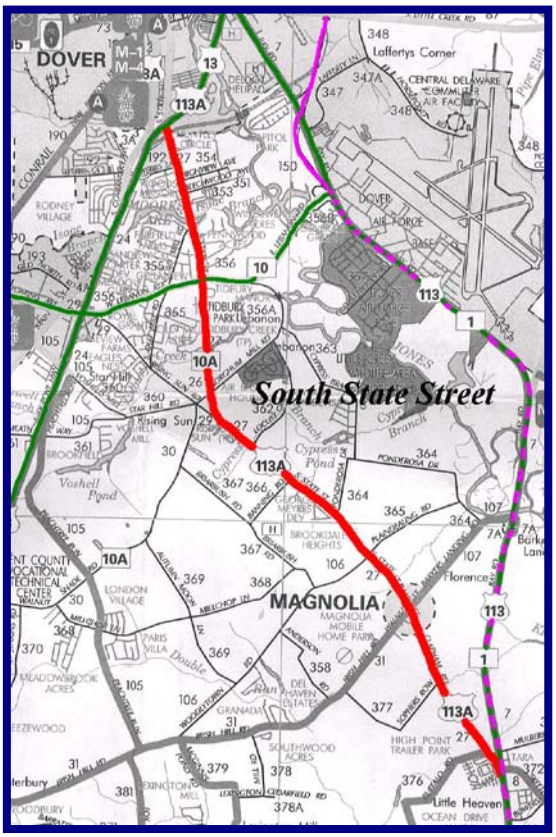
SOUTH STATE STREET AREA AND ACCESS STUDY



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FINAL DRAFT

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EXECUTIVE SUMMARY

FORWARD

Transportation systems throughout the county and across the state are facing greater and more complex problems with each passing year. Suburban sprawl, increasing land development, congestion, and environmental impacts are just a few of the issues facing not only Kent County, but the entire state. While budgets remain tight, roadways become increasingly congested, and pollution levels rise, the enhancement and expansion of today's transportation infrastructure becomes more difficult.

Such is the case with the area in and around US Route 113 Alternate (US 113A), commonly known as the South State Street (S. State St.) corridor. This corridor has long been recognized as a problem area by members of the community, state officials, local officials, planners and engineers. The corridor is located within a Kent County's growth zone and comprises a vast array of differing land uses. With continued development, this corridor is expected to experience greater demands on its transportation facilities.

Together with the Delaware Department of Transportation (DelDOT), private consultants, and the community, the Dover / Kent County Metropolitan Planning Organization (MPO) performed a study of this corridor in order to quantify and address its existing transportation problems and issues as well as to begin developing a plan for its future. This study, known as the "South State Street Area and Access Study", and its findings are presented within this report.

PROJECT DESCRIPTION

The primary focus of the study was to ascertain travel patterns of motorists using S. State St. and to develop methods to encourage the use of alternate parallel facilities. Additionally, the study concentrated on developing strategies and potential improvements for managing the area's existing and future transportation needs.

The study analyzed the existing transportation system, current transportation planning initiatives, and transit, bicycle, pedestrian and automobile traffic today and for short-term projections for the Year 2005.

Traffic counts, transit service, socioeconomic, and land use data were compiled, factored, and analyzed. An origin-destination study using license plate survey techniques was conducted in order to assess the travel patterns of the S. State St. corridor. Additionally, detailed analyses of eight (8) identified critical intersections were also performed using a level of service and capacity analysis.

SUMMARY OF FINDINGS

This study found that there are transportation deficiencies along the S. State St. corridor that need to be addressed and as such, the study offers five (5) recommendations. These recommendations comprise geometric, planning, and conceptual improvements to the study area's transportation infrastructure and management systems. A brief summary of the five (5) recommendations follow:

1. The investigation, planning, and design of various Transportation System Management (TSM) measures including traffic signal installation, signal timing/phasing adjustments, intelligent transportation systems (ITS), intersection geometry improvements, signage, lighting, and speed limit reductions along the S. State St. corridor should be short-term improvements, when warranted, to meet the needs of the area; and

2. A comprehensive larger-scale land use and transportation study, including access to and from the City of Dover, recreational routes such as State Route (SR) 1 and SR 8, should be performed using this study as the established 'needs statement' in order to further evaluate long-range improvement measures within the area;

3. The existing S. State St. corridor, being designated by the DelDOT roadway classification system as a US route and minor arterial, should be investigated for conversion over time to a Delaware state route and minor arterial, including the appropriate measures for re-classification and change in signage;

4. The promotion of multimodal and alternate route transportation within the study area should be initiated over time in order to divert more trips to ride sharing and/or parallel facilities through improved interconnectivity between residential areas and/or the investigation of a park and ride facility for the area;

5. Various Travel Demand Management (TDM) measures should be investigated for implementation. Measures including land use and zoning evaluation, flexible work schedule programs and efforts for future community involvement in transportation planning should be considered.

I. PROJECT OVERVIEW

A. PURPOSE

The main purpose of the "South State Street Area and Access Study" was to examine the existing and projected traffic conditions along the US Route 113 Alternate (US 113A) corridor, also commonly known as the S. State St. corridor. The study involved the following tasks:

- Understand the existing travel patterns of motorists in and around the S. State St. corridor;
- Understand and develop origin and destination relationships of trips in and around the corridor;
- Develop strategies and/or potential improvements, altogether referred to herein as alternatives, to encourage the use alternate facilities, including additional modes and parallel road systems; and
- Develop alternatives to improve the operation and safety of area traffic.

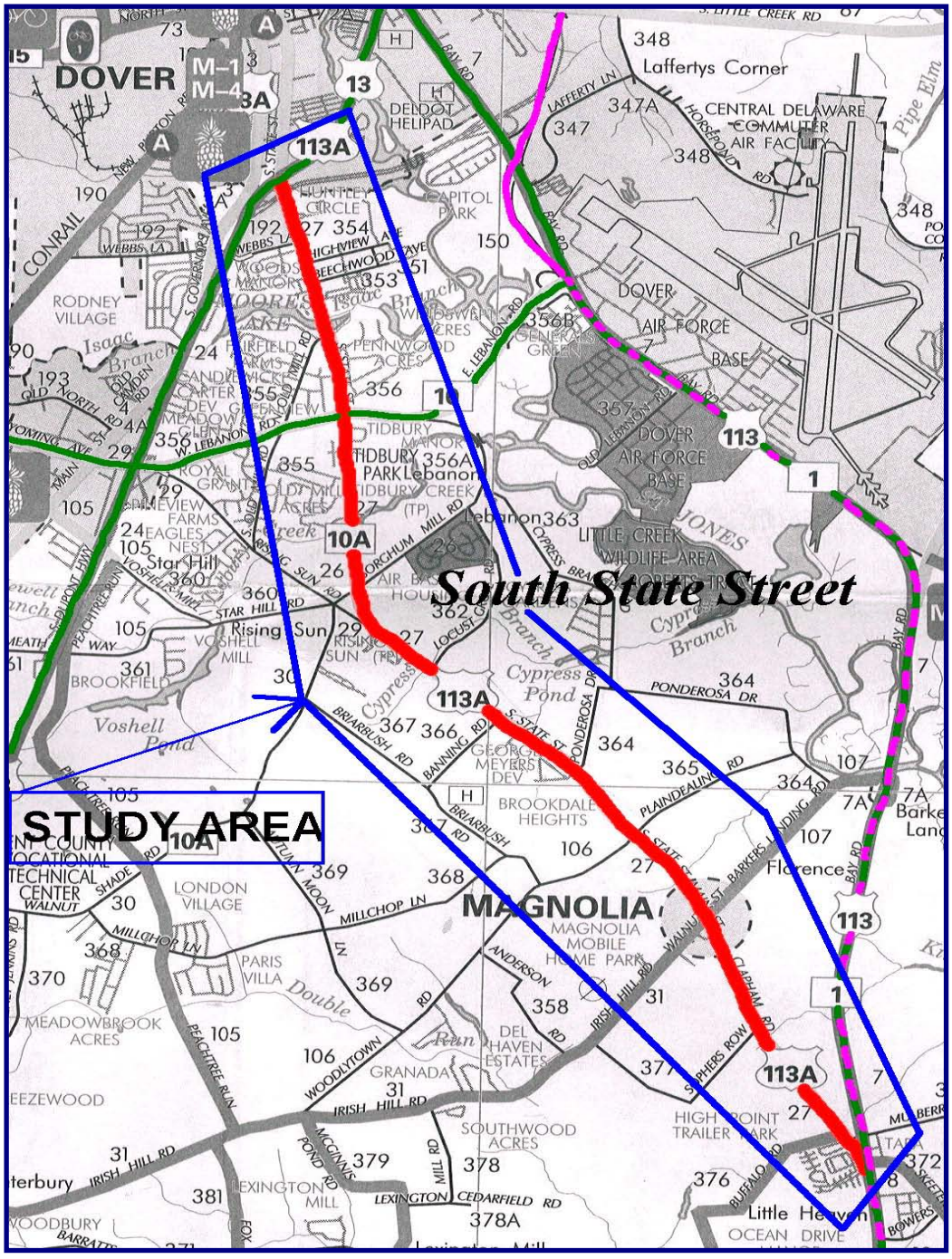
B. STUDY AREA

The study area is generally defined as the geographical region contributing to the potential need for transportation improvements along S. State St. from US 13 in Dover to SR 1/US 113 in Little Heaven. This area is generally bounded by DE 8 in the north and SR 1/US 11 3 to the east and south with the east and west boundaries falling along the parcel limits on each side of S. State St. Figure 1 highlights the pertinent sections of S. State St.

For purposes of the Origin and Destination Study, which is discussed later within this report, a more robust geographical area of the transportation system, incorporating more points of ingress and egress, was used for data collection. However, it should be noted that this data collection area was not the study area used for purposes of the detailed analyses, including intersection, socioeconomic, and land use information.

Dover / Kent County Metropolitan Planning Organization

Figure 1: Study Area



C. SCOPE

The study collected, compiled, and analyzed information on the existing and projected land use, transportation facilities, and needs for existing average conditions (Year 2001) and for the projected Year 2005 conditions. The study also examined strategies and improvements for managing the area's future transportation needs, including multi-modal transportation and intersection and/or roadway improvements.

The information collected for purposes of the study ranged from traffic count data to origin destination matches to land use and zoning data to socioeconomic data provided by the MPO.

Under the guidance of the Technical Advisory Group, being comprised of professionals from the public and private sectors as well as other shareholders in the study, the scope of the study evolved and focused during project development. A copy of the original scope of work can be found in Appendix A.

Traffic volume data was compiled for 27 intersections along S. State St. A Level of Service (LOS) analysis was conducted for each intersection using the Transportation Research Board's Highway Capacity Manual 2000, 4th Edition (HCM 2000). Out of the 27 intersections, eight were identified as critical, based on their function within the corridor, the results of the LOS analysis, and input from the Advisory Group. The critical intersections were the following:

1. S. State St. and US Route 13;
2. S. State St. and Old Mill Rd.;
3. S. State St. and State Route 10 (Lebanon Rd.);
4. S. State St. and Sorghum Mill Rd. (K26);
5. S. State St. and Locust Grove Rd. (K362);
6. S. State St. and Brookdale Heights – Ponderosa Drive;
7. S. State St. and Plaindealing Drive; and
8. S. State St. and Walnut Street (K31) in Magnolia.

D. METHODOLOGY

In order to perform an analysis of the identified critical intersections, specific tools and information were required. Foremost accurate and sufficient traffic data was needed, collected, compiled, and then analyzed.

Secondly, as prescribed by the HCM 2000, level of service and delay-based analyses can provide both meaningful and valuable Measures of Effectiveness (MOE) in assessing the performance of intersections, roadways, and other transportation facilities. These MOE were calculated for the peak hour periods. These peak hour periods reflect the times of greatest demand experienced by corridor.

As such, the study evaluated the existing and projected performance of the critical intersections using the HCM2000 methods for both two-way, stop-controlled intersections and signalized intersections as implemented by the Highway Capacity Software 2000, maintained by the McTrans Center at the University of Florida.

Additionally a simulation-based analysis using the microscopic-modeling capabilities of CORSIM (Corridor-Simulation) funded by the Federal Highway Administration (FHWA) was used to determine additional measures of effectiveness for purposes of alternative evaluation and selection as well as the HCM levels of service.

In order to determine the impact of through trips on the corridor, a formal Origin Destination (OD) study employing a license plate survey technique was executed at 14 stations in and around the S. State St. study area.

The complaints received by the MPO indicated that residents were concerned about traffic issues in the S. State St. corridor. Consequently, public outreach was an integral element of the study. A citizens advisory group was formed and five public meetings were held between January 18, 2001 and June 13, 2002 as well as two public workshops on May 23, 2001 and June 19, 2002. The advisory group comprised residents and businesses in the area as well as representatives of public organization within Kent County. Table I summarizes comments received from the public.

Table I – Summary of Public Comments and Responses

South State Street Study

Summary of Public Comments and Responses

Comments	Response
♦ The study area is too small	Comment has already been addressed on page 41 paragraph 2. It has been stated that DelDOT will undertake a larger comprehensive Long Range Tranportation/Land Use study that encompasses these areas.
♦ The study should address impacts of air quality	It was made known in course of the study that air quality issues will not be address by the study at this stage
♦ Improvement will accelerate new development and only be a prelude to increased commercial activity along the corridor, thus the area may become another Rte 8 West of Dover	The larger DelDOT study mentioned in page 41 paragraph 2 of the final report should address future growth and traffic issues.
♦ Some of the proposed traffic lights could result in slower traffic	The travel modeling conducted in the study showed that overall travel time would decrease. Results of the model are shown in page 31 and 32.
♦ Traffic calming device at the Moores Lake area to ensure safety of people who use the recreational facility	The MPO has added this comment into the final report and is shown on page 38 paragraph 4
♦ Traffic lights (both existing and proposed) should be re-evaluated to show flashing yellow after the evening peak period	The MPO has added this comment into the final report and is shown on page 38 paragraph 2
♦ The corridor should be made a county numbered road and should only be known as South State Street and not US Rte 113A	This recommendation can be found on Page 41 point # 3.
♦ How long will it take before improvements are implemented?	Implementation is dependent on project priority locally and statewide and the availability of funding.
♦ Should include bus shelters	The MPO has added this comment into the final report and can be found on page 39 paragraph 3.
♦ Establishment of a 3rd (passing) lane will encourage speeding and create dangerous conditions.	The study recommends adding turn lanes at individual intersections, but not a continuous left turn lane
♦ Impact of traffic light at Old Mill and Elizabeth Avenue	The MPO has added this comment into the final report and is can be found on page 38 paragraph 1.
♦ Include South State Street in corridor preservation	Implementation of this idea is counter to the purpose of the roadway.

♦ What criteria will the MPO Council use in the adoption of the report?	The MPO Council will make its decision on the viability and merit of the recommendations to improve travel and livability in the corridor.
♦ Functional classification of South State Street is misleading	This has been elaborated further on page 34 to show that different segments are classified differently.
♦ List all 27 intersections for which LOS analysis were conducted	The MPO will provide results of all the 27 intersection LOS if requested.
♦ Old Mill Road and other intersections are not critical intersections as described.	The critical intersections were selected with inputs received from advisory group meetings and other analysis done by the technical team. Other intersections may be critical than some of the selected 8 but for short-term improvements, the 8 were considered appropriate.
♦ Report does not develop methods to encourage the use of alternate parallel facilities.	This recommendation is found on page 2 within the Executive Summary, and is intended as a 'strategy' to encourage additional modes of transportation, thus conforming to task #3 found on page 3, which ask for the development of alternatives to encourage the use of alternate facilities and additional modes
♦ The O&D seem to indicate that South State Street is not a northbound commuter route.	O&D data were collected according to UNI-directional stations so deducing northbound or southbound travel may be inappropriate. The study does not deduce that there is absence of northbound travel but rather the usage was quite small according to some of the results of the O&D study.
♦ The statement that "southern portion is more of a rural with no shoulders or striping while the northern end is more urban with striping, shoulders and turn lanes" is incorrect.	This has been corrected and elaborated on page 7.
♦ Construct Sidewalks North of Route 10	Due to construction constraints it is only feasible to complete gaps in the sidewalk system between Webbs Lane and Cooper Road

II. EXISTING TRANSPORTATION

A. FACILITIES

1. Roadways

S. State St., as well as US Route 13 within the study area, are classified according to the Federal Functional Classification System as minor arterials. SR 10 and Walnut Street (K31) are classified as major collectors and SR1/US Route 113 is classified as a rural principal arterial.

Within the study area, US 13, SR 1/US 113, and US 113A primarily provide access to and from the City of Dover and its suburbs. SR 10 traverses the study area in an east-west direction and tends to serve as a link between south Dover locations, such as Camden, Wyoming and Dover Air Force Base. These roadways funnel regional and local traffic from all directions to centers of employment, commerce, government, and military services.

In addition, many local and rural roads traverse the study area and serve more local traffic. Such roadways include Webbs Lane, Old Mill Road, Plaindealing Drive, and Walnut Street.

Physical Condition

Within the corridor study area, some of the adjoining side streets and local roads along S. State St. lack shoulder space and/ or adequate signage and striping. The larger more heavily traveled routes, including US 13, SR 1/US 113, and SR 10, have medians and larger lateral clearance on the shoulders as well as adequate signage and striping.

S. State St. itself currently exists as a combination of the features described above. According to DelDOT's Year 2001 Traffic Summary, S. State St. is classified as a rural arterial from SR1/US113 to Sorghum Mill Road (K 26) and from Sorghum Mill Road to US Route 13, it is classified as an urban arterial.

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Traffic Control

Within the study area, four of the previously identified critical intersections are controlled by a traffic signal. Those intersections are:

- US Route 13 and S. State St
- State Route 10 and S. State St
- S. State St. and Sorghum Mill Road (K26); and
- S. State St. and Walnut Street (K31).

The remaining intersections are either two-way or one-way stop-controlled.

2. Public Transit

Within the study area, there are two DART First State bus routes providing public transit service to and from the corridor. These routes operate between 6:00 AM and 6:00 PM. Bus Route 105 serves customers along SR 10 and S. State St., with stops at Carroll's Corner and Moore's Lake Shopping Center. Also, Bus Route 303 serves S. State St. with stops at Carroll's Corner, Webbs Lane, Faith Community Church, Moore's Lake Shopping Center, Richardson Lane, Howe Drive, Sorghum Mill Road (K26), Fosky Drive, Irish Hill Road (Walnut Street), Jury Drive, and High Point Trailer Park. These routes also stop at the Water Street Transfer Center in Dover for connection to routes serving Dover and Wilmington. Please refer to Figure 2 for a map of the DART First State routes.

3. Bicycle

S. State St. is designated as a secondary bicycle route while Walnut Street (K31 and K107) in Magnolia and Buffalo Drive (K376) near Little Heaven are designated as primary bicycle routes. A secondary bicycle route is classified as having above medium motor vehicle traffic, having good or poor shoulder areas and is generally used with caution by local bicyclists. A primary bicycle route is classified as having low to medium motor vehicle traffic, or as having good shoulder areas. Please refer to Figure 3 for a map of the bicycle routes. Note that the blue routes indicated on the map are primary bicycle routes, those in yellow are considered secondary, and those in red are considered dangerous bicycle routes.

Figure 2: DART Routes

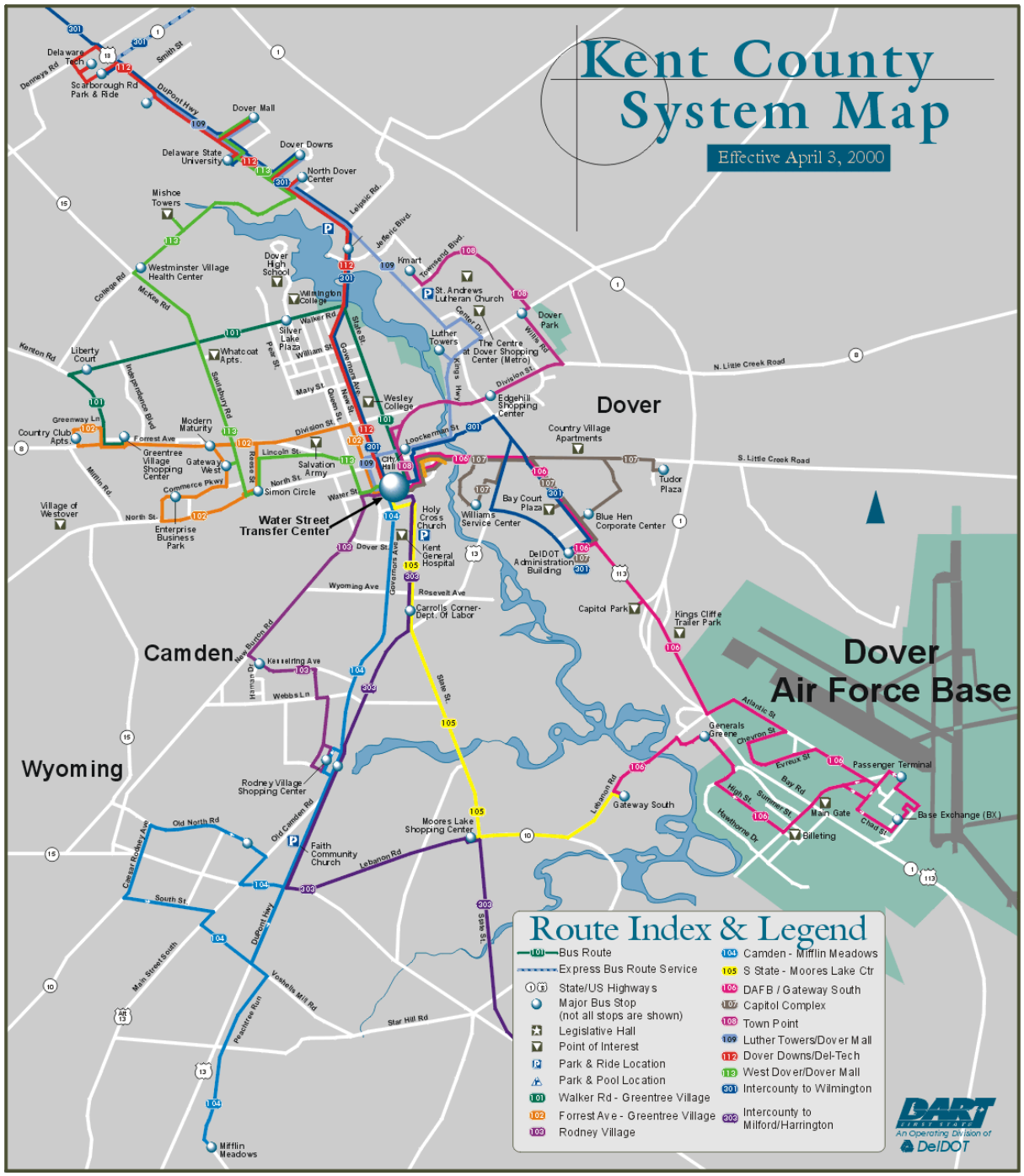
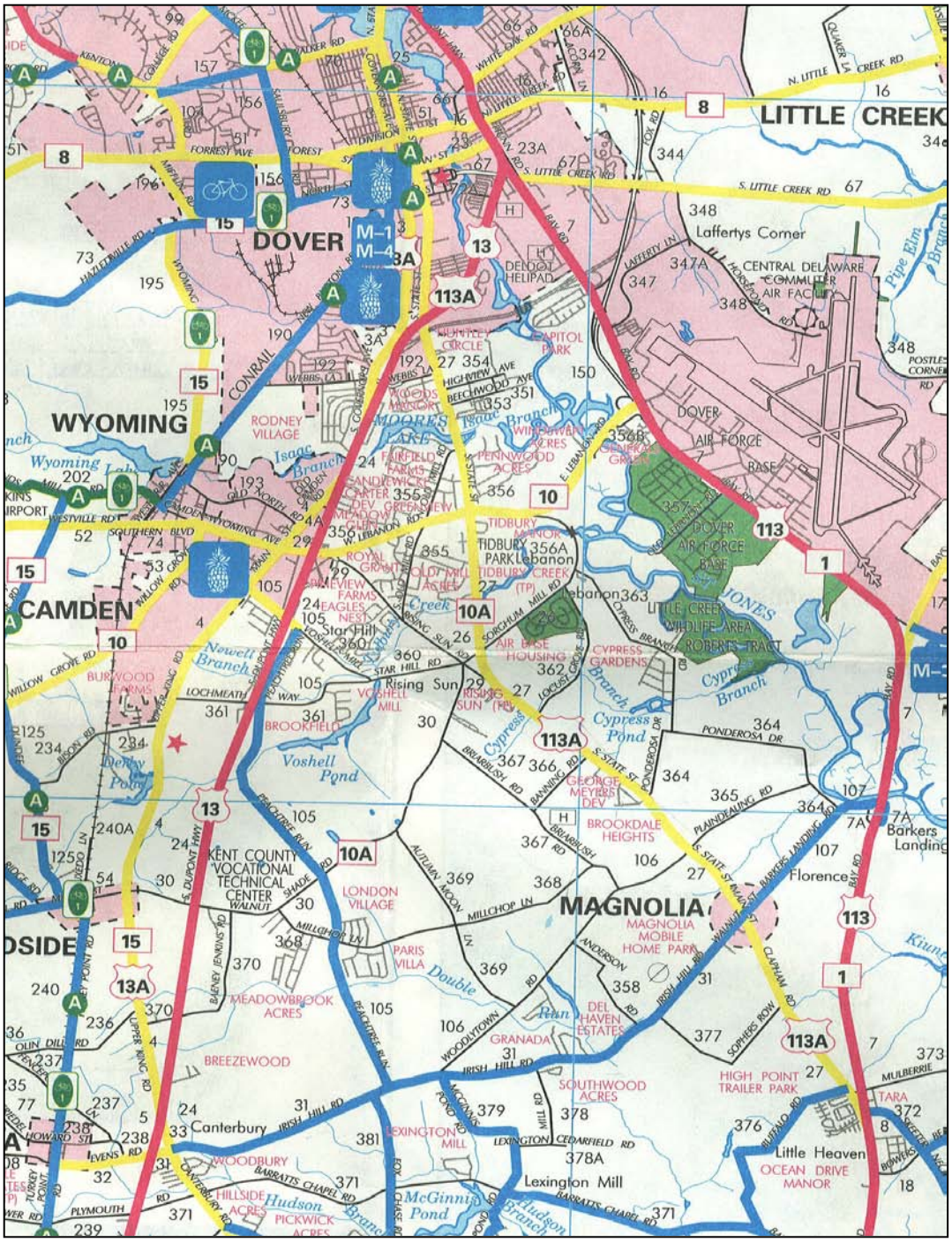


Figure 3: DelDOT Bicycle Routes



4. Pedestrian

With the exception of the incorporated town limits of Magnolia and Rising Sun, there are few, if any, pedestrian facilities in operation within the study area. Sidewalks and/or side paths do not exist along most of the side streets intersecting S. State St. or along S. State St. itself.

B. TRAFFIC

1. Average Annual Daily Traffic

In addition to traffic counts at intersections, traffic volumes along the roadway were compiled. As can be seen in Figure 5, the volumes remain constant between SR 1/US 113, but rise sharply north of SR 10. This progression corresponds with the increase in the developed land north of SR 10.

2. Peak Hour Volumes

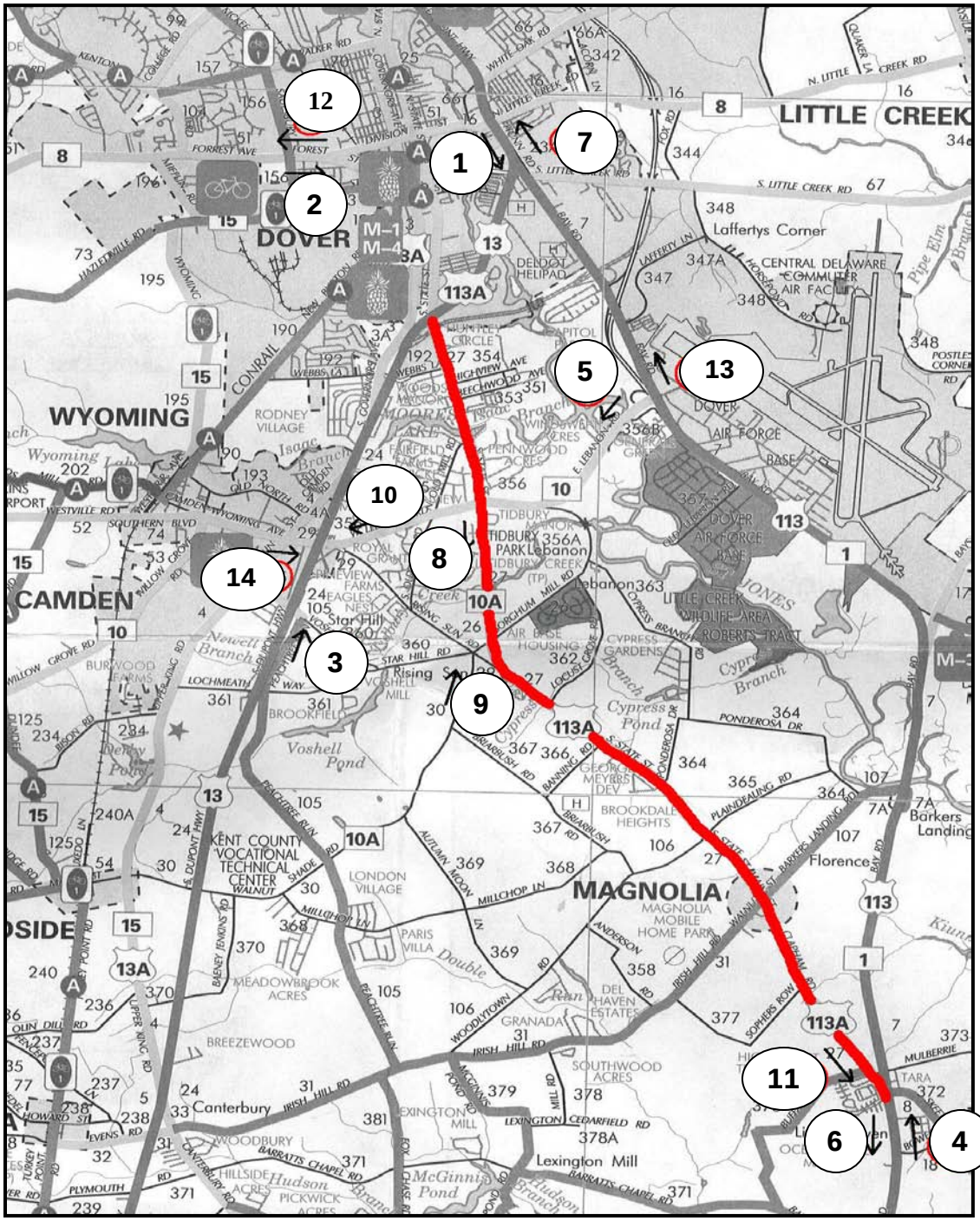
Existing traffic count data was obtained from available and recent studies and other counts conducted by DelDOT. Appendix B contains the existing traffic volumes at the key eight intersections.

3. Travel Patterns

Travel patterns were determined by observing the origin and destination of routes taken by motorists. This information was gathered by recording the license plates and their times of arrival at 14 locations within the study area. Ultimately the routes taken by the recorded vehicles were tracked and the travel patterns of area motorists were determined. Please refer to Figure 4 for a map showing these locations.

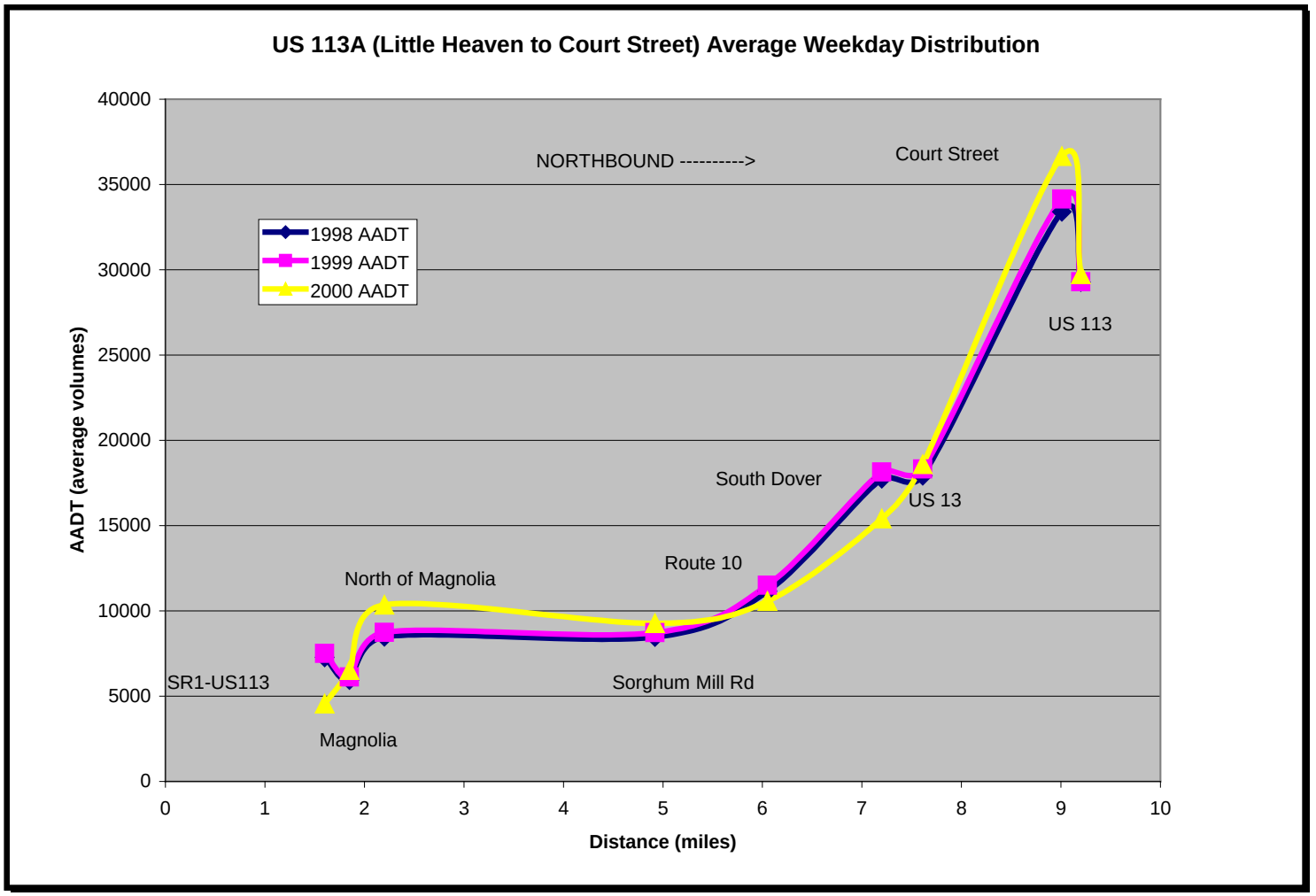
The study found that as much as 10 percent of vehicles exiting Dover via US 13 during the evening rush hour used S. State St. Of this traffic only 6 percent of the vehicles traveling southbound continue their routes into Little Heaven. This figure suggests that more local travel occurs along S. State St. and that traffic dissipates into the various subdivisions and developments

Figure 4: Locations of License Plate Survey Stations



along the corridor. Please refer to Figure 5 for a schematic showing the progression of daily traffic along the corridor. These figures as well as a more detailed report on the 'Origin-Destination Study' can be found in Appendix C.

Figure 5: Progression of Daily Traffic



C. MEASURE OF EFFECTIVENESS

The existing levels of service for each of the critical intersections can be found on Table 2 below. Along with each level of service value is its corresponding delay and volume-to-capacity ratio. These parameters provide an operational description of the intersections' performance under peak travel conditions. Figure 6 provides a study area map showing the intersections' levels of service along the corridor.

Along with the Level of Service analysis, a CORSIM model was run to measure vehicle hours and miles of travel on the network of S. State St. and the connecting roadways.

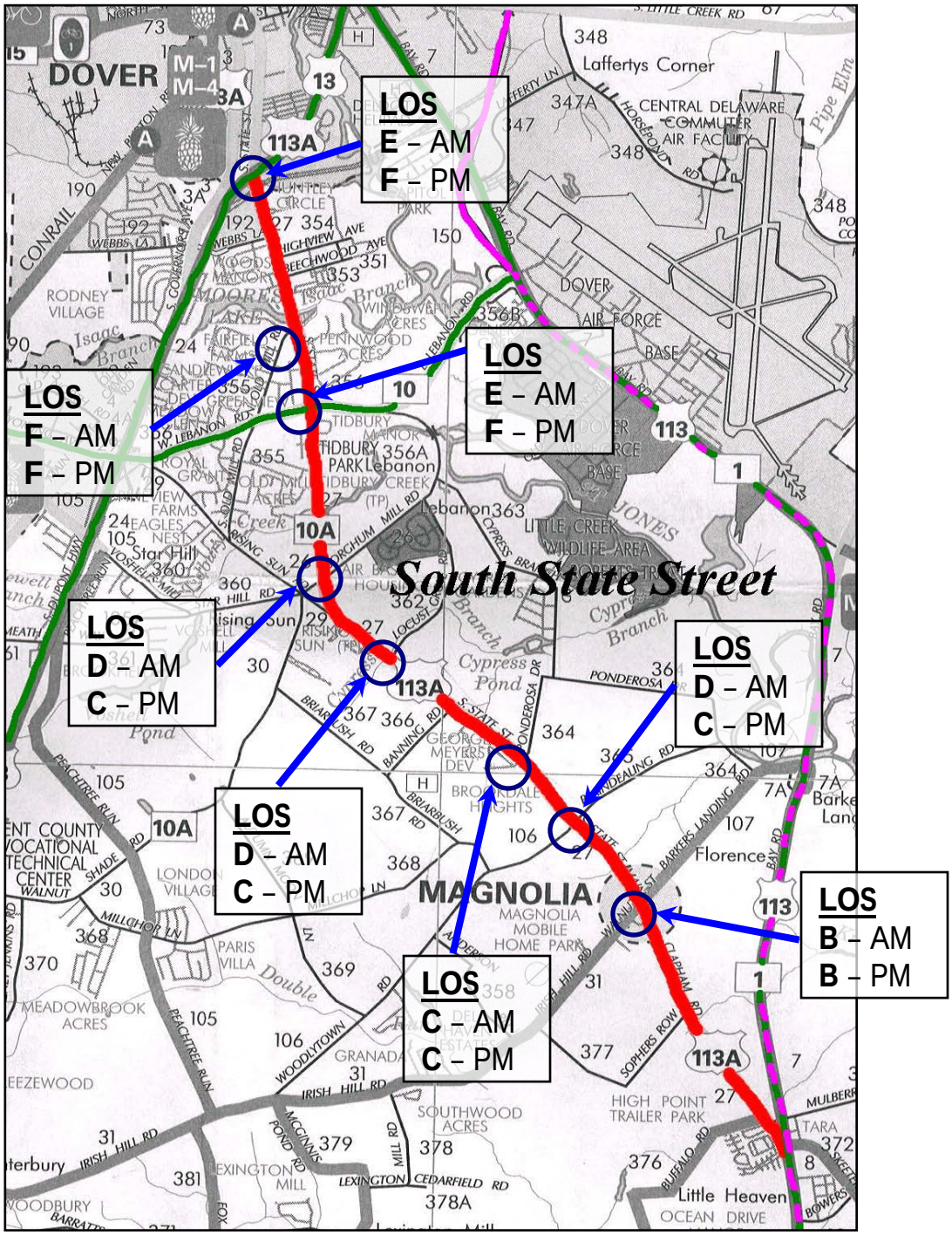
Table 2: Existing Levels of Service

INTERSECTION CAPACITY ANALYSIS (EXISTING CONDITION)						
	AM PEAK HOUR			PM PEAK HOUR		
	LOS[1]	DELAY[2]	V/C[3]	LOS	DELAY	V/C
US 113A and US 13	**E**	**58.2**	**0.80**	**F**	**122.9**	**1.03**
US 113A and Old Mill Rd	**F**	**85.3**	**0.73**	**F**	**50.5**	**0.41**
US 113A and Lebanon Rd	**E**	**57.1**	**0.83**	**F**	**84.4**	**1.06**
US 113A and Sorghum Hill Rd	**D**	**38.2**	**0.73**	**C**	**32.2**	**0.48**
US 113A and Locust Grove	**C**	**24.8**	**0.26**	**C**	**21.6**	**0.15**
US 113A and Brookdale Road/Ponderosa Drive	**C**	**16.8**	**0.02**	**C**	**15.6**	**0.01**
US 113A and Plaindealing Rd	**C**	**16.6**	**0.02**	**C**	**18.5**	**0.17**
US 113A and Walnut Street	**B**	**14.4**	**0.34**	**B**	**10.5**	**0.39**

Notes:
1. Level of service (LOS) as defined in the 2000 Highway Capacity Manual, Transportation Research Board, Washington, D.C.
2. Average Vehicle Delay (Control Delay) in Seconds per Vehicle

3. Volume/ Capacity Ratio

Figure 6: Existing Levels of Service



D. SUMMARY

The level of service analysis shows that deficiencies currently exist at 3 of the 8 critical locations. These deficiencies occur when the amount of delay experienced by the driver exceed acceptable levels; thus the intersection is assigned a grade or a LOS, ranging from LOS A, the best, to LOS F, the worst. Appendix D contains detailed analyses tables for each of the individual critical intersections.

III. LAND USE / TRANSPORTATION CONNECTION

A. LAND USE AND ZONING

The purpose of this land use and zoning section is to identify existing patterns of development and to determine the effects that continued residential and commercial growth would have on area traffic patterns. The predominant land use along S. State St. is residential with a mix of commercial/office areas.

1. Residential

Residences consist of existing, under construction, and planned subdivisions as well as individual homesteads and incorporated municipalities in the study area. There are 38 subdivisions in various stages of planning, construction or completion along the S. State St. corridor.
They are listed below in no particular order:

- High Point Trailer Park
- Barker's Landing Trailer Park
- Jonathon's Landing
- Church Creek
- Fields at Mangolia
- Doe Run
- Brookdale Heights
- Grandview Meadows
- Pleasant Hill
- Town of Rising Sun
- Hideaway Acres
- Huntley
- Kirby Metz
- Kirkwood Holding Company
- Thomas B. Richards
- Tara
- Triarchia Partership
- William and Shirley Bush
- Woods Manor East
- The Orchards
- Old Mill Acres I & II
- Tall Pine Trailer Park
- Tidbury Manor
- Pennwood
- Lakeland Trailer Park
- Beechwood Trailer Park and
- Kents Acres
- Annville
- George Myers
- Harry Rudnick and Sons
- Richardson Estates
- Rodric Village
- Shady Lane
- South Dover Manor
- Sweet Briar Estates
- Superior Homes
- Thomas H. Nielson

2. Commercial

There are also various commercial uses along the S. State St. corridor. These uses consist of developments, single parcels and strip development. From the south to north, the designated areas and their respective developments are as follows:

- Linkside Center (S. State St., between Plaindealing Rd. and Ponderosa Dr);
- Rising Sun Plaza (S. State St., north of Sorghum Mill Rd.); and
- Moore's Lake Shopping Center (SR 10)

The Moore's Lake Shopping Center is located at the southwest corner of the intersection of S. State St. and SR 10. The development consists of many commercial and retail tenants. This center is a destination for many area motorists during peak and off peak hours.

3. Institutional (School Zones)

There are currently three established school zones within the study area, including two public schools and one private. The public schools are located in close proximity to one another and serve just over 1400 students. These schools generate a significant amount of traffic. Each school and its respective location are as follows:

- Saint Thomas Moore Academy (Plaindealing Rd., K 365)
- E. Neil Postlethwait Middle School (S. State St.)
- Alan Frear Elementary School (Sorghum Mill Rd., K26)

EFFECT OF LAND USE ON TRANSPORTATION

Land use and transportation essentially exist as a cause and effect relationship. Sources of commercial, residential, industrial, and institutional services are typical origins and destinations of area motorists and such is the case along the S. State St. corridor. As area development continues, area traffic increases. Figure 7 shows the distribution of different types of land use in the S. State St. corridor as adopted in the Kent County Comprehensive Plan.

DENSITY

The area from Loockerman St in the City of Dover to the southern city limits consists of high density residential with an intermix of commercial/office/public facilities in a traditional urban/town setting. The area from the southern city limits to SR 10 (Lebanon Rd.) consists of low-to-medium residential development within subdivisions with a few areas of commercial/office development centered on the SR 10/S. State St. intersection.

The area from SR 10 (Lebanon Rd.) to US 113/SR 1 (Little Heaven) consists of low density residential development. A few medium to high density residential areas are intermixed with the low density residential along with several small commercial areas and one larger commercial area at Linkside (Jonathans Landing area). This area also has several active farming properties.

The Town of Magnolia has a medium residential density with several commercial/office uses in a town setting. The existing zoning classifications along S. State St. match the existing land use patterns in that the predominate classifications are A-C (Agricultural Conservation), A-R (Agricultural Residential), RS-1 and RS-5 (Single-family Residential) and RHM (Residential Manufactured Home).

Figures 7 and 8 provide maps of the existing land use and zoning within and around the study area.

Figure 7: Kent County Comprehensive Plan

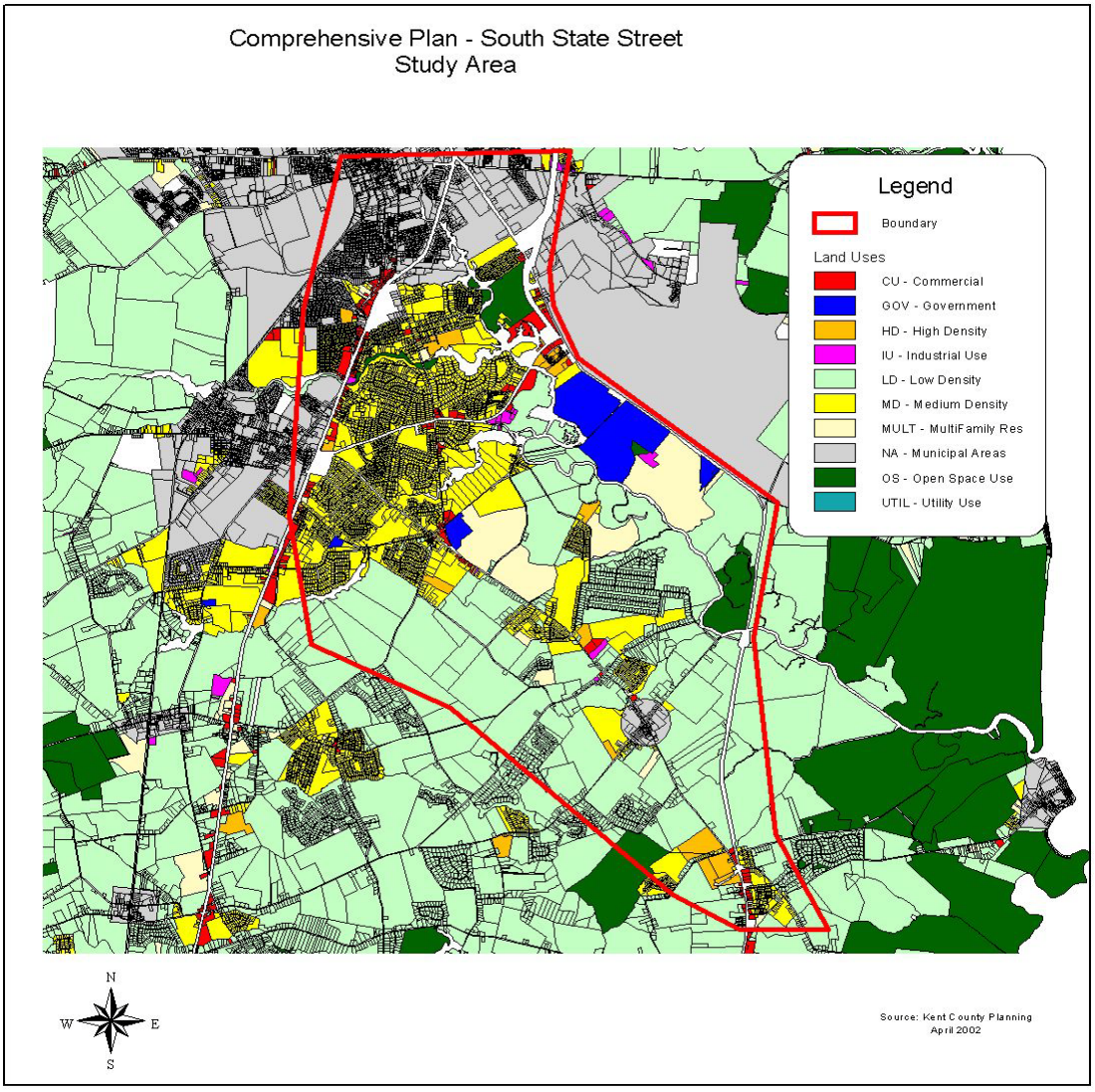
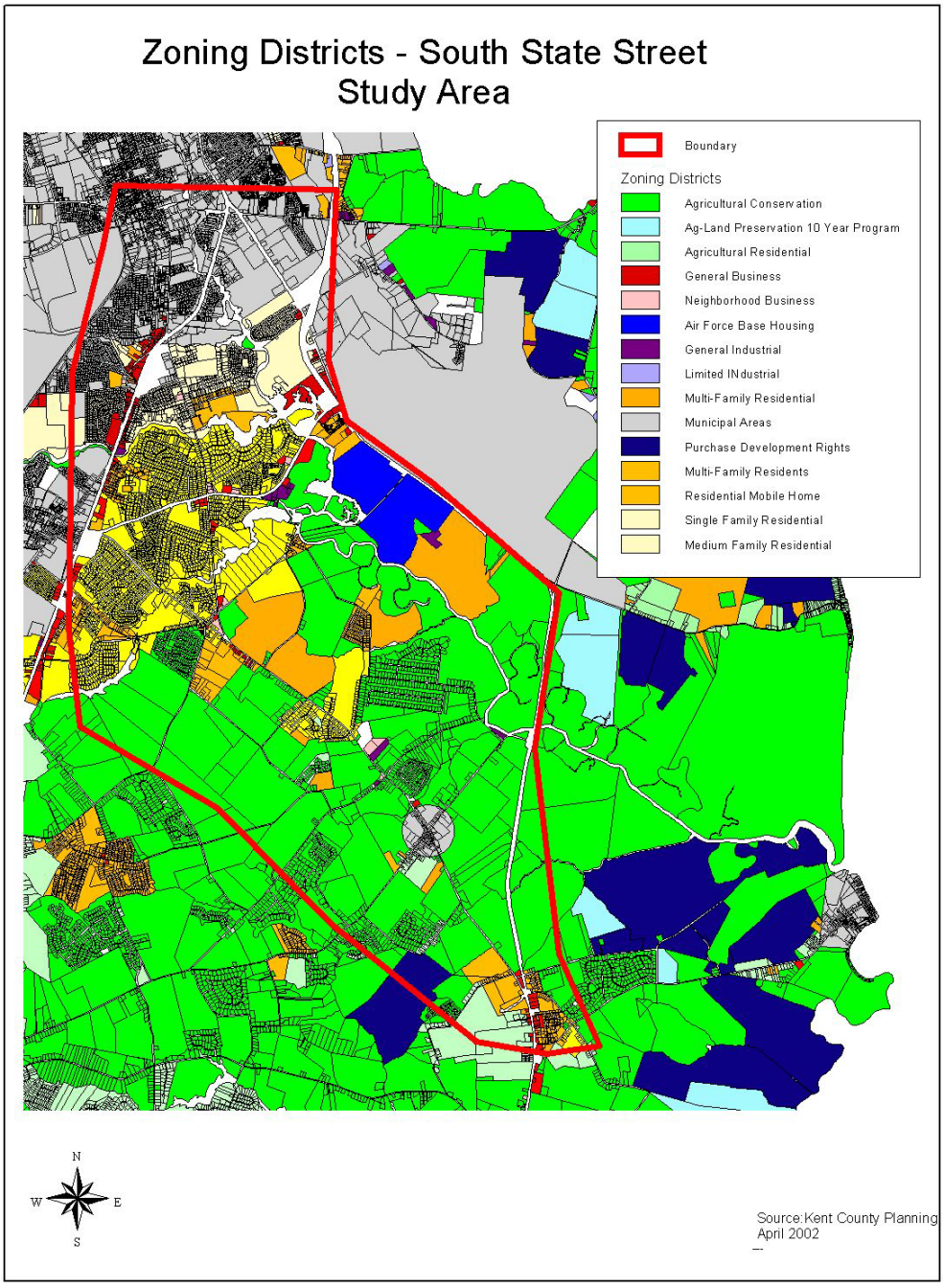


Figure 8: Existing Zoning



B. SOCIOECONOMIC TREND

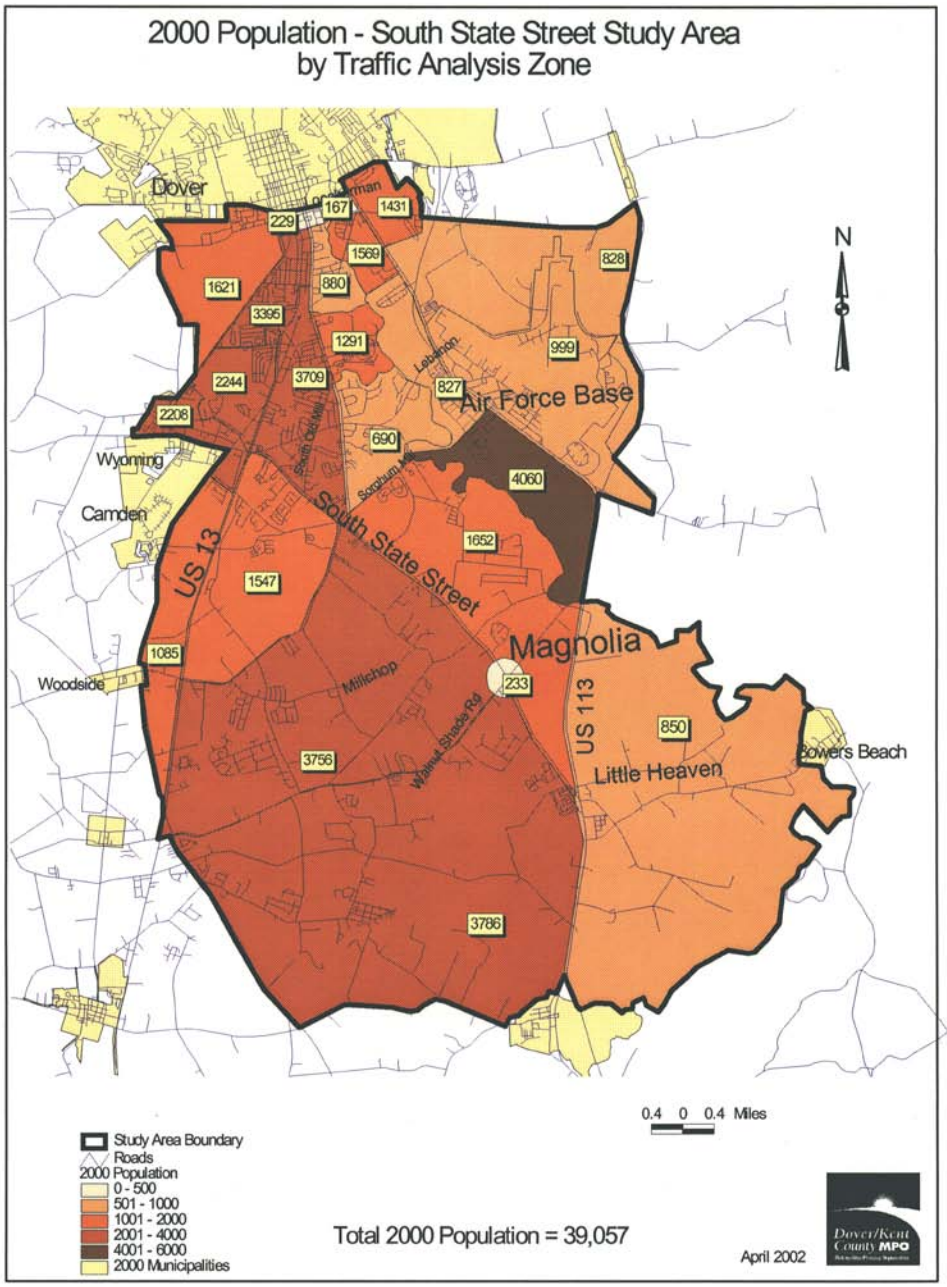
Socioeconomic trends are expressed by showing projected changes in population, households and employment. As can be seen in Table 3, population and households are expected to grow by only eight percent by 2025. Employment is expected to increase slightly faster, by nine percent.

Figure 9 shows the area from which the data was taken. Additional maps showing the changes in population, household and employment are available from the MPO.

Table 3: Socioeconomics Summary

	Demographics of the Study Area		
Year	**Population**	**Household**	**Employment**
2000 (Existing)	39,057	14,919	20,684
2005 (Projected)	39,714	15,670	21,934
2025 (Projected)	42,496	18,443	23,235

Figure 9: Existing Population



C. SUMMARY

As shown in Figures 7 and 8, it appears that land use is generally consistent with the zoning set forth by the county within the study area. However this area was designated as a secondary growth area by the State and in Kent County's 2001 Comprehensive Plan. As such, the rate of development may increase along the S. State St. corridor.

IV. FUTURE TRANSPORTATION

A. FACILITIES

1. Roadways

With the exception of programmed construction projects within the study area, it can be assumed that the existing facilities will remain and function in a similar manner in the future.

2. Public Transit

The Delaware Transit Corporation is currently planning to extend the Dover, Milford, and Harrington route to include routes to and from Georgetown. An express bus route is planned for the corridor in fiscal year 2003/2004. There are no other planned additional public transit services within the study area.

3. Bicycle

With the exception of potential interconnecting sidewalks and paths between future subdivisions within the study area, there are no current plans to construct new bicycle facilities in the near future within the study area.

4. Pedestrian

With the exception of potential interconnecting sidewalks and paths between future subdivisions within the study area, there are no current plans to construct new pedestrian facilities in the near future within the study area.

B. PROJECTED TRAFFIC

1. Peak Hour Volumes

Within the study area, traffic over the next five years is expected to grow in tandem with development along the corridor and the region. Currently, there are a large number of potentially developable properties in and around the corridor for both commercial and residential development. As such, it is

expected that this area may experience significant growth in travel demand, placing additional burdens on all modes, including pedestrian, bicycle, transit, and vehicular traffic.

DelDOT maintains a travel demand model that utilizes the socio-economic data-population, households and employment information by each Traffic Analysis Zone (TAZ). For this, DelDOT depends upon the employment, household, and population projections approved by the MPO.

The following methodology was employed to develop projected volumes used in the subsequent analyses:

- Existing traffic volumes were collected from previously developed studies and from DelDOT counts throughout the study area. Most of the existing information was from the years 1999 and 2000.
- The existing volumes were projected to a base year of 2001.
- The DelDOT Travel Demand Model was then run utilizing the base year volumes to obtain year 2025 Average Annual Daily Traffic (AADT) estimates of the various roadway segments and intersections.
- Growth factors were calculated from the changes in the 2001 AADT and 2005 AADT.
- Average annual percentage changes were calculated for the years 2001 through 2005
- Average annual percentage changes were applied to existing AM and PM Peak Hour Volumes (PHV).
- A linear growth (straight line) of PHV was assumed for the years 2001 through 2005.

Please refer to Appendix D for the projected future traffic volumes.

2. Travel Patterns

With continued development along the corridor and throughout the county, traffic volumes are expected to increase approximately one percent per year over the next 20 to 25 years. These additional vehicles are expected to follow current travel patterns with regard to route and time of day. Consequently, the level of congestion in the corridor is expected to gradually increase. Refer to Appendix C for the trip matrices derived from the OD study.

C. MEASURES OF EFFECTIVENESS (MOE)

1. Level of Service (LOS)

Table 4 provides the projected LOS based on the estimated peak hour volumes derived from the DelDOT model.

These projected LOS describe the degree of operation of the critical intersections along the corridor. The most favorable LOS is A, while the least favorable condition is F. LOS is determined according to a set of criteria established by the Transportation Research Board, Washington D.C., which is based on an immense amount of research into motorists' perceptions and driving behavior.

Figure 10 provides a map of the study area showing the projected intersection levels of service in the Year 2005.

Figure 10: Projected Year 2005 Levels of Service

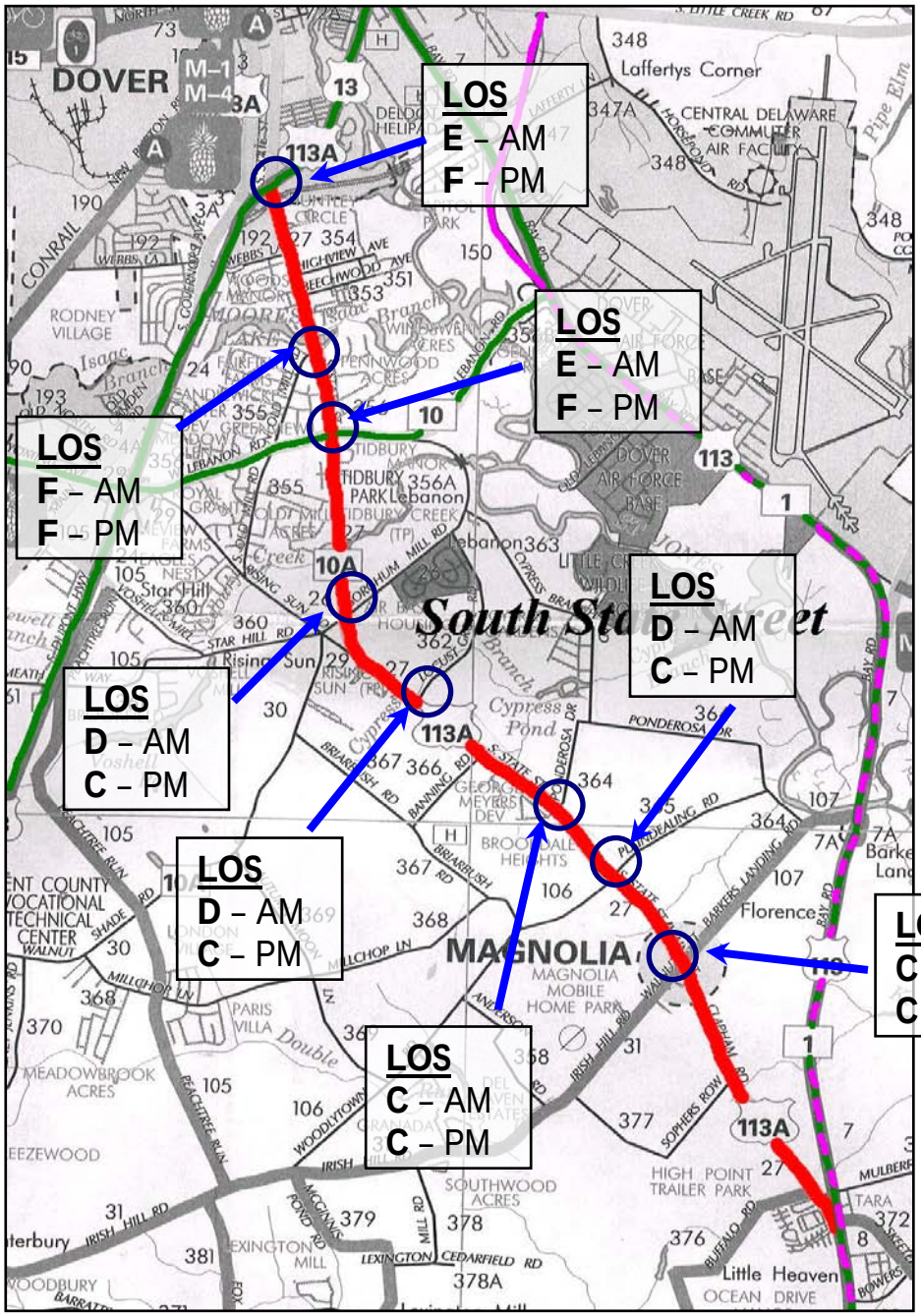


Table 4: Year 2005 Levels of Service

INTERSECTION CAPACITY ANALYSIS (YEAR 2005)						
	AM PEAK HR			PM PEAK HR		
	LOS[1]	DELAY[2]	V/C[3]	LOS	DELAY	V/C
US 113A and US 13	E	73.3	0.85	F	127.4	0.92
US 113 A and Old Mill Rd	F	119.9	0.86	F	51.5	0.43
US 113A and Lebanon Rd	E	75.7	0.97	F	107.6	1.06
US 113A and Sorghum Hill Rd	D	49.3	0.48	C	32.1	0.48
US 113A and Locust Grove	D	28.4	0.29	C	24.2	0.17
US 113A and Brookdale Road/Ponderosa Drive	C	18.5	0.02	C	17.0	0.01
US 113A and Plaindealing Rd	D	34.3	0.28	C	21.0	0.2
US 113A and Walnut Street	C	23.3	0.38	C	25.9	0.39

Notes:
1. Level of service as defined in the 2000 Highway Capacity Manual
2. Delay in Seconds
3. Volume/ Capacity Ratio

D. Summary

By the year 2005, 5 of the critical intersections are shown to operate at LOS D or worse during the peak hour periods. With unanticipated development within the study area, the performance of these intersections can be expected to be worse than the analysis results stated above. Please refer to Appendix F for more detailed LOS results for the projected future traffic volumes in the Year 2005 at each of the critical intersections.

V. IMPROVEMENT ALTERNATIVES

A. EVALUATION

This section outlines the potential improvements that were evaluated for application.

1. Transportation System Management (TSM) Options

TSM options are designed to reduce traffic congestion and to facilitate the flow of existing traffic. The first TSM option is to analyze various intersections within the corridor that may realize an increase in level of services by placing additional traffic signals, adjusting signal phase timing, or implementing minor geometric improvements. Other TSM type corridor improvements are also described later in this section.

2. Travel Demand Management (TDM) Options

TDM measures attempt to reduce the demand for vehicle trips as a long-term goal or to shift the time when trips are made throughout the S. State St. corridor.

3. Promote Alternative Modes of Transportation

Promote alternative modes of transportation along S. State St. from US 13 to Little Heaven, but primarily in the area from SR 10 to Magnolia, which could reduce auto usage.

4. Two-Way Center Left Turn Lane

Reconstruct S. State St. to provide a two-way center left turn lane from Webbs Lane to Sorghum Mill Road, which could increase the ability of vehicles to turn into or out of a side road. This option may require widening of the existing roadway and provision of additional right-of-way.

B. ANALYSIS OF ALTERNATIVES

This section provides the methodology and specific improvement scenarios which were analyzed by the study.

1. Transportation System Management Options

The eight critical intersections were analyzed taking into account the previously listed improvements. The results of the analyses are shown in the Table 5 below. Appendix E contains the detailed summaries of the eight intersections. Refer to Figure 11 for a map of the study area with the projected improvement LOS.

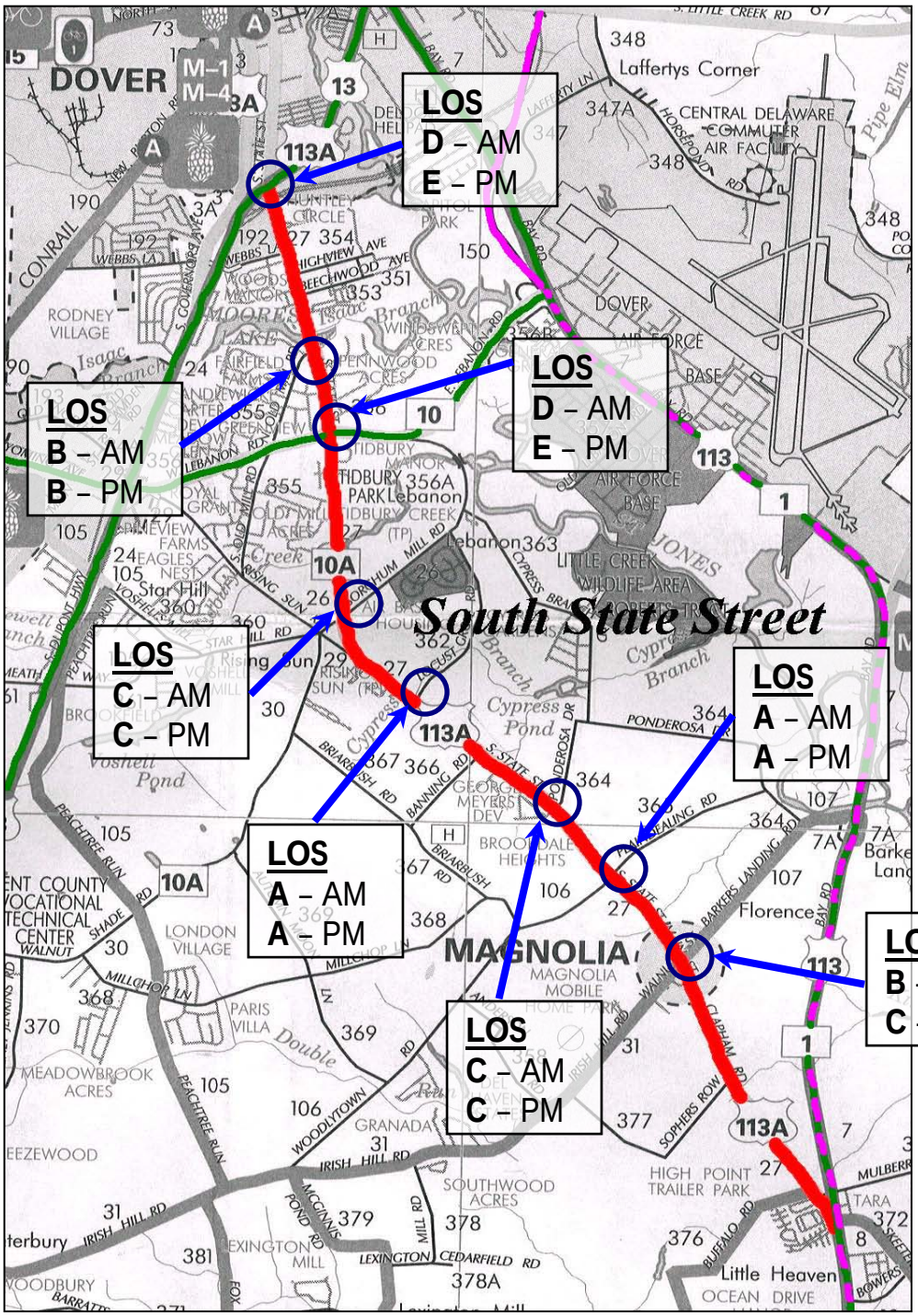
Table 5: Improvement Levels of Service Projected for Year 2005

CAPACITY ANALYSIS WITH SIGNAL AND LANE IMPROVEMENTS (YEAR 2005)						
	AM PEAK HOUR			PM PEAK HOUR		
	LOS[1]	DELAY[2]	V/C[3]	LOS	DELAY	V/C
US 113A and US 13	D	41.7	0.79	E	60.5	0.93
US 113A and Old Mill Rd	B	16.5	0.71	B	14.0	0.56
US 113A and Lebanon Rd	D	50.0	0.81	E	57.7	0.90
US 113A and Sorghum Hill Rd	C	32.3	0.67	C	29.0	0.53
US 113A and Locust Grove	A	8.1	0.79	A	8.1	0.79
US 113A and Brookdale Road/Ponderosa Drive	C	18.5	0.02	C	17.0	0.01
US 113A and Plaindealing Rd	A	7.2	0.38	A	6.7	0.4
US 113A and Walnut Street	B	16.6	0.40	C	21.7	0.53

Notes:

1. Level of service as defined in the 2000 Highway Capacity Manual
2. Delay in Seconds
3. Volume/ Capacity Ratio

Figure 11: Projected Year 2005 Levels of Service with Improvements



The analyzed improvement details of the eight critical intersections within the study area are listed as follows:

1) S. State St. and US 13
   - Signal Timing – improved coordinated and actuated phases.

2) S. State St. and Old Mill
   - Signal Installation – semi-actuated operation.
   - Separate turn lanes along minor approach.

3) S. State St. and SR10
   - Signal Timing – minimize the amount of lost time

4) S. State St. and Sorghum Mill Rd.
   - Refine Signal timing
   - Separate left turn lanes along minor approaches.

5) S. State St. and Locust Grove (K362)
   - Signal Installation – semi-actuated operation
   - Separate turn lanes along minor approach.

6) S. State St. and Brookdale Heights-Ponderosa
   - None

7) S. State St. and Plaindealing
   - Signal Installation – semi-actuated operation.
   - Separate right turn lanes on minor approaches

8) S. State St. and Walnut Street
   - Signal Timing – minimize the amount of lost time.

Additionally other TSM improvements were evaluated and considered and they are as follows:

- Eliminate signage that directs traffic to use S. State St. as a main access route to Dover and add signage along Route 113 south of Little Heaven to promote alternative travel routes such as Route 1 or Route 113, reducing

driver dependency on S. State St. as a though-route between Dover and the project area.

- Increase the amount of roadway lighting throughout the corridor, particularly in the area north of Rising Sun.

- Develop a geometric modification solution for westbound SR 10 and S. State St. and the entrances to the Wilmington Trust on SR 10 and S. State St.

- Implement a NO PASSING ZONE for the entire length of S. State St. Restrict passing on shoulders to only designated bypass areas.

- Reduce speed limits on S. State St. from south of Rising Sun to the Dover City limits. Reduce the speed limit on Route 10 in the vicinity of S. State St.

2. Travel Demand Management Options

TDM options have been proven in other areas to be effective, particularly when cooperation occurs between private and public sectors. The magnitude of success depends on the options implemented and size of the traffic population they impacts.

- Implement voluntary or incentive based flexible work schedules by City, County and State government and the Dover Air Force Base (DAFB) to mitigate congested travel periods during the morning and evening peak hours on S. State St.

- Eliminate the US Route designation of "113 Alternate" for S. State St.

- Investigate the applicability of traffic calming measures to the corridor including speed limit reductions and bulbouts according to the DelDOT Traffic Calming Design Manual, August 2000.

3. Promote Alternative Modes of Transportation

In cooperation with DART, increase the use of buses. Increase bicycling and walking by interconnecting residential and commercial centers.

- Review existing facilities and promote increased use of buses, bikes and walking.
- Interconnect pedestrian facilities between developments (prioritize areas for sidewalks/bike lanes).
- Construct Park-and-Ride facilities at Little Heaven, Rising Sun, and/or the Moores Lake areas.
- Review bus options for SR 13.

4. Two-Way Center Left Turn Lane

A CORSIM MOE study was conducted. The following table lists the results.

Table 6: CORSIM Results with Improvements

TABLE 6 -- Year 2005 Average Traffic Condition With Intersection Improvements and Additional Center Left Turn Lane		
	AM Peak Hour	**PM Peak Hour**
Total Vehicle-Miles [Average Speed in mph] (Move Time to Total Time Ratio)	12066.2 [30.6] (0.73)	11726.8 [26.9] (0.65)
Total Vehicle-hours [Delay Time] (Total Time)	289.1 [110.3] (399.4)	291.7 [160.4] (452.1)

C. SUMMARY

The table below provides a comparison of the advantages and disadvantages of the aforementioned improvement alternatives:

Table 7: Comparison of Improvement Strategies

TABLE 7 -- Comparison of Improvement Strategies		
Strategies	**Advantages**	**Disadvantages**
TSM Options	• Improved intersection LOS • Improved coordinated and actuated phasing • Reduce side-road delay • Reduce frequency of angle type accidents • May increase use of alternate routes • Reduce speeding • Smaller capital costs	• Increase frequency of rear-end type accidents • Increase in delay for S. State St. traffic
TDM Options	• May increase use of alternate routes • Reduce frequency of angle type accidents • May improve intersection LOS • Improved coordination between land use and transportation long-range plans • Smaller capital costs	• Capital cost to revise plans • Cost to investigate existing policies.
Alternative Modes of Transportation	• Reduce forecasted traffic volumes • Reduce frequency of angle type accidents • Reduce side-road delay	• R/W and capital cost for Park-n-Rides
Two-Way Center Left Turn Lane	• Increase ability of vehicles to effectively turn into and out of side-roads • Reduce frequency of angle type accidents • Reduce delay for S. State St. traffic at congested intersections	• R/W required • Larger capital costs

VI. CONCLUSIONS

A. NEEDS

Based on the analysis performed by this study, there is an existing need for transportation improvements within the S. State St. Corridor. Population, housing, and employment are expected to increase over the next 20 to 25 years, with a large influx in particular of subdivision development in and around the corridor. Due in part to the current operation and condition of the study area intersections, available transit service, and other multi-modal facilities, improvements may be needed in the near future within the study area.

B. ALTERNATIVES

- Network Measures of Effectiveness

  The CORSIM analysis showed that with the intersection improvements and additional two-way left turn lane, the total travel time and delay time of the network decreased while the average speed increased. Appendix G contains the detailed comparison.

- Intersection LOS

  The LOS analysis showed that with the additional signals, signal improvements and separating turn lanes on minor approaches, the intersections LOS are improved. Appendix F contains the detailed summaries of the eight intersections.

C. RECOMMENDATION

1. Transportation Systems Management (TSM) Options

According to the analysis and comparison of the eight intersections described above, it is recommended that three semi-actuated signal control devices be installed at the intersections of S. State St. at Old Mill Road, S. State St. at Locust Grove Road, and S. State St. at Plaindealing Road. It is expected that the additional traffic signals will improve the intersection LOS and provide adequate gaps to allow side road traffic access to S. State St. Additional study should be conducted at the intersection of S. State St. and Old Mill Road to ensure that a traffic signal at that location will not

adversely impact motorists coming out of Elizabeth Avenue and residents of Pennwood. Signal warrant studies should also be completed for these locations.

For the signalized intersections, adjusting the signal phase timing is recommended to improve intersection performance and corridor progression. Signal timing adjustments should be applied to the intersections of US 13 at S. State St., S. State St. at SR 10, S. State St. at Sorghum Mill Road and S. State St. at Walnut Street. It is also recommended that traffic lights in the corridor be evaluated to determine whether or not they should revert to flashing yellow when traffic volumes are low.

In order to reduce the number of angle type accidents and order the side road movements, separating turn lanes along minor approaches at the intersections is also recommended. Separations should occur at the intersections of S. State St. at Old Mill Road, S. State St. at Sorghum Mill Road, S. State St. at Locust Grove Road and S. State St. at Plaindealing Road.

The other TSM options, such as signing, pavement markings, additional lighting, No Passing Zones and speed limit reductions should be implemented in an attempt to reduce accidents and minimize through commuter trips. Construction of a traffic-calming device at the Moores Lake Recreation area to increase safety of people who cross the road to use that recreational facility should be investigated.

2. Travel Demand Management Options

S. State St. provides the primary access to the City of Dover, which is the center of employment, commerce, and governmental and institutional services. It is not expected that TDM measures alone will increase the operational characteristics of the corridor or to modify driver dependency on S. State St. as a main route to and from Dover. Existing and future trips internal to the project area are sufficient to negatively impact levels of service on S. State St. In addition, even if there were sufficient incentive to utilize parallel routes, there is an insufficient transportation network in an east-west direction to facilitate these trips. Therefore, policies should be implemented and/or remain in place that support TDM options as a form of transportation infrastructure improvement.

3. Promote Alternative Modes of Transportation

To reduce the auto usage, alternative modes, such as public transit, bicycle and walking, are promoted. The promotion of multimodal transportation to help alleviate automobile traffic in the future could be implemented with advanced user systems

through intelligent transportation systems, improved or added transit routes, and intersection improvements to accommodate pedestrians and bicycles.

- Transit / DART Recommendations

There are currently no DART transit stops along S. State St. between Foskey Drive in Rising Sun and Walnut Street in Magnolia. However, there is extensive residential and commercial growth within this area. As such, future transit service may be warranted. Therefore, it is recommended that current and future development projects provide accommodations for bus and/or transit service as well as bus shelters in these areas.

- Bicycle Paths / Routes Recommendations

With the extensive development occurring between Magnolia and SR 10, future needs to accommodate bicyclists are essential. Existing geometrics along S. State St. include full shoulders, which provide a safe location for traveling bicyclists and pedestrians.

Walnut Street in Magnolia is currently shown as a primary bicycle route, and it may be desirable to connect bicycle facilities along S. State St. to this primary route. Therefore, future consideration of a striped bicycle lane along S. State St. should be given. All planned and future subdivisions should include requirements to provide for interconnectivity into the planned bicycle route network located within existing developments and along S. State St.

- Pedestrian Facilities / Sidewalk Recommendations

Due to the rural nature of the study area, there is no system of sidewalks and pedestrian facilities. However, it is recommended that future developments be required to accommodate pedestrian traffic. This should include sidewalks in, around and between each site.

4. Two-way Center Left Turn Lane

The recent capital project from Webbs Lane to SR 10 to provide left turn/bypass lanes at selected intersections effectively increases the ability of vehicles to turn into and out of side roads and reduce delays for S. State St. traffic. Thus, it is recommended

that, at a minimum, S. State St. similarly be reconstructed to provide left turn lanes at selected intersections from SR 10 to south of Sorghum Mill Road. However a full-fledged center left turn lane may not be economical. Therefore, the selected intersection improvements previously outlined should be considered instead.

A long-term plan for S. State St. should manage access, including consolidation of additional access points as commercial and residential development continues.

4. Further Study

Travel demand management is a key component to reducing the traffic impact of the projected non-uniform increase in population and jobs within each traffic analysis zone. Encouraging drivers to take US 113/SR 1 could reduce traffic on S. State St. Within the study area, SR 10 is the only arterial traversing an east-west direction, which leads to the idea of an additional/upgraded east-west route. The additional cross route could provide access to US 113/SR 1 from internal residential areas. However, the impact outside of the S. State St. study area along US 113/SR 1 up to an interchange at SR 8 would need to be analyzed. A larger, more comprehensive DelDOT study that encompasses these areas should be undertaken.

D. SUMMARY

Five improvement alternatives and strategies are described, analyzed, compared and recommended above. It is expected that selectively applying these alternatives will improve corridor operation and safety and encourage use of alternate parallel routes to S. State St. They are the following:

1. TSM improvements including traffic signals, signal timing adjustments, Intelligent Transportation System (ITS) applications, left turn lane construction, design consistency and conformity, improved signage, and lighting should be required today and in the near future.

2. A larger scale study to address long-range improvements should be conducted. This study establishes the need for system improvements and may serve as the foundation for future study along the S. State St. corridor.

3. US 113A should be considered for conversion to a state route in lieu of its current US route status. US 113A no longer serves as a parallel facility for US 113, but rather as a local route for traffic accessing Magnolia, Rising Sun, Camden and Wyoming.

4. Multimodal improvements within the area should be considered including park and ride facilities and the implementation of intelligent transportation systems.

5. The implementation of TDM initiatives should be investigated as long-term improvements to help better manage land use, zoning and future development as well as the additional traffic expected from future development.

These recommendations are previously outlined in the executive summary at the front of this report.

GLOSSARY OF TERMS

ANNUAL AVERAGE DAILY TRAFFIC (AADT): The total volume of traffic passing a point or segment of a highway or roadway facility in both directions for one year divided by the number of days in the year.

CORRIDOR: A set of parallel or interacting transportation facilities designed for travel between two common points. A corridor may contain subsystems such as freeways, rural or two lane highways and/or roadways, arterials, collector roads, transit, pedestrian, and bicycle facilities.

FUNCTIONAL CLASSIFICATION: The process by which public streets and highways are grouped into classes according to the character of service they are intended to provide where generally highways fall into one of four broad categories being principal arterial, minor arterials, collector roads, or local roads.

LEVEL OF SERVICES (LOS): A qualitative measure describing the operation of conditions within a traffic stream, based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience.

MICROSCOPIC MODEL: A mathematical model that captures the movement of individual vehicles traveling through a user-defined transportation system. CORSIM is such a model.

PEAK HOUR PERIOD: A time frame during the course of day in which the flow of traffic, including automobile, heavy vehicle, transit, pedestrian, and / or bicycle traffic, is higher than at any other point during the day.

SIMULATION MODEL: A computer program that uses mathematical models to conduct experiments with traffic events on a transportation facility or system over extended periods of time.

VOLUME: The number of persons or vehicles passing a point on a lane, roadway, or other traffic-way during some time interval, often1 hour, expressed in vehicles, bicycles, or persons per hour.

VOLUME-TO-CAPACITY RATIO: The ratio of flow rate to capacity for a transportation facility.

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