Estimations
US 11E Corridor Study ~ Subarea JC2

Intersection Cross-Street	Time Period	CO Emmissions (kg/day)	NOx Emmisions (kg/day)	VOC Emmisions (kg/day)
State Route 92	2004	49.8	9.5	11.5
	2010	53.1	10.3	12.3
Russell Avenue	2004	15.0	2.9	3.5
	2010	16.4	3.2	3.7
George Avenue	2004	20.1	3.9	4.7
	2010	21.8	4.2	5.1
Odell Avenue	2004	24.1	4.7	5.6
	2010	26.0	5.1	6.0
Hicks Road	2004	25.0	4.9	5.8
	2010	28.5	5.5	6.6
Mainline	2004	415.8	57.9	44.7
	2010	285.8	38.9	30.1
TOTALS	**2004**	**549.8**	**83.8**	**75.8**
	2010	**431.5**	**67.2**	**63.8**

Roadway Design and Access

Right-of-Way

From Hicks Road to just east of Odell Avenue, the right-of-way is consistent at 180'. From here through the rest of this segment, a 100' right-of-way is held. The right-of-way of cross streets varies from approximately 100' on SR 92 to 50' or less for more minor streets in this area.

Geometry

The mainline is a four lane section containing 4 @ 12' travel lanes separated by a non-traversable grass median. Most intersections have appropriate turn lanes and can adequately accommodate the existing traffic volumes; this is usually characterized by at least a separate left turn lane on the mainline.

Median Openings

Throughout the section limits, median openings are provided at various locations. Typically, these should be located at intersections with public streets and at a spacing consistent with TDOT's urban design criteria (660' preferred with 4400' – 880' being acceptable). Median opening spacings here are largely compliant with this current TDOT policy.

The grass median through this section is a benefit to the mobility and integrity of US 11E and should be maintained. A noticeable problem with the median comes generally at locations where a full median opening is provided, but no additional separated turn lanes exist. At these situations, two or more vehicles may enter a median opening from the same direction, resulting in conflicts. This situation occurs at Pearl Avenue and should be considered for correction (see *Recommendations*).

Closely spaced median openings (here at the Food City driveway and Odell Avenue) can be problematic.

Shoulders and Curb

Curb-and-gutter drainage exists through most of this section. A 5' sidewalk and utility strip is located outside and adjacent to the curb. A 1' – 2' inside shoulder buffers the grass median on both sides.

Sidewalks

Sidewalks exist on both sides of the road through most of the limits defined as Subarea JC2. In-depth study would likely reveal several problems in conforming to ADA standards, including: poor condition (cracks over ½" wide), broken segments, obstacles in the path of the sidewalk, and a lack of sidewalk ramps. Also, no signalized intersection provides pedestrian displays and pushbutton activation. Painted crosswalks do not exist on any approach of an intersection.

This area is especially suited to increased pedestrian travel. A large number of residences are located less than ¼ mile from this shopping corridor which includes establishments such as groceries, restaurants, banks, etc. Also, with the 2,200-student Carson-Newman College located in close proximity, pedestrian improvements may be justified.

Intersection Spacing

Through Subarea JC2, existing signalized intersections are spaced an average of approximately ¼ mile apart. This spacing is very good from a signal coordination standpoint. Several other unsignalized intersections exist in the area, but would not likely hinder the progression capabilities between Hicks Road and State Route 92.

Site Access and Circulation

Site Layout

As discussed under Land Use, this subarea has few major generators for which site circulation is notable; at the Food Lion shopping center site, however, several steps have been taken to alleviate the impacts to US 11E from generated traffic. Methods used here include shared driveways (with McDonald's), right-in, right-out only driveways,

separated turn lanes into full-movement driveways, and access to a signal via a side street (Russell Avenue).

Most developments are individual smaller businesses relying less on internal movements and more on access to US 11E. Along the 1.13± mile section, 46 driveway openings exist. Added to the 9 public roads, this is an average access density of 49 access points per mile. Parking is generally sufficient and does not appear to interfere with operation of the driveways.

Driveways

Partly due to the small frontage lengths on US 11E for individual frontage and partly due to a perceived advantage of having direct access to the arterial, most businesses maintain at least one driveway onto US 11E. While more driveways may mean a perceived convenience for the business owner and patrons, they raise the accident rate, average delay, and overall integrity of this principal arterial.

Several of the properties within this section maintain two driveways onto US 11E and some have an additional driveway onto an adjacent cross street. The radii of some separate driveways touch, separated by as little as a 5' grass strip or section of curb. Such redundant driveways should be considered for removal.

Some businesses in this area, however, operate well on shared driveways. Just east of Odell Avenue, four businesses (El Sazon Restaurant, Pizza Hut Restaurant, Advance Auto Parts, and a dry cleaners) effectively operate with two right-in, right-out driveways onto US 11E. An additional access onto Odell Avenue also helps traffic access this site, but not at the expense of disruption to the mainline.

Overall, given the small lot sizes, the number of businesses, and the built-up nature of the area, existing driveways are numerous but have been relatively well managed.

Access to Cross-Streets

Of the 49 individual parcels with frontage onto US 11E, 24 are situated on a corner of a public road, therefore with frontage onto two streets. Of these, three properties do not contain direct access onto US 11E. These properties operate with one or more access points from the minor street and/or through a shared driveway arrangement. These properties are (1) George Street Methodist Church, (2) a bank (under construction) at Pearl Avenue, and (3) a car lot owned by Farris Motors at Harrington Street.

Other properties that do maintain direct access from their US 11E frontage have connected a significant distance from the intersection; the driveway to College Park Shopping Center from US 11E, for example, is located almost 400' from Hicks Road. Keeping driveways outside of the functional areas of intersections helps traffic move best at both the intersection and the driveway.

Supporting Streets

Subarea JC2 has the benefit of a parallel supporting street network connecting several of its minor cross streets. On the north side of the corridor, Elmwood Street, Jefferson Street, and Ellis Street allow traffic to move from SR 92 south to Hicks Road without access US 11E. Likewise, on the south side, traffic could conceivably move between Russell Avenue and Odell Avenue by using Highland Street and E. Elmwood Street. The benefit of most of the streets listed here is that they border the back of the properties fronting US 11E. While a few businesses take advantage of this "dual frontage", most do not.

E. Jefferson St. provides ideal rear access to the Taco Bell restaurant.

Recommendations

Signalization

Traffic congestion is increasingly becoming an important quality of life issue in many areas of the country. Uncoordinated signals in urban areas greatly contribute to congestion. A complete, properly maintained traffic management system has been shown to significantly reduce congestion as well as vehicle emissions.

Although an advanced traffic control system may include many different elements, the study focuses on the following strategies as being most suitable to Jefferson City:

- Use of a tiered approach to divide signals into prioritized groups and subgroups.
- Implementation of a communication network to connect and coordinate traffic signals.
- Establishment of a centralized location from which all signals may be remotely controlled and monitored.
- Implementation of a traffic surveillance program utilizing closed-circuit video cameras.

Advanced traffic management systems, which include the measures above, have proven to be a very cost effective element in managing traffic demand. Before/after studies have shown welcomed results.

Base Condition	Potential Improvement in Speed or Travel Time
Non-interconnected, pre-timed signals with old timing plans	25%
Existing Interconnected signal system with old timing plans	17%
Non-interconnected signals under actuated control	16%

Source: A Toolbox for Alleviating Traffic Congestion, ITE, 1989.

(1) An effective improvement to enhance movement through the corridor is establishing and implementing a signal coordination program for the five signalized intersections defined by Subarea JC2.

In estimating the benefits to an updated timing program, Synchro was used to optimize cycle offsets while maintaining a cycle length of 90 seconds. This analysis was completed for the PM peak scenarios of 2004 and 2010. Comparison results of the existing system versus the optimized system are below.

2004:

Location	*Before* Avg. Delay (sec)	*After* Avg. Delay (sec)	*Before* LOS	*After* LOS	*Before* CO Emmissions (kg/day)	*After* CO Emmissions (kg/day)	*Before* Nox Emmisions (kg/day)	*After* Nox Emmisions (kg/day)	*Before* VOC Emmisions (kg/day)	*After* VOC Emmisions (kg/day)
State Route 92 S	15.7	13.8	B	B	49.8	48.4	9.5	9.4	11.5	11.2
Russell Avenue	12.5	8.4	B	A	15.0	13.5	2.9	2.6	3.5	3.1
George Avenue	14	9.6	B	A	20.1	18.5	3.9	3.6	4.7	4.3
Odell Avenue	9.6	8	A	A	24.1	21.5	4.7	4.2	5.6	5.0
Hicks Road	10.5	8.4	B	A	25.0	21.9	4.9	4.3	5.8	5.1
Mainline	N/A	N/A	N/A	N/A	415.8	415.8	57.9	57.9	44.7	44.7
TOTAL	**N/A**	**N/A**	**N/A**	**N/A**	**549.8**	**539.5**	**83.8**	**82.0**	**75.8**	**73.4**

2010:

Location	*Before* Avg. Delay (sec)	*After* Avg. Delay (sec)	*Before* LOS	*After* LOS	*Before* CO Emmissions (kg/day)	*After* CO Emmissions (kg/day)	*Before* Nox Emmisions (kg/day)	*After* Nox Emmisions (kg/day)	*Before* VOC Emmisions (kg/day)	*After* VOC Emmisions (kg/day)
State Route 92 S	16	15.9	B	B	53.1	48.0	10.3	10.0	12.3	12.0
Russell Avenue	12.7	12.2	B	B	16.4	17.5	3.2	3.4	3.7	4.0
George Avenue	15	15	B	B	21.8	21.5	4.2	4.2	5.1	5.0
Odell Avenue	10	9.5	A	A	26.0	25.0	5.1	4.9	6.0	5.8
Hicks Road	11.6	11.8	B	B	28.5	30.6	5.5	5.9	6.6	7.1
Mainline	N/A	N/A	N/A	N/A	285.8	285.8	38.9	38.9	30.1	30.1
TOTAL	**N/A**	**N/A**	**N/A**	**N/A**	**431.6**	**428.4**	**67.2**	**67.3**	**63.8**	**64.0**

From this data (in 2004), it can be concluded that introduction of a coordinated signal system in this area could decrease overall average delay by over 20% and could decrease total mobile source emissions by roughly 8% or 15 kg/day.

(2) In implementing a JC2 signal system between SR 92 and Hicks Road, several communication methods may be considered:

- **Twisted-Pair** cable is a commonly used communication technology in traffic control system operations. The cable typically consists of multiple twisted pair, shielded, 300-volt communications "telephone type" cable with varying conductor sizes. The cable may be installed overhead, in duct or conduit, or by direct burial.

  Twisted pair cable communicates in closed-loop system using Time Division Multiplexing (TDM) at a 1,200 baud rate between intersections and provides dependable and efficient two-way communication. It does not require complicated installation techniques and should be able to be maintained by the City's current staff.

- **Fiber-Optic** cable has gained popularity in many areas and is in the process of replacing twisted pair cable as the preferred traffic control system cable.

  Fiber-optic cable has several advanced features over conventional twisted pair cable. It communicates using TDM at an increased baud rate (1,200 to 19,200 baud); it provides a very large bandwidth for greater capacity in data transmission; it provides immunity from line noise and interference; it can transmit a signal over substantial distances; and it has enhanced video transmission capabilities for intersection surveillance.

  The cable may be installed overhead, in duct or conduit, or direct burial. It is also advantageous because it can be installed in the same conduit with lines carrying electrical current.

- **Spread Spectrum Radio** has often been used in traffic signal communication due to the higher costs associated with cable based system interconnect. The principal limitation to the use of radio technology has been the availability of frequency channels to handle the data rates needed and FCC licensing requirements.

  Spread-spectrum radio has been used for military applications and has been available since 1985 for use in civilian applications in the 900 MHz band at powers up to 1 watt. While the frequency and watt restriction generally have range limitations, spread-spectrum has been gaining popularity, especially in areas where cable installations are not possible or cost effective.

Spread-spectrum radio communicates using various modulation techniques at a baud rate of 1,200 to 1,900 in a full duplex mode. While spread spectrum radio is adequate for basic traffic signal control communications, there is a lack of video surveillance capabilities with spread-spectrum communications.

It is proposed that a new subsystem in this area be developed using spread-spectrum radio communication. This will allow implementation of basic timing patterns appropriate for this portion of the corridor for at least 10 years. If city plans are to develop a comprehensive citywide advanced traffic management system, more consideration should be made of a fiber-optic system than one communicating with radio. *Estimated Cost: $6,000 per intersection*

(3) Other considerations for implementation of a signal subsystem include:

- Cabinets at all five intersections should be replaced with 8-phase controller cabinets. While base-mounted cabinets are preferred and are more standard, space may be limited. In this case, 8-phase pole-mounted cabinets may be installed. This may requires some rewiring of the signal. *Estimated Cost: $12,000 per intersection*

- A master controller must be installed at one location for a signal system. Observations of line of sight show that the George Avenue intersection is the most favorable master location for a radio system. Its elevation appears to give it the best line of sight to other signals; this can be verified by a signal contractor in field tests. *Estimated Cost: $6,000*

(4) With or without the addition of signal coordination in Subarea JC2, the following recommendations should help traffic operation in this area:

- Hicks Road – Currently, Phase 1 directs east and westbound left turns simultaneously, even if one of these movements is not called. An additional phase should be added to allow independent calling of these two left turn arrows. Intersection clearance intervals should be recalculated. *Estimated Cost: $12,000 (for new cabinet and rewiring)*
- Odell Avenue – Like at Hicks Road, Phase 1 directs east and westbound left turns simultaneously, even if one of these movements is not called. An additional phase should be added to allow independent calling of these two left turn arrows. Intersection clearance intervals should be recalculated. *Estimated Cost: $12,000 (for new cabinet and rewiring)*

Traffic operation through Subarea JC2 can be helped through coordination, individual signal improvements, or both.

- Russell Avenue - Phase 4 currently directs east and westbound left turns simultaneously, even if one of these movements is not called. An additional phase should be added to allow independent calling of these two left turn arrows. Intersection clearance intervals should be recalculated. *Estimated Cost: $12,000 (for new cabinet and rewiring)*
- State Route 92 – Operations should be changed to allow eight phases. Split phase operation here is inefficient and unnecessary. For the minor street approaches, the cycle can lead with the dual left turns then allow simultaneous north and south movement. However, current and future operations here are adequate and significant modifications will be required only with increased development in this area. *Estimated Cost: $12,000 (for new cabinet and rewiring)*

(5) Another important signal-related improvement is the installation of pedestrian equipment. The presence of sidewalks makes pedestrian signal equipment highly desirable and pedestrian signal heads and pushbutton activation are recommended as a part of other signal improvements. *Estimated Cost: $8,000 per intersection*

Roadway Geometrics

(1) To reduce driver conflict and structure turning movements from the mainline, the construction of separate left turn lanes at all median openings should be considered. In this section the only additional left turn bays to be added would be from eastbound US 11E to northbound Pearl Avenue, from westbound US 11E to southbound Pearl Avenue, and from eastbound US 11E to northbound Harrington Street. All other median openings contain turn bays already. *Estimated Cost: $12,000 per location*

(2) Related to recommendation (1), median openings should be limited to a number easily negotiated by the motorist. Many available turning opportunities in a short distance can create confusion and delay efficient movement. In retrofitting this area, it is recommended that no two median openings be located closer than 200’ apart. Specifically, this would require the closure of only one median opening which serves the Food City supermarket between Odell and Pearl Avenues. *Estimated Cost: $8,000*

This opening is approximately 160’ from the Odell Avenue intersection and can have an effect on its operation. This property already maintains a reasonable level of access from driveways on Odell and Pearl Avenues.

(3) Because of the potential of pedestrian travel in this area and to encourage this alternative form of transportation, pedestrian facilities should be improved throughout the area. This may include reconstruction of broken or missing sidewalk segments either on US 11E or on cross streets, construction of ADA compliant ramps, and, as mentioned above, installation of pedestrian signal equipment. *While more in-depth sidewalk study would be required to present*

site-specific cost figures, current estimates for removal and reconstruction of a 5' sidewalk are $12 per foot and $14 per foot, respectively.

Site Access

Limiting the number of driveways in this portion of the corridor will help to control the number of conflict points faced by drivers. Practically, however, it would prove difficult to successfully combine and/or eliminate all the existing driveways needed to create a significantly improved corridor. Thus, recommendations are made only at particularly hazardous or confusing locations, where property owner objections may not be severe, or where general provisions may help guide future redevelopment.

It is important to note that driveway modifications are only recommended and may not be practical. Incentives for property owner cooperation or purchase of access rights may be negotiated, but closure of existing access points should not be required. *General costs for curb modifications at driveways are estimated to be $5,000 per location.*

Access Improvement Recommendations
US 11E Corridor Study ~ Subarea JC2

Property	Location	Problem	Solution	Comment
Shell Gas Station	At Russell Avenue	Unstructured access in intersection influence area.	Curb driveway close to intersection to provide definition.	
Marathon Gas Station	At George Avenue	Unstructured access in intersection influence area.	Curb driveway close to intersection to provide definition.	
Sonic Restaurant	At Beeler Avenue	Unstructured access in intersection influence area.	Curb driveway close to intersection to provide definition.	Access should be defined only along Pearl and Beeler Avenues.
The Creamery Restaurant	At Beeler Avenue	Unstructured access (along Beeler Ave).	Curb driveway to provide definition.	
Food City Supermarket	Odell and Pearl Avenues	Access in intersection influence area.	Close existing median cut.	Reasonable access provided from Odell and Pearl Avenues.

General guidelines for future development or redevelopment access in this area are as follows:

A. The number of driveway openings should be minimized or decreased by closing unused driveways, combining driveways for comparable-use properties, removing redundant driveways, and utilizing driveways onto cross-streets to as great an extent as possible.

B. Requests for new driveways onto US 11E in Subarea JC2 should only be considered if the following criteria are met:
    1. Reasonable access cannot be provided through an existing shared driveway arrangement, by connection to a minor cross-street or by rear access to a parallel street.
    2. The proposed driveway will be located outside of any signalized intersection influence area. This minimum distance in Subarea JC2 is 300' upstream of the intersection and 250' downstream of it. This recommendation would essentially prohibit any new driveways from being established on either side of US 11E between George Avenue and Harrington Street.
    3. The proposed driveway will not warrant signalization or require an additional median opening.

C. Due to the built-up nature of this area and the already close spacing of public street intersections, no new roads should be allowed intersection with US 11E. Improvement or realignment of existing intersections should only be considered if the modification conforms to the city's ideals for a efficient, safe, and coordinated signal system.

Summarized Improvement Recommendations
US 11E Corridor Study ~ Subarea JC2

Location	Improvement	Estimated Costs	Completion Rating (1=High, 5=Low)
SR 92S, Russell Ave, George Ave, Odell Ave, Hicks Rd	Implementation of signal coordination subsytem using radio-based communication	$90,000	2
SR 92S, Russell Ave, Odell Ave, Hicks Rd	Signal phasing improvements (new cabinets required)	$12,000 per intersection. Included in above cost.	2 - 5
SR 92S, Russell Ave, George Ave, Odell Ave, Hicks Rd	Pedestrian signal heads and pushbutton activation	$5,000 per intersection	3
At Pearl Ave and at Harrington St	Addition of separate left turn lanes	$12,000 per location ($36,000 total)	3
Between Pearl and Odell Ave	Median closure	$8,000	3
Various	Pedestrian facility enhancements	N/A	4
Various	Curbing modifications at driveways	$5,000 per location ($20,000 total)	3

CHAPTER 4

Subarea R – From Hicks Road to Howell Road (8.36± miles)

Although US 11E is classified as an urban arterial throughout the project limits, this subarea is largely rural with open pasture prevalent.

Land Use

Description

While the City Limits of both Jefferson City and Morristown extend to their respective county lines along US 11E, this subarea is best described as rural. Much of the property fronting the roadway is large-tract pastureland with small individual businesses or residences.

Several exceptions exist, however. A pocket of increased development surrounds the area within the influence of the State Route 160 intersection. This area is more suburban in nature and extends approximately 0.86± miles in length along the corridor. Likewise, property in close proximity to Chucky Pike has developed more than other areas. Another area of variable land use is the industrial park located on Commerce Boulevard. While not directly part of the corridor, its activities influence travel patterns in this area.

Zoning

The portion of this area between lying in Jefferson County (between Hicks Road and the county line) is zoned as Highway Business District (B-3). In Hamblen County, between the county line and Britton Drive, zoning is primarily a Medium Density Residential District (R-2). From here through the subarea limit at SR 342, the corridor lies almost entirely within the Intermediate Business District (IB). However, 2100'± of frontage from Commerce Boulevard east on the south side of US 11E is defined as a Heavy Industrial District (HI).

Generators

Subarea R is influenced by a varying degree of development types, from single family residences to a multi-operation industrial park. Most notable are a Wal-Mart Supercenter and associated outparcel retail situated just east of Chucky Pike in Jefferson City and a conglomeration of large industrial facilities located off of Commerce Boulevard in Hamblen County.

The majority of the residential base along this corridor is located in Subarea R. Situated largely between Dogwood Lane and State Route 342, the most dense residential development is located roughly ½ mile north of US 11E.

Parcels

Parcel sizes fronting US 11E within Subarea R vary widely in size from 0.2 acres to almost 100 acres. Frontage lengths are also widely variable. An estimated average size lot

with frontage to US 11E in this corridor is 3 – 4 acres, suitable for the numerous small businesses and residences found here.

Growth Potential

Though specific locations are unknown, a few areas within this 8+ miles segment may be expected to develop more quickly than other areas. Current trends predict the more urbanized areas of both cities, Jefferson City and Morristown, to continue stretching east and west, respectively. Two clear signs of this trend is the construction of the Wal-Mart site on the eastern outskirts of Jefferson City's core area, and the proposal for a high level of retail activity at the proposed Merchants Green Road corridor (see Subarea M1), located west of Morristown's heaviest developments.

Development of open land will bring new access needs to Subarea R.

With the completion of the Merchants Green Road, the moderately developed property in the vicinity of State Route 160 may see less activity. Because the new facility will connect SR 160 and US 11E, much of the traffic bound for Morristown may use the new road as a detour to the east. Also, the Merchants Green corridor will likely be competition for retail that might have considered locating in the SR 160 area.

An area with a high propensity for industrial growth is the Odyssey Road corridor. Currently, this facility serves only one major industry, but at least three large tracts are available with access to Odyssey Road.

Residential developments have primarily been on a relatively small scale in this part of Jefferson and Hamblen Counties. While this trend is not expected to change dramatically, several large tracts of open land could accept this type of growth with some utility service increases.

Traffic Analyses

Average Daily Traffic (ADT)

TDOT maintains four counting stations within this subarea. A station located just west of Lakeshore Road recorded a 2003 ADT of 24,680 vehicles per day (counted as a total of both directions). Just south of the Hamblen County line, a count of 24,390 was taken. A count station is located just east of Odyssey Road where traffic averaged 19,250 vehicles per day. The last station is just west of Chucky Pike, where an average flow of 25,400 was recorded. Using growth factors (2 – 3% annually, based on 17-year TDOT data), the projected ADT levels range from 35,500 to almost 47,000 vehicles per day by the 2030 design year (see Figure 1-1). The higher growth rate here is indicative of healthy growth patterns for this region. This growth should not be completely attributed to new residential activity taking place over the past 10 years just north of this corridor. While

this does contribute, this growth may also be a sign of the growing attractiveness of destinations in Morristown and Jefferson City, with this rural segment being the primary conduit between the two.

Turning Movement Counts

Turning movement counts at most public streets were made during AM and PM peak hours; generally, 7:15 – 8:15 AM and 4:30 – 5:30 PM in this subarea (additional counts were made at Lakeshore Road, see *Signalization*). Using standard traffic growth procedures based on historical counts, movements for 2010 and 2030 have been estimated. These are given as Figures 4-1 through 4-3.

Signalization

Five signalized intersections exist in Subarea R (at Hicks Road, Chucky Pike, Odyssey Road, State Route 160, and State Route 342). A summary of an inventory of the signal equipment at each of these locations is presented below. None of the four signals currently operate in a coordinated manner nor have the equipment capabilities to do so.

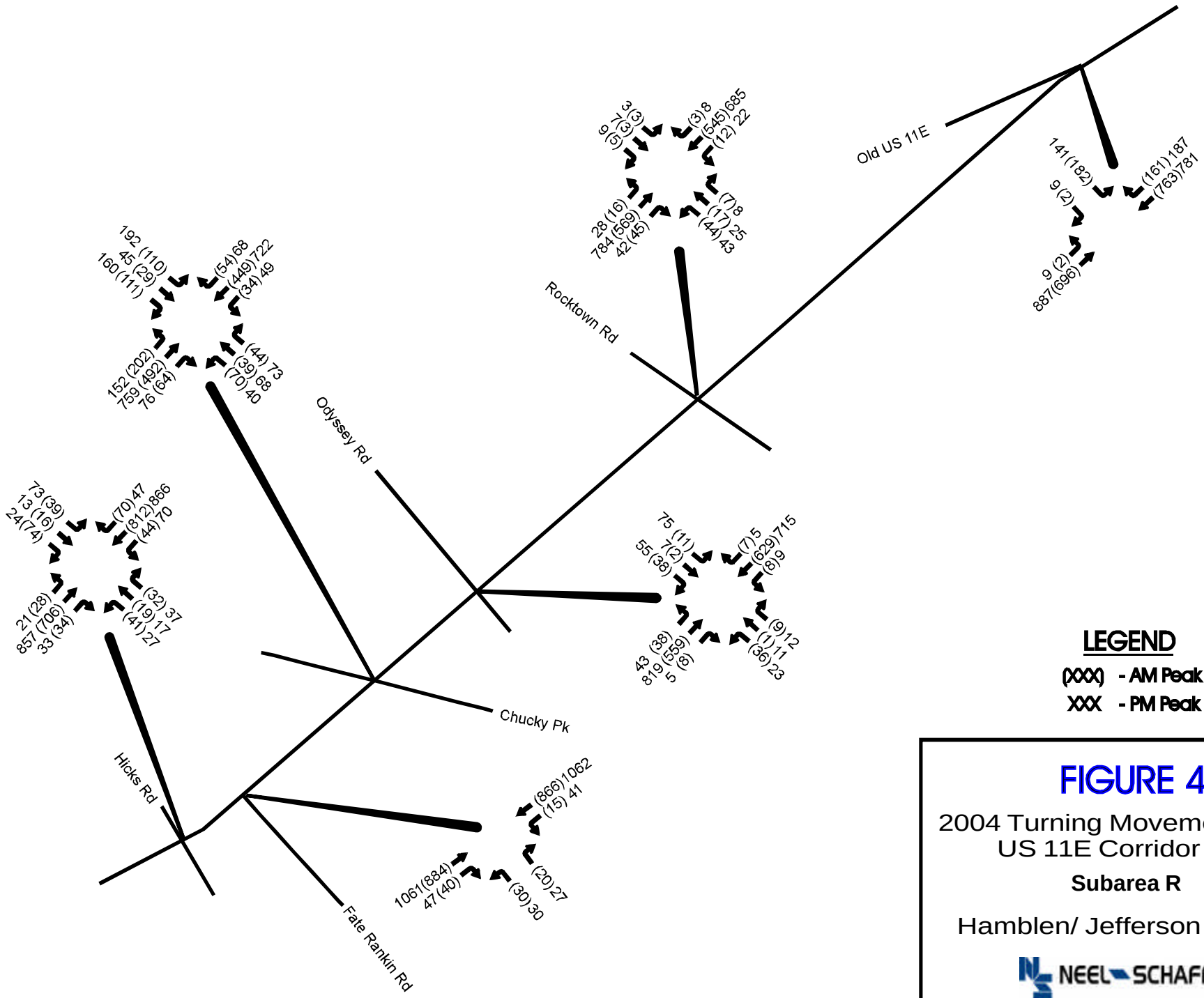
Overall, each signal is operating well; all equipment, including signal heads, was found to be in good condition. Signal improvement recommendations are given at the end of this chapter.

TRAFFIC SIGNAL EQUIPMENT INVENTORY

Intersection	Signal Controller	Signal Cabinet	Signal Phasing and Operation	Master Controller	Existing Signal Interconnect	Communications Equipment	Preemption Detection
US 11E at							
Hicks Road	Transyt 3000	Pole	Isolated, Semi-Actuated, 3 Phase	None	None	None	Yes
Chucky Pike	Epac 3108	Base	Isolated, Actuated, 6 Phase	None	None	None	No
Odyssey Road	Epac 3104	Pole	Isolated, Actuated, 4 Phase	None	None	None	No
State Route 160	Epac 3608	Base	Isolated, Actuated, 6 Phase	None	None	None	Yes
State Route 342	Epac 3608	Base	Isolated, Actuated, 6 Phase	None	None	None	Yes

Because of request for specific study of the intersection of Lakeshore Road at US 11E, additional analysis has been undertaken at this intersection. This analysis included a full 8-hour traffic turning movement count, study of reported crash information, and evaluation and application of signal warrant procedures. Differing proposals on how to remedy problems of this intersection have included signalization and the addition of acceleration and/or deceleration lanes along US 11E.

The heaviest hours of operation here are 7-8 AM, 11 AM-1 PM, and 3-5 PM. From procedures outlined in the Manual on Uniform Traffic Control Devices (MUTCD), this intersection meets the following signal warrants:



LEGEND

(XXX) - AM Peak

XXX - PM Peak

FIGURE 4-1a

2004 Turning Movement Counts
US 11E Corridor Study

Subarea R

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

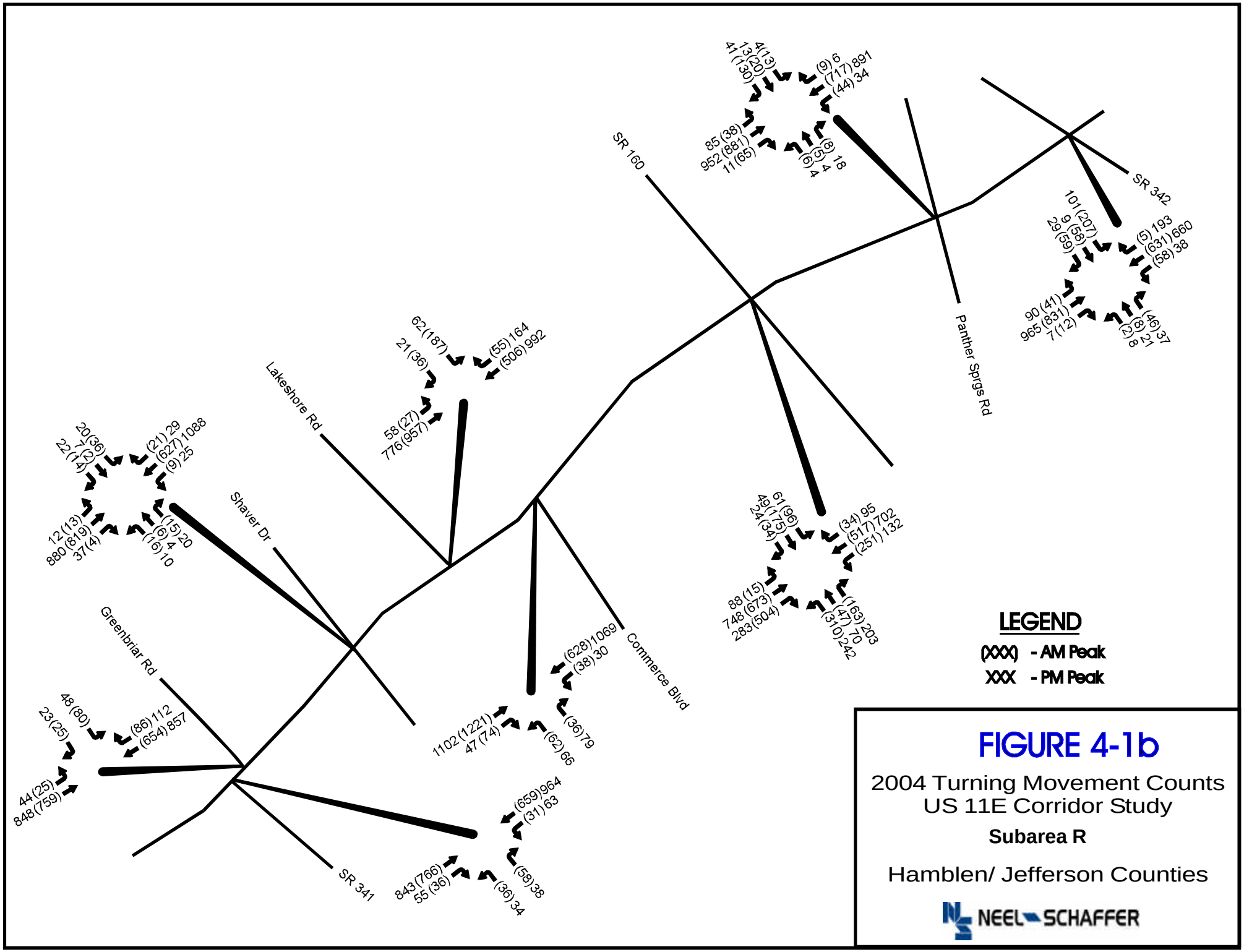


FIGURE 4-1b

2004 Turning Movement Counts
US 11E Corridor Study

Subarea R

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

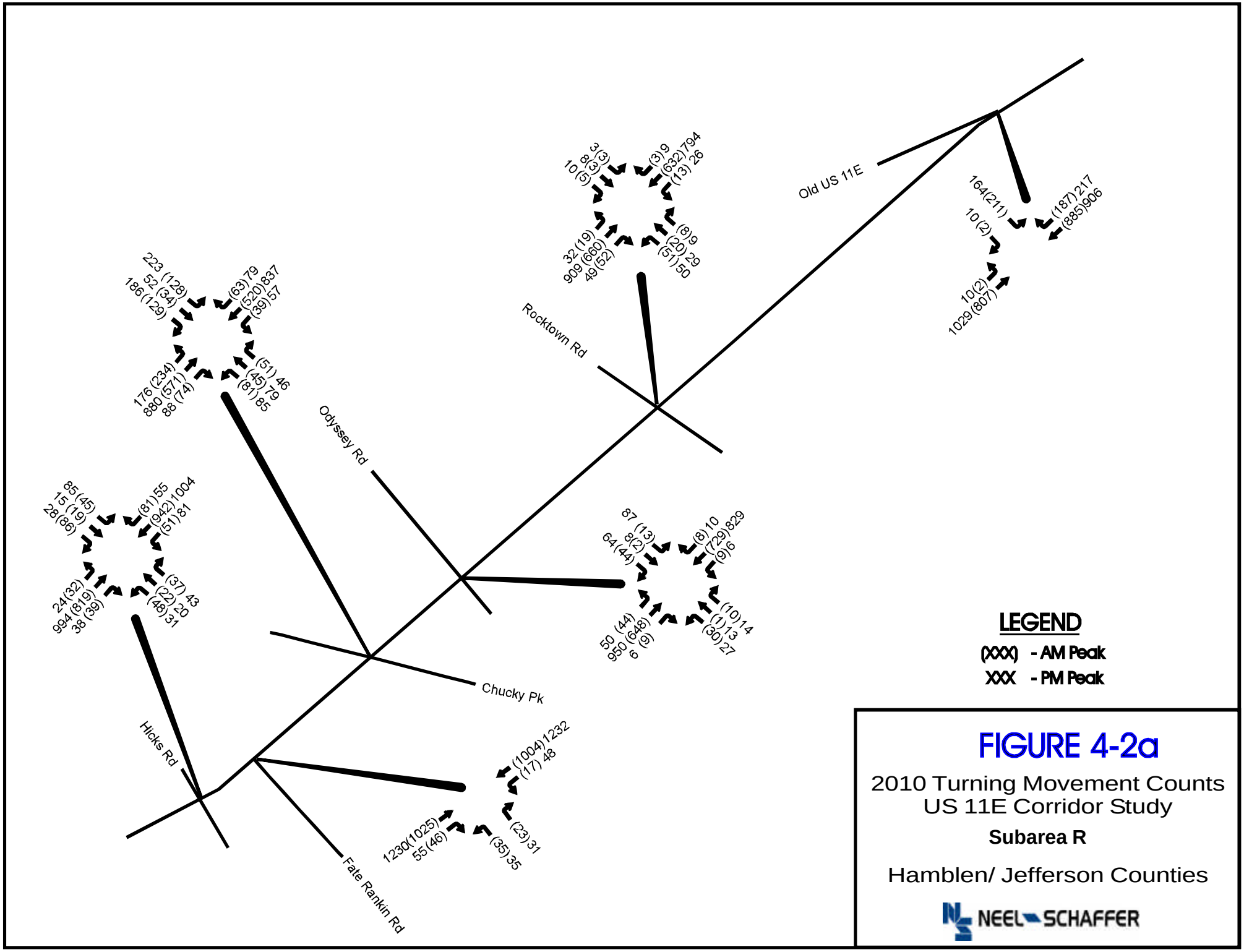


FIGURE 4-2a

2010 Turning Movement Counts
US 11E Corridor Study

Subarea R

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

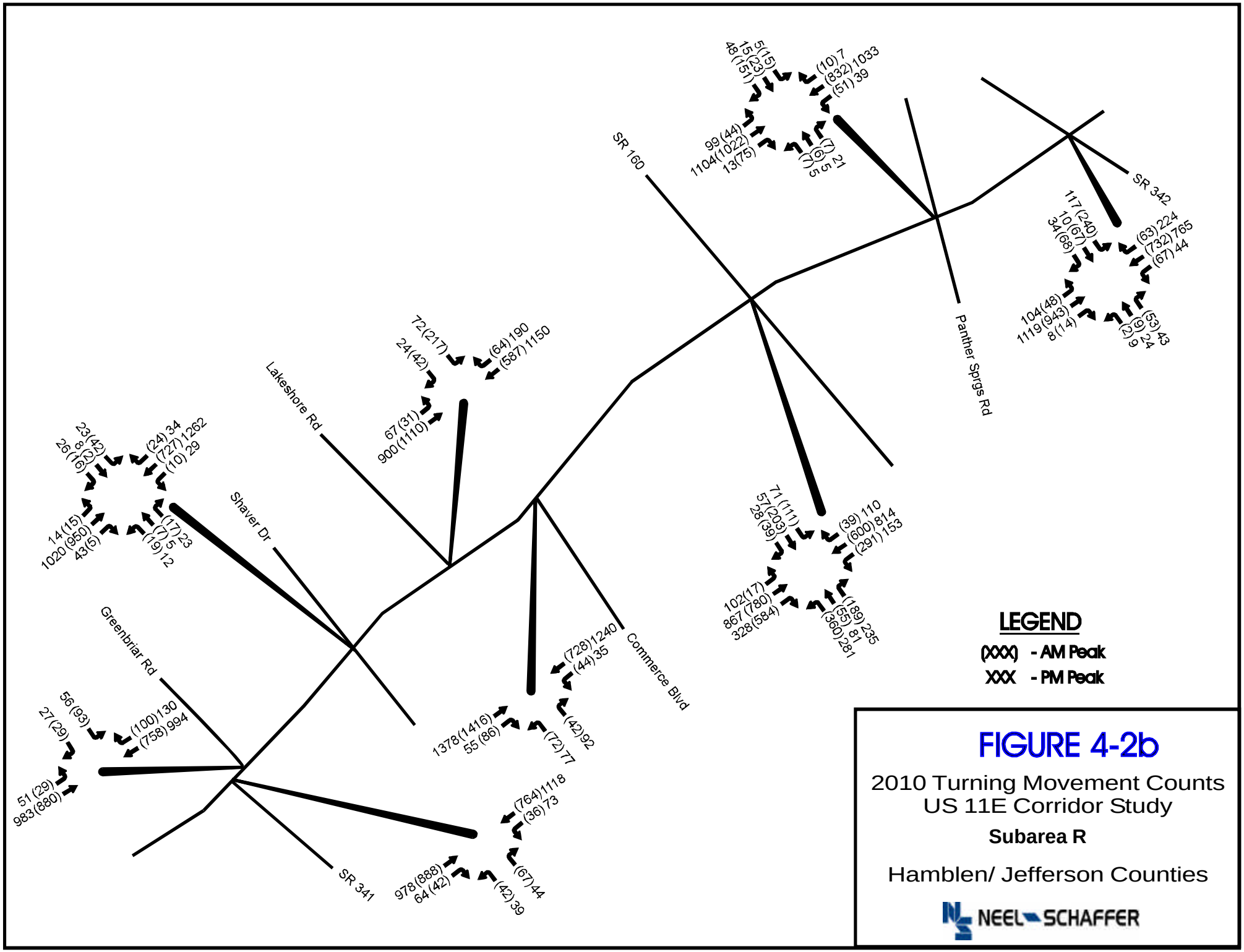


FIGURE 4-2b

2010 Turning Movement Counts
US 11E Corridor Study

Subarea R

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

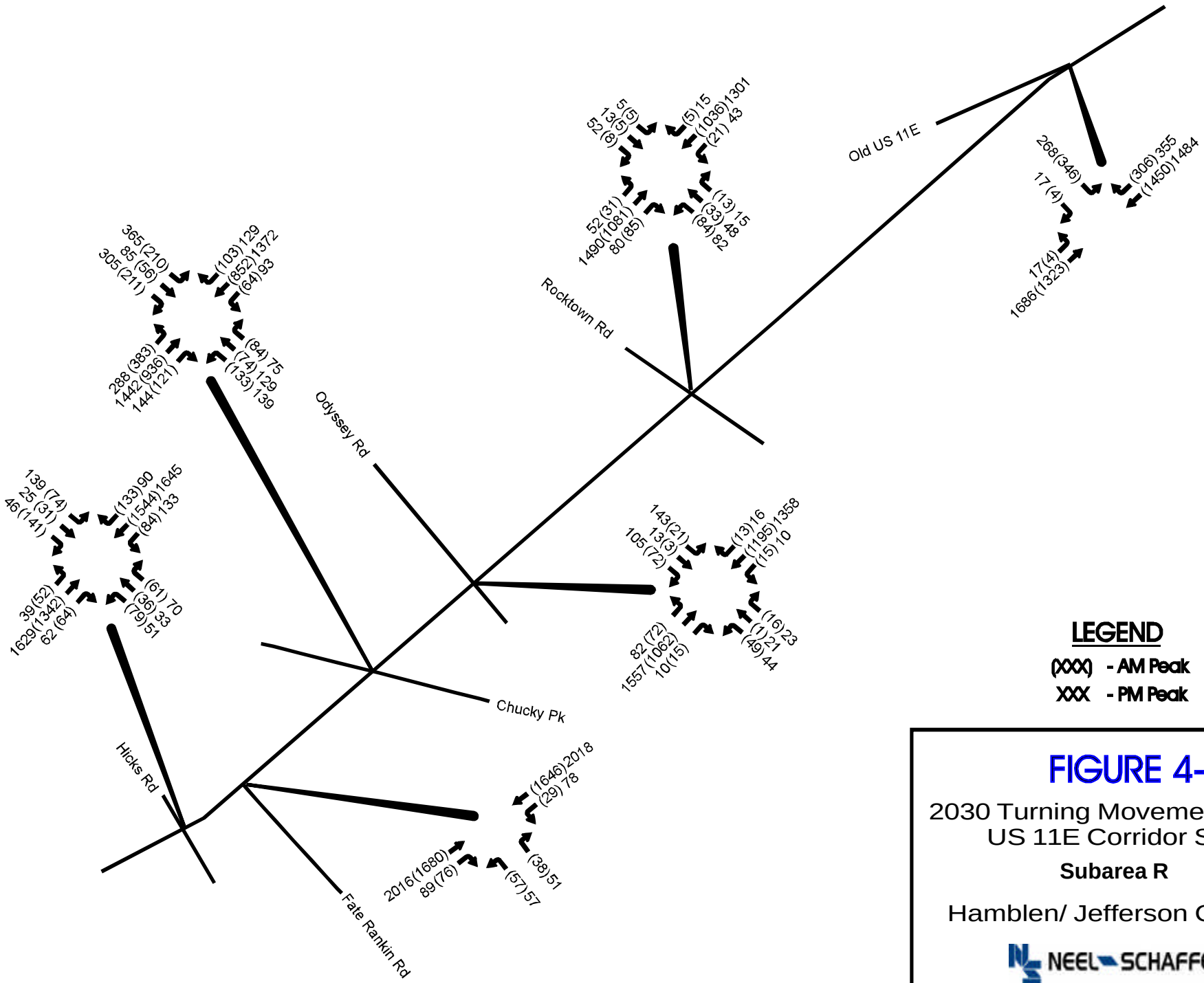


FIGURE 4-3a

2030 Turning Movement Counts
US 11E Corridor Study

Subarea R

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

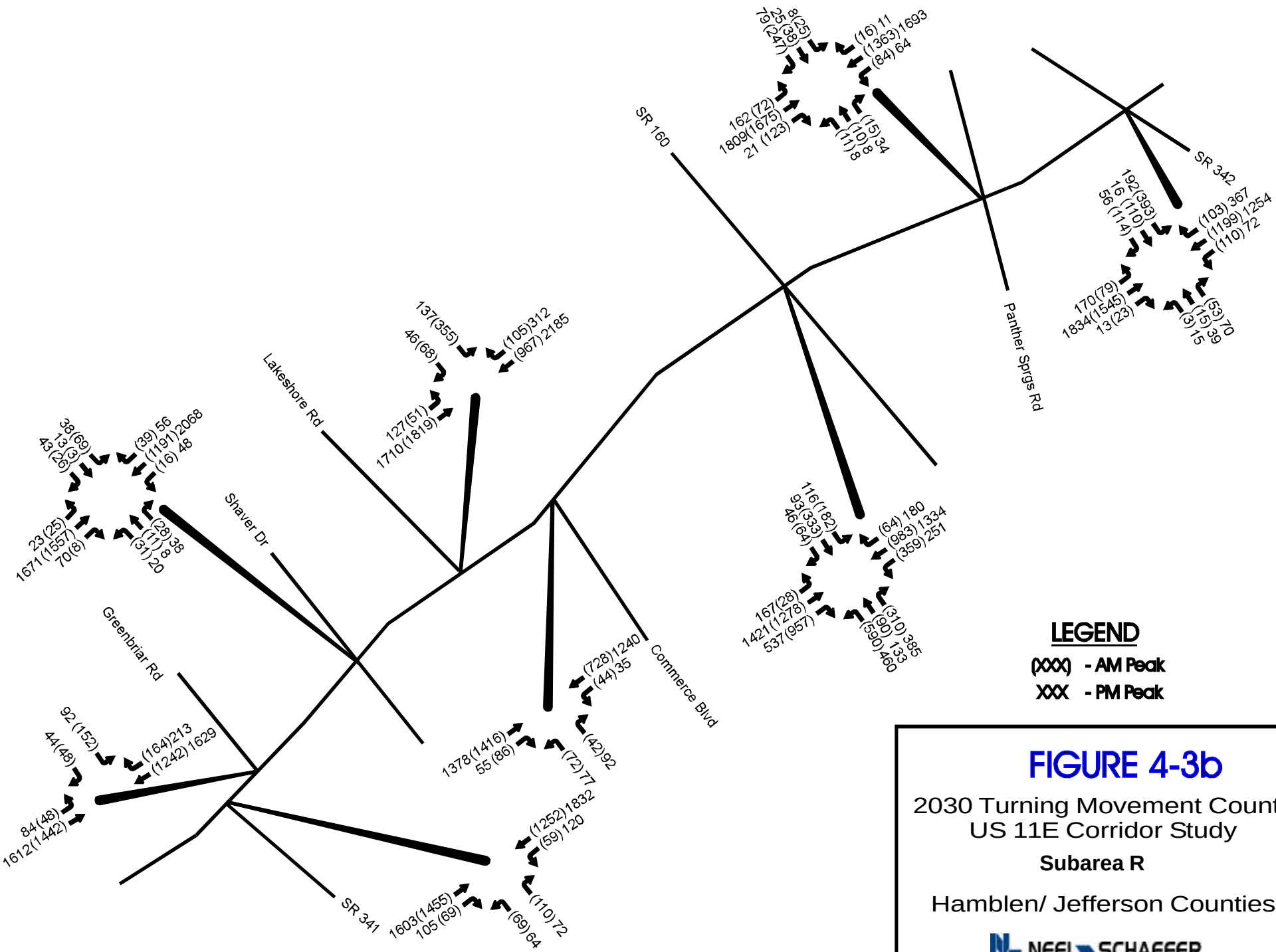


FIGURE 4-3b

2030 Turning Movement Counts
US 11E Corridor Study

Subarea R

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

- Warrant 1, 8-Hour Vehicular Volume: Often considered the most compelling warrant, this one demonstrates a possible need for signalization continuously throughout the day. The 100% and 70% factors of Condition B (Interruption of Continuous Traffic) are met (see MUTCD p. 4C-5).
- Warrant 2, 4-Hour Vehicular Volume: This one demonstrates a possible need for signalization due to the volume of intersecting minor-street traffic. The 70% factor is met in 5 of the 8 hours (see MUTCD p. 4C-7).
- Warrant 3, Peak Hour: Generally applicable for large origin/destination sites such as office complexes, this warrant checks undue delay for minor street traffic during 1 peak hour. The 100% and 70% factors are met during the 7:00 AM hour (see MUTCD p. 4C-9)
- Warrant 7, Crash Experience: Applicable where the number and type of crashes at the intersection may justify signal installation. The accident statistics from April 2002 to April 2003 list 6 crashes (5 are required to meet warrant), all potentially correctable by signalization. All other requirements of Warrant 7 are met as well (see MUTCD p. 4C-12).

Features like right turn acceleration lanes can improve the operation of unsignalized intersections.

If signalization is considered here (see *Recommendations*), the signal should likely operate without subsystem progression. Located more than 1.2 miles west of the SR 160 intersection, the interval is too great to efficiently accommodate signal coordination.

Speed and Delay

As outlined in Chapter 1, speed and delay data has been gathered through the entire length of the corridor. The results for Subarea R are given below.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
Kidwell Ridge Rd							
Panther Creek Rd (SR 342)	1.35	101.0	0.0	0.0	50	48.1	48.1
Collinson Rd (SR 160)	1.17	111.5	22.0	0.5	50	37.9	47.2
Talbott Kansas Rd (SR 341)	2.13	150.0	0.0	0.0	50	51.1	51.1
Odssey Rd	3.10	210.0	0.0	0.0	55-45	53.2	53.2
Chucky Pike	0.36	48.5	17.0	0.5	45	26.6	40.9
Hicks Rd	0.87	76.0	2.0	0.5	45-40	41.0	42.1
Total	8.98	697.0	41.0	1.5		43.0	47.1

Entering Jefferson City (WB) during the AM peak.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
Hicks Rd							
Chucky Pike	0.88	88.5	17.0	0.5	40-45	35.7	44.2
Odssey Rd	0.35	35.0	1.5	0.5	45	36.2	37.9
Talbott Kansas Rd (SR 341)	3.10	218.0	0.0	0.0	45-55	51.3	51.3
Collinson Rd (SR 160)	2.13	177.5	20.5	0.5	50	43.2	48.8
Panther Creek Rd (SR 342)	1.17	88.0	0.0	0.0	50	48.0	48.0
Kidwell Ridge Rd	1.35	110.0	0.0	0.0	50	44.2	44.2
Total	8.99	717.0	39.0	1.5		43.1	45.7

Entering Morristown (EB) during the AM peak.

During the AM peak, and between both directions of travel, at least one stop was experienced at all of the signalized intersections except State Route 342. The longest average delay was experienced at State Route 160 (42.5 seconds total, accounting for over half of the delay in this 8+ mile segment), followed by Chucky Pike. Analysis of the running speeds, however, shows good movement, averaging approximately 46 mph through this subarea. This would be expected for this type of rural area with limited signalization.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
Hicks Rd							
Chucky Pike	0.88	71.0	0.0	0.0	40-45	44.5	44.5
Odssey Rd	0.35	33.3	2.3	0.3	45	38.0	40.9
Talbott Kansas Rd (SR 341)	3.10	208.3	0.0	0.0	45-55	53.6	53.6
Collinson Rd (SR 160)	2.13	158.3	4.7	1.0	50	48.4	49.9
Panther Creek Rd (SR 342)	1.17	88.3	0.0	0.0	50	47.7	47.7
Kidwell Ridge Rd	1.36	99.7	0.0	0.0	50	49.2	49.2
Total	8.99	659.0	7.0	1.3		46.9	47.6

Leaving Jefferson City (EB) during the PM peak.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
Kidwell Ridge Rd							
Panther Creek Rd (SR 342)	1.34	105.5	7.0	0.5	50	45.9	49.1
Collinson Rd (SR 160)	1.17	133.5	40.0	1.0	50	31.6	45.2
Talbott Kansas Rd (SR 341)	2.13	148.0	0.0	0.0	50	51.8	51.8
Odssey Rd	3.10	210.0	2.5	0.5	55-45	53.1	53.8
Chucky Pike	0.36	44.5	8.5	0.5	45	29.3	36.3
Hicks Rd	0.86	87.0	9.0	0.5	45-40	35.7	39.8
Total	8.97	728.5	67.0	3.0		41.2	46.0

Leaving Morristown (WB) during the PM peak.

The PM peak here experiences similar operation through almost all signalized intersections.

Level of Service

There are approximately 35 public street intersections in the segment defined as Subarea R. Shown above, only 5 of these are signalized and many of the others are small dead end or no outlet streets serving a small number of residences. While counts were collected at almost all of the intersections, only cursory investigations of these stop-controlled intersections were necessary; capacity and traffic control is deemed adequate for their current use.

Several intersections along this segment, however, played a significant role on the section and have been included in the modeling process including the operational analyses (see Figures 4-1 through 4-3). As outlined in Chapter 1, procedures from the *Highway Capacity Manual 2000* have been used to summarize intersection operation in base and

future years. The table below presents the current and future LOS of each intersection, assuming no improvements are made.

Signalized Intersection Capacity Analysis Summary
US 11E Corridor Study ~ Subarea R

Intersection Cross-Street	Time Period	Avg. Intersection Delay (sec.)	Level of Service	Time Period	Avg. Intersection Delay (sec.)	Level of Service
Hicks Road	AM 2004	8.7	A	PM 2004	10.5	B
	AM 2010	10.7	B	PM 2010	11.6	B
	AM 2030	30.7	C	PM 2030	56.9	E
Chucky Pike	AM 2004	19.7	B	PM 2004	25	C
	AM 2010	21.5	C	PM 2010	29.1	C
	AM 2030	51.9	D	PM 2030	120	F
Odyssey Road	AM 2004	12.9	B	PM 2004	15.6	B
	AM 2010	13	B	PM 2010	18.9	B
	AM 2030	18.9	B	PM 2030	48.8	D
SR 160	AM 2004	23.8	C	PM 2004	18.2	B
	AM 2010	31.8	C	PM 2010	20.9	C
	AM 2030	98.7	F	PM 2030	78.1	E
SR 342	AM 2004	16.6	B	PM 2004	9.2	A
	AM 2010	20.2	C	PM 2010	11.1	B
	AM 2030	62.3	E	PM 2030	37.3	D

From the results above, most of the signalized intersections in Subarea R are expected to realize capacity problems by the 2030 design year. These could occur sooner if this area experiences rapid development. The intersections with Hicks Road, Chucky Pike, SR 160, and SR 342 may operate under LOS "E" conditions or worse during one or both peak periods. Some of the most apparent problem movements and possible solutions are discussed in *Recommendations*.

Of all the stop-controlled intersections in this segment, Lakeshore Road currently has the lowest level of operation. With almost 200 left turns in the AM peak hour, operations here are inefficient. Drivers may accept shorter gaps due to excessive delay and, as discussed for signal warrant, a high number of right-angle crashes occur here. Other non-signalized intersections in this area also experience some delay, though not to the level of Lakeshore Road. If a signal were to be located here, a residual effect would likely be improved performance of other nearby stop-controlled intersections (including Commerce Boulevard, Shaver Drive, and possibly Greenbrier Road/SR 341) due to the introduction of gaps in the mainline traffic stream.

Air Quality

Estimates of mobile source emissions inside of Subarea R reveal the following 2004 and 2010 levels:

Air Quality Estimations
US 11E Corridor Study ~ Subarea R

Intersection Cross-Street	Time Period	CO Emmissions (kg/day)	NOx Emmisions (kg/day)	VOC Emmisions (kg/day)
Hicks Road	See Subarea JC2			
Chucky Pike	2004	44.2	7.8	10.3
	2010	53.3	10.4	12.4
Odyssey Road	2004	38.1	7.4	8.8
	2010	46.5	9.1	10.8
SR 160	2004	48.9	12.2	14.6
	2010	74.3	14.5	17.2
SR 342	2004	43.2	8.4	10.0
	2010	50.7	9.9	11.8
Mainline	2004	3364.2	454.9	285.6
	2010	2577.8	342.7	217.8
TOTALS	**2004**	**3,538.5**	**490.7**	**329.3**
	2010	**2,802.7**	**386.5**	**269.9**

Roadway Design and Access

Right-of-Way

The existing right-of-way is variable from 100’ to over 200’ in width. From Howell Road to just west of Meadowood Drive, a 100’ right-of-way exists. West of Meadowood Drive through the subarea to Hicks Road, the 180’ is typical. Some segments control more right-of-way, particularly where newer roads have been constructed.

Cross-street right-of-way generally ranges from 250’ at SR 160 to 40’ at some small local roads. A 50’ right-of-way is typical for subdivision streets in this area.

Geometry

Generally adequate through the study section, the mainline is a four lane section containing 4 @ 12’ travel lanes divided by a non-traversable grass median. Most intersections have appropriate turn lanes and can adequately accommodate the existing traffic volumes; this is usually characterized by at least a separate left turn lane on the mainline. Some geometric deficiencies at signalized intersections are defined in *Recommendations*. Sight distances and other design factors appear adequate given the operating speed of the roadway.

Median Openings
Throughout the section limits, median openings are provided at various locations. Typically, these are located at intersections with public streets and at a spacing consistent with TDOT's rural design criteria (1,320' preferred with 880' – 1,760' being acceptable). Some, but not all, median openings have adjacent left turn lanes associated with them.

Shoulders and Curb
In general, this segment has a 10' – 12' paved outside shoulder through its length. At some intersections, these shoulders are dropped to provide separated right turn lanes from the mainline. At other intersections, drivers will use the shoulder as a right turn/deceleration lane, though it is not striped as such. At a few intersections such as Commerce Boulevard and the driveway from Vifan USA, the outside shoulder is striped as a parallel acceleration lane.

Intersection Spacing
In this area, intersection spacing is more critical from a safety perspective than a signal coordination standpoint. The spacing of public street intersections range from less than 250' to just less than 1 mile with an average spacing being approximately 1400'. Overall, neither public street nor private driveway spacings are overly problematic.

Site Access and Circulation
Site Layout
Two properties in this area have significant multiple destinations on the same site. The first is the Wal-Mart Supercenter and associated retail located just east of Chucky Pike. Four driveways (two onto Chucky Pike, two onto US 11E) provide ample access/egress opportunity for this high volume site. As is typical for this type of development, ample parking exists and other circulation-related issues have been mitigated by well-structured access.

The other site with some internal circulation is a large furniture store with retail outparcels located west of State Route 160. Here, four driveways are present to serve approximately six different businesses. Only one of these driveways, however, is fully directional, others are right in, right out only. While some landscaped islands serve to restrict movements, structured site circulation is minimal. Low volumes here combined with long setbacks from US 11E, however, allow sufficient access to the property.

Future large-scale development in this area should likewise plan for a high level of internal access, particularly where multiple destinations exist on one property. Care should be taken that access-related queuing or other problems do not affect the US 11E mainline.

Driveways
On the average, the number of driveways is not as high as in other subareas, and therefore does not present as many problems. Because allowance of median openings is more limited here, additional care in the efficient alignment of driveway points with median

openings is necessary. As a whole, driveways operate well; specific improvements to be considered are presented in *Recommendations*.

Access to Cross-Streets

Very few properties with access to a street in additional to US 11E have access solely from that minor cross street. Two notable examples of businesses that do are Royston Auto Sales at State Route 342 and Suntrust Bank at Brady Drive.

Recommendations

Signalization

(1) As stated in Traffic Analyses, all current signals except Odyssey Road are expected to operate inefficiently by the 2030 design year, based on current signal timings and growth through this period averaging 2.5% per year. The problem movements and potential corrections at each location are given below. Improvements to Chucky Pike are presented as Figure 4-4 and SR 342 is given as Figure 4-5.

Intersection Improvement Recommendations
US 11E Corridor Study ~ Subarea R

Intersection	Problem Movement	Recommendation and Comment	*Estimated Costs*
Hicks Road	See Recommendations for Subarea JC2		
Chucky Pike	SB Chucky to EB US 11E (left turn)	Shared lanes create need for inefficient split-phase operation. Construct (or restripe) separate left turn lanes on both approaches and operate in 8 phases.	*$140,000 (lane additions), $14,000 (signal modifications)*
	NB Chucky to WB US 11E (left turn)	Shared lanes create need for inefficient split-phase operation. Construct separate left turn lanes on both approaches and operate in 8 phases.	
	EB US 11E to NB Chucky (left turn)	Dual left turn lane may be needed as volume approaches 300 vph. Evaluate after removing signal from split-phase operation.	*N/A*
	EB & WB US 11E through	8-phase signal operation should allow more through green time, see recommendations above.	*N/A*
SR 160	WB US 11E to SB SR 160 (left turn)	If current growth continues, this movement will be 360 vph; dual left turn will be needed (construction of Merchants Green will likely lessen this, however). Reevaluate after construction.	*N/A*
	EB US 11E to SB SR 160 (right turn)	Predicted to be almost 1000 vpd. While split-phase removal will help, may consider modifing signal to allow movement overlap (right-tun arrow).	*$2,000*
SR 342	SB SR 342 to EB US 11E	Morning movement into Morristown forecast to be almost 400 vph. Dual left turn lanes should be considered. Protected only phasing would be required.	*$295,000*

FIGURE 4-4

Proposed Improvements
at Chucky Pike

US 11E Corridor Study
Hamblen/ Jefferson Counties

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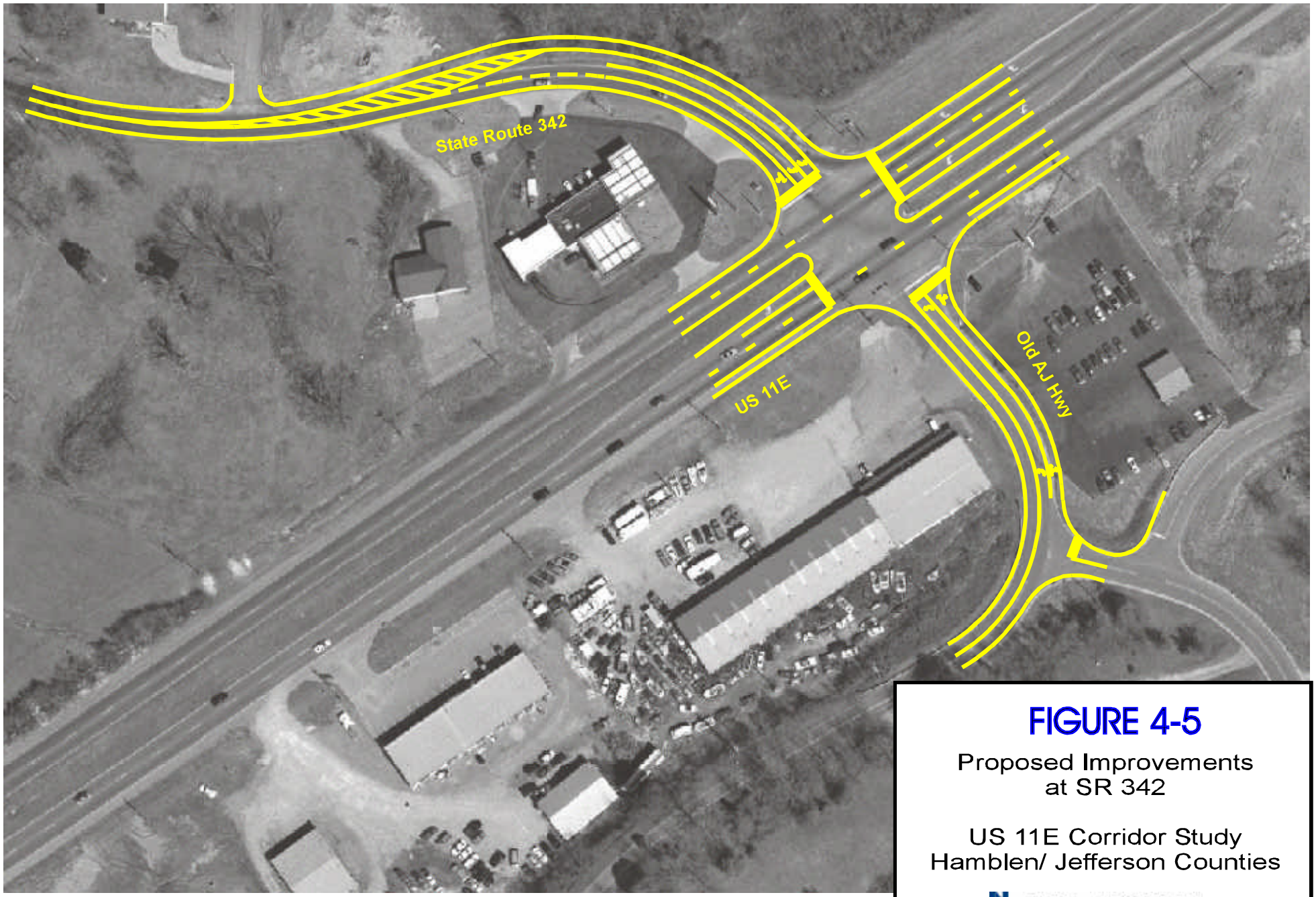

FIGURE 4-5

Proposed Improvements
at SR 342

US 11E Corridor Study
Hamblen/ Jefferson Counties

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(2) Recommendations for establishment of a new signal subsystem for the growing portions of Morristown from State Route 160 to Kidwells Ridge Road are made in Subarea M1. This subsytem would include the US 11E intersections with State Route 160 and State Route 342.

(3) The proximity of the Odyssey Road and Chucky Pike intersections in Jefferson City as well as the growth found in this area prompt the recommendation of signal coordination between these two intersections. As outlined for Subarea JC2, this may be accomplished through the use of spread-spectrum radio communication. A master controller would be required, along with associated communications equipment. Also, because all other controllers in Jefferson City are Transyt models, the EPAC controllers here may be considered for replacement in order to simplify operation and maintenance. *Estimated Costs: $16,000 (cabinet and master controller at Odyssey), $9,000 (controller and radio equipment at Chucky)*

(4) Study of the Lakeshore Road intersection has shown a need for an increased level of traffic control. Excessive delays here have created a safety problem that should be addressed. This analysis as well as investigation undertaken by TDOT has shown that a signal is warranted.

It is recommended that an 8-phase fully-actuated signal be installed here. Other methods of correction such as auxiliary lanes would not correct the underlying problem. At a minimum, widening on Lakeshore Road should accommodate separate left and right turn lanes. Other minor geometric improvements may be required as well. If specific study reveals a significant shift in travel patterns likely to use a new signal here, additional capacity may be desired (see Figure 4-6). Communications equipment should also be considered as part of this signal to allow operational surveillance as part of a new subsystem (see *Subarea M2*). *Estimated Cost: $205,000*

(5) Spacing considerations for potential future signalized intersection locations are given under *Site Access*.

Roadway Geometrics

(1) From the intersection operational analysis undertaken, several intersections may be in need of future geometric improvement. See the chart above.

(2) To reduce driver conflict and structure turning movements from the mainline, the construction of separate left turn lanes at all rural area median openings should be considered. Whether at public streets, driveways, or for U-turns, this refuge will improve traffic flow along the corridor and increase the safety of left turns. Improvement should be considered at the locations following. *Estimated Costs: $22,000 (per turn lane), $10,000 (median closure)*

FIGURE 4-6

Proposed Lakeshore Road Improvements

US 11E Corridor Study
Hamblen/ Jefferson Counties

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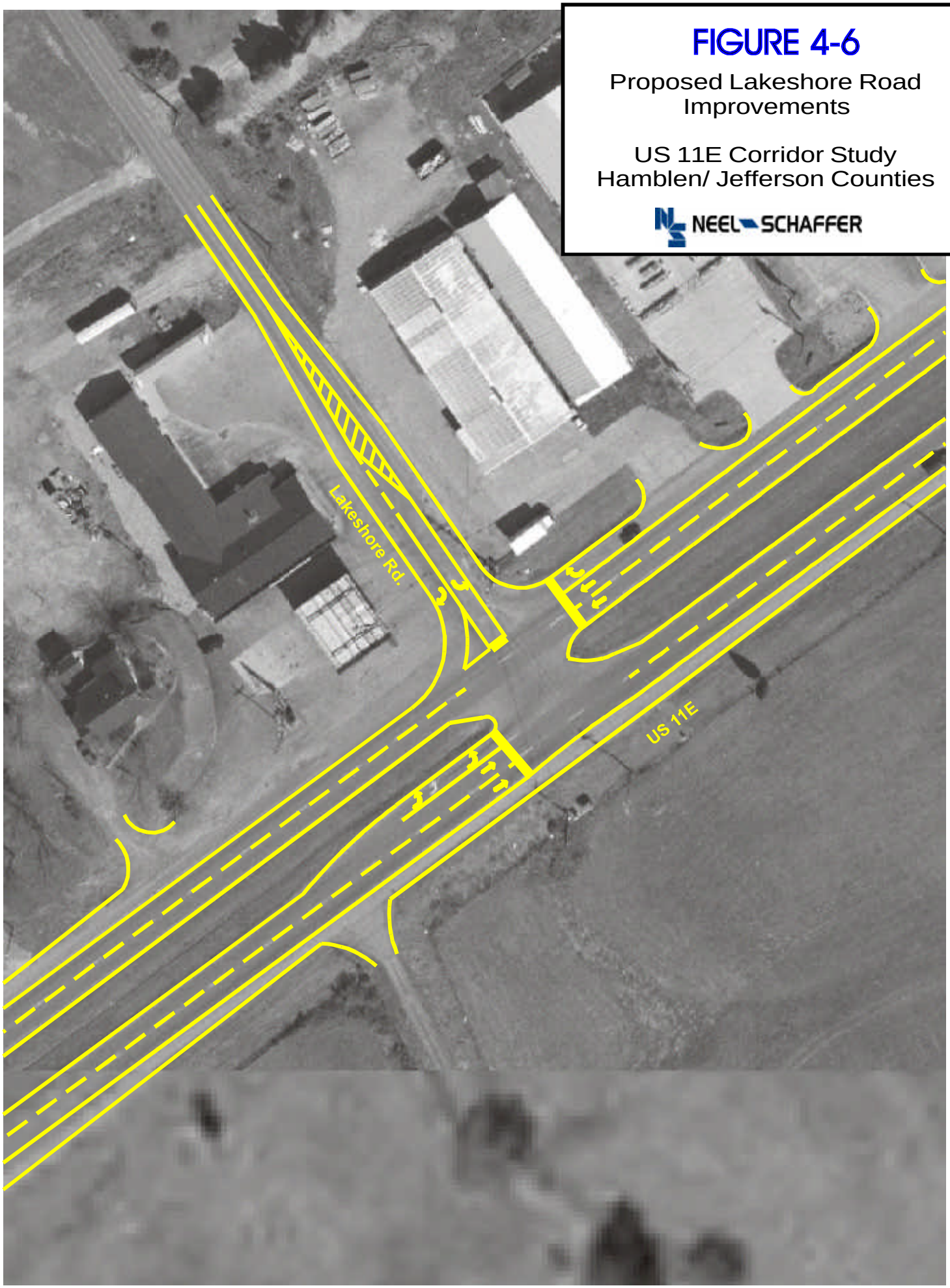
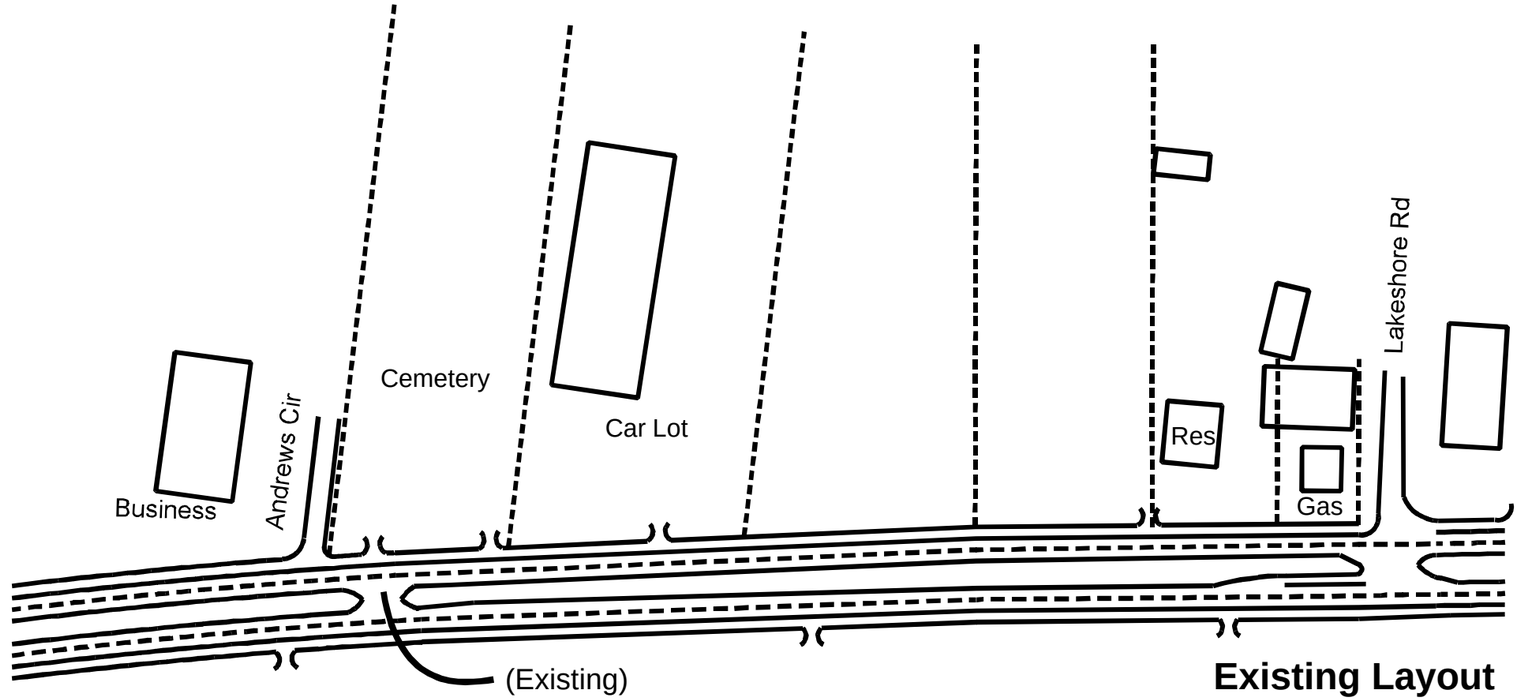


(3) Request for study of a median opening at a car dealership situated between Andrews Circle and Lakeshore Road has prompted further study of this location. Discussion with local officials and TDOT has helped form the recommendation that an existing median opening be moved to align with Andrews Circle. An additional median opening should be constructed to serve the car dealership in an area defined as no less than 440' from either of the two existing (one being relocated) median openings immediately adjacent (see Figure 4-7). A new driveway in this area will allow improved access to this property while maintaining a reasonable median opening spacing in this area. *Estimated Cost: $92,000 (does not include private driveway at dealership)*

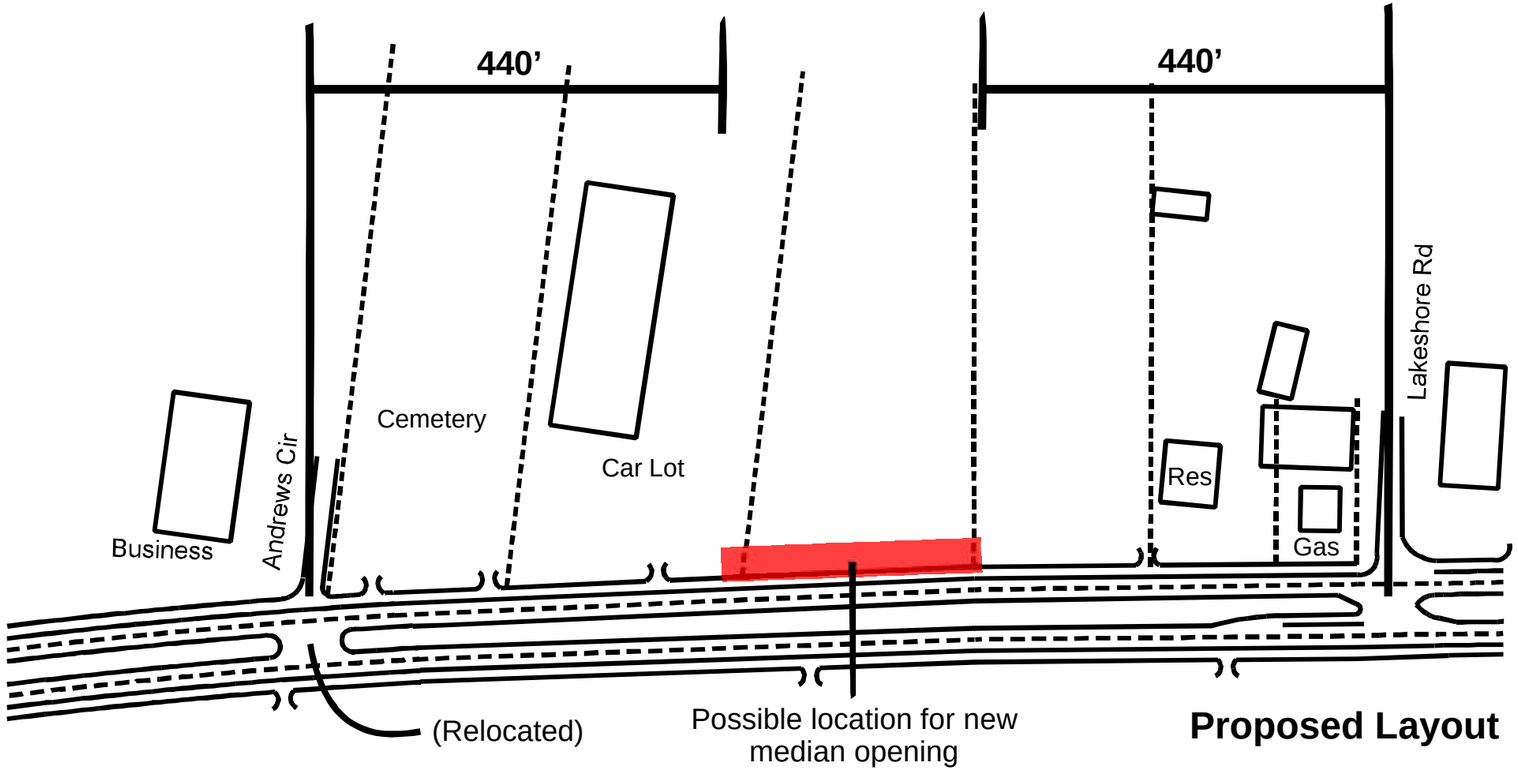
Construction of a median opening in front of the existing dealership driveway has been discussed as a possible solution. However, because this driveway is located approximately 350' east of Andrews Circle, full median openings at both locations would not satisfy TDOT requirements for adequate median opening spacings. Any improvement concerning the median or median openings along US 11E will require approval by TDOT officials.

Based on TDOT minimum urban median opening spacing (660' preferred with 440' - 880' being acceptable), the area shown in red is the zone for an acceptable median opening in this area.

An existing median opening should be realigned to match Andrews Circle.



Existing Layout



Proposed Layout

FIGURE 4-7

Proposed Median Opening Between Andrews Circle and Lakeshore Road

US 11E Corridor Study
Hamblen/ Jefferson Counties

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Median Improvement Recommendations
US 11E Corridor Study ~ Subarea R

Median Opening Location	Left Turn Lane EB	Left Turn Lane WB	Improvement*	Comments
550' E of Odyssey Rd.	No	No	Add 50' EB and WB left turn lanes.	
980' E of Odyssey Rd.	No	No	Add 50' EB and WB left turn lanes.	
2490' E of Odyssey Rd.	No	No	Add 50' EB and WB left turn lanes.	
3480' E of Odyssey Rd.	No	No	Add 50' EB and WB left turn lanes.	
640' W of Rocktown Rd.	No	No	Add 50' EB and WB left turn lanes.	
At Rocktown Rd.	No	No	Add 50' EB and WB left turn lanes.	
400' E of structure	No	No	Add 50' WB left turn lanes.	Taper likely to reach bridge area in EB lane.
1190' W of Old AJ Hwy	No	No	Add 50' EB and WB left turn lanes.	
650' W of Old AJ Hwy	No	No	Add 50' EB and WB left turn lanes.	
At Old AJ Hwy	No	No	Add 50' EB and WB left turn lanes.	
At Willow Garden Circle (west)			Add 50' EB and WB left turn lanes.	
At Dogwood Ln	Yes	No	Add 50' WB left turn lane.	
30' E of Lucille Ln	No	No	Add 50' EB and WB left turn lanes.	Median should be relocated to align with Lucille Ln.
305' E of Lucille Ln.	No	No	Add 50' EB and WB left turn lanes.	
At Old AJ Hwy (Co Line)	No	No	Add 50' EB and WB left turn lanes.	
30' W of Mayfield Rd.	No	No	Add 50' EB and WB left turn lanes.	Median should be relocated to align with Mayfield Rd.
1000' W of SR 341	No	No	Add 50' EB and WB left turn lanes.	
At SR 341	No	Yes	Add 100' EB left turn lane.	Left turn lane should accommodate U-turns or turns into church.
At Greenbrier Rd.	Yes	No	Add 50' WB left turn lane.	
1000' E of Greenbrier Rd.	No	Yes	Add 50' EB left turn lane	
800' W of Brittion Dr.	No	No	Add 50' EB and WB left turn lanes.	
At Brittion/Shaver Dr.	No	No	Add 50' EB and WB left turn lanes.	
100' E of Andrews Cir.	No	No	Add 50' EB and WB left turn lanes.	Median should be relocated to align with Andrew Cir. Install opening midway between Andrews and Lakeshore.
At Lakeshore Rd.	Yes	No	Add 50' WB left turn lane	
At Navajo Trl.	No	No	Add 50' EB and WB left turn lanes.	
At Archer Cir. (west)	No	No	Add 50' EB and WB left turn lanes.	
At Commerce Blvd.	No	Yes	Install "No U-Turn" sign for EB left.	
At Archer Cir. (east)	No	No	Add 50' EB and WB left turn lanes.	
At Poplar Ridge Rd.	Yes	No	Add 50' WB left turn lane.	
850' W of Meadowood Dr. (Vifan entrance)	No	Yes	Add 50' EB left turn lane	
At Meadowood Dr.	Yes	No	Add 50' WB left turn lane.	Narrow median opening, align with Meadowood Dr.
460' E of Meadowood Dr.	No	No	Add 50' EB and WB left turn lanes.	
970' W of SR 160	No	Yes	Add 50' EB left turn lane	
820' E of SR 160	No	No	Add 50' EB and WB left turn lanes.	
At Brady Dr.	Yes	No	Add 50' WB left turn lane.	
At Woods Dr.	No	No	Add 50' EB and WB left turn lanes.	
At Panda Dr.	Yes	No	Add "No U-Turn" sign for WB left.	
540' E of Panda Dr.	No	No	Add 50' EB and WB left turn lanes.	

*NOTE: Distances shown are recommended queue storage lengths and do not reflect the total turn lane length.

Site Access

Particularly with improvements such as signalization of Lakeshore Road or the construction of new roadways accessing land parcels, consideration should be given to increased connectivity of streets. For example, if Lakeshore Road were to be signalized, properties along Navaho Trail and Andrews Circle will be able to use the signal as well. However, residences accessed by Shaver Drive would not currently benefit from the signal (except that it will provide additional mainline gaps) because of a lack of connectivity parallel to US 11E. Roadway connectivity will also create levels of functionality of streets. As some streets connect others, they may take the role of collectors and become more efficient movers of traffic. This roadway classification can help establish more efficient land usage as developments take on more complex, connected, and profitable patterns, moving away from the single cul-de-sac developments using only local roads.

Lack of structured access at Lakeshore Road intersection.

Decreasing the number or improving the function of driveways in this portion of the corridor will help to limit the number of conflict points faced by drivers. Most of the recommendations in this subarea are minor and efforts may be focused on higher priority locations first.

Access Improvement Recommendations
US 11E Corridor Study ~ Subarea R

Property	Location	Problem	Solution	Comment
Phillips 66 Service Station	At Fate Rankin Road	Redundant driveways. One in intersection influence area.	Remove drive closest to Fate Rankin Road.	
Morgan Imports Auto	At Willow Garden Circle	Redundant driveways. One in intersection influence area.	Remove drive closest to Willow Garden Cir.	
Eddies Auto Sales	East of Hamblen County Line	Unstructured access.	Curb driveway to provide definition.	
Shell Gas Station	At Lakeshore Road	Unstructured access.	Curb driveway to provide definition.	
Strip Mall	At SR 160	Unstructured access.	Curb driveway to provide definition.	
BP Gas Station	At SR 342	Redundant driveways. One in intersection influence area.	Remove drive closest to SR 342.	Three other driveways exist.

It is important to note that driveway modifications are only recommended and may not be enforceable. Incentives for property owner cooperation or purchase of access rights may be negotiated, but existing access points should not be required to close. *General costs for curb modifications at driveways are estimated to be $5,000 per location.*

General guidelines for future development access in this area are as follow (see Figures 4-8 through 4-11):

A. The number of driveway openings should be controlled by combining driveways for comparable-use properties, removing redundant driveways, and utilizing driveways onto cross-streets to as great an extent as possible.

B. Proposals for the construction of new public street intersections to US 11E in this area should be carefully considered. Preferred street characteristics include:
    1. Extended connectivity to streets other than US 11E. Dead-end streets should be discouraged.
    2. Location of intersections outside of the influence areas of existing intersections. The influence areas of the two intersections (existing and proposed) should not overlap.

3. Additional signalization may be considered where established warrants are met and consideration of several related factors is satisfied. These include:
   i. Will the signal be beneficial for ongoing or future development activity and can it continue to operate efficiently into the future? A signalized intersection should not be approved for a subdivision containing a small number of houses if no additional growth can occur there, for example.
   ii. Is the spacing such that coordination can be achieved in the future? While communication between traffic control devices between Jefferson City and Morristown is likely many years in the future, consideration of appropriate spacing should begin now.
   iii. What are the roles of the developer, the city, the county, TDOT, and others? Coordination between all interested parties should be developed.
4. Alignment across from existing streets, driveways, or median cuts is preferred.
5. Properties immediately adjacent to the proposed street should move access to the proposed street and off of US 11E, if possible.
6. New development should exclusively access adjacent minor streets, to as great an extent possible.

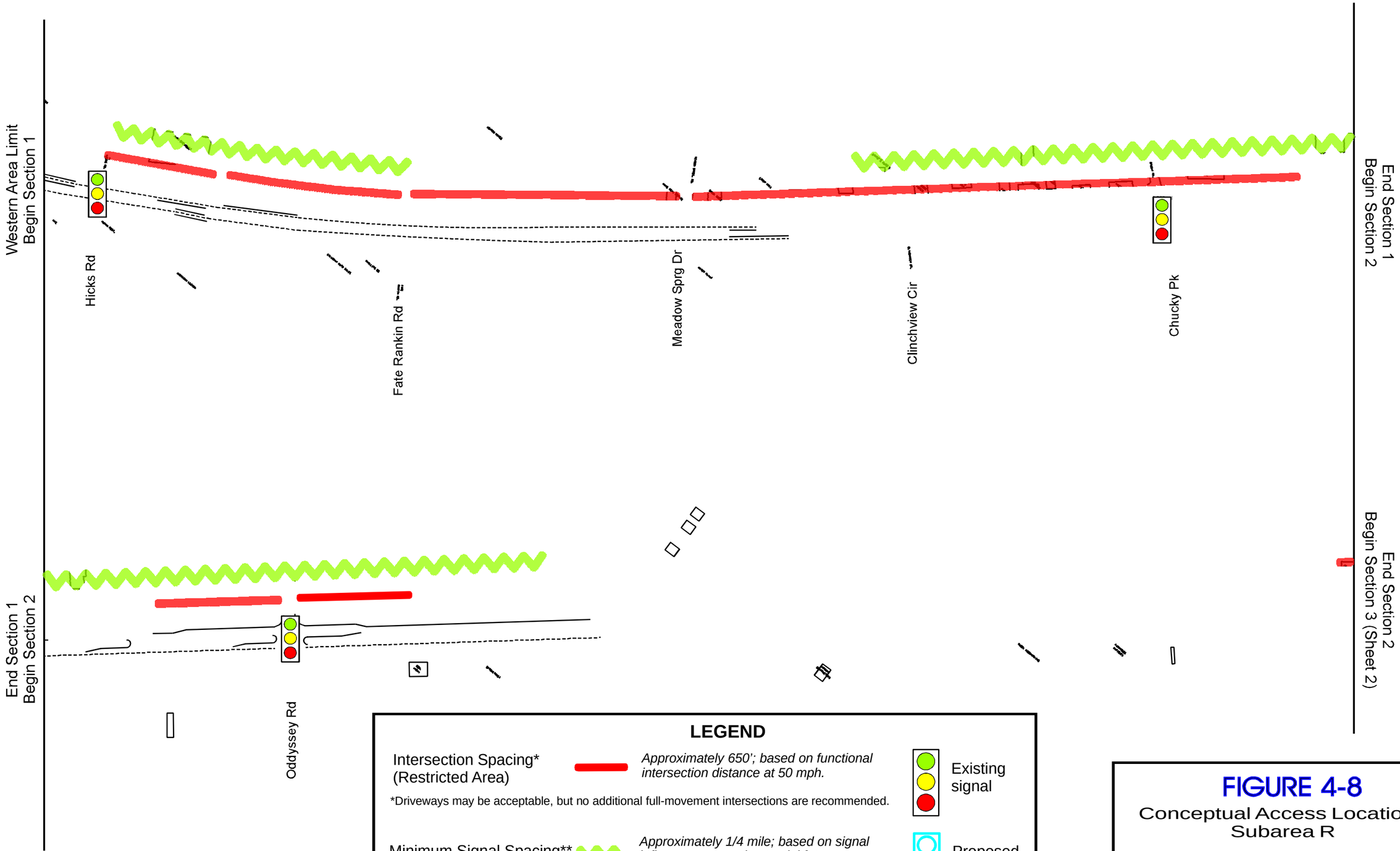

FIGURE 4-8

Conceptual Access Locations
Subarea R

US 11E Corridor Study
Hamblen/ Jefferson Counties

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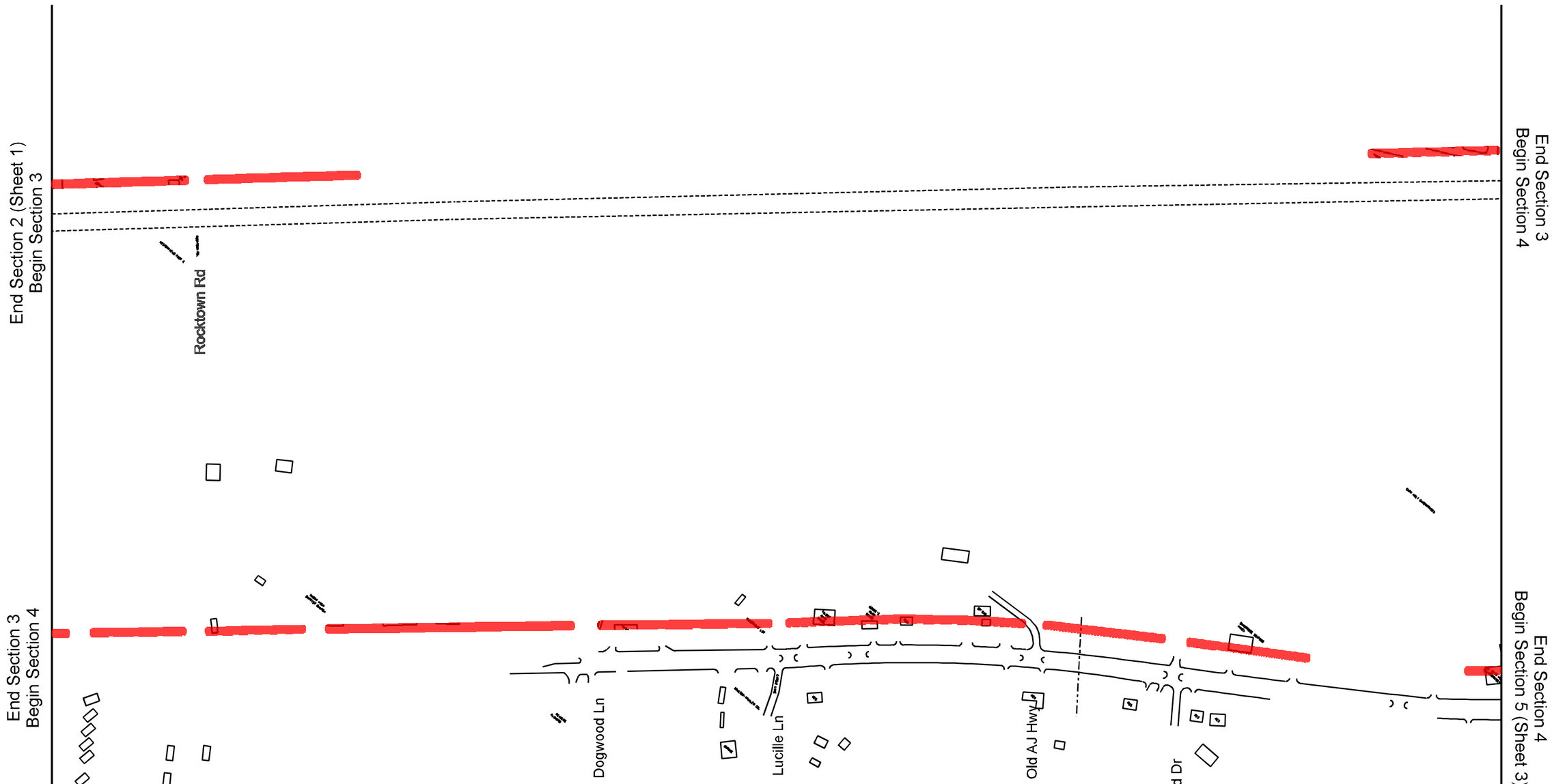

LEGEND

Intersection Spacing* (Restricted Area) — *Approximately 650'; based on functional intersection distance at 50 mph.*

*Driveways may be acceptable, but no additional full-movement intersections are recommended.

Minimum Signal Spacing** (Restricted Area) — *Approximately 1/4 mile; based on signal influence area and potential future progression.*

**New signals in this area may present progression problems. Additional analysis recommended.

Existing signal

Proposed signal

FIGURE 4-9

Conceptual Access Locations
Subarea R

US 11E Corridor Study
Hamblen/ Jefferson Counties

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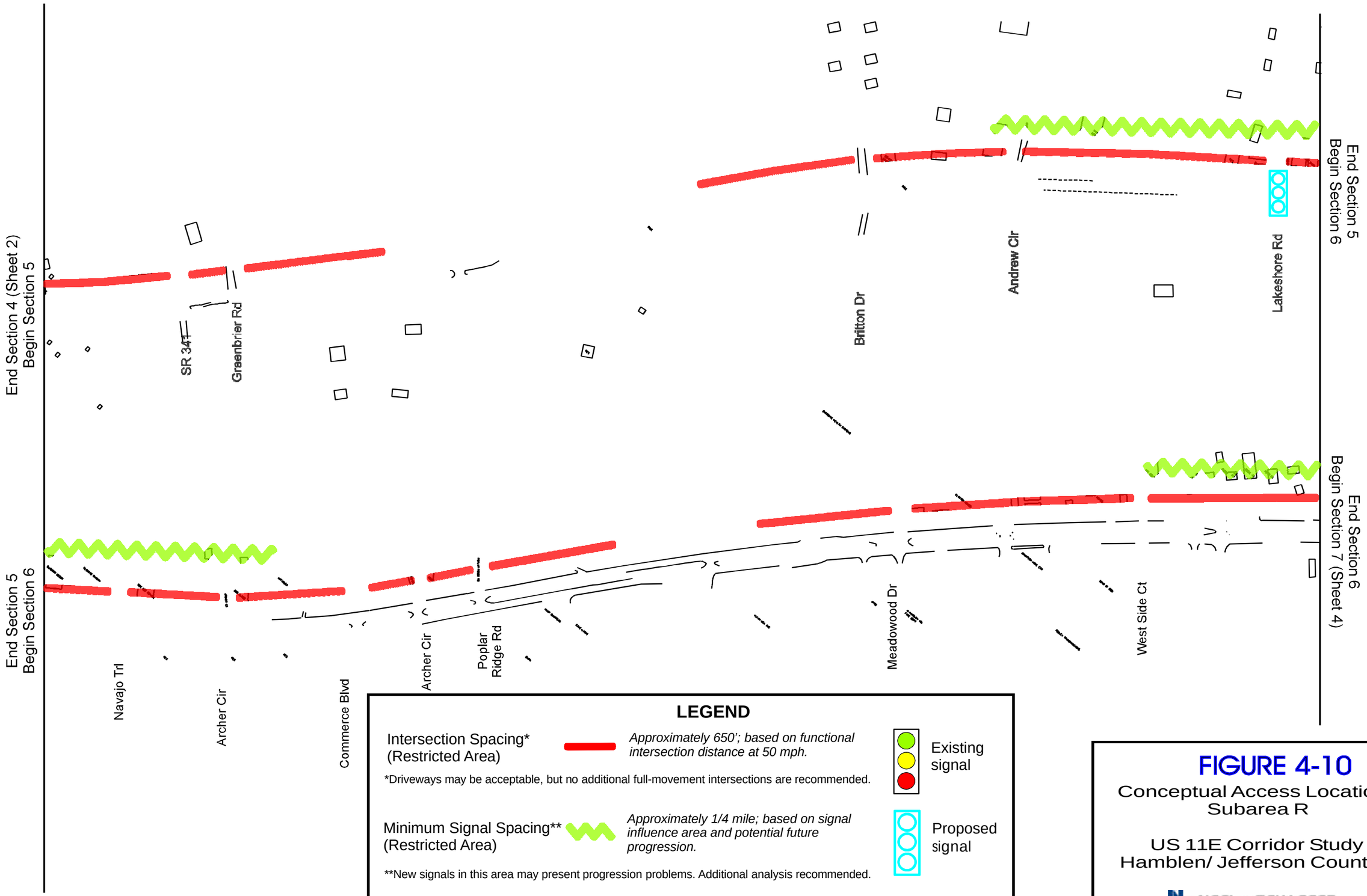

FIGURE 4-10

Conceptual Access Locations
Subarea R

US 11E Corridor Study
Hamblen/ Jefferson Counties

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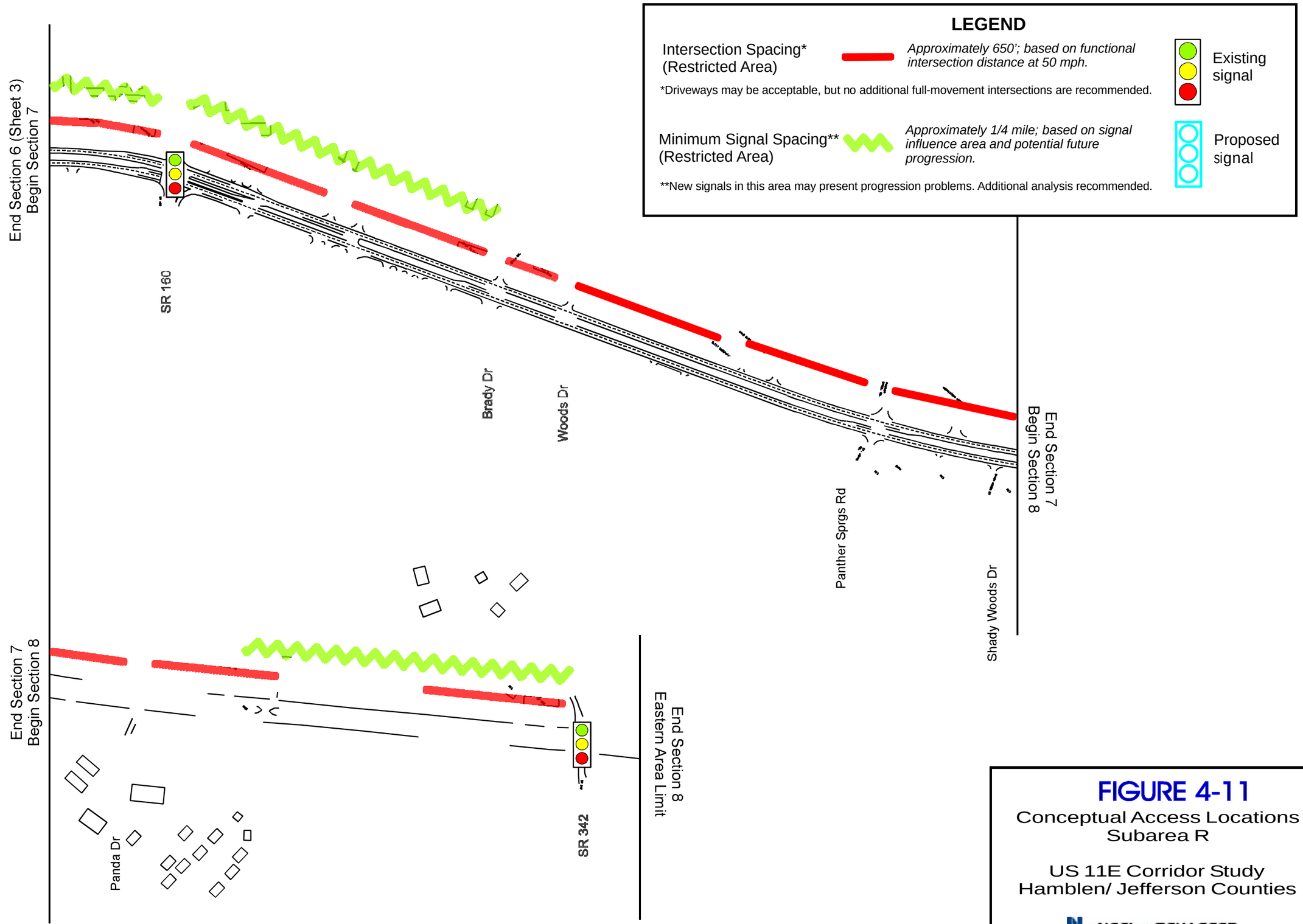

FIGURE 4-11

Conceptual Access Locations
Subarea R

US 11E Corridor Study
Hamblen/ Jefferson Counties

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Summarized Improvement Recommendations
US 11E Corridor Study ~ Subarea R

Location	Improvement	Estimated Costs	Completion Rating (1=High, 5=Low)
Chucky Pike	Lane construction and signal modifications	$140,000	5
State Route 160	Update signal operation	$2,000	4
State Route 342	Lane construction and signal modifications	$295,000	4
Chucky Pike, Odyssey Rd	Signal coordination using radio-based communication	$25,000	3
Lakeshore Rd	Intersection improvement including signalization	$205,000	2
Various	Addition of separate left turn lanes	$22,000 per turn lane ($1,342,000 total)	3
Andrews Cir to Lakeshore Rd	Redefinition of median openings	$92,000	4
Various	Curbing modifications at driveways	$5,000 per location ($30,000 total)	4

CHAPTER 5

Subarea M1 – Howell Road to McCrary Road (1.16± miles)

Supporting the fastest growing portions of west Morristown, this subarea has a variable cross-section and a high propensity for development.

Land Use

Description

Subarea M1 is defined by a mix of land use types ranging from single-family residences to large commercial sites. Some undeveloped parcels exist, but most are improved, albeit to a lower density than in Subarea M2. Parcels are generally larger than in M2, but smaller than in Subarea R. Typical uses require more area dedicated to parking such as churches and hotels.

Zoning

Immediate frontage through the limits of this area is located in Morristown's Intermediate Business District (IB).

Major Generators

Currently, no one site stands out as a major traffic generator. A large church has a significant impact on operations, but it occurs only during the meeting hours, outside of the peak periods of adjacent streets. Also, a supermarket-anchored development at the intersection of Kidwells Ridge Road is significant, but mainly because of its future build-out potential.

Growth Potential

Two locations within Subarea M1 have the potential to become major trip producers. First, the supermarket-anchored development located at Kidwells Ridge Road has approximately 20 acres available for retail development. Under full property utilization and depending on the development, this property could attract a significant number of additional trips. Secondly, the beginning of construction of Merchants Green Drive has signaled a major shift in travel patterns in west Morristown. Changes in land use intensity in this area will undoubtedly affect the operation of traffic on this portion of US 11E.

Significant retail growth is likely, particularly at the Ingles site.

Parcels

As defined, Subarea M1 encompasses 44 lots with frontage on US 11E. Of this number, 24 have no other available access opportunity as they have frontage to no other cross-street. 45 driveways onto the corridor currently exist in this segment.

Traffic Analyses

Average Daily Traffic (ADT)

TDOT maintains one counting station within this subarea. Located just west of Kidwell Ridge Road, the station's 2003 ADT was 26,250 vehicles per day (counted as a total of both directions). Using growth factors (0.8% annually, based on 17-year TDOT data), the projected ADT levels are 30,700 in 2010 and 35,200 by 2030. See Figure 1-1.

Turning Movement Counts

Turning movement counts at public streets were also made during AM and PM peak hours; generally, 7:15 – 8:15 AM and 4:30 – 5:30 PM in this subarea. Using standard traffic growth procedures based on historical counts, movements for 2010 and 2030 have also been estimated. These are given as Figures 5-1 through 5-3.

Signalization

Two signalized intersections exist in Subarea M1. A summary of an inventory of the signal equipment at each of these locations is presented below. Of the two signals, only McCrary Road has the capability of coordinated operation by means of spread-spectrum radio interconnect. This intersection could operate in a signal subsystem with signals located to the east, discussed in Subarea M2. Overall, both signals currently operate well; all equipment, including signal heads, was found to be in good condition.

In March 2004, construction began on a new roadway facility that will intersect US 11E inside the limits of Subarea M1. Merchants Green Road will be primarily a commercial corridor linking US 11E with State Route 160. The design of the signalized intersection is currently under development. Recommendations for this signal are given at the end of this chapter.

TRAFFIC SIGNAL EQUIPMENT INVENTORY

Intersection	Signal Controller	Signal Cabinet	Signal Phasing and Operation	Master Controller	Existing Signal Interconnect	Communications Equipment	Preemption Detection
US 11E at							
Merchants Green Road	FUTURE (see *Recommendations*)						
Kidwells Ridge Road	Epac 3608	Base	Isolated, Actuated, 4 Phase	None	None	None	Yes
McCrary Road	Epac 3208	Base	Isolated, Actuated, 6 Phase	None	Spread-Spectrum Radio	Radio Antenna, Data Receiver, Power Supply Present **(Not Operating)**	Yes

Speed and Delay

As outlined in Chapter 1, speed and delay data has been gathered through the entire length of the corridor. The results for Subarea M1 are given below.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
Panther Creek Rd (SR 342)							
Kidwell Ridge Rd	1.35	110.0	0.0	0.0	50	44.2	44.2
Mccrary Dr	0.53	52.0	0.0	0.0	40	36.8	36.8
Total	1.88	162.0	0.0	0.0		40.5	40.5

Entering Morristown (EB) during the AM peak.

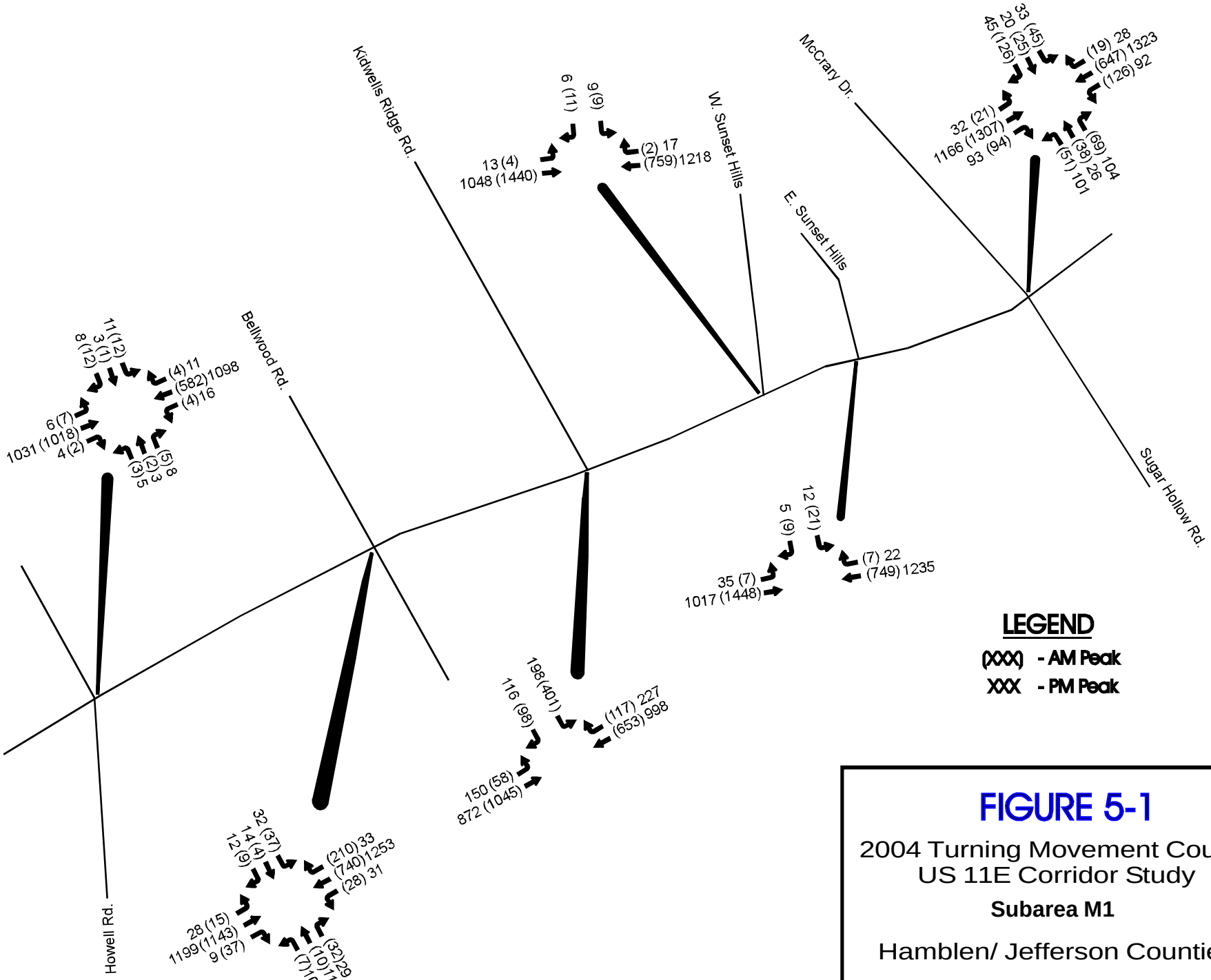


FIGURE 5-1

2004 Turning Movement Counts
US 11E Corridor Study

Subarea M1

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

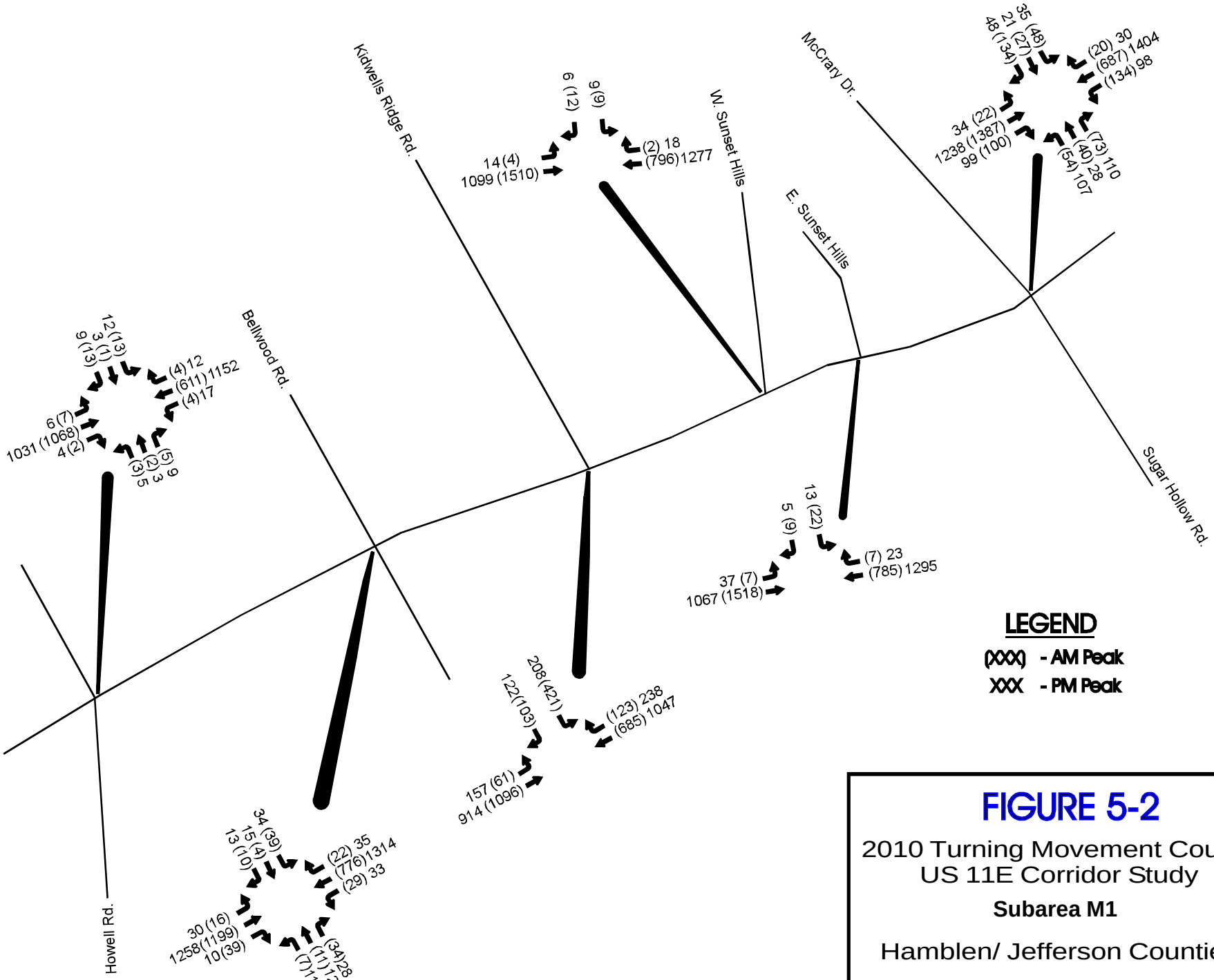


FIGURE 5-2

2010 Turning Movement Counts
US 11E Corridor Study

Subarea M1

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

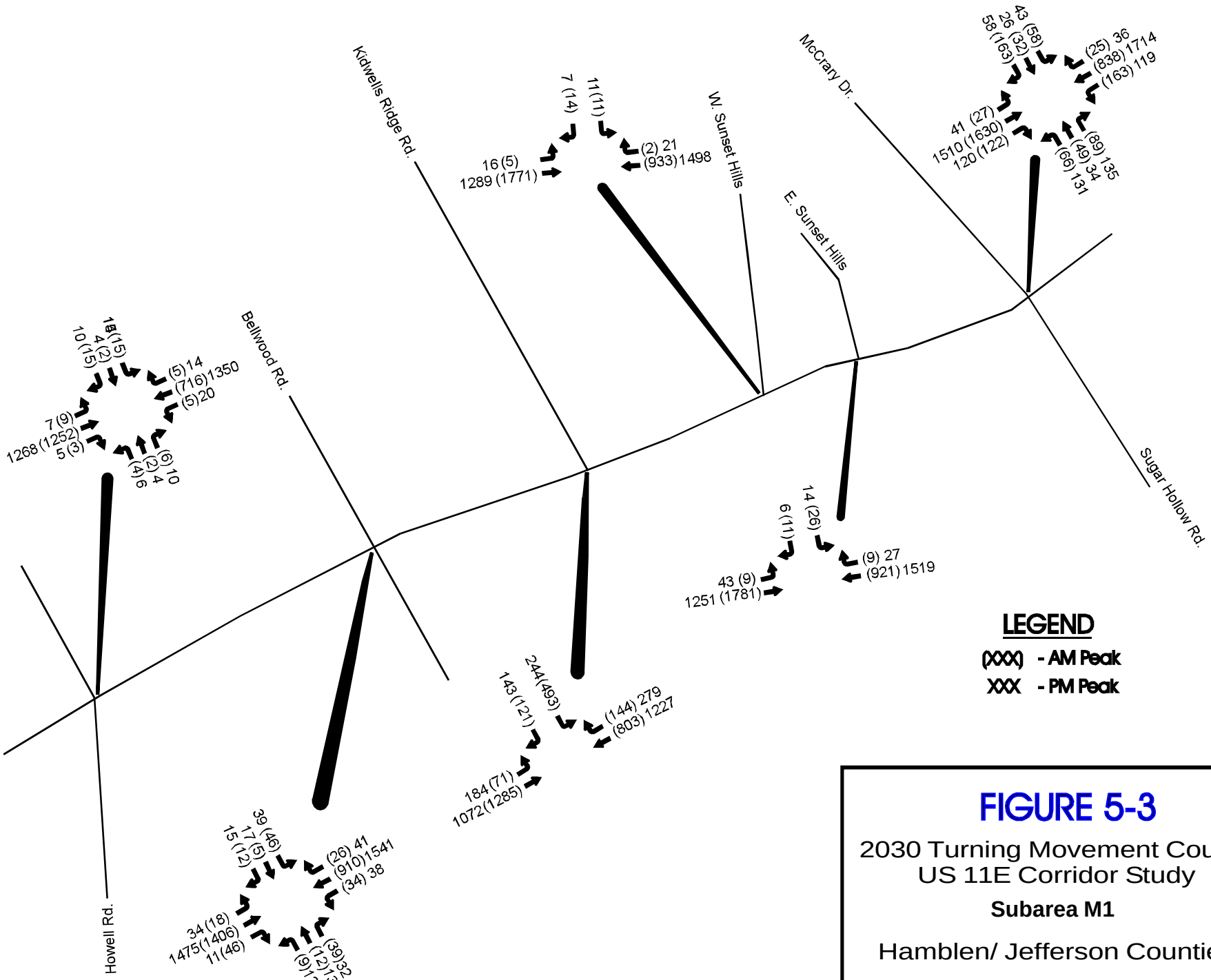


FIGURE 5-3

2030 Turning Movement Counts
US 11E Corridor Study

Subarea M1

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

During the AM peak, no stops were noted at either of the signals. No stopped delay was experienced through Subarea M1 entering the Morristown area during the morning peak.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
Mccrary Dr							
Kidwell Ridge Rd	0.53	65.5	14.5	0.5	45	29.2	37.5
Panther Creek Rd (SR 342)	1.34	105.5	7.0	0.5	50	45.9	49.1
Total	1.88	171.0	21.5	1.0		37.6	43.3

Leaving Morristown (WB) during the PM peak.

Of note during the PM peak is the average running speed between McCrary and Kidwell Ridge Roads. Traffic travels almost 10 mph below the posted speed limit, a possible indication of turbulence in the traffic stream such as vehicles entering the stream from access points or slowing to turn right into them. Overall, movement is good through this area.

Level of Service

As outlined in Chapter 1, procedures from the *Highway Capacity Manual 2000* have been used to summarize intersection operation in base and future years. The table below presents the current and future LOS of each intersection, assuming no improvements are made.

Signalized Intersection Capacity Analysis Summary
US 11E Corridor Study ~ Subarea M1

Intersection Cross-Street	Time Period	Avg. Intersection Delay (sec.)	Level of Service	Time Period	Avg. Intersection Delay (sec.)	Level of Service
Merchants Green Road	Future					
Kidwells Ridge Road	AM 2004	17.9	B	PM 2004	14	B
	AM 2010	19.7	B	PM 2010	15.6	B
	AM 2030	28	C	PM 2030	21	C
McCrary Dr.	AM 2004	22.7	C	PM 2004	18.4	B
	AM 2010	25.2	C	PM 2010	20.6	C
	AM 2030	43.7	D	PM 2030	33.8	C

From the results above, all intersections are expected to operate acceptably through the 2030 design year.

Air Quality

Estimates of mobile source emissions inside of Subarea R reveal the following 2004 and 2010 levels:

Air Quality Estimations US 11E Corridor Study ~ Subarea M1				
Intersection Cross-Street	Time Period	CO Emmissions (kg/day)	NOx Emmisions (kg/day)	VOC Emmisions (kg/day)
Merchants Green Road	Future			
Kidwells Ridge Road	2004	39.4	7.7	9.1
	2010	40.6	7.9	9.4
McCrary Dr.	2004	47.6	9.3	11.0
	2010	52.2	10.1	12.1
Mainline	2004	480.4	64.5	43.2
	2010	332.1	43.8	29.6
TOTALS	**2004**	**567.5**	**81.4**	**63.4**
	2010	**424.9**	**61.8**	**51.1**

Roadway Design and Access

Right-of-Way

The existing right-of-way is generally 100' through this subarea. Some segments are variable from 120' to 85'. A 50' right-of-way is typical for cross-streets, but ranges from 90' to 30'.

Geometry

The mainline is a four lane section containing 4 @ 12' travel lanes divided by a non-traversable grass median. In fact, between Kidwells Ridge Road and McCrary Road, the road is a transition between a divided roadway and a five-lane section. East of McCrary, an urban five-lane section begins, the grass median replaced by a center two-way left turn lane. The median contains many openings, including several directional openings. Most major intersections have appropriate turn lanes and can adequately accommodate the existing traffic volumes; this is usually characterized by at least a separate left turn lane on the mainline. Left turn lanes also exist at most median openings.

Several aspects of the Kidwells Road intersection are problematic. Here, the 50' right-of-way along the minor street at the intersection may be inadequate to accommodate the recommended improvements. A short section of guardrail protects a signal pole and the signal controller cabinet. Two driveways serving a small real estate office also allow additional turning movement close to the intersection. The Kidwell Ridge approach to the intersection is also defined by a steep downgrade. Also, an offset driveway and a public road, W. Manley Court, lie within the influence zone of the intersection, creating confusing turning situations.

Shoulders and Curb
The roadside of most portions of this segment are defined by a 10' paved shoulder outside of the travel lanes in both directions. In several locations, this shoulder functions as a de facto continuous right turn lane. From McCrary Road to E. Sunset Hills Drive, curb-and-gutter drainage and a utility strip containing a 5' sidewalk behind is located outside of this shoulder. No curb exists west of E. Sunset Hills Drive.

Sidewalks
Sidewalks exist on both sides of the road between McCrary Road and E. Sunset Hills Drive. In-depth study would likely reveal several problems in conforming to ADA standards including: poor condition (cracks over ½" wide), broken segments, and a lack of sidewalk ramps. Also, no signalized intersection provides pedestrian displays and pushbutton activation. No crosswalks exist.

Intersection Spacing
As shown in the *Speed and Delay* section, the spacing between the two signalized intersections, Kidwells Ridge Road and McCrary Drive is just over ½ mile. These signals, however, are not coordinated and will not likely be so in the future (unless intermediate signals are installed). Of more interest is the spacing between Kidwells Ridge Road and the future Merchants Green intersection as coordination between these signals is likely in the future. These intersections will be located approximately 0.4 miles apart. Other unsignalized intersections exist in the area, but do not hinder the future progression capabilities, nor do they present significant safety problems.

Site Access and Circulation
Site Layout
This subarea has few major existing generators for which site circulation is notable, the largest and possibly most imminent opportunity for higher levels of development being at the Ingles site. While approximately 20 acres is available for retail or other commercial use, efforts have been taken to ensure proper internal circulation. Here, well spaced driveways exist (two on US 11E, two on Kidwells Ridge Road) one with limited right-in, right-out only access. Appropriate separated turn lanes exist at all driveway connections. Also, two three-lane roads are constructed to provide internal movement between outparcels.

Other sites, such as occupied by Angelo's Restaurant operate well with shared internal driveways. The Manley Baptist Church maintains three operating driveways on US 11E. These are well spaced, however, and contain satisfactory turn lanes and connect to an internal circulation road that allows additional movement inside the property.

Most other developments are individual smaller businesses relying less on internal movements and more on access to US 11E. Along the 1.16± mile section, 45 driveway openings exist. Added to the 10 existing and proposed public roads, this is an average access density of 47 access points per mile. Parking is generally sufficient and does not

appear to interfere with operation of the driveways, though a few properties may benefit from driveway definition (see *Recommendations*).

Driveways

Few parcels in this subarea posses unnecessary or problematic driveway intersections. A few are located within the influence area of adjacent intersections, however. Also, some driveways should be partially curbed to structure movements in and out of the property. Good examples of driveway sharing exist in this area such as noted at Angelo's Restaurant east of E. Sunset Hills Drive while others such as the Burger King Restaurant at McCrary Road should be encouraged to incorporate these private driveway connections.

Good use of shared driveways at Angelo's Restaurant.

Access to Cross-Streets

Of the 44 individual parcels with frontage onto US 11E, 20 are situated on a corner of a public road, therefore with frontage onto two streets. Of these, only three properties do not contain apparent direct access onto US 11E. These are: (1) Cherokee Health Systems at Bellwood Drive, (2) a residence at Bellwood Drive, and (3) a nursery at W. Manley Court.

Good examples of secondary access to a cross street instead of the mainline do exist here, however (United Way property onto W. Sunset Hills Road, Meineke Automotive onto E. Manley Court). Most of the 20 parcels with dual frontage do have at least one driveway onto the minor cross street.

Supporting Streets

No real usable support or parallel street network exists as an east-west alternative to US 11E in Subarea M1. However, due to the size and type of development in this area, as well as the existing control of turning movements provided by the grass median, this is less needed than in more urban areas (such as Subareas JC2 and M2). Development of a parallel system in this area would also be difficult because of the long distance between high traffic driveways, the setback and therefore necessary acquisition of multiple structures off of the corridor, and a lack of effective signalized intersections with which to connect the supporting road facility.

Recommendations

Signalization

Traffic congestion is increasingly becoming an important quality of life issue in many areas of the country. Uncoordinated signals in urban areas greatly contribute to congestion. A complete, properly maintained traffic management system has been shown to significantly reduce congestion as well as vehicle emissions.

Although an advanced traffic control system may include many different elements, the study focuses on the following strategies as being most suitable to Morristown:

- Use of a tiered approach to divide signals into prioritized groups and subgroups.
- Implementation of a communication network to connect and coordinate traffic signals.
- Establishment of a centralized location from which all signals may be remotely controlled and monitored.
- Implementation of a traffic surveillance program utilizing closed-circuit video cameras.

Advanced traffic management systems, which include the measures above, have proven to be a very cost effective element in managing traffic demand. Before/after studies have shown welcomed results.

Base Condition	Potential Improvement in Speed or Travel Time
Non-interconnected, pre-timed signals with old timing plans	25%
Existing Interconnected signal system with old timing plans	17%
Non-interconnected signals under actuated control	16%

Source: A Toolbox for Alleviating Traffic Congestion, ITE, 1989.

(1) Improvements regarding the signal subsystem in which the McCrary Road intersection is included are located in Subarea M2.

Currently, no signal coordination equipment is installed at the Kidwells Ridge Road intersection. While improvements could be made to include this intersection in the Subarea M2 subsystem (installation of radio communication equipment would be required as well as likely relocating the master controller or installing signal repeaters to allow communication to Kidwells Ridge due to terrain), this is not recommended. Instead, plans should be made to begin development of a new Subarea M1 progression plan to include the intersections of Kidwells Ridge Road, Merchants Green Road, State Route 342, and State Route 160. Additional communication should be installed at Lakeshore Road as part of this system for operational surveillance purposes.

The distances between these intersections range from 0.4± miles (Kidwells Ridge to Merchants Green Road) to 1.2± miles (SR 342 to SR 160). In order to maintain effective coordination, any new signals located between SR 160

and Kidwells Ridge Road should be located an acceptable distance from other signalized intersections (see *Site Access*).

In developing a new M1 subsystem, several communication methods may be considered:

- **Twisted-Pair** cable is a commonly used communication technology in traffic control system operations. The cable typically consists of multiple twisted pair, shielded, 300-volt communications "telephone type" cable with varying conductor sizes. The cable may be installed overhead, in duct or conduit, or by direct burial.

  Twisted pair cable communicates in closed-loop system using Time Division Multiplexing (TDM) at a 1,200 baud rate between intersections and provides dependable and efficient two-way communication. It does not require complicated installation techniques and can be maintained by the City's current staff.

- **Fiber-Optic** cable has gained popularity in many areas and is in the process of replacing twisted pair cable as the preferred traffic control system cable.

  Fiber-optic cable has several advanced features over conventional twisted pair cable. It communicates using TDM at an increased baud rate (1,200 to 19,200 baud); it provides a very large bandwidth for greater capacity in data transmission; it provides immunity from line noise and interference; it can transmit a signal over substantial distances; and it has enhanced video transmission capabilities for intersection surveillance.

  The cable may be installed overhead, in duct or conduit, or direct burial. It is also advantageous because it can be installed in the same conduit with lines carrying electrical current.

- **Spread Spectrum Radio** has often been used in traffic signal communication due to the higher costs associated with cable based system interconnect. The principal limitation to the use of radio technology has been the availability of frequency channels to handle the data rates needed and FCC licensing requirements.

  Spread-spectrum radio has been used for military applications and has been available since 1985 for use in civilian applications in the 900 MHz band at powers up to 1 watt. While the frequency and watt restriction generally have range limitations, spread-spectrum has been gaining popularity, especially in areas where cable installations are not possible or cost effective.

Spread-spectrum radio communicates using various modulation techniques at a baud rate of 1,200 to 1,900 in a full duplex mode. While spread spectrum radio is adequate for basic traffic signal control communications, there is a lack of video surveillance capabilities with spread-spectrum communications.

It is proposed that a new subsystem in this area be developed using fiber-optic technology. This will allow a wider range of flexibility and control, likely needed for the traffic levels expected by 2030. As any of these four signals require new components, it is recommended they be replaced with fiber-capable equipment. This recommendation applies to the Merchants Green Road signal, currently under design. Here, the design should specify a fiber-ready eight phase master controller and appropriate cabinet.

(2) Signal modification will be required at Kidwells Ridge Road, if the southbound approach is widened. If any signal equipment requires replacement at that time, recommendations under item (1) should be considered.

Roadway Geometrics

(1) From a safety and ease of operation standpoint, the southbound approach of Kidwells Ridge Road should be improved. In this, the southbound approach should be widened to accommodate two left-turn lanes and a single right turn lane. Current left southbound left turn AM volumes here are 401 per hour, and queues approach 400'. All improvement should be to the east side of Kidwells Ridge Road as this land is currently unimproved (see Figure 5-4). *Estimated Cost (Kidwells Ridge approach only): $185,000*

An optional secondary improvement at this location is to relocate the northern terminus of W. Manley Court to align with the improved Kidwells Ridge Road. This would create a four-leg intersection and improve overall operation. Property acquisition including purchase of the Advantage Auto Sales property would be required. *Estimated Cost: $225,000*

(2) The grass median through Subarea M1 should remain. While some directional median openings are located close together, they provide a reasonable level of access to businesses and may be maintained. One wide median opening, located across from E. Sunset Hills Drive should be narrowed. This will eliminate a secondary left-turn lane into Manley Baptist Church, however, another left turn lane exists immediately east of this one. *Estimated Cost: $6,000*

FIGURE 5-4

Proposed Improvements at
Kidwells Ridge Road

US 11E Corridor Study
Hamblen/ Jefferson Counties

NEEL-SCHAFFER

Site Access

Decreasing the number of driveways in this portion of the corridor will help to limit the number of conflict points faced by drivers. Practically, however, it would prove difficult to successfully combine and/or eliminate all the driveways needed to create a significantly improved corridor. Thus, recommendations are made only at particularly hazardous or confusing locations, where property owner objections may not be severe, and where general provisions may help guide future redevelopment.

Acceptable use of precast curb to define parking area at Manley Baptist Church.

It is important to note that driveway modifications are only recommended and may not be enforceable. Incentives for property owner cooperation or purchase of access rights may be negotiated, but existing access points should not be required to close. *General costs for curb modifications at driveways are expected to be approximately $5,000 per location.*

Access Improvement Recommendations
US 11E Corridor Study ~ Subarea M1

Property	Location	Problem	Solution	Comment
Pedal Shop	West of Sunset Strip	Unstructured access.	Curb driveway to provide definition.	
Audio Concepts	West of Sunset Strip	Unstructured access.	Curb driveway to provide definition.	
C&C Auto	West of Sunset Strip	Unstructured access.	Curb driveway to provide definition.	
Little Rascals Daycare	East of Sunset Strip	Unstructured access.	Curb driveway on Sunset Strip to provide definition.	
Precision Atuo Paint	South of Kidwells Ridge Rd.	Drive in intersection influence area.	Relocate to connect with W. Manley Court.	Only applies if W. Manley Court is relocated.
Manley Baptist Church	West of McCrary Drive	Unused drives in front of property.	Remove drives.	
Burger King Restaurant	West of McCrary Drive	Drive in intersection influence area.	Remove driveway onto US 11E.	Investigate shared drive with Western Willow Shopping Center.

General guidelines for future redevelopment access in this area are as follow:

A. The number of driveway openings should be maintained or decreased by closing unused driveways, combining driveways for comparable-use properties, removing redundant driveways, and utilizing driveways onto cross-streets to as great an extent as possible.

B. Requests for new driveways onto US 11E in Subarea M1 should only be considered if the following criteria are met:
    1. Reasonable access cannot be provided through an existing shared driveway arrangement or by connection to a minor cross-street.
    2. The proposed driveway will be located outside of any signalized intersection influence area. This minimum distance in Subarea M1 is 400' upstream of the intersection and 350' downstream of it.
    3. The proposed driveway will not require signalization.

C. Proposals for the construction of new public street intersections to US 11E in this area should be carefully considered. Preferred street characteristics include:
    1. Extended connectivity to streets other than US 11E. Dead-end streets are discouraged.
    2. Location of intersections outside of the influence areas of existing intersections. The influence areas of the two intersections (existing and proposed) should not overlap.
    3. Additional signalization should only be allowed in conjunction with a properly planned signal subsystem in this area. Due to the spacing of existing signals and for optimal progression spacing, no new signalized intersections should be considered in this subarea.
    4. Alignment across from existing streets or driveways is preferred.
    5. Properties immediately adjacent to the proposed street should move access to the proposed street and off of US 11E, if possible.

Summarized Improvement Recommendations
US 11E Corridor Study ~ Subarea M1

Location	Improvement	Estimated Costs	Completion Rating (1=High, 5=Low)
Kidwells Ridge Rd	Intersection improvement (Kidwells Ridge Rd approach only)	$185,000	2
Kidwells Ridge Rd	Realignment of W. Manley Ct and associated driveway modifications	$225,000	4
E. Sunset Hills Dr	Median opening narrowing	$6,000	4
Various	Curbing modifications at driveways	$5,000 per location ($35,000 total)	4

CHAPTER 6

Subarea M2 – McCrary Road to E. Economy Road *(1.68± miles)*

The most urbanized segment within the study limits, Subarea M2 supports a high percentage of the Morristown retail basis.

Land Use

Description

Current land use fronting US 11E is best described as almost exclusively commercial with isolated residential dwellings. Established neighborhoods, however, can be found just north of US 11E (as at White Avenue) and roughly 300' south of it (as at Western Avenue). Some undeveloped land exists a short distance off of the corridor, but may not be suitable for large-scale development due to steep grades and/or high capacity driveway limitations.

Zoning

The majority of this area is defined as an Intermediate Business District (IB). Exceptions are north of the corridor at White Avenue (180'± Single Family Residential, R-1), south of the corridor at White Avenue (470'± Medium Density Residential, R-2), north of the corridor at Austin Road (580'± Single Family Residential, R-1), south of the corridor in the vicinity of Barker and Austin Roads, (1400'± Office, Medical, Professional, OMP), and in the northeast quadrant of the E. Economy Road intersection with US 11E (180'± Local Business, LB).

Generators

Subarea M2 is made up of various types of retail properties, but none individually has an obvious significant impact on traffic patterns. Two large home improvement warehouse stores have recently opened with one (Lowe's) expecting to attract enough trips to warrant a new signalized intersection. The Lowe's site has one undeveloped outparcel, but is of limited size. Several supermarkets with associated retail are relatively large generators within the corridor. The majority of developments, however, are high turnover establishments (fueling stations, fast food restaurants, etc.) requiring limited parking areas and simple site circulation.

Parcels

Subarea M2 currently describes 94 individual parcels with frontage to US 11E. Of this number, 70 require direct access to the corridor because of a lack of frontage to a minor cross-street. The area currently has 116 driveway openings onto US 11E.

Growth Potential

Because of the small parcel size and the already dense use of existing land, major growth in this area is not expected. Many properties already posses multiple access points along US 11E and additional driveway openings are unlikely. The largest site currently

available for redevelopment is the 4.5-acre site currently occupied by the Coop Tobacco Warehouse. Depending on the future use of this site, additional access may be required. Likewise, areas immediately adjacent to the corridor in this section have experienced a high degree of development. While there is some additional land available for new developments, these would be limited in size and should not have a significant impact on the existing network.

Additional land does exist immediately behind properties fronting US 11E, particularly on the north side. For this portion of west Morristown to experience a high degree of additional retail or other commercial area, it is likely that efforts will have to be taken to abandon the strip development along the corridor that has been characteristic. Instead, future businesses may be established off of the US 11E corridor by means of a supplemental street network (see *Site Access and Circulation*).

Traffic Analyses

Average Daily Traffic (ADT)

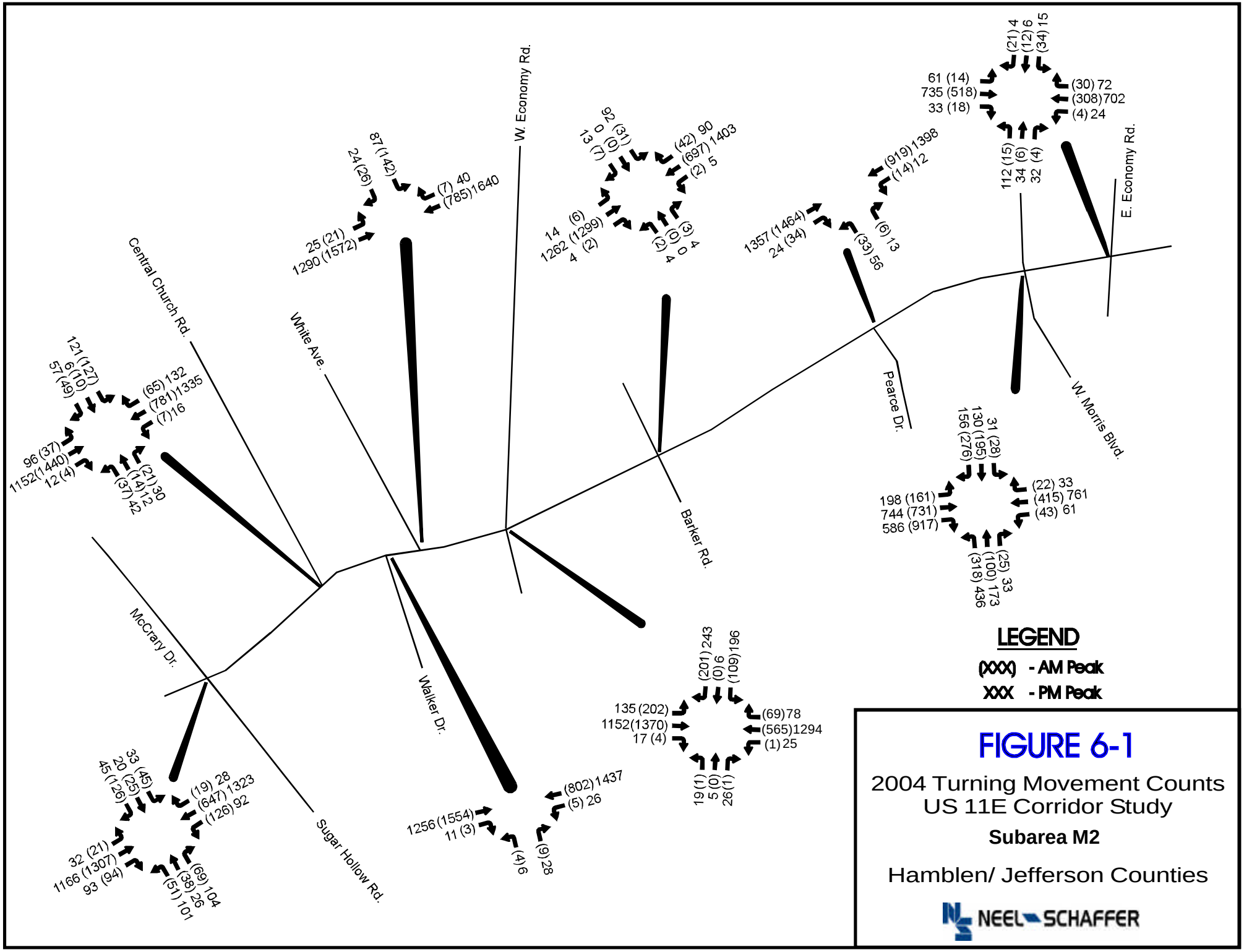
TDOT maintains one counting station within this subarea. Located just east of Morris Boulevard, the station's 2003 ADT was 22,040 vehicles per day (counted as a total of both directions). To supplement this data, Neel-Schaffer performed a count just west of Morris Boulevard (between Western Avenue and Pearce Drive) to capture the full traffic on US 11E before the traffic break of Morris Boulevard. This count revealed an ADT of 36,600 daily vehicles in 2004. Using growth factors (0.8% annually, based on 17-year TDOT data), the projected ADT levels are 38,900 in 2010 and 47,400 by 2030 (see Figure 1-1). The urban nature of this segment and the resulting level of build-out contributes to the lower traffic growth in this area.

Turning Movement Counts

Turning movement counts at public streets were also made during AM and PM peak hours; generally, 7:15 – 8:15 AM and 3:00 – 4:00 PM in this subarea. Using standard traffic growth procedures based on historical counts, movements for 2010 and 2030 have also been estimated. These are given as Figures 6-1 through 6-3.

Signalization

Eight signalized intersections exist in Subarea M2. A summary of an inventory of the signal equipment at each of these locations is presented below. Of the 8 signals, all have the capability of coordinated operation by means of spread-spectrum radio interconnect. However, only the signals at Barker Drive, W. Economy Road, White Avenue, and Central Church Road are currently in coordinated operation. At these four signals, two plans (a morning and an afternoon plan) increase or decrease the maximum split times based on the predominant traffic flow. Overall, the system is operating well; all equipment, including signal heads, was found to be in good condition. Signal improvement recommendations are given at the end of this chapter.



LEGEND

(XXX) - AM Peak

XXX - PM Peak

FIGURE 6-1

2004 Turning Movement Counts
US 11E Corridor Study

Subarea M2

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

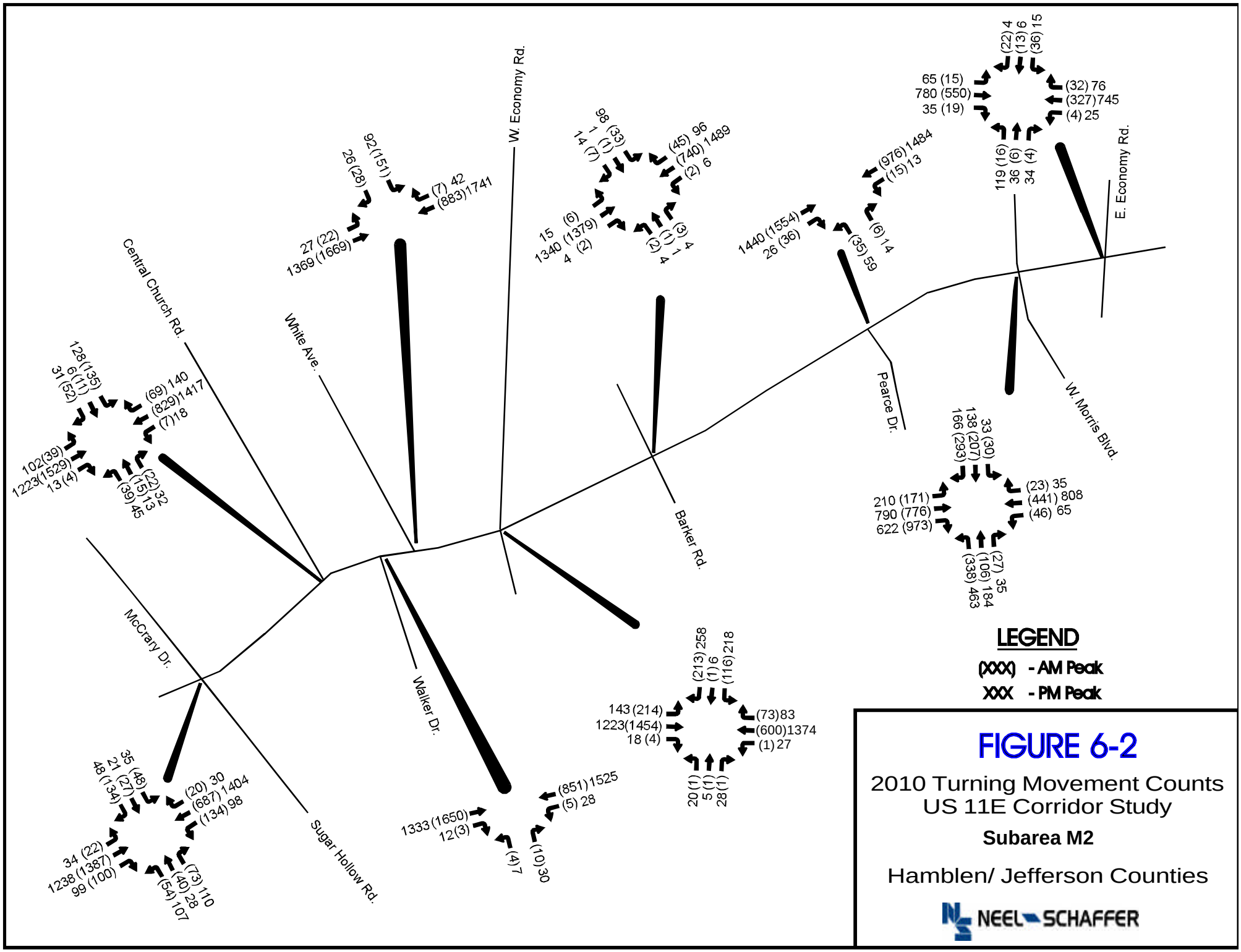


FIGURE 6-2

2010 Turning Movement Counts
US 11E Corridor Study

Subarea M2

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

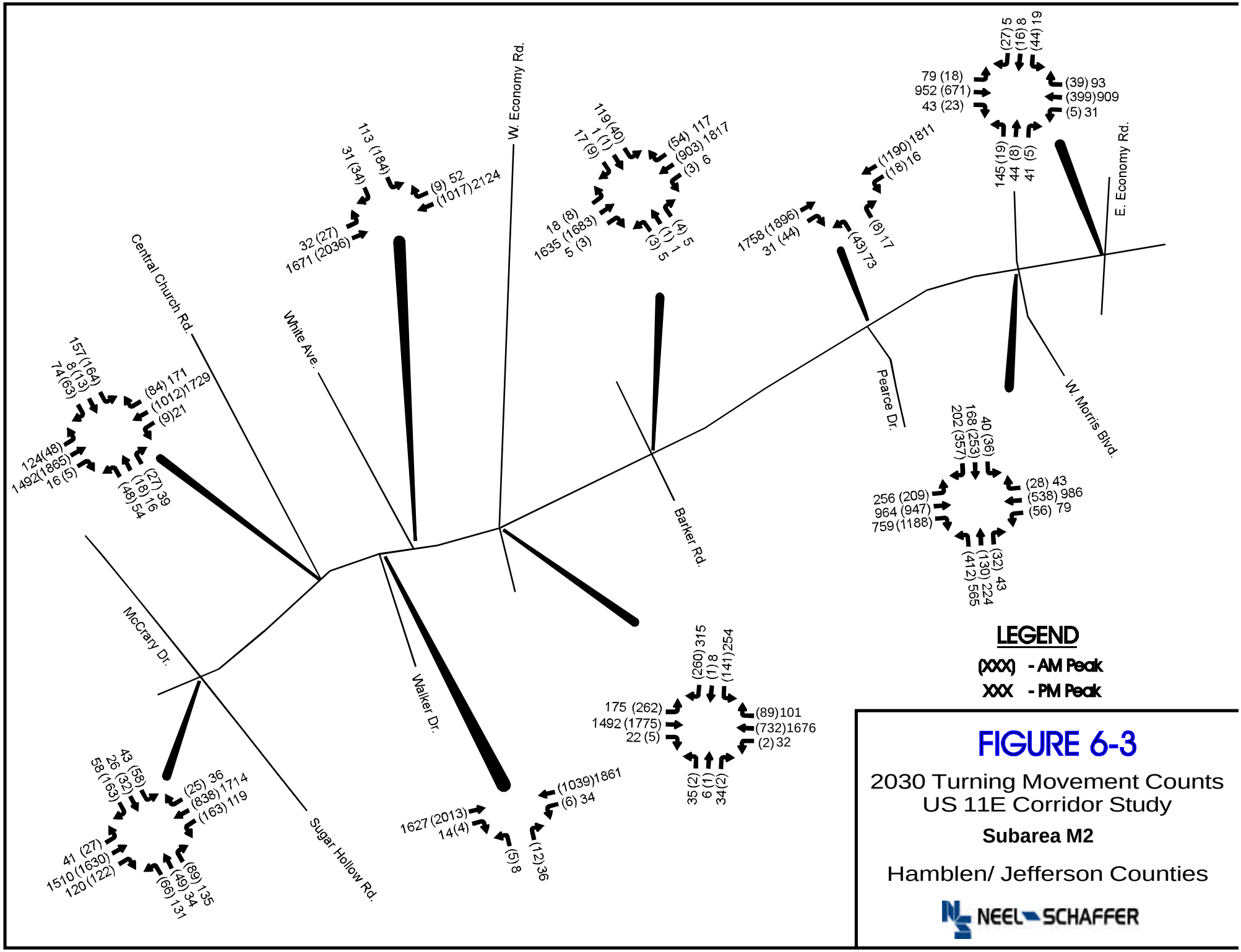


FIGURE 6-3

2030 Turning Movement Counts
US 11E Corridor Study

Subarea M2

Hamblen/ Jefferson Counties

NEEL-SCHAFFER

TRAFFIC SIGNAL EQUIPMENT INVENTORY

Intersection	Signal Controller	Signal Cabinet	Signal Phasing and Operation	Master Controller	Existing Signal Interconnect	Communications Equipment	Preemption Detection
US 11E at							
McCrary Road	Epac 3208	Base	Isolated, Actuated, 6 Phase	None	Spread-Spectrum Radio	Radio Antenna, Data Receiver, Power Supply Present **(Not Operating)**	Yes
Central Church Road	Epac 3208	Base	Coordinated, Actuated, 6 Phase	None	Spread-Spectrum Radio	Radio Antenna, Data Receiver, Power Supply Present	Yes
White Avenue	Epac 3608	Pole	Coordinated, Actuated, 3 Phase	None	Spread-Spectrum Radio	Radio Antenna, Data Receiver, Power Supply Present	No
W. Economy Road	Epac 3208	Base	Coordinated, Actuated, 8 Phase	None	Spread-Spectrum Radio	Radio Antenna, Data Receiver, Power Supply Present	Yes
Barker Road	Epac 3208	Base	Coordinated, Actuated, 3 Phase	None	Spread-Spectrum Radio	Radio Antenna, Data Receiver, Power Supply Present	Yes
Pearce Drive	Epac 3608	Pole	Isolated, Actuated, 3 Phase	None	Spread-Spectrum Radio	Radio Antenna, Data Receiver, Power Supply Present **(Not Operating)**	Yes
W. Morris Boulevard	Epac 3608	Base	Isolated, Actuated, 6 Phase	Marc 300	Spread-Spectrum Radio	Radio Antenna, Data Receiver, Power Supply Present	Yes
E. Economy Road	Epac 3608	Base	Isolated, Actuated, 6 Phase	None	Spread-Spectrum Radio	Radio Antenna, Data Receiver, Power Supply Present **(Not Operating)**	Yes

Speed and Delay

As outlined in Chapter 1, speed and delay data has been gathered through the entire length of the corridor. The results for Subarea M2 are given below.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (mph) Average	Speed (mph) Running
Mccrary Dr							
Central Church Rd	0.25	46.0	18.5	0.5	40	19.8	33.2
White Ave	0.18	22.5	0.0	0.0	40	28.3	28.3
W Economy Rd	0.15	16.0	0.0	0.0	40	33.8	33.8
Lowe's	0.28	25.5	0.0	0.0	40	39.0	39.0
Pearce Dr	0.42	36.5	0.0	0.0	40	41.1	41.1
W Morris Blvd	0.26	45.5	16.0	0.5	40	20.6	31.8
E Economy Dr	0.15	25.0	4.5	0.5	40	22.1	26.9
Total	1.69	217.0	39.0	1.5		29.2	33.4

Entering Morristown (EB) during the AM peak.

During the AM peak, stops were noted at the Central Church Road, Morris Boulevard, and East Economy Road signals. The longest delay was experienced at Central Church Road (this signal appears to be operating on the wrong timing plan in the morning, discussed further in *Recommendations*), followed by Morris Boulevard. Traffic moving slower than the posted speed limit is typical for this type of urban arterial where frequent right-turns and congested lanes can slow travel.

Feature Description	Link Length (mi)	Travel Time (sec)	Delay (sec)	Stops	Posted Speed (mph)	Speed (MPH) Average	Speed (MPH) Running
E Economy Rd							
W Morris Blvd	0.15	80.5	59.0	1.0	40	6.9	25.8
Pearce Dr	0.26	26.0	0.0	0.0	40	36.0	36.0
Lowe's	0.41	39.0	2.5	0.5	40	38.1	40.7
W Economy Rd	0.28	26.0	0.0	0.0	40	38.6	38.6
White Ave	0.15	13.0	0.0	0.0	40	40.9	40.9
Central Church Rd	0.18	16.0	0.0	0.0	40	40.4	40.4
Mccrary Dr	0.26	23.5	0.0	0.0	40	39.2	39.2
Total	1.69	224.0	61.5	1.5		34.3	37.4

Leaving Morristown (WB) during the PM peak.

The PM peak in this section experiences better operation through almost all signalized intersections. The exception is at Morris Boulevard where heavy turning movements require longer cycles.

Level of Service

As outlined in Chapter 1, procedures from the *Highway Capacity Manual 2000* have been used to summarize intersection operation in base and future years. The table below presents the current and future LOS of each intersection, assuming no improvements are made.

Signalized Intersection Capacity Analysis Summary
US 11E Corridor Study ~ Subarea M2

Intersection Cross-Street	Time Period	Avg. Intersection Delay (sec.)	Level of Service	Time Period	Avg. Intersection Delay (sec.)	Level of Service
E. Economy Rd.	AM 2004	8.1	A	PM 2004	13	B
	AM 2010	8.1	A	PM 2010	13.3	B
	AM 2030	8.2	A	PM 2030	16.8	B
W. Morris Blvd.	AM 2004	39.6	D	PM 2004	34.5	C
	AM 2010	47.8	D	PM 2010	38.9	D
	AM 2030	86.1	F	PM 2030	58.1	E
Pearce Dr.	AM 2004	4.6	A	PM 2004	5.7	A
	AM 2010	4.7	A	PM 2010	6	A
	AM 2030	6	A	PM 2030	8.3	A
Barker Rd.	AM 2004	2.6	A	PM 2004	6.1	A
	AM 2010	2.9	A	PM 2010	6.9	A
	AM 2030	3.7	A	PM 2030	9.4	A
E. Economy Rd.	AM 2004	6.1	A	PM 2004	14.4	B
	AM 2010	6.8	A	PM 2010	16.2	B
	AM 2030	8.7	A	PM 2030	27.1	C
White Ave.	AM 2004	11.1	B	PM 2004	6.2	A
	AM 2010	11.8	B	PM 2010	6.6	A
	AM 2030	16.1	B	PM 2030	11.3	B
Central Church Rd.	AM 2004	14.5	B	PM 2004	15.3	B
	AM 2010	16.2	B	PM 2010	14.8	B
	AM 2030	21.7	C	PM 2030	23.1	C
McCrary Dr.	AM 2004	22.7	C	PM 2004	18.4	B
	AM 2010	25.2	C	PM 2010	20.6	C
	AM 2030	43.7	D	PM 2030	33.8	C

From the results above, all intersections are expected to operate acceptably through the 2030 design year with the exception of US 11E at W. Morris Boulevard. Here, the high number of northbound left turns in conflict with heavy eastbound and westbound through movements make operations reach unacceptable levels of service by the 2030 design year.

Air Quality
Analysis of the Subarea M2 segment yields the following emissions estimates for 2004 and 2010:

Air Quality Estimations
US 11E Corridor Study ~ Subarea M2

Intersection Cross-Street	Time Period	CO Emmissions (kg/day)	NOx Emmisions (kg/day)	VOC Emmisions (kg/day)
E. Economy Rd.	2004	18.4	3.5	4.2
	2010	18.8	3.7	4.4
W. Morris Blvd.	2004	46.2	9.0	10.7
	2010	51.5	10.0	12.0
Pearce Dr.	2004	32.1	6.2	7.4
	2010	34.4	6.7	8.0
Barker Rd.	2004	34.3	6.7	8.0
	2010	37.2	7.2	8.6
W. Economy Rd.	2004	39.9	7.8	9.3
	2010	43.6	8.5	10.1
White Ave.	2004	16.8	3.3	4.0
	2010	18.3	3.6	4.2
Central Church Rd.	2004	36.5	7.1	8.5
	2010	38.3	7.5	8.9
McCrary Dr.	2004	47.6	9.3	11.0
	2010	52.2	10.1	12.1
Mainline	2004	916.2	124.8	90.8
	2010	570.7	76.2	55.9
TOTALS	**2004**	**1,188.0**	**177.6**	**153.8**
	2010	**864.9**	**133.4**	**124.1**

Roadway Design and Access

Right-of-Way
The existing right-of-way is consistent at 100’ through this subarea. A 50’ right-of-way is typical for cross-streets, but ranges from 80’ (Morris Boulevard) to 30’ (Barker Road).

Geometry
Generally adequate through the study section, the mainline is a five lane section containing 4 @ 12’ travel lanes separated by a center two-way left turn lane. The center turn lane also serves as a de facto left-turn lane at intersections, though not striped as

such. Most intersections have appropriate turn lanes and can adequately accommodate the existing traffic volumes; this is usually characterized by at least a separate left turn lane on the mainline. Because cross-street volumes are relatively minor and some are operating under a split phase, intersection geometries are not critical.

Evidence of zero-radius curb at Pearce Dr.

One geometric problem noted was the lack of curb radius consistency at public street intersections. While most are sufficient, the radius appeared substandard at at least two minor cross-streets, Pearce Drive and Barker Road.

Shoulders and Curb

The roadside of most portions of this segment are defined by a 3'-7' paved shoulder outside of the travel lanes in both directions, curb-and-gutter drainage, and a utility strip containing a 5' sidewalk behind this. In some locations, the extra shoulder width is dropped to allow a separated right turn lane.

Sidewalks

Sidewalks exist on both sides of the road through the limits defined as Subarea M2. In-depth study would likely reveal several problems in conforming to ADA standards, including: poor condition (cracks over ½" wide), broken segments, obstacles in the path of the sidewalk, and a lack of sidewalk ramps. Also, no signalized intersection provides pedestrian displays and pushbutton activation. A painted crosswalk only exists on one side of the Barker Road intersection.

Intersection Spacing

In this area, intersection spacing is more critical from a signal coordination standpoint than a safety perspective. As shown in the *Speed and Delay* section, average signalized intersection spacing is just under ¼ mile, with the longest segment, between Barker Road and Pearce Drive being less than ½ mile. This close intersection spacing is favorable in this area due to the increased ability to effectively coordinate signals. Several other unsignalized intersections exist in the area, but do not hinder the progression capabilities between E. Economy Road and McCrary Road.

Site Access and Circulation

Site Layout

As discussed under *Land Use*, this subarea has few major generators for which site circulation is notable; at the Home Depot and the Lowe's sites, steps have been taken to alleviate the impacts to US 11E from generated traffic. Instead, most developments are individual smaller businesses relying less on internal movements and more on direct access to US 11E. Along the 1.68± mile section, 116 driveway openings exist. Added to the 12 public roads, this is an average access density of 76 access points per mile. Parking is generally sufficient and does not appear to interfere with operation of the driveways.

Driveways
Partly due to the small frontage lengths to US 11E for individual frontage and partly due to a perceived advantage of having direct access to the arterial, an average of only 76' between driveways exists. While more driveways may be conceived as a convenience for the business owner and patron, they raise the accident rate, average delay, and overall integrity of this principal arterial.

Many of the properties within this section maintain two driveways onto US 11E and several have an additional driveway onto an adjacent cross street. The radii of some separate driveways touch, separated by as little as a 5' grass strip. Other driveway openings have been abandoned and are closed by landscaping or parked cars.

Access to Cross-Streets
Of the 94 individual parcels with frontage onto US 11E, 24 are situated on a corner of a public road, with frontage onto two streets. Of these, only five properties do not contain direct access onto US 11E. These properties operate with one or more access points from the minor street and/or through a shared driveway arrangement. These properties are (1) residence at White Avenue, (2) Pennzoil Lube at White Avenue, (3) Morristown Self Storage at New Line Road, (4) psychic at Barker Road, (5) Colors Decorating at Western Avenue, and (6) Long John Silver's Restaurant at Western Avenue.

Supporting Streets
The supporting street network in Subarea M2 is limited to the minor intersecting cross-streets; little east-west movement occurs in this area apart from the study corridor. A small amount of traffic north of the corridor may use the Economy Roads to bypass the congested Morris Boulevard intersection when traveling to downtown. Also, some traffic eastbound along US 11E may use Pearce and Maden Drives to continue along US 11E. However, the added length of travel and inconveniences such as railroad crossings make these impractical diversions from the mainline for large amounts of traffic.

This sign at a private drive directs traffic to a non-signalized approach. Access can be improved through a system of supporting street connectivity.

Recommendations
Signalization
(1) A simple and effective improvement to enhance movement through the corridor is establishing and implementing an updated signal coordination program for the eight intersections defined by Subarea M2. All of these intersections have the necessary communications equipment already (spread-spectrum radio) and four of the intersections are currently operating on AM and PM peak plans. No additional equipment is needed to implement an

improved timing program, but a higher level of signal analysis may be required.

NOTE: The intersection at Central Church Road appears to be operating on an incorrect timing plan during the AM Peak period (plan 111 instead of 211). This is creating a greater likelihood that mainline traffic will experience longer delays at this intersection, as evidenced by the travel time data.

In estimating the benefits to an updated timing program, Synchro was used to optimize cycle offsets while maintaining a cycle length of 120 seconds. This analysis was completed for the PM peak scenarios of 2004 and 2010. Comparison results of the existing system versus the optimized system are below.

2004:

Location	*Before* Avg. Delay (sec)	*After* Avg. Delay (sec)	*Before* LOS	*After* LOS	*Before* CO Emmissions (kg/day)	*After* CO Emmissions (kg/day)	*Before* Nox Emmisions (kg/day)	*After* Nox Emmisions (kg/day)	*Before* VOC Emmisions (kg/day)	*After* VOC Emmisions (kg/day)
E. Economy Rd.	13	11.1	B	B	18.4	16	3.5	3.1	4.2	3.7
W. Morris Blvd.	34.5	24.1	C	C	46.2	40	9	7.8	10.7	9.3
Pearce Dr.	5.7	4.7	A	A	32.1	30.1	6.2	6	7.4	7.1
Barker Rd.	6.1	6.1	A	A	34.3	35.6	6.7	6.9	8	8.2
W. Economy Rd.	14.4	8.9	B	A	39.9	36.5	7.8	7.1	9.3	8.4
White Ave.	6.2	5.6	A	A	16.8	16.6	3.3	3.2	4	3.9
Central Church Rd.	15.3	11.8	B	B	36.5	35.1	7.1	6.8	8.5	8.1
McCrary Dr.	18.4	15.1	B	B	47.6	44.3	9.3	8.6	11	10.3
Mainline	N/A	N/A	N/A	N/A	916.2	916.2	124.8	124.8	90.8	90.8
TOTAL	**N/A**	**N/A**	**N/A**	**N/A**	**1188**	**1170.4**	**177.7**	**174.3**	**153.9**	**149.8**

2010:

Location	*Before* Avg. Delay (sec)	*After* Avg. Delay (sec)	*Before* LOS	*After* LOS	*Before* CO Emmissions (kg/day)	*After* CO Emmissions (kg/day)	*Before* Nox Emmisions (kg/day)	*After* Nox Emmisions (kg/day)	*Before* VOC Emmisions (kg/day)	*After* VOC Emmisions (kg/day)
E. Economy Rd.	13.3	12.9	B	B	18.8	19.9	3.7	3.9	4.4	4.6
W. Morris Blvd.	38.9	24.8	D	C	51.5	50.7	10	9.9	12	11.8
Pearce Dr.	6	5.9	A	A	34.4	24.6	6.7	6.7	8	8
Barker Rd.	6.9	5.7	A	A	37.2	35.9	7.2	7.8	8.6	8.3
W. Economy Rd.	16.2	11.5	B	B	43.6	38.1	8.5	7.4	10.1	8.8
White Ave.	6.6	6.7	A	A	18.3	19.3	3.6	3.8	4.2	4.5
Central Church Rd.	14.8	12.6	B	B	38.3	29.5	7.5	5.7	8.9	6.8
McCrary Dr.	20.6	18.6	C	B	52.2	54.2	10.1	10.5	12.1	12.6
Mainline	N/A	N/A	N/A	N/A	570.7	570.7	76.2	76.2	55.9	55.9
TOTAL	**N/A**	**N/A**	**N/A**	**N/A**	**865**	**842.9**	**133.5**	**131.9**	**124.2**	**121.3**

From this data (in 2004), it can be concluded that introduction of a coordinated signal system in this area could decrease overall average delay by over 20% and could decrease total mobile source emissions by roughly 6% or 25 kg/day.

In making the recommendation to implement improved subsystem timings in this subarea, Neel-Schaffer has developed preliminary timings that may be used to begin development of an improved signal system.

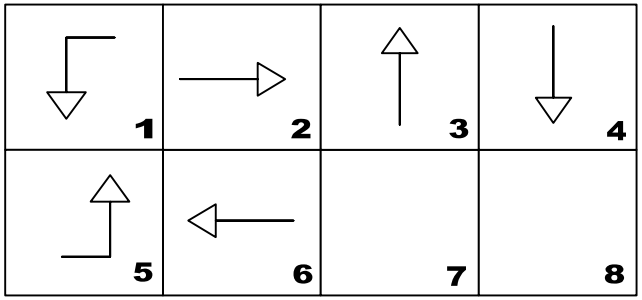
Using the directional peak hour traffic volume counts as a guide, two different signal timing patters were developed for the subsystem. The patterns consist of three basic components: cycle lengths, splits, and offset. Together, all three parameters define the "bandwidth" of green time that allows traffic to proceed along the signalized arterial system with minimized delay and stops. Time-space diagrams developed for each proposed pattern were reviewed and adjusted as needed to maximize green bandwidths for both arterial travel directions. The tables on the following pages provide the newly developed timing patterns by defining the cycle lengths, phase splits, and signal offsets.

IMPORTANT: These timings were developed based only on theoretical modeled scenarios and should be regarded as a beginning point for further development of the signal subsystem. While the model was built around actual traffic count and travel time data collected for this study, it will only provide an approximation of real-time conditions. Thus, close attention should be given to the system operation if any signal timings are modified and calibrated appropriately to ensure optimal performance.

MCCRARY DRIVE

Timing Pattern	Total Maximum Split (% of cycle) by Phase								Cycle Length (sec)	Offset (sec)
	1	2	3	4	5	6	7	8		
AM Peak (7:15 - 8:15)	15	59	14	22	12	62			110	66
PM Peak (3:30 - 5:00)	15	65	21	19	14	66			120	56
Off Peak	Free									

Phasing (as existing)



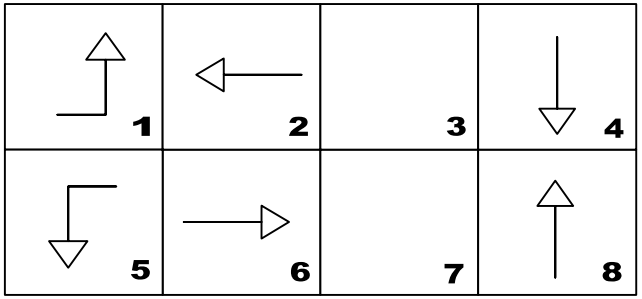
Recommended All-Red Timings

Phase	Yellow Time (sec)	All Red Time (sec)
1	4.0	0.5
2	4.0	2.0
3	4.0	1.5
4	4.0	1.5
5	4.0	0.5
6	4.0	2.0
7		
8		

CENTRAL CHURCH ROAD

Timing Pattern	Total Maximum Split (% of cycle) by Phase								Cycle Length (sec)	Offset (sec)
	1	2	3	4	5	6	7	8		
AM Peak (7:15 - 8:15)	12	67		31	12	67		31	110	89
PM Peak (3:30 - 5:00)	15	72		33	13	74		33	120	27
Off Peak	Free									

Phasing (as existing)



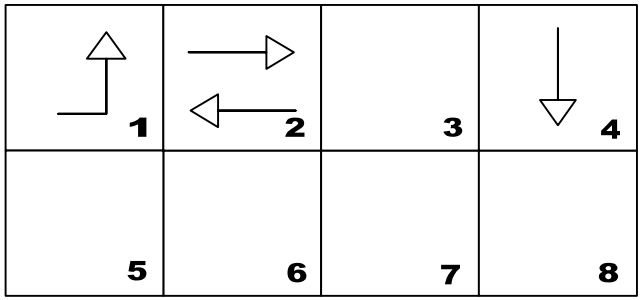
Recommended All-Red Timings

Phase	Yellow Time (sec)	All Red Time (sec)
1	4.0	0.5
2	4.0	2.0
3		
4	4.0	1.5
5	4.0	0.5
6	4.0	2.0
7		
8	4.0	1.5

WHITE AVENUE

Timing Pattern	Total Maximum Split (% of cycle) by Phase								Cycle Length (sec)	Offset (sec)
	1	2	3	4	5	6	7	8		
AM Peak (7:15 - 8:15)	14	71		25					110	79
PM Peak (3:30 - 5:00)	16	81		23					120	0
Off Peak	Free									

Phasing (as existing)



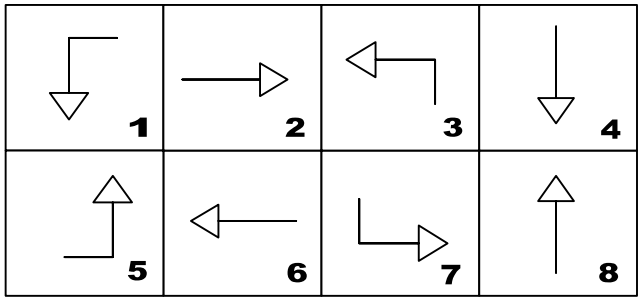
Recommended All-Red Timings

Phase	Yellow Time (sec)	All Red Time (sec)
1	4.0	0.5
2	4.0	2.0
3		
4	4.0	2.0
5		
6		
7		
8		

W. ECONOMY DRIVE

Timing Pattern	Total Maximum Split (% of cycle) by Phase								Cycle Length (sec)	Offset (sec)
	1	2	3	4	5	6	7	8		
AM Peak (7:15 - 8:15)	14	64	14	18	18	60	15	17	110	11
PM Peak (3:30 - 5:00)	12	73	12	23	18	57	20	15	120	107
Off Peak	Free									

Phasing (as existing)



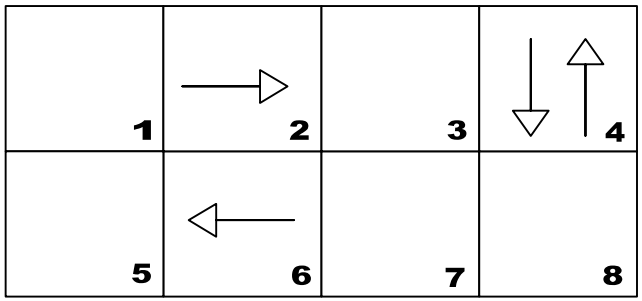
Recommended All-Red Timings

Phase	Yellow Time (sec)	All Red Time (sec)
1	4.0	0.5
2	4.0	2.0
3	4.0	0.5
4	4.0	1.5
5	4.0	0.5
6	4.0	2.0
7	4.0	0.5
8	4.0	1.5

BARKER DRIVE

Timing Pattern	Total Maximum Split (% of cycle) by Phase								Cycle Length (sec)	Offset (sec)
	1	2	3	4	5	6	7	8		
AM Peak (7:15 - 8:15)		76		34					110	34
PM Peak (3:30 - 5:00)		83		37					120	2
Off Peak	Free									

Phasing (as existing)



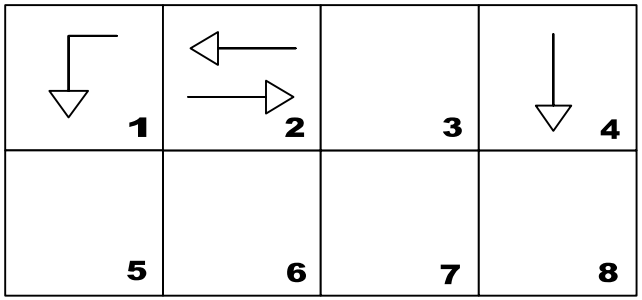
Recommended All-Red Timings

Phase	Yellow Time (sec)	All Red Time (sec)
1		
2	4.0	0.5
3		
4	4.0	1.0
5		
6	4.0	0.5
7		
8		

PEARCE DRIVE

Timing Pattern	Total Maximum Split (% of cycle) by Phase								Cycle Length (sec)	Offset (sec)
	1	2	3	4	5	6	7	8		
AM Peak (7:15 - 8:15)	18	71		21					110	69
PM Peak (3:30 - 5:00)	21	75		24					120	89
Off Peak	Free									

Phasing (as existing)



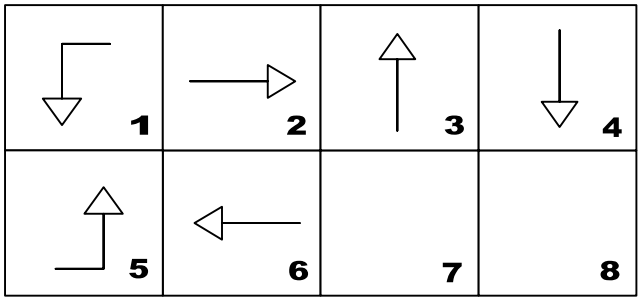
Recommended All-Red Timings

Phase	Yellow Time (sec)	All Red Time (sec)
1	4.0	0.5
2	4.0	2.0
3		
4	4.0	2.0
5		
6		
7		
8		

W. MORRIS BOULEVARD

Timing Pattern	Total Maximum Split (% of cycle) by Phase								Cycle Length (sec)	Offset (sec)
	1	2	3	4	5	6	7	8		
AM Peak (7:15 - 8:15)	12	50	15	33	13	49			110	84
PM Peak (3:30 - 5:00)	12	51	26	31	21	42			120	100
Off Peak	Free									

Phasing (as existing)



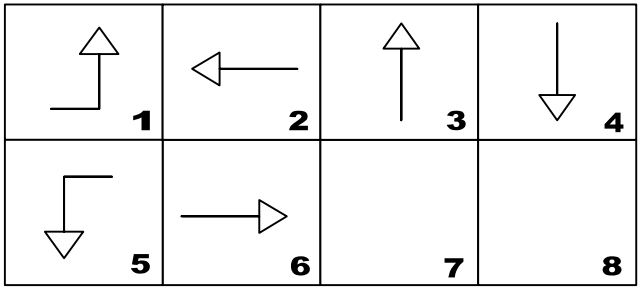
Recommended All-Red Timings

Phase	Yellow Time (sec)	All Red Time (sec)
1	4.0	0.5
2	4.0	2.0
3	4.0	2.0
4	4.0	2.0
5	4.0	0.5
6	4.0	2.0
7		
8		

E. ECONOMY DRIVE

Timing Pattern	Total Maximum Split (% of cycle) by Phase								Cycle Length (sec)	Offset (sec)
	1	2	3	4	5	6	7	8		
AM Peak (7:15 - 8:15)	22	41	22	25	22	41			110	4
PM Peak (3:30 - 5:00)	20	50	27	23	20	50			120	9
Off Peak	Free									

Phasing (as existing)



Recommended All-Red Timings

Phase	Yellow Time (sec)	All Red Time (sec)
1	4.0	0.5
2	4.0	2.0
3	4.0	2.0
4	4.0	2.0
5	4.0	0.5
6	4.0	2.0
7		
8		

(2) Building off of the existing system from E. Economy Road to McCrary Road, other improvements should be made as funds allow.

- Upgrade from the existing MARC software to ACTRA, a PC-based traffic management tool that allows monitoring and control of the system from the city engineering office. *Estimated Cost : $10,000 - $20,000*
- Install system loops. These 6'x6' loops can be used as a simple form of ITS to report real-time traffic operation. Continuous data such as speed and volume counts can be collected and alarms can be set to notify of drastic operational pattern changes. *Estimated Cost: $20,000*
- The radio communication currently should reach from the master controller at Morris Boulevard to the last subsystem intersection at McCrary Road. A contractor should verify this. If the signal is unreliable consideration should be made to move the master controller.
- New 8-phase, base-mounted cabinets should be installed at White Avenue and at Pearce Drive. The cabinets should be rewired to take advantage of all eight phases. *Estimated Cost: $10,000 (per location)*

(3) Another change in operation that should be considered is the removal of the intersections at E. Economy Road and at McCrary Road from split-phase operation. At E. Economy Road, all north and southbound traffic should operate concurrently on phase 4. At McCrary Road, dual entry operation under phase 4 should be considered. *Estimated Cost: $2,000 (per location)*

(4) A more capital-intensive improvement is the installation of pedestrian equipment. The City of Morristown Greenway Master Plan identifies the portion of Subarea M2 between W. Economy Road and McCrary Road as carrying a "Type B" greenway. With this designation, pedestrian signal heads and pushbutton activation are strongly recommended. Even outside of this greenway designation, the presence of sidewalks makes pedestrian signal equipment highly desirable. *Estimated Cost: $5,000 per intersection*

(5) In looking toward the 2030 design year, a more complete and complex signal system may be warranted in this area. While the radio communication works well now, it does have some limitations. As traffic growth makes congestion more pronounced, more operational flexibility may be desired. This can come in the form of real ITS applications including video surveillance of key intersections. As controllers or other signal equipment is replaced, attention should be given to its fiber-optic capabilities. A fiber system will yield the highest level of intersection control, but with the highest cost as well.

Roadway Geometrics

(1) From the intersection operational analysis undertaken, the only location in need of additional capacity is the Morris Boulevard intersection. Here, predominant movements are the northbound left turn and the eastbound right turn (through movements following the US 11E designation) and the east and

westbound through movements. However, because of severe right-of-way impacts in improving any of these lanes, another improvement is recommended.

By adding a second eastbound left turn lane, an acceptable service life for this intersection may be extended. This dual left turn lane would adequately serve the expected 250± left turns here in the design year and allow more green time to be given to other heavy movements. An additional receiving lane would be required on the southern terminus of Walters Drive and would likely extend for approximately 300' before tapering. Right-of-way acquisition on this leg of the intersection is expected to be less expensive and have less impact than added through lanes along US 11E. In order to add the additional left turn lane along US 11E, it may be necessary to narrow all lanes to an 11' width. It is expected that this improvement could then be completed inside of the existing 100' right-of-way. See Figure 6-4. *Estimated Cost: $235,000*

Another improvement already planned for this intersection is the addition of a separate right turn lane along the southbound Walters Drive approach. Current city plans estimate that this work can be completed inside the existing right-of-way and the above additional improvement has been developed in conjunction with the city plans.

(2) The curb radii of intersecting streets should be improved at Pearce Drive. With consideration of occasional truck traffic, the desired ability to make right turns easily from US 11E, and ease and safety of pedestrian crossing, it is recommended to reconstruct the radii to 30'. Minimal right-of-way acquisition and/or damages would be required to implement this improvement. *Estimated Cost: $7,000*

While the curb radii of other minor streets such as Barker Road may be shorter than desired, the limited type and volume of traffic on these streets makes improvement unnecessary at this time.

(3) A major issue in this area is the functionality of the 5-lane cross section. Much has been documented on the appropriate use of the two-way left-turn lane (TWLTL) and several characteristics of this facility violate those guidelines. The *Andrew Johnson Highway Access Management Study* prepared for the City of Morristown in January 2004 correctly lists these violations including: improper application for a principal arterial, the number and spacing of driveways can make the TWLTL hazardous, and the volume of traffic exceeds optimal operation.

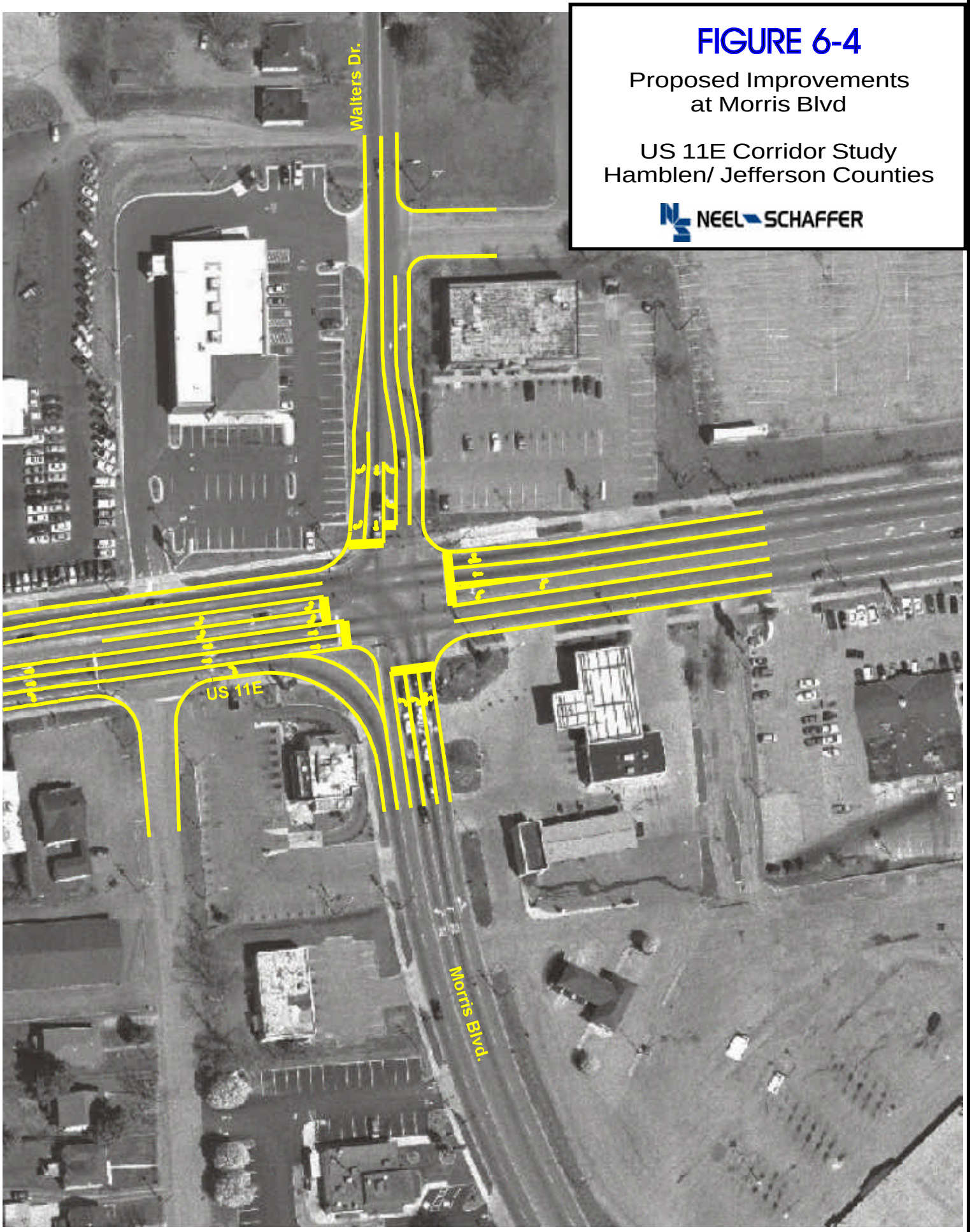
This same report made a series of potential geometric solutions to promote increased efficiency in operation between E. Economy Road and Pearce Drive. The first level of improvement was to open adjacent parcels up to allow private driveway connections between properties west of Morris Boulevard

FIGURE 6-4

Proposed Improvements
at Morris Blvd

US 11E Corridor Study
Hamblen/ Jefferson Counties

NEEL-SCHAFFER



and east of Pearce Drive. Because of the stated legal implications and the impracticality of continuing this plan west of Pearce Drive due to increasing distances between developed properties, private driveway connections are not recommended as a provision of large scale alternative access in Subarea M2.

Instead, in agreement with more stringent recommendations made in the report, alternative rear access streets may be developed. This would allow access to properties from behind and would ease the effects of implementation of a non-traversable median on US 11E. Furthermore, city planners could build upon the facility to promote an alternative growth pattern away from the current strip development.

This parallel road network would, at a minimum, likely consist of approximately 2.5± miles of three-lane roadway following, as much as possible, the rear property lines of those properties with frontage onto US 11E. This type of alignment would allow needed rear access to properties from which left turn to/from US 11E would be prohibited. North of the US 11E corridor, the parallel roadway would connect Walters Drive with W. Economy Road. Additional connections could be made at Pearce Drive and Barker Road. South of US 11E, a parallel street could feasibly be constructed between Pearce Drive and Sugar Hollow Road. Additional connections here would include Walker Drive, New Line Road, Barker Road, and Austin Road.

The key to this plan in improving mobility along US 11E through this section of Morristown is the construction of a center median to replace the TWLTL. Except at median openings for public streets and U-turns, all left turns would be prohibited. In conformity to TDOT median policy, openings should only be planned at public drives and to allow consistent urban spacing (660' with 440' – 880' being acceptable). In order to "replace" the opportunity to make left turns, parallel two-way streets are proposed.

South of the corridor, the parallel road would extend from Sugar Hollow Road to Pearce Drive. North of US 11E, the road would run between Walters Drive and W. Economy Road. These roads would allow access to signalized intersections to allow structured left turns from fronting properties.

Proposed median and parallel street construction is shown as Figures 6-5 through 6-8. *Estimated Cost: $3,835,000*

(4) Apart from modifying the cross-section of this segment of US 11E, preliminary planning for a parallel roadway further south of this corridor is under consideration. Four alternatives are being investigated that would provide a secondary roadway from W. Morris Boulevard south of the Norfolk Southern Railroad bridge to Howell Road. Notable intersections would include W. Morris Boulevard, Sugar Hollow Road, and State Route 66 (currently under construction).

Using current and forecast traffic data, estimates have been made as to the likely traffic impact of such a connector. For purposes of the evaluation, only two alternatives were considered; one intersecting Sugar Hollow Road approximately 1500' south of US 11E, and the other intersecting Sugar Hollow Road approximately 2700' south of US 11E. Other variations found in the four proposed alternatives are insignificant with respect to major traffic patterns.

Figure 6-9 shows the likely impact of adding a new facility in this area. Carrying an expected 13,000 – 18,000 vehicles per day by the year 2023, a reduction of traffic on US 11E of roughly 35 – 50% may be seen.

Site Access

Decreasing the number of driveways in this portion of the corridor will help to limit the number of conflict points faced by drivers. Practically, however, it would prove difficult to successfully combine and/or eliminate all the driveways needed to create a significantly improved corridor. Thus, recommendations are made only at particularly hazardous or confusing locations, where property owner objections may not be severe, or where general provisions may help guide future redevelopment.

Unused driveways like these should be removed.

It is important to note that driveway modifications are only recommended and may not be enforceable. Incentives for property owner cooperation or purchase of access rights may be negotiated, but existing access points should not be required to close. *General costs for curb modifications at driveways are estimated to be $5,000 per location.*

General guidelines for future redevelopment access in this area are as follow:

A. The number of driveway openings should be maintained or decreased by closing unused driveways, combining driveways for comparable-use properties, removing redundant driveways, and utilizing driveways onto cross-streets to as great an extent as possible.

B. Requests for new driveways onto US 11E in Subarea M2 should only be considered if the following criteria are met:
   1. Reasonable access cannot be provided through an existing shared driveway arrangement or by connection to a minor cross-street.
   2. The proposed driveway will be located outside of any signalized intersection influence area. This minimum distance in Subarea M2 is 300' upstream of the intersection and 250' downstream of it.
   3. The proposed driveway will not warrant signalization.

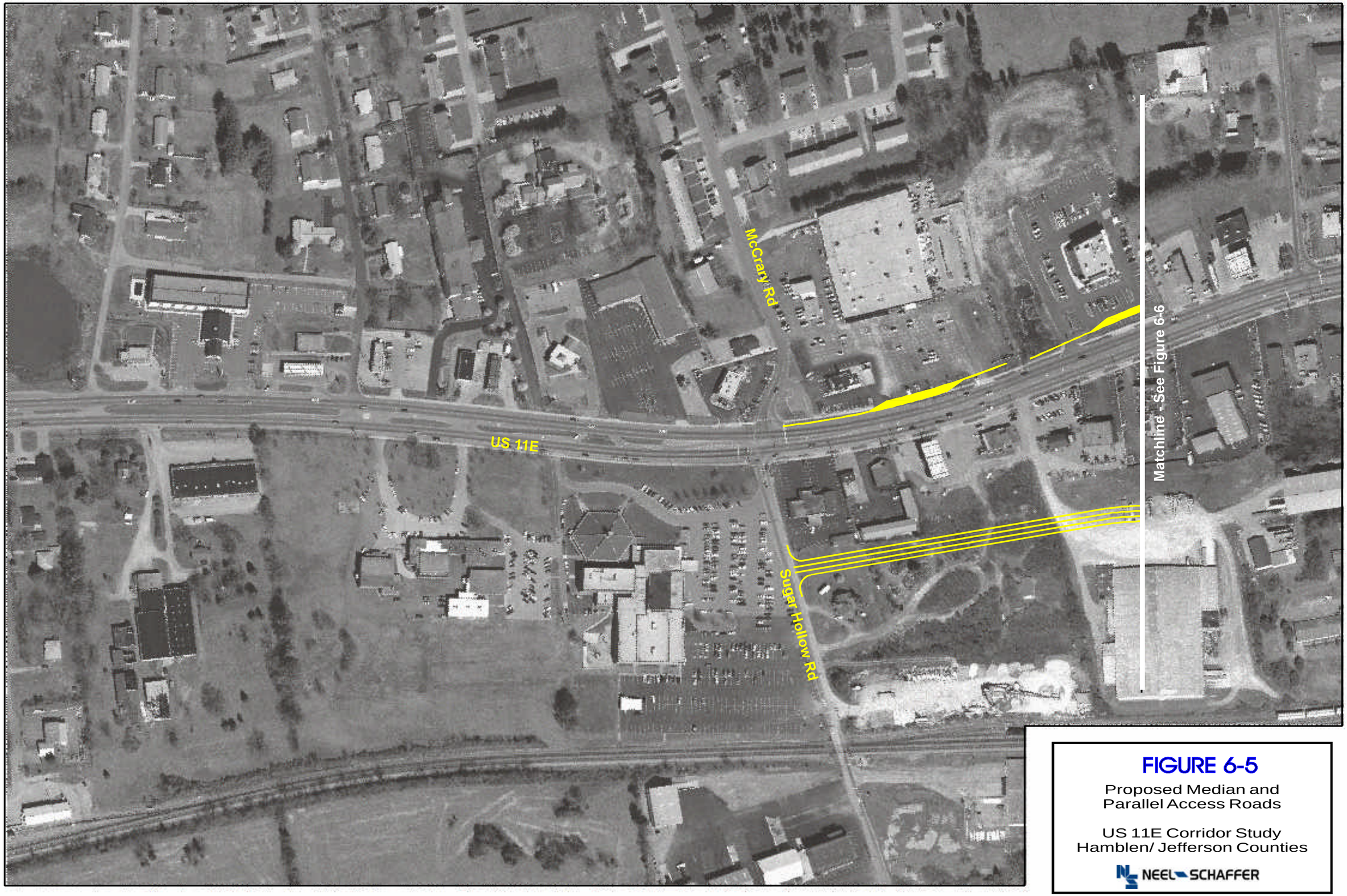


FIGURE 6-5

Proposed Median and Parallel Access Roads

US 11E Corridor Study
Hamblen/ Jefferson Counties

NEEL-SCHAFFER

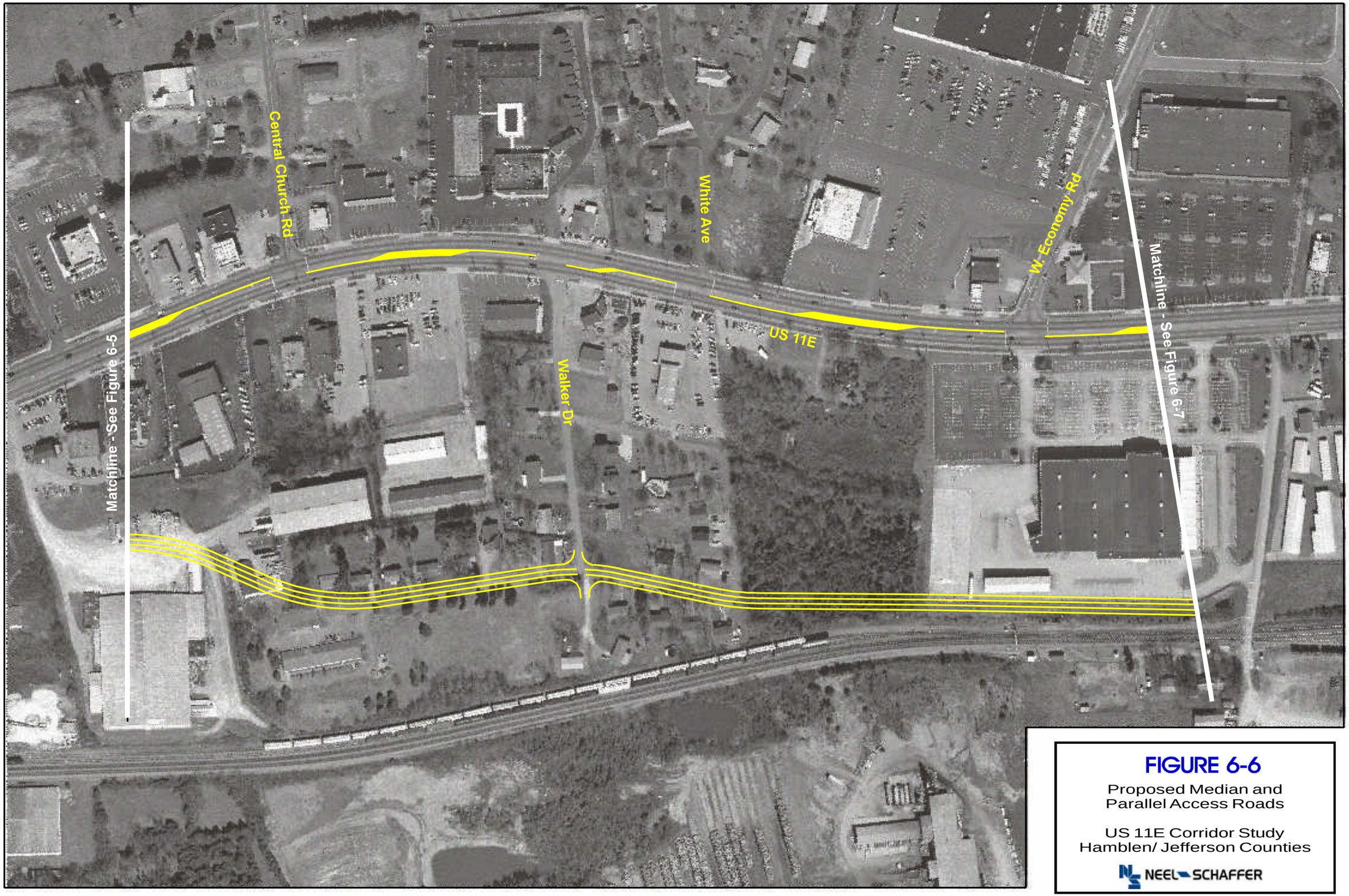


FIGURE 6-6

Proposed Median and Parallel Access Roads

US 11E Corridor Study
Hamblen/ Jefferson Counties

NEEL-SCHAFFER

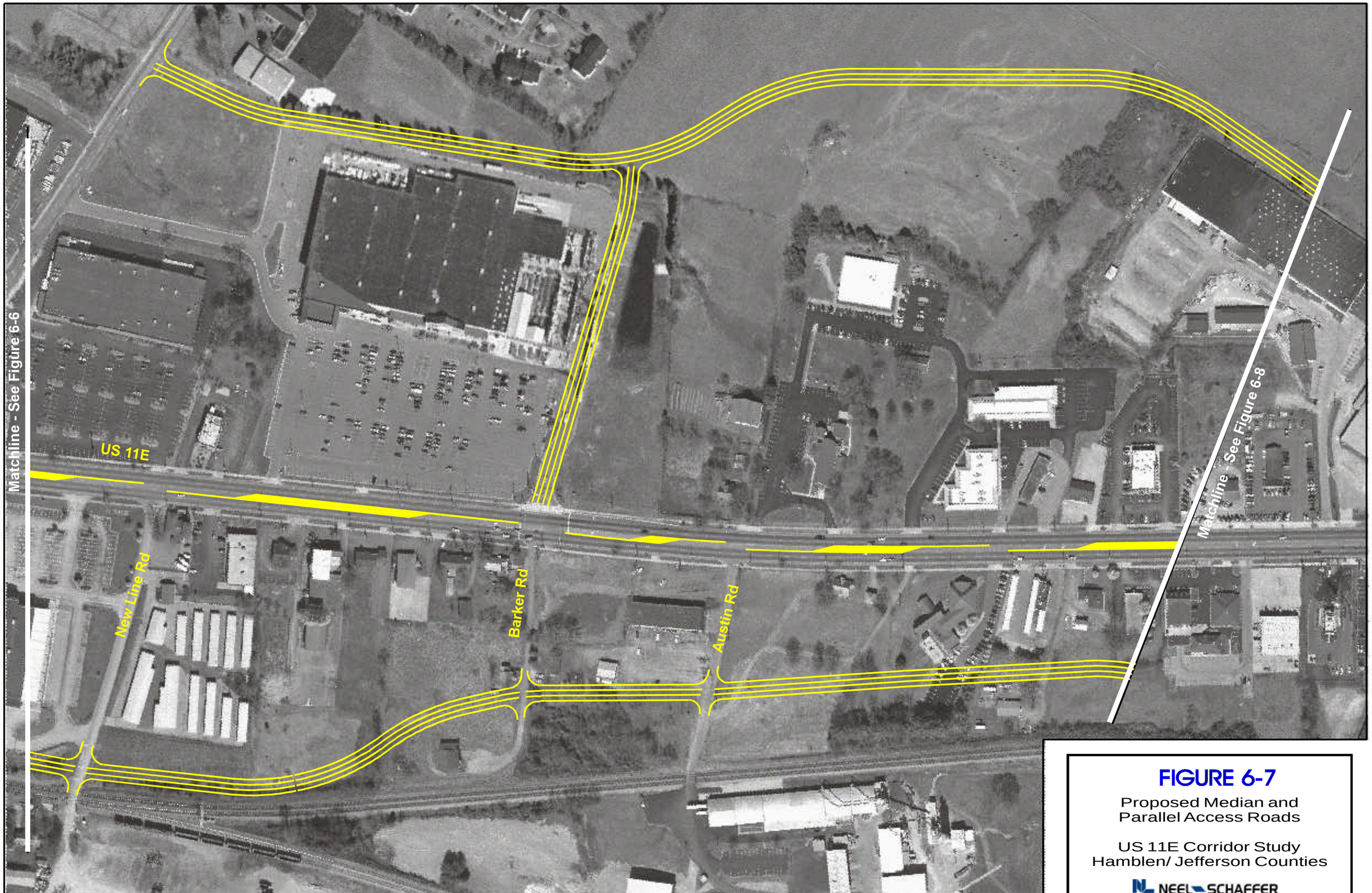


FIGURE 6-7

Proposed Median and Parallel Access Roads

US 11E Corridor Study
Hamblen/ Jefferson Counties

NEEL-SCHAFFER

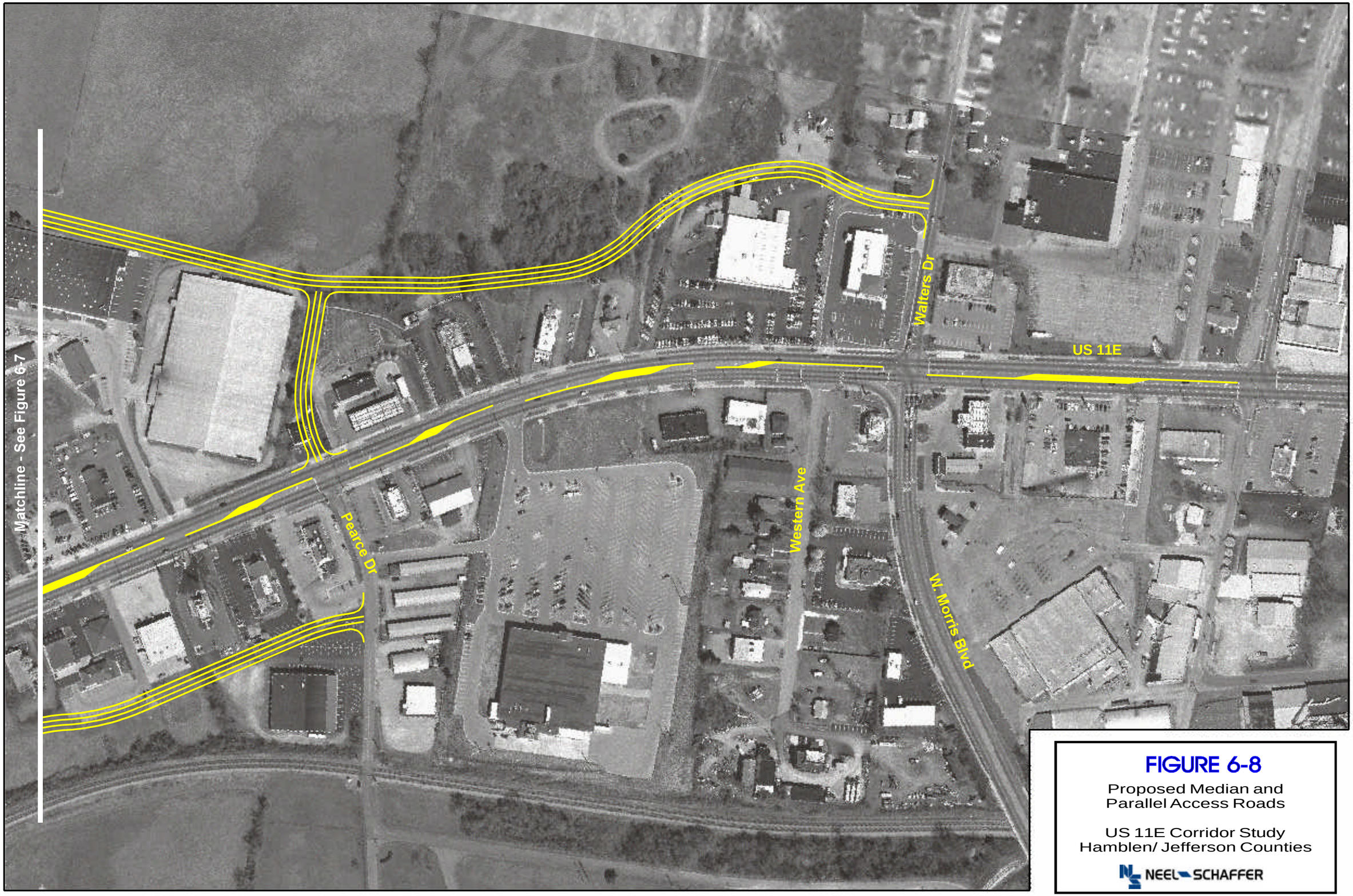


FIGURE 6-8

Proposed Median and Parallel Access Roads

US 11E Corridor Study
Hamblen/ Jefferson Counties

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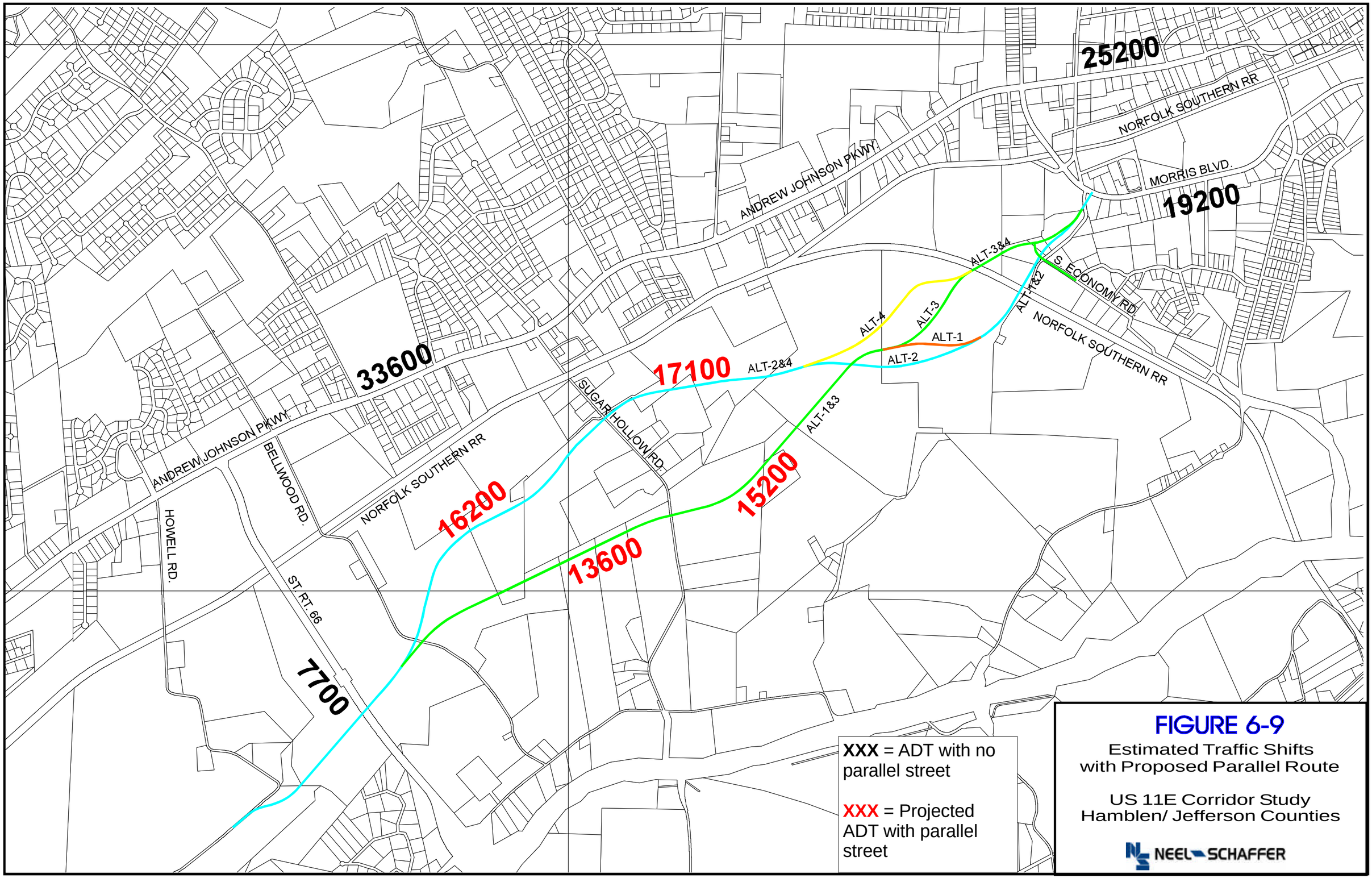

FIGURE 6-9

Estimated Traffic Shifts with Proposed Parallel Route

US 11E Corridor Study
Hamblen/ Jefferson Counties

NEEL-SCHAFFER

C. Proposals for the construction of new public street intersections to US 11E in this area should be carefully considered. Preferred street characteristics include:
    1. Extended connectivity to streets other than US 11E. Dead-end streets are discouraged.
    2. Location of intersections outside of the influence areas of existing intersections. The influence areas of the two intersections (existing and proposed) should not overlap.
    3. Additional signalization is not recommended, but may be allowed with careful study of the signal timing system. New signals should fit into the existing system and allow proper progression.
    4. Alignment across from existing streets or driveways is preferred.
    5. Properties immediately adjacent to the proposed street should move access to the proposed street and off of US 11E, if possible.

Access Improvement Recommendations US 11E Corridor Study ~ Subarea M2				
Property	Location	Problem	Solution	Comment
Westside Chapel Funeral Home	West side of Sugar Hollow Road	Unstructured access. Drive within intersection influence area.	Curb driveway onto Sugar Hollow to provide definition. Close drive on US 11E closest to Sugar Hollow.	Two other driveways exist.
Tractor Supply Co.	East of McCrary Dr.	Unused drive at eastern edge of property.	Remove drive.	
O' Charleys Restaurant	East of McCrary Dr.	Two eastern driveways unused.	Remove drives.	
Pilot Gas Station	West of Central Church Rd.	Drive on US 11E within intersection influence area.	Remove drive.	Two other driveways exist.
New Direction Christian Center	East of McCrary Dr.	Redundant driveways.	Remove second drive east of Central Church Rd	Two other driveways exist.
Tea Room Market	West of Walker Rd.	Unstructured access.	Curb driveway onto Walker Rd. to provide definition.	
Lakeway Auto	South of White Ave.	Redundant driveways.	Remove drive to gravel lot.	Remove 1 section of wooden fence to allow internal circulation.
Fastop Gas Station	West of W. Economy Rd.	Redundant driveways. One in intersection influence area.	Remove two drives in front of station.	Two other driveways exist.
Lowe's	West of Barker Rd.	Unused drive in middle of property.	Remove driveway.	
Family Denistry	West of Pearce Dr.	Unused drive directly in front of building.	Remove driveway.	
Henderson Motor Co.	West of Pearce Dr.	Continuous, unused drive.	Remove drive by returning sidewalk and grass strip.	Currently fenced by property owner.
Taco Bell Restaurant	East of Pearce Dr.	Driveway in intersection influence area.	Remove drive closest to Pearce Dr.	Two other driveways exist.
Texaco Gas Station	East of Pearce Dr.	Driveway in intersection influence area.	Remove drive closest to Pearce Dr.	Existing vehicles run red signal at Pearce due to proximity. One improved drive should accomodat Texaco/McDonald's
Chik-Fil-A Restaurant	East of Pearce Dr.	Unused drives in front of property.	Remove drives.	
Morristown Buick	West of Western Ave.	Unused drive, closest to Western.	Remove drive.	
Walgreen's	East of Morris Blvd.	Driveway in intersection influence area.	Remove drive closest to Morris Blvd.	Three other driveways exist.
Free Service Tire	West of E. Economy Rd.	Unused driveway closest to E. Economy Rd.	Remove drive.	

Summarized Improvement Recommendations
US 11E Corridor Study ~ Subarea M2

Location	Improvement	Estimated Costs	Completion Rating (1=High, 5=Low)
McCrary Rd, Central Church Rd, White Ave, W. Economy Rd, Barker Dr, Pearce Ave, Morris Blvd, E. Economy Rd	Update timing plans and signal operations		1
Existing Subsystem	Upgrade from MARC to ACTRA signal control software		3
Existing Subsystem	Install 6'x6' traffic monitoring loops (2 sets = 8 loops)	$20,000	3
White Ave, Pearce Dr	Install 8-phase cabinets	$10,000 per location	3
McCrary Rd, E. Economy Rd	Remove from split-phase operation	$2,000 per location	2
McCrary Rd, Central Church Rd, White Ave, W. Economy Rd, Barker Dr, Pearce Ave, Morris Blvd, E. Economy Rd	Pedestrian signal heads and pushbutton activation	$5,000 per intersection	3
Morris Blvd	Construction of dual left turn lane from US 11E	$235,000	4
Pearce Dr	Curb radii improvements	$7,000	4
Throughout Subarea	Construction of non-traversable median and parallel access roads	$3,175,000 (access roads) $660,000 (concrete median)	3
Various	Curbing modifications at driveways	$5,000 per location ($95,000 total)	3

CHAPTER 7

Summary

Local engineering and planning officials in conjunction with the Lakeway Area Metropolitan Transportation Planning Organization (LAMTPO) have undertaken this study to work towards the improvement of this corridor in the efficient movement of current and future traffic volumes. Additionally, this study presents the basic tenants of an access improvement strategy, including improvements to existing intersections, the provision of guidelines and policy considerations for the creation of access at new developments, alterations of existing median openings, traffic operations along segments already having multiple signals, and the implementation of specific geometric design standards with respect to access points. The focus of this study is limited to the roughly 13-mile segment of US 11E between Jefferson City in Jefferson County and Morristown in Hamblen County.

Recommendations range from signal timing updates to an advanced traffic management system to a parallel access roadway network. Detailed analysis and descriptions of recommendations are contained in the previous chapters. A summary of recommended improvements is contained in the following table.

Summarized Improvement Recommendations
US 11E Corridor Study

Location	Improvement	Estimated Costs	Completion Rating (1=High, 5=Low)
US 11E Corridor Study ~ Subarea JC1 (SR 92 North to SR 92 South in Jefferson City)			
US 11E at SR 92 north	Intersection improvement including signalization	$215,000	3
Various	Addition of separate left turn lanes	$22,000 per turn lane ($264,000 total)	3
East of Universal Dr	Median closure	$10,000	4
US 11E Corridor Study ~ Subarea JC2 (SR 92 South to Hicks Road in Jefferson City)			
SR 92S, Russell Ave, George Ave, Odell Ave, Hicks Rd	Implementation of signal coordination subsystem using radio-based communication	$90,000	2
SR 92S, Russell Ave, Odell Ave, Hicks Rd	Signal phasing improvements (new cabinets required)	$12,000 per intersection. Included in above cost.	2 - 5
SR 92S, Russell Ave, George Ave, Odell Ave, Hicks Rd	Pedestrian signal heads and pushbutton activation	$5,000 per intersection	3
At Pearl Ave and at Harrington St	Addition of separate left turn lanes	$12,000 per location ($36,000 total)	3
Between Pearl and Odell Ave	Median closure	$8,000	3
Various	Pedestrian facility enhancements	N/A	4
Various	Curbing modifications at driveways	$5,000 per location ($20,000 total)	3
US 11E Corridor Study ~ Subarea R (Hicks Road in Jefferson City to Howell Road in Morristown)			
Chucky Pike	Lane construction and signal modifications	$140,000	5
State Route 160	Update signal operation	$2,000	4
State Route 342	Lane construction and signal modifications	$295,000	4
Chucky Pike, Odyssey Rd	Signal coordination using radio-based communication	$25,000	3
Lakeshore Rd	Intersection improvement including signalization	$205,000	2
Various	Addition of separate left turn lanes	$22,000 per turn lane ($1,342,000 total)	3
Andrews Cir to Lakeshore Rd	Redefinition of median openings	$92,000	4
Various	Curbing modifications at driveways	$5,000 per location ($30,000 total)	4

Location	Improvement	Estimated Costs	Completion Rating (1=High, 5=Low)
US 11E Corridor Study ~ Subarea M1 (Howell Road to McCrary Road in Morristown)			
Kidwells Ridge Rd	Intersection improvement (Kidwells Ridge Rd approach only)	$185,000	2
Kidwells Ridge Rd	Realignment of W. Manley Ct and associated driveway modifications	$225,000	4
E. Sunset Hills Dr	Median opening narrowing	$6,000	4
Various	Curbing modifications at driveways	$5,000 per location ($35,000 total)	4
US 11E Corridor Study ~ Subarea M2 (McCrary Road to East Economy Road in Morristown)			
McCrary Rd, Central Church Rd, White Ave, W. Economy Rd, Barker Dr, Pearce Ave, Morris Blvd, E. Economy Rd	Update timing plans and signal operations		1
Existing Subsystem	Upgrade from MARC to ACTRA signal control software for initiation of ATMS system		3
Existing Subsystem	Install 6'x6' traffic monitoring loops (2 sets = 8 loops) for ATMS system	$20,000	3
White Ave, Pearce Dr	Install 8-phase cabinets	$10,000 per location	3
McCrary Rd, E. Economy Rd	Remove from split-phase operation	$2,000 per location	2
McCrary Rd, Central Church Rd, White Ave, W. Economy Rd, Barker Dr, Pearce Ave, Morris Blvd, E. Economy Rd	Pedestrian signal heads and pushbutton activation	$5,000 per intersection	3
Morris Blvd	Construction of dual left turn lane from US 11E	$235,000	4
Pearce Dr	Curb radii improvements	$7,000	4
Throughout Subarea	Construction of non-traversable median and parallel access roads	$3,175,000 (access roads) $660,000 (concrete median)	3
Various	Curbing modifications at driveways	$5,000 per location ($95,000 total)	3

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