

ACCESS MANAGEMENT

Along Pennsylvania Highways

IN THE DELAWARE VALLEY



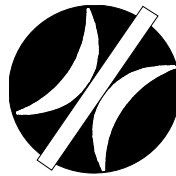
State Road/US 1
Case Study Corridor



Delaware Valley Regional Planning Commission

2006

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency that provides continuing, comprehensive and coordinated planning to shape a vision for the future growth of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties, as well as the City of Philadelphia, in Pennsylvania; and Burlington, Camden, Gloucester and Mercer counties in New Jersey. DVRPC provides technical assistance and services; conducts high priority studies that respond to the requests and demands of member state and local governments; fosters cooperation among various constituents to forge a consensus on diverse regional issues; determines and meets the needs of the private sector; and practices public outreach efforts to promote two-way communication and public awareness of regional issues and the Commission.



Our logo is adapted from the official DVRPC seal, and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole, while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for its findings and conclusions, which may not represent the official views or policies of the funding agencies.

TABLE OF CONTENTS

Executive Summary	01
Chapter 1 Introduction	03
Chapter 2 Roadway and Traffic Characteristics	04
Chapter 3 Traffic Safety	09
Chapter 4 Conceptual Plans	16
Chapter 5 Conclusions / Next Steps	32
Chapter 6 References	33

LIST OF FIGURES

Figure 1 Location Map	02
Figure 2 Access Management with Respect to Roadway Classification	04
Figure 3 Traffic Volumes and Land Use	07
Figure 4 Traffic Accident Patterns	11
Figure 5 Effects of Speed Differential between Turning Vehicles and Through Traffic on Crash Potential	15
Figure 6 Traffic Signal Permit Plan – Collins Drive \ Marple Shopping Center Drive and State Road – US 1	19
Figure 7 Traffic Signal Permit Plan – Meetinghouse Lane and State Road – US 1	23
Figure 8 Traffic Signal Permit Plan – Springfield Road and State Road – US 1	27
Figure 9 Median Closure Typical Section	30
Figure 10 Conceptual Highway Access Management Plan	Back Pocket

LIST OF TABLES

Table 1 Accident Locations	09
Table 2 Accident Patterns	10
Table 3 Proposed Improvements State Road – US 1 at Collins Drive \ Marple Shopping Center Drive	16
Table 4 Proposed Improvements State Road – US 1 at Meetinghouse Lane	21
Table 5 Proposed Improvements State Road – US 1 at Springfield Road	25
Table 6 Proposed Improvements State Road – US 1 at Buttonwood Drive	29
Table 7 Preliminary Engineering & Construction Cost Estimate State Road – US 1 Improvements	31

EXECUTIVE SUMMARY

This report provides an analysis for the improvement of safety and congestion along State Road – US 1 between Collins Drive and Springfield Road. Access management principles are the basis of the analysis and the recommended improvements. The study effort supports PENNDOT’s effort to implement model access management ordinances for state and local highways—statewide. To that end, staff of the Delaware Valley Regional Planning Commission (DVRPC) used PENNDOT’s *Access Management Ordinances for Pennsylvania Municipalities Handbook* as a core reference in this project.

DVRPC’s access management work program involved a steering committee comprised of regional and county transportation and community planners, and representatives from the City of Philadelphia’s Streets Department, PENNDOT District 6-0 Traffic Engineering and Highway Permits units, and SEPTA Service Planning Department. Drawing from the long range plan, congestion management systems, and corridor studies, the steering committee helped DVRPC staff identify two corridors for case study evaluation: State Road – US 1 (Collins Drive to Springfield Road), and John Fries Highway – PA 663 (Krammes Road to PA 309). Each corridor illustrates an area at a different stage of development, and therefore, are good examples of access management implementation in diverse circumstances.

This Technical Memorandum focuses on State Road – US 1 between Collins Drive and Springfield Road (Figure 1). The study highway is a four through lane road with a frontage road serving fully developed commercial development abutting single family neighborhoods on both sides of the roadway. Improvements noted within this report focus on modification of existing facilities to improve safety (pedestrian and vehicular) and access \ traffic flow.

DVRPC staff evaluated the corridor using PennDOT’s model ordinances and related reference material. Proposed recommendations were prepared with municipal and PENNDOT staff participation and are noted using existing PENNDOT traffic signal permit plans and a conceptual corridor plan formulated from 2000 aerial photography. Details are provided within the text of this report, and cost estimates are provided to help foster implementation of the identified improvements.

In summary, the conceptual plan recommends closure of the lone non-signalized median opening on State Road, improved signage and pavement markings at signalized intersections, and reestablishing coordinated traffic signalization to progress traffic through the corridor. The total project cost estimated for the identified improvements is \$ 90,000.

1 INTRODUCTION

Access management is one of many strategies available to a municipality to improve the function of its roadways. The methods employed in access management seek to optimize and maintain the existing transportation system while preparing for its future growth. Access management can be a relatively low cost means of reducing congestion and increasing both the efficiency and safety of a roadway. It can be introduced on a case-by-case basis by retrofitting at individual parcels, or incrementally along growing corridors through the land development application process.

When consistently implemented, access management can produce impressive results. National studies indicate that access management techniques can contribute to a 40 percent reduction in highway collisions and may increase vehicular mobility by 30 percent. The methodology behind DVRPC's work program emphasized the correct implementation of appropriate access management strategies in association with PENNDOT's Model Access Management Ordinances project to extend the serviceability and improve the traffic safety along state and local roads.

DVRPC's methodology for access management planning draws from its regional Congestion Management Process (CMP) planning. The congestion management system aims to minimize congestion and enhance the mobility of both people and goods. Congestion management processes act as a connection between the region's Long Range Plan and the region's Transportation Improvement Program (TIP) to ensure that the appropriate regional transportation facilities are improved. An initial step of Congestion Management Process Planning was to define congested corridors and sub-corridors within the Delaware Valley. The plan then considered the characteristics of each sub-corridor and provided strategies for congestion mitigation at each location, including access management strategies.

DVRPC's access management work program was created to support the effort of PENNDOT's Model Access Management Ordinance project. To do this, DVRPC's work program for this project focuses on case studies. As such, it was a logical step to use the Congestion Management Process Planning as a guiding philosophy for selecting case study areas. To help DVRPC narrow the candidate case study corridors, a steering committee was formed to contribute to the work and provide comments on the products. The steering committee was comprised of regional and county transportation and community planners, and representatives from the City of Philadelphia's Streets Department, PENNDOT District 6-0 Traffic Engineering and Highway Permits Units, and SEPTA Service Planning Department. The steering committee helped DVRPC staff identify the candidate case study corridors and municipal contacts. Additionally, the "host" steering committee member participated in working meetings with the local municipality. All steering committee and local municipal staff were provided the opportunity to review the draft report and its findings.

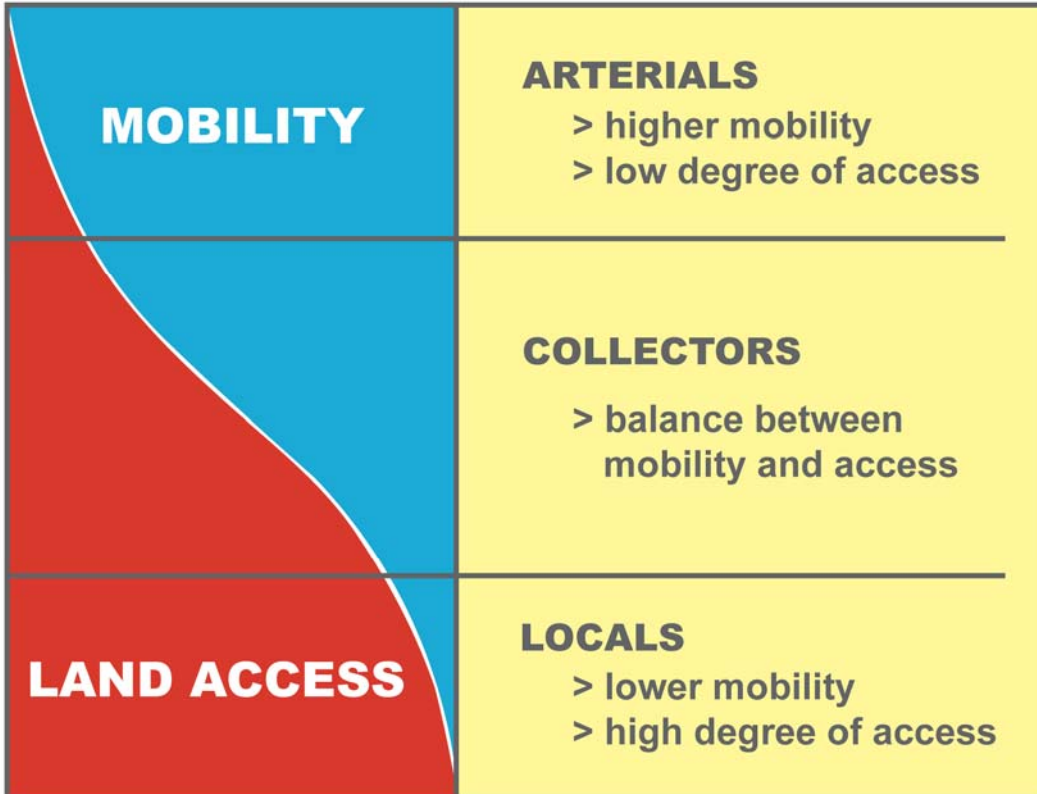
Two corridor studies were conducted during the FY 2006 work program year: State Road - US 1 (Collins Drive to Springfield Road) and John Fries Highway - PA 663 (Krammes Road to PA 309). Each corridor illustrates areas at different stages of development, and therefore are good examples of access management's application in diverse circumstances.

This Technical Memorandum focuses on State Road – US 1 between Collins Drive and Springfield Road. The study highway is a four through lane highway, with a frontage road, abutting fully developed commercial properties intermingled with mature developments of single family homes. Sidewalks are present the entire length of the project on both sides of the roadway. Therefore improvements noted within this report focus on modification of existing facilities to improve safety (pedestrian and vehicular) and access \ traffic flow.

2 ROADWAY and TRAFFIC CHARACTERISTICS

Highway functional classification is a qualitative description for the balance between mobility and land access provided by a highway. The relevance of the aforementioned roadway classifications with respect to highway access management are graphically depicted in Figure 2.

Figure 2 - Access Management with Respect to Roadway Classification



Source: Safety Effectiveness of Highway Design Features Volume 1, Access Control, FHWA, 1992

The study corridor's roadways are classified as follows:

- State Road – US 1 (S.R. 0001) is an “Other Freeway and Expressway”.
- Sproul Road – PA 320 (S.R. 0320) is a “Principal Arterial”.
- Springfield Road (S.R. 2009) is a “Principal Arterial”.
- Collins Drive (Township Road) is a “Local Road”.
- Stratford Drive (Township Road) is a “Local Road”.
- Meetinghouse Lane (Township Road) is a “Local Road”.
- Buttonwood Drive (Township Road) is a “Local Road”.

There are also a variety of commercial and residential driveways intersecting State Road – US 1 in the study segment.

State Road – US 1 is a divided highway (“expressway”) with three lanes in both directions at the southern approach to the signalized Collins Drive \ Marple Shopping Center Driveway intersection. A diamond interchange with Sproul Road – PA 320 starts at the aforementioned signalized intersection and ends at the signalized Meetinghouse Lane \ Meadowgreen Park Entrance intersection. The mainline, which goes under Sproul Road, through this area consists of two lanes in both directions and one to two lanes on the frontage roads. State Road – US 1 between Meetinghouse Lane and the signalized Springfield Road intersection is two through lanes southbound and three lanes northbound converging to two lanes northbound and a right turn lane at Springfield Road. In this section, there is a median opening at \ for Buttonwood Drive. This is the only unsignalized median opening in the State Road – US 1 case study segment. State Road – US 1 on the northern approach to Springfield Road is two through lanes southbound and northbound.

The posted speed for State Road – US 1 within the study corridor varies from 45 MPH to 55 MPH. The Annual Average Daily Traffic (AADT) volume on State Road – US 1 within the study corridor is 45,100 vehicles. North of Springfield Road, daily traffic levels approximate 34,400 vehicles (see Figure 3). Daily traffic levels on cross streets or nearby highways in the study corridor are also shown on Figure 3.

SEPTA operates two bus routes along in the study area: Route 110 from 69th Street Terminal to Penn State via Springfield Mall and Media and Route 111 from 69th Street Terminal to Chadds Ford. Both routes provide service along State road and utilize the frontage road serving numerous commercial and shopping developments. Five bus stops provide access points for passengers and are marked at the following locations:

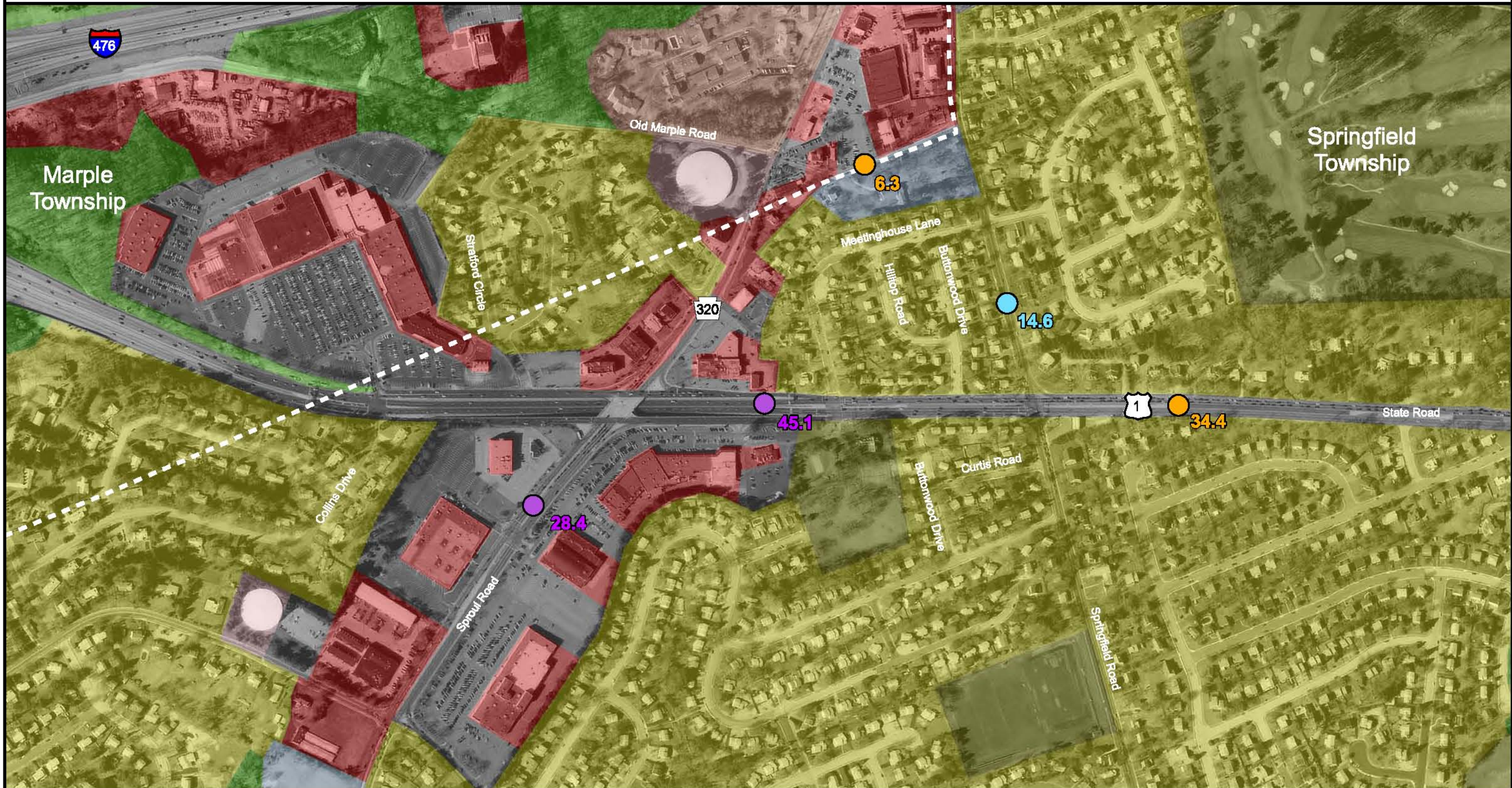
Westbound: Springfield Road (FS), Meetinghouse Lane (NS) Sproul Road/Stratford Circle (MB). Eastbound: Sproul Road (FS), Springfield Road (FS)

The Marple Crossroads Shopping Center is directly serviced by Route 110, while Route 111 continues on the limited access highway linking Springfield and Middletown Townships. As part of SEPTA's Fiscal Year 2007 Annual Service Plan, Route 107 now provides north/south transit service along PA Route 320 between Lawrence Park Shopping Center and Springfield Mall. Transfer opportunities are possible between Routes 107, 110 and 111 at State and Sproul Roads. Route 107 service was implemented on August 28, 2006.

Land use within the corridor is also illustrated on Figure 3. North \ west of the study highway segment, commercial development dominates from the Marple Crossroads Shopping Center to Meetinghouse Lane, and a residential neighborhood (single family detached) occupies the land from Meetinghouse Lane to Springfield Road, on the north \ east. On the south \ west portion of the corridor, a neighborhood of single family detached homes (served by Collins Drive) lies adjacent to commercial development. A shopping center also occupies the south \ east quadrant, extending to Meadowgreen Park Entrance, with a residential neighborhood between it and Springfield Road.

State Road (US 1) Case Study Corridor

Figure 3: Traffic Volumes & Land Use



0 100 200 400 600
Feet

Delaware Valley
Regional Planning Commission
June 2006

Total Daily Traffic
Volume (In Thousands)

2001 2002 2004

2000 Land Use

- Commercial
- Community Services
- Recreation
- Residential: Multi-Family
- Residential: Single-Family Detached
- Transportation and Parking
- Utility
- Wooded

3 TRAFFIC SAFETY

Access management aims to improve both the efficiency and safety of a given roadway or corridor. Increased safety is addressed through access management by eliminating turning movements, reducing through travel interruptions, and making vehicle entrances and exits to / from driveways and roadways as controlled as possible. To assess the current traffic safety conditions along State Road – US 1, traffic accident information was obtained from PENNDOT (1997 through 2003, excluding 2002 which was not available from PENNDOT).

PENNDOT crash data is available through a database of reportable accidents¹ occurring on state highways in the commonwealth. Organizing traffic accidents by location and type is a logical way of assessing traffic safety conditions in the corridor. In turn, number of accidents, general accident patterns and causation factors have been summarized and categorized. With general knowledge as to the contributing factors to the incidents, a focused group of possible access management related countermeasures were derived.

Locations:

The four intersections with median openings within the State Road – US 1 study corridor where accident analysis was performed were:

#	Cross Street Location	Signalized?
1	Collins Drive \ Marple Shopping Center	Y
2	Meetinghouse Lane \ Meadowgreen Park	Y
3	Buttonwood Drive	N
4	Springfield Road	Y

Table 1 summarizes the traffic accident conditions at the four (4) intersections.

TABLE 1 – ACCIDENT LOCATIONS

Location	Accidents (1997 -2003, EXCL. 2002)		Injuries (1997 -2003, EXCL. 2002)	Fatalities (1997 -2003, EXCL. 2002)
	#	% of Total	#	#
Collins Drive	85	37.3%	93	0
Meetinghouse Lane	30	13.2%	33	0
Buttonwood Drive	10	4.4%	9	0
Springfield Road	103	45.2%	116	0
TOTAL	228	100%	251	0

Source: PENNDOT (1997 through 2003, excluding 2002)

¹Reportable accidents in Pennsylvania are defined to be those resulting in injury or death and/or requiring a tow-away. These are the only accidents that are reported to PENNDOT and kept on file in their database.

Ninety six (96) percent of the accidents occurred at the signalized intersections. Most accidents (45.2 %) occurred at the Springfield Road intersection followed closely by the Collins Drive \ Marple Shopping Center intersection (37.3 %). Buttonwood Drive accounted for ten accidents or 4.4 percent of the total.

Patterns:

The pie charts in Figure 4 provide a comparison of the types of accidents that occurred at each analyzed location. The size of the pie chart is reflective of the number of accidents occurring at the intersection. As shown, the highest number of accidents occur at the Springfield Road intersection, followed by Collins Drive, Meetinghouse Lane and Buttonwood Drive. All locations (with the exception of Buttonwood Drive) show a majority of angle accidents (yellow) and a substantial number of rear-end accidents (blue). The remaining composition varies between sites.

Table 2 corresponds to the pie charts in Figure 4 and enumerates the type of each accident.

TABLE 2 – ACCIDENT PATTERNS

Accident Type	Collins Drive		Meetinghouse Lane		Buttonwood Drive		Springfield Road		TOTAL	
	#	% OF Total	#	% OF Total	#	% OF Total	#	% OF Total	#	% OF Total
Non - Collision	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Rear - End	27	31.8%	8	26.7%	4	40.0%	25	24.3%	64	28.1%
Head On	0	0.0%	0	0.0%	1	10.0%	2	1.9%	3	1.3%
Angle	46	54.1%	16	53.3%	3	30.0%	69	67.0%	134	58.8%
Sideswipe	4	5%	4	13%	1	10%	2	2%	11	5%
Hit Fixed Object	5	6%	1	3%	0	0%	5	5%	11	5%
Other	3	4%	1	3%	1	10%	0	0%	5	2%
TOTAL	85	100.0%	30	100.0%	10	100.0%	103	100.0%	228	100.0%

Source: PENNDOT (1997 through 2003, excluding 2002)

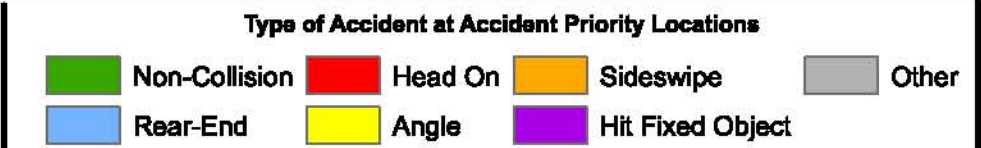
State Road (US 1) Case Study Corridor

Figure 4: Traffic Accident Patterns



- State Road Intersections**
- 1 Collins Dr
 - 2 Meetinghouse Ln
 - 3 Buttonwood Dr
 - 4 Springfield Rd

Source: PENNDOT Accident Reports (1997-2003, excluding 2002)



A description of the nature of each major pattern at each intersection is provided and where appropriate, general countermeasures to remediate the accident type are identified. This section is intended to provide a preliminary understanding of access management and traffic safety improvement techniques that can be implemented.

Contributing Factors:

For each location factors contributing to traffic accidents were judged based upon field views of the intersections.

Accidents at Collins Drive and State Road – US 1

Contributing factors leading to the preponderance of angle accidents were based upon field views and include:

- 1) US 1 SB traffic turning right across the US 1 SB Frontage Road into Marple Shopping Center.
- 2) the right turn yield movement from the Marple Shopping Center to US 1 SB, merging without clearance interval, exacerbated by the speed differential of the turning and through movements.
- 3) left turns “cheating” on the signal’s clearance interval.

Field observation indicates rear-end accident patterns maybe due to:

- 1) confusion regarding lane control and turning movements.
- 2) excessive travel speeds (especially US 1 SB on the downgrade).
- 3) the right turn yield movement from the Marple Shopping Center to US 1 SB (speed differential).
- 4) lack of demarcation of hazards (i.e. sudden stops due to end islands not being marked).

Accidents at Meetinghouse Lane and State Road – US 1

Contributing factors for angle accidents include:

- 1) US 1 NB traffic turning right across the US 1 NB Frontage Road into Meadowgreen Park \ shopping center.
- 2) left turns “cheating” on the signal’s clearance interval.

Rear-end accident contributing factors include:

- 1) confusion regarding US 1 NB turning movements.
 - 2) poor alignment of the Meadowgreen Park leg of the intersection.
-

Accidents at Buttonwood Drive and State Road – US 1

Based upon field observations of the intersection factors contributing to angle accidents at the intersection are:

- 1) speed differential between turning movements and through traffic.
- 2) the lack of “gaps” on US 1 for turns to / from Buttonwood traffic.

Rear-end accidents contributing factors include:

- 1) insufficient deceleration lane length in the two-way left turn lane.
- 2) confusion regarding turning movements onto Buttonwood Drive.

Accidents at Springfield Road and State Road – US 1

Contributing factors leading to the preponderance of angle accidents were based upon field views and include:

- 1) poor level of service
- 2) left turns “cheating” on the signal’s clearance interval.

Field observation indicates rear-end accident patterns maybe due to:

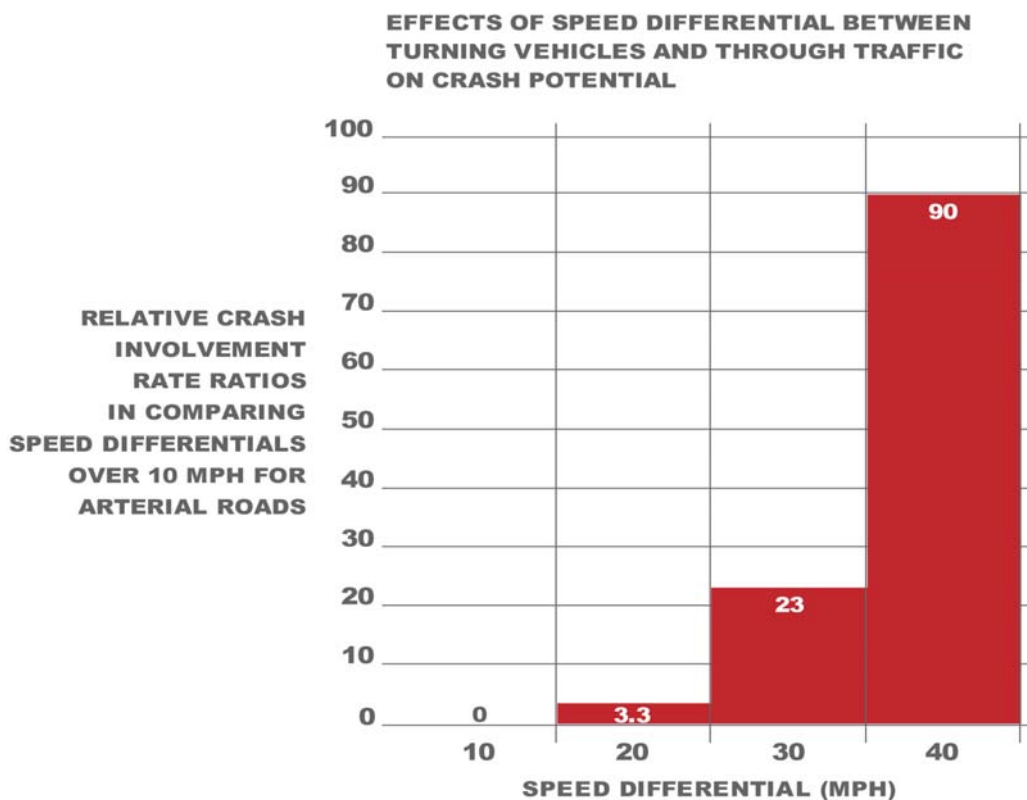
- 1) missing signage leading to confusion regarding turning movements.
 - 2) lack of demarcation of hazards.
-

Countermeasures:

PennDOT’s publication: *Access Management Model Ordinances for Pennsylvania Municipalities Handbook* was the prime resource used in generating recommendations in the study corridor. These ordinances are separated into three tiers in which differing strategies are applied over different physical limits / geographic areas. The first tier focuses on access management techniques for individual parcels (i.e., number, placement and design of driveways serving a parcel). The second tier addresses techniques for roadways (i.e. provisions for separate turning lanes along, and driveway placement within a given roadway segment). The third tier reviews more complex and comprehensive traffic and land use planning practices (including: overlay districts, official maps, and continuous two-way left turn lanes versus non-traversable medians).

Traffic safety countermeasures were identified through analyses of the accident patterns and field observation. In general, the applicable measures included proper lane control through pavement making and signing, hazard demarcation, non-traversable medians to reduce left turn conflicts, appropriate traffic control devices, and traffic signal progression. As an example, Figure 5 illustrates the benefits of installing a “NO TURN ON RED” sign at a signalized intersection experiencing angle accidents.

Figure 5 – Effects of Speed Differential between Turning Vehicles and Through Traffic on Crash Potential



Source: Access Management Manual, Access Design, Transportation Research Board, 2003

4 CONCEPTUAL PLANS

Preliminary improvement schemes were formulated by DVRPC staff, and were reviewed with PENNDOT and municipal staff prior to recommending the corridor's conceptual plan.

It was determined that the corridor was best analyzed at the four (4) intersections where there are median openings. Tables 3 through 6 detail the current conditions and proposed improvements along State Road – US 1 at the study intersections. Visually augmenting these tables are modified signal permit plans (Figures 6 through 8), photographs, a typical section (Figure 9), and the corridor's conceptual access management plan (Figure 10) located in the back pocket of this report.

TABLE 3 – PROPOSED IMPROVEMENTS STATE ROAD – US 1 at COLLINS DRIVE \ MARPLE SHOPPING CENTER DRIVE (See Figure 6)	
Existing Conditions	Proposed Improvements
<ul style="list-style-type: none"> • Signalized Intersection • US 1 NB; 1 separate left turn lane, 2 through lanes, and 1 through \ right turn lane (frontage road) • US 1 SB; 1 separate left turn lane, 2 through lanes, 1 through lane (frontage road) and 1 right turn lane (frontage road) • Collins Drive WB; 1 left \ through \ right lane. • Marple Center Shopping Drive EB; 1 right turn lane (yield movement), 1 through \ left lane and 1 separate left turn lane. 	<ul style="list-style-type: none"> • US 1 NB, add warning sign(s) to traffic island separating through movement from the frontage road \ right turn movement. • US 1 NB, add warning sign(s) between the main line and the frontage road. • US 1 SB, add a “NO TURNS” sign between the main line through movement and the frontage road through movement. • US 1 SB, add skip mark lines between the main line through movement and the frontage road through movement. • Marple Center Shopping Drive, make the right turn move onto US 1 SB a signal controlled, no turn on red movement by adding a stop bar and “NO TURN ON RED” sign and removing the yield sign. • Add Tubular Markers on all Islands throughout the Intersection area. • REINSTALL ALL MISSING PERMIT SIGNAGE.

Source: DVRPC, 2006

The posting of “NO TURNS” signs and skip mark lines (between the SB main line through movement and the frontage road through movement) should help reduce the occurrence of the illegal (and hazardous) right turn from the SB main line to the Marple Shopping Center. The changing of the “yield” controlled movement from Marple Shopping Center to US 1 S.B. to a signal controlled, no turn on red movement should reduce or eliminate the occurrence of accidents wherein dangerous speed differentials are identified as contributing factors. The replacement of missing signal permit signs and demarcation of islands with tubular markers should reduce “confusion” and “island \ median” related accidents. Implementation of these improvements should help reduce the “angle”, “rear end”, and “hit fixed object” accidents detailed in the traffic safety section of this report (Table 2 and Figure 4).



Marple Shopping Center EB, existing right turn lane “yield” movement proposed to be made a “signal controlled, NO TURN ON RED” movement

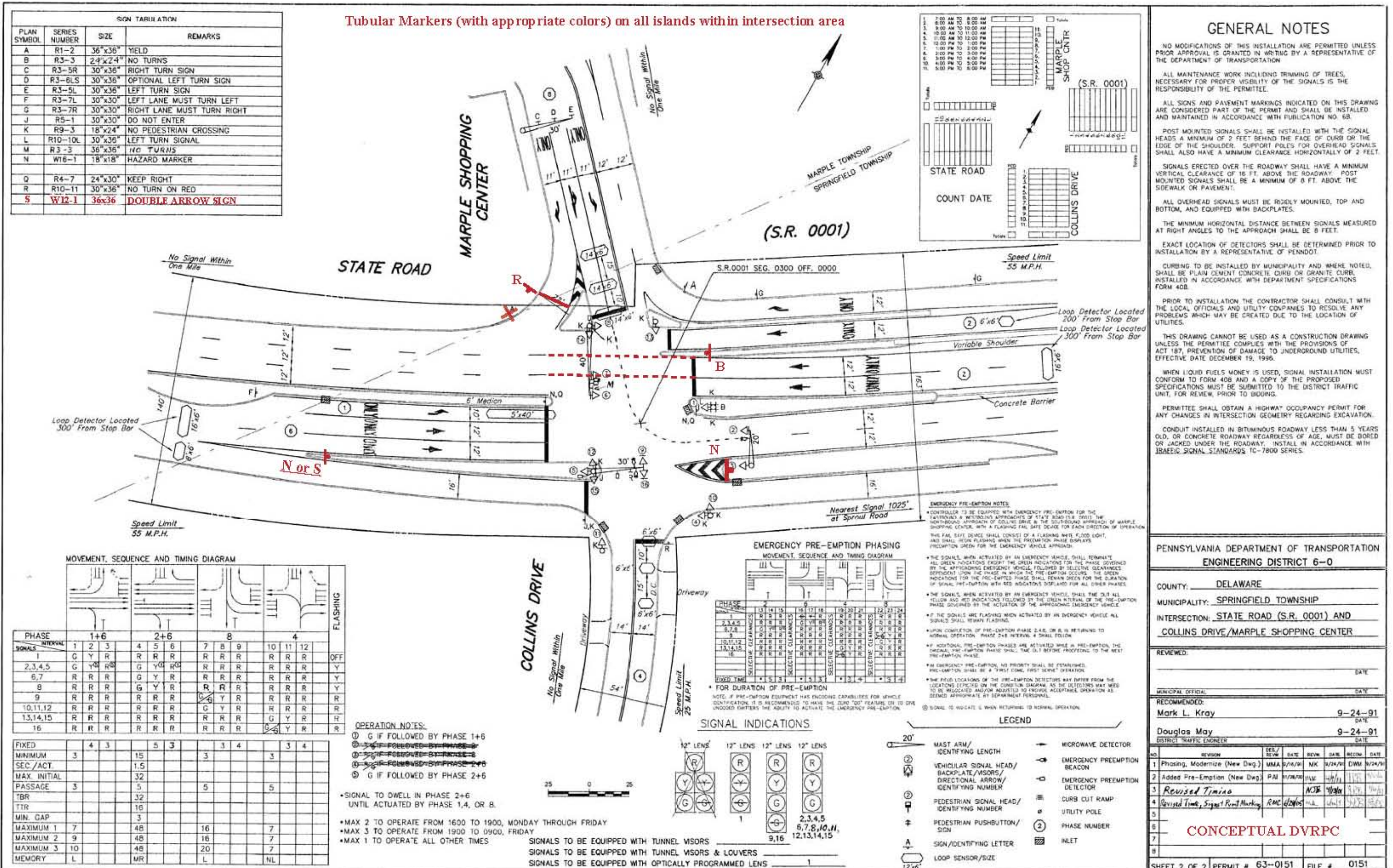


Marple Shopping Center Drive EB at US 1



US 1 NB approaching Collins Drive with proposed demarcation of traffic island

Figure 6: Traffic Signal Permit Plan - Collins Drive/Marple Shopping Center Drive and State Road-US1



Tubular Markers (with appropriate colors) on all islands within intersection area

GENERAL NOTES

NO MODIFICATIONS OF THIS INSTALLATION ARE PERMITTED UNLESS PRIOR APPROVAL IS GRANTED IN WRITING BY A REPRESENTATIVE OF THE DEPARTMENT OF TRANSPORTATION.

ALL MAINTENANCE WORK INCLUDING TRIMMING OF TREES, NECESSARY FOR PROPER VISIBILITY OF THE SIGNALS IS THE RESPONSIBILITY OF THE PERMITTEE.

ALL SIGNS AND PAVEMENT MARKINGS INDICATED ON THIS DRAWING ARE CONSIDERED PART OF THE PERMIT AND SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH PUBLICATION NO. 6B.

POST MOUNTED SIGNALS SHALL BE INSTALLED WITH THE SIGNAL HEADS A MINIMUM OF 2 FEET BEHIND THE FACE OF CURB OR THE EDGE OF THE SHOULDER. SUPPORT POLES FOR OVERHEAD SIGNALS SHALL ALSO HAVE A MINIMUM CLEARANCE HORIZONTALLY OF 2 FEET.

SIGNALS ERECTED OVER THE ROADWAY SHALL HAVE A MINIMUM VERTICAL CLEARANCE OF 16 FT. ABOVE THE ROADWAY. POST MOUNTED SIGNALS SHALL BE A MINIMUM OF 8 FT. ABOVE THE SIDEWALK OR PAVEMENT.

ALL OVERHEAD SIGNALS MUST BE RIGIDLY MOUNTED, TOP AND BOTTOM, AND EQUIPPED WITH BACKPLATES.

THE MINIMUM HORIZONTAL DISTANCE BETWEEN SIGNALS MEASURED AT RIGHT ANGLES TO THE APPROACH SHALL BE 8 FEET.

EXACT LOCATION OF DETECTORS SHALL BE DETERMINED PRIOR TO INSTALLATION BY A REPRESENTATIVE OF PENNDOT.

CURBING TO BE INSTALLED BY MUNICIPALITY AND WHERE NOTED, SHALL BE PLAIN CEMENT CONCRETE CURB OR GRANITE CURB, INSTALLED IN ACCORDANCE WITH DEPARTMENT SPECIFICATIONS FORM 40B.

PRIOR TO INSTALLATION THE CONTRACTOR SHALL CONSULT WITH THE LOCAL OFFICIALS AND UTILITY COMPANIES TO RESOLVE ANY PROBLEMS WHICH MAY BE CREATED DUE TO THE LOCATION OF UTILITIES.

THIS DRAWING CANNOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF ACT 187, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES, EFFECTIVE DATE DECEMBER 19, 1996.

WHEN LIQUID FUELS MONEY IS USED, SIGNAL INSTALLATION MUST CONFORM TO FORM 40B AND A COPY OF THE PROPOSED SPECIFICATIONS MUST BE SUBMITTED TO THE DISTRICT TRAFFIC UNIT, FOR REVIEW, PRIOR TO BIDDING.

PERMITTEE SHALL OBTAIN A HIGHWAY OCCUPANCY PERMIT FOR ANY CHANGES IN INTERSECTION GEOMETRY REGARDING EXCAVATION.

CONDUIT INSTALLED IN BITUMINOUS ROADWAY LESS THAN 5 YEARS OLD, OR CONCRETE ROADWAY REGARDLESS OF AGE, MUST BE BORED OR JACKED UNDER THE ROADWAY. INSTALL IN ACCORDANCE WITH TRAFFIC SIGNAL STANDARDS TC-7800 SERIES.

EMERGENCY PRE-EMPTION PHASING

MOVEMENT, SEQUENCE AND TIMING DIAGRAM

PHASE	1+6	2+6	8	4	FLASHING
1	G	Y	R	R	OFF
2,3,4,5	G	Y	R	R	OFF
6,7	R	R	R	G	Y
8	R	R	R	G	Y
9	R	R	R	R	R
10,11,12	R	R	R	R	R
13,14,15	R	R	R	R	R
16	R	R	R	R	R

OPERATION NOTES:

① G IF FOLLOWED BY PHASE 1+6
② Y IF FOLLOWED BY PHASE 2+6
③ R IF FOLLOWED BY PHASE 8
④ G IF FOLLOWED BY PHASE 2+6
⑤ G IF FOLLOWED BY PHASE 2+6

• SIGNAL TO DWELL IN PHASE 2+6 UNTIL ACTUATED BY PHASE 1, 4, OR 8.

• MAX 2 TO OPERATE FROM 1600 TO 1900, MONDAY THROUGH FRIDAY
• MAX 3 TO OPERATE FROM 1900 TO 0900, FRIDAY
• MAX 1 TO OPERATE ALL OTHER TIMES

SIGNALS TO BE EQUIPPED WITH TUNNEL VISORS
SIGNALS TO BE EQUIPPED WITH TUNNEL VISORS & LOUVERS
SIGNALS TO BE EQUIPPED WITH OPTICALLY PROGRAMMED LENS

EMERGENCY PRE-EMPTION PHASING

MOVEMENT, SEQUENCE AND TIMING DIAGRAM

PHASE	1+6	2+6	8	4
1	G	Y	R	R
2,3,4,5	G	Y	R	R
6,7	R	R	R	G
8	R	R	R	G
9	R	R	R	R
10,11,12	R	R	R	R
13,14,15	R	R	R	R
16	R	R	R	R

LEGEND

MAST ARM/IDENTIFYING LENGTH
VEHICULAR SIGNAL HEAD/BACKPLATE/MSORS/DIRECTIONAL ARROW/IDENTIFYING NUMBER
PEDESTRIAN SIGNAL HEAD/IDENTIFYING NUMBER
PEDESTRIAN PUSHBUTTON/SIGN
SIGN/IDENTIFYING LETTER
LOOP SENSOR/SIZE

MICROWAVE DETECTOR
EMERGENCY PREEMPTION BEACON
EMERGENCY PREEMPTION DETECTOR
CURB CUT RAMP
UTILITY POLE
PHASE NUMBER
INLET

MOVEMENT, SEQUENCE AND TIMING DIAGRAM

PHASE	1+6	2+6	8	4	FLASHING
1	G	Y	R	R	OFF
2,3,4,5	G	Y	R	R	OFF
6,7	R	R	R	G	Y
8	R	R	R	G	Y
9	R	R	R	R	R
10,11,12	R	R	R	R	R
13,14,15	R	R	R	R	R
16	R	R	R	R	R

OPERATION NOTES:

① G IF FOLLOWED BY PHASE 1+6
② Y IF FOLLOWED BY PHASE 2+6
③ R IF FOLLOWED BY PHASE 8
④ G IF FOLLOWED BY PHASE 2+6
⑤ G IF FOLLOWED BY PHASE 2+6

• SIGNAL TO DWELL IN PHASE 2+6 UNTIL ACTUATED BY PHASE 1, 4, OR 8.

• MAX 2 TO OPERATE FROM 1600 TO 1900, MONDAY THROUGH FRIDAY
• MAX 3 TO OPERATE FROM 1900 TO 0900, FRIDAY
• MAX 1 TO OPERATE ALL OTHER TIMES

SIGNALS TO BE EQUIPPED WITH TUNNEL VISORS
SIGNALS TO BE EQUIPPED WITH TUNNEL VISORS & LOUVERS
SIGNALS TO BE EQUIPPED WITH OPTICALLY PROGRAMMED LENS

TABLE 4 – PROPOSED IMPROVEMENTS STATE ROAD – US 1 at MEADOWGREEN PARK ENTRANCE \ MEETINGHOUSE LANE (See Figure 7)	
Existing Conditions	Proposed Improvements
<ul style="list-style-type: none"> • Signalized Intersection • US 1 NB; 2 through lanes and 1 through lane (frontage road), and 1 right turn lane (frontage road) • US 1 SB; 2 through lanes and 1 separate left turn lane • Meadowgreen Park Entrance; 1 left turn lane and 1 right turn lane. • Meetinghouse Lane; 1 through \ right turn lane and 1 separate left turn lane. (One Way Street) 	<ul style="list-style-type: none"> • Reestablish signal coordination with the signal at Springfield Road • Add Tubular Markers on all Islands throughout the Intersection area • REINSTALL ALL MISSING PERMIT SIGNAGE

Source: DVRPC, 2006

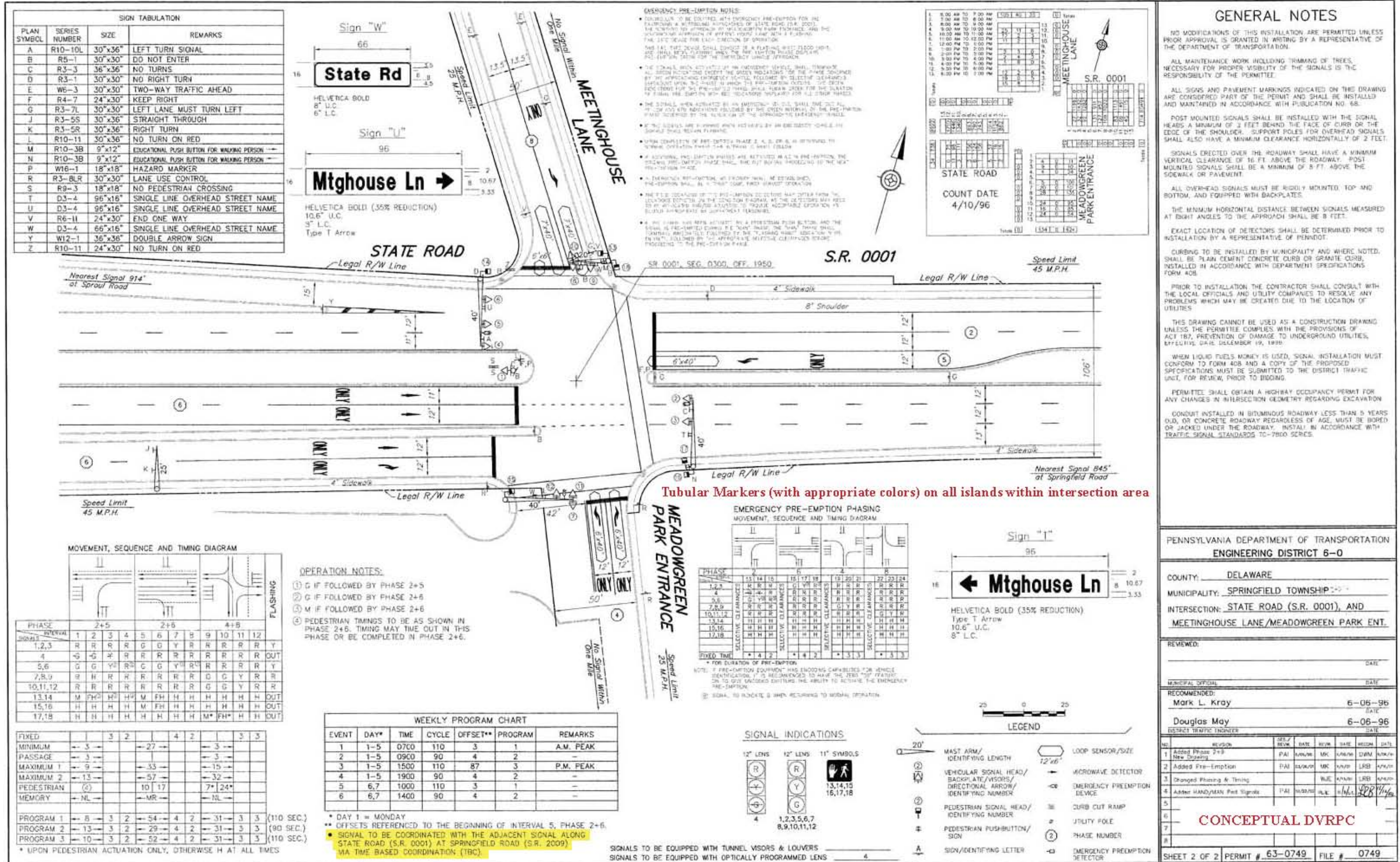
The reestablishment of signal coordination offers the opportunity to moderate traffic speeds and improve level of service along US 1. More effective use of green time on US 1 may be apportioned to other phases / approaches at the intersection. Installation of tubular markers on islands and replacement of missing signal permit signs should help reduce “island” and “confusion” related accidents. These improvements should improve traffic flow and reduce the number of “angle” and “rear end” accidents.

Other improvements related to the Meadowgreen Park Entrance approach to State Road – US 1 were investigated and conceptually designed as part of this study, but were not acceptable to Springfield Township.



US 1 looking SB at Meadowgreen Park Entrance \ Meetinghouse Lane

Figure 7: Traffic Signal Permit Plan - Meetinghouse Lane and State Road-US1



CONCEPTUAL DVRPC

**TABLE 5 – PROPOSED IMPROVEMENTS STATE ROAD – US 1
 at SPRINGFIELD ROAD
 (See Figure 8)**

Existing Conditions	Proposed Improvements
<ul style="list-style-type: none"> • Signalized Intersection • US 1 NB; 1 separate left turn lane, 2 through lanes, and 1 separate right turn lane • US 1 SB; 1 separate left turn lane, 1 through lane, and 1 through \ right lane • Springfield Road; 1 through \ right lane, and 1 separate left turn lane on both approaches 	<ul style="list-style-type: none"> • Reestablish signal coordination with the signal at Meetinghouse Lane • Add Tubular Markers on all Islands throughout the Intersection area • Close 1 of the gas station’s access driveways on Springfield Road (Due to proximity to the intersection) • REINSTALL ALL MISSING PERMIT SIGNAGE

Source: DVRPC, 2006

The reestablishment of signal coordination should improve traffic flow and thus reduce the need of drivers to “cheat” the clearance interval. This would directly help reduce the 67 percent rate of “angle” accidents. The removal of one gas station access point will reduce “confusion” and conflict movement at the intersection. The replacement of missing signal permit signs and demarcation of islands with tubular markers should reduce “confusion” and “hit fixed object” related accidents. These proposed improvements should improve traffic flow and reduce “angle” and “rear end” accidents.



US 1 looking SB at Springfield Road



Springfield Road WB at US 1 – Gas Station entrance proposed for closure

Figure 8: Traffic Signal Permit Plan - Springfield Road and State Road-US1

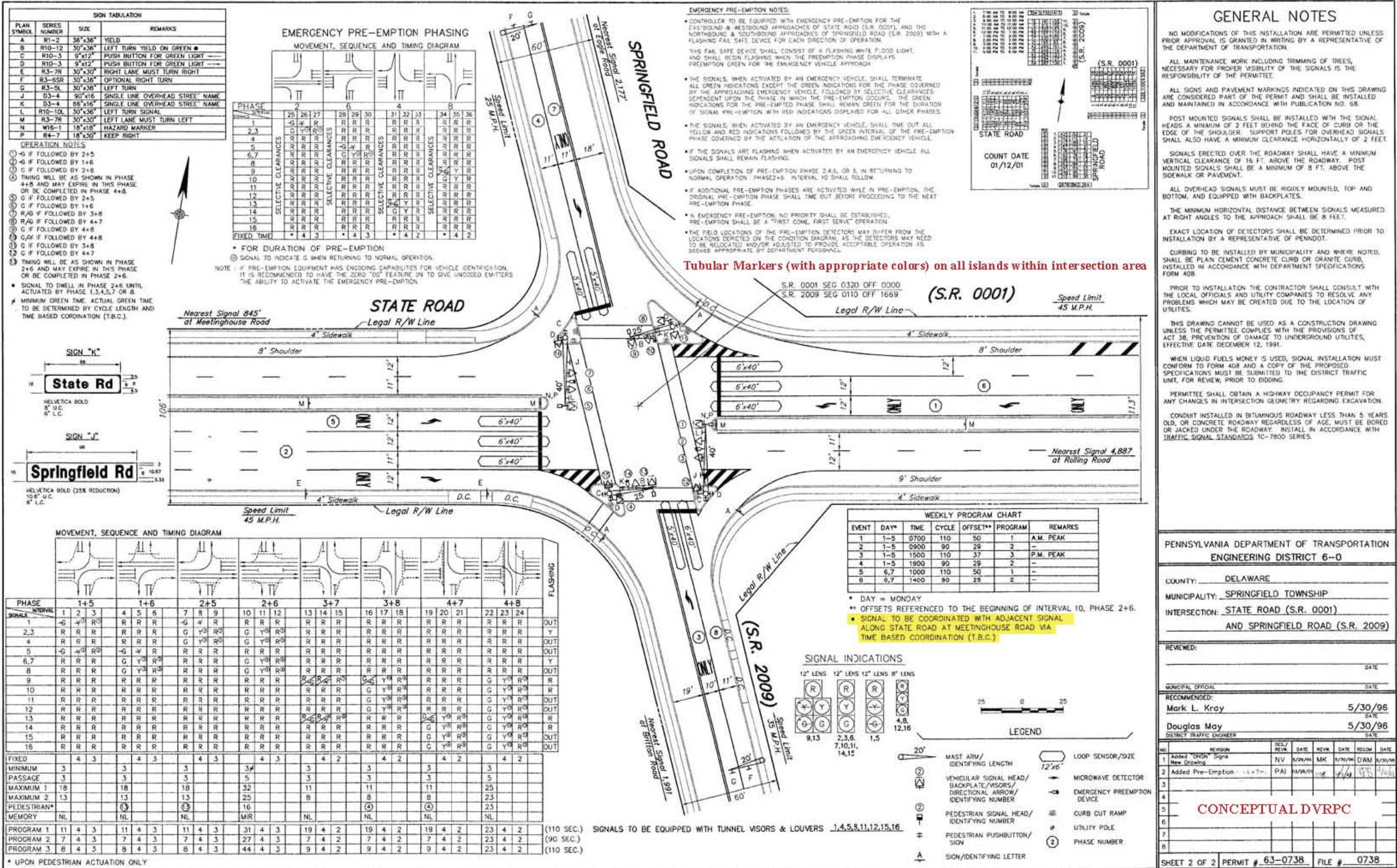


TABLE 6 – PROPOSED IMPROVEMENTS STATE ROAD – US 1 at BUTTONWOOD DRIVE (See Figure 9)	
Existing Conditions	Proposed Improvements
<ul style="list-style-type: none"> • Unsignalized Intersection • US 1 NB; 3 through lanes, and a two-way left turn lane • US 1 SB; 2 through lanes and a two-way left turn lane • Buttonwood Drive; 1 left \ through \ right lane on each approach. Approach offset approximately 150 feet at US 1 – State Road 	<ul style="list-style-type: none"> • US 1; remove the shared left turn lane by extending the concrete median from the Meetinghouse Lane intersection to the Springfield Road intersection. • Add “All Traffic Must Turn Right” signs on both Buttonwood Drive approaches.

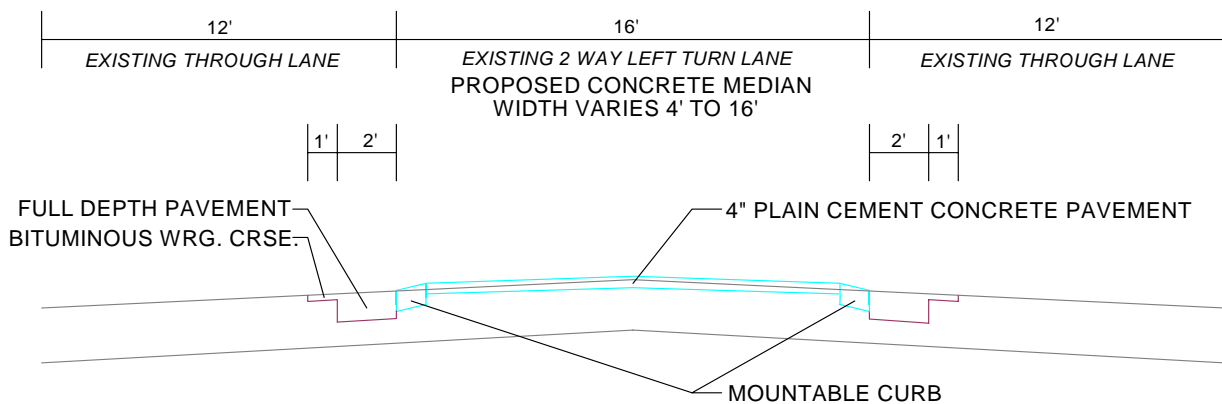
Source: DVRPC, 2006

These proposed improvements should eliminate the potential for “head on” accidents and significantly reduce “rear end” accidents. There is a 15 percent to 57 percent reduction in crashes on four lane roads when a two-way left turn lane is replaced with a nontraversable median (source, *Access Management Manual*, Transportation Research Board, 2003). In addition to safety considerations, this recommendation (median closure) is consistent with limiting local access to roadways classified as “Other Freeways and Expressways.” Strategies which reduce or eliminate the amount of turning vehicles (i.e., a nontraversable median on US 1) will reduce crash potential as well as severity.



US 1 looking SB at Buttonwood Drive proposed median closure (inset: existing condition)

Figure 9 – Median Closure Typical Section



**TYPICAL SECTION US 1
 @ BUTTONWOOD DRIVE
 (LOOKING SB)
 N.T.S.**

The cost estimate for the entire set of State Road – US 1 corridor improvements is detailed in Table 7.

TABLE 7 - STATE ROAD (US 1) CORRIDOR IMPROVEMENTS ENGINEERING AND CONSTRUCTION PRELIMINARY COST ESTIMATE				
Item Description	Unit	Quantity	Unit Cost	Item Cost
Excavation	C.Y.	175	25	\$ 4,375
4' Plain Cement Concrete Pavement	S.Y.	325	50	\$ 16,250
Curb (Plain or Mountable)	L.F.	540	25	\$ 13,500
*Bituminous Concrete Pavement	L.S.			\$ 6,500
* Paving associated with the installation of the concrete median				
Post Mounted Signs	S.F.	110	35	\$ 3,850
Pavement Marking	L.S.	L.S.		\$ 1,500
Tubular Markers	EA.	95	35	\$ 3,325
Traffic Control	L.S.	L.S.		\$ 10,000
*Signal Coordination	L.S.	L.S.		\$ 6,000
*Meetinghouse Lane to Springfield Road, controller and gps device at each intersection				
Subtotal				\$ 65,300
Engineering @ 15 %				\$ 9,795
Contingencies @ 20 %				\$ 13,060
Total				\$ 88,155

Source: DVRPC, 2006

The cost of the median closure @ Buttonwood Drive is estimated to be approximately \$ 70,000.

5 CONCLUSIONS / NEXT STEPS

This case study addresses safety and mobility of US 1 – State Road, a four lane expressway and principal arterial through a maturely developed suburban area. Recommendations have been developed based upon technical analyses and field observations. Specific improvements have been identified which focus upon strategies that control or define traffic movement at four median openings between Collins Drive and Springfield Road. The most significant improvement is a proposed median closure at the unsignalized Buttonwood Drive offset intersection.

Costs for the complete improvement program are estimated at \$ 90,000. \$ 70,000 representing the estimated cost of the recommended median closure at Buttonwood Drive and \$ 20,000 for the balance of the program which includes improved signage and pavement markings at signalized intersections, and reestablishing coordinated traffic signalization through the segment. The median closure probably (if implemented) would be best constructed by PennDOT under a maintenance contract while the balance of the program would fall within the scope of typical township maintenance.

In addition, DVRPC in partnership with Delaware County Planning, PENNDOT, and the Federal Highway Administration will take steps to “realign” the highway functional classification of State Road between Collins Drive and Springfield Road from “Expressway” to “Principal Arterial” to more precisely describe the highway’s character. The recommendations forwarded in the body of this report are not compromised by this action.

With this report, DVRPC has identified and proposed improvement to the congested regional highway network—emphasizing the principles of highway access management for state and local highways being promoted by PennDOT. The recommendations may require further study and coordination between the municipality and PennDOT before they can be implemented. The report, its recommendations and conceptual plans have been developed to foster those conversations and potential actions.

6 REFERENCES

Pennsylvania Department of Transportation, *Access Management Model Ordinances For Pennsylvania Municipalities Handbook*, April 2005.

Federal Highway Administration, *Manual of Uniform Traffic Control Devices*, December 2000.

Transportation Research Board, *Access Management Manual*, 2003.

American Association of State Highway and Transportation Officials, *Geometric Design of Highways and Streets*, 2004.



For Intersection Recommendations See Signal Permit Plan

"Frontage Road"

"Frontage Road"

For Intersection Recommendations See Signal Permit Plan

For Intersection Recommendations See Signal Permit Plan

Extend Concrete Median

Depiction of Proposed Concrete Median Extension

0 105 210 420 630
Feet

- Municipal Boundary
- Parcel Boundary
- Proposed Concrete Median
- Existing Signalized Intersection

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

Title: Access Management Along Pennsylvania Highways in the Delaware Valley — State Road – US 1 Case Study Corridor	Date Published: June 2006
	Publication No: 06020

Geographic Area Covered: Springfield and Marple townships in Delaware County, Pennsylvania.

Key Words: Access Management, congestion management, traffic safety, accident mitigation, corridor planning, model ordinance, growth management

ABSTRACT

This report was prepared in support of PENNDOT's effort to establish model access management ordinances for use by municipalities statewide. A case study of State Road – US 1 between Collins Drive and Springfield Road was prepared to illustrate the tangible benefits of implementing access management strategies along state and local highways. The work was performed with the participation of member governments, regional transportation providers, PENNDOT, and the affected municipalities.

The project began with the documentation of existing conditions along the State Road – US 1 corridor. Access management related problem areas and specific issues were identified and studied in specific detail. Improvement recommendations addressing congestion and safety concerns along the corridor were formulated based on PENNDOT's *Access Management Model Ordinances for Pennsylvania Municipalities Handbook*, *The Manual on Uniform Traffic Control Devices*, the Transportation Research Board's *Access Management Manual*, and the American Association of State Highway and Transportation Officials' *Geometric Design of Highways and Streets*.

Improvement recommendations have been illustrated on traffic signal permit drawings and on a corridor conceptual plan; and preliminary cost estimates for the improvements are provided.

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