DELAWARE VALLEY
REGIONAL PLANNING
COMMISSION
2008

MERCER CROSSINGS

Transportation Study

BUILDING *a* FOUNDATION *for* REDEVELOPMENT

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.

Contents

List of Figures

List of Tables

Executive Summary

This study builds on a redevelopment visioning process by the Urban Land Institute (ULI) in 2004 for the area around N. Olden Avenue where Ewing Township, Lawrence Township, and Trenton City meet. The ULI recommended “branding” the area as “Mercer Crossings” and described a vision for desirable changes in land use, given form by the creation of an urban street grid in place of underutilized super-parcels.

At the request of Mercer County Planning Division, DVRPC evaluated the ULI recommendations and identified potential strategies to improve connectivity and facilitate redevelopment. The premise of this study is that traffic must flow efficiently if Mercer Crossings is to be successfully redeveloped; and, echoing the ULI study, that it is possible to change the character of Mercer Crossings streets to make them less like highways and more like destinations.

N. Olden Avenue N. Olden Avenue is an important Mercer Crossings access route and a regionally significant commuter route. Traffic flows unimpeded on N. Olden Avenue west of Princeton Avenue, where there are two travel lanes by direction. In contrast, east of Princeton Avenue, where there is only one travel lane by direction, the roadway is congested for much of the day. As a result, N. Olden Avenue traffic bound for Mercer Crossings and points west is delayed.

To successfully redevelop Mercer Crossings, traffic congestion on N. Olden Avenue between Princeton Avenue and New York Avenue must be reduced. The capacity of the roadway is already taxed and additional traffic could cause it to fail. Most improvement on N. Olden Avenue will come from improving the performance and safety of the Princeton Avenue and New York Avenue intersections.

Princeton Avenue

On westbound N. Olden Avenue, the focus should be improving traffic flow. On eastbound N. Olden Avenue, the focus should be improving the safety of the merge area. In addition, to increase the safety of pedestrians using the northside Princeton Avenue crosswalk, a pedestrian phase should be added to the traffic signal.

New York Avenue
The priority at this intersection should be improving the safety of the Route 1 off-ramp. However, these improvements should be postponed until the work at Princeton Avenue is completed since they depend on improved traffic flow on westbound N. Olden Avenue. To increase the safety of pedestrians using the northside New York Avenue crosswalk, a pedestrian phase should be added to the traffic signal.

Spruce Street Spruce Street is an important Mercer Crossings access route and a regionally significant commuter route. The Trenton Farmers Market, Halo Farm, Capital Plaza, and other Lawrence and Ewing businesses have driveways on Spruce Street. With higher traffic volume, retail access may no longer be efficient. Tiffany Woods Road, the only access road for approximately 90 families in the Tiffany Woods neighborhood, is also located on Spruce Street.

The Urban Land Institute recommended a new vision for Spruce Street: To create a destination accessible by all modes of travel, instead of a roadway that primarily serves regional through traffic. This vision has led to a proposal for a 4 lane to 3 lane conversion, commonly called a "road diet", between Arctic Parkway and Princeton Avenue.

Analysis in this study shows that traffic volumes on Spruce Street are now near the threshold for a road diet to work without diminishing traffic flow on the segment. While dropping a travel lane in each direction may still have positive effects on safety, it may negatively affect mobility. Before implementing a road diet on this segment, this study recommends that some of the unknowns be dealt with by performing a forecast of future travel demand on Spruce Street. The most important unknown is the new Wal-Mart. The traffic modeling should include the potentially mitigating effects of driveway access management and additional traffic control. Finally, the possibility that the proposed road diet would have to be abandoned should be anticipated and contingency plans developed.

Two problems require attention:

- High crash rates at the Halo Farm and Farmers Market Spruce Street driveways; and

- Severe delays at Tiffany Woods Road. Delays are projected to become much worse if the new Wal-Mart is built.

Strategies for dealing with each of these problems have been identified in this report. The preferred strategy is to install a traffic signal that could serve Halo Farm and the Farmers Market. The best location may be opposite the Capital Plaza driveway, which would maximize its benefits by also serving mall traffic. A short access road connecting Tiffany Woods neighborhood and the traffic signal would also be constructed.

Calhoun Street Extension The Calhoun Street Extension (CSE) was a central transportation recommendation of the ULI study. The Transfer Station and the adjacent Boehm site divide the neighborhoods of Mercer Crossings from each other and from nearby commercial districts. Dozens of streets dead end at the outside boundaries of these properties. The CSE is the last alignment available to begin to tie together Mercer Crossings with an urban street grid. It has the potential to stimulate redevelopment of vacant or under-utilized land at the Boehm site, Capital Plaza, and the Farmers Market.

Travel demand was analyzed to determine how many vehicles the CSE is likely to attract and how many vehicles it will remove from other facilities. Projected traffic volume on the complete, two-way facility is approximately 8,200 vehicles per day (vpd). Most of the CSE traffic would be removed from Princeton Avenue.

The most benefit would come from building the complete alignment. However, Lawrence Township has expressed concern about the section north of Spruce Street, which lies within its boundaries.

Therefore, the best means of moving forward may be to concentrate on the section of the CSE south of N. Olden Avenue. Construction of that section as a stand-alone project would increase the attractiveness of the Boehm site and adjacent parcels on Princess Diana Drive. It would also provide an alternate route for large truck traffic, drawing it away from neighborhoods on MLK Boulevard and Calhoun Street, where the noise and vibrations disturb residents; and also drawing it away from the substandard N. Olden Avenue/ Princeton Avenue intersection, which was not designed to accommodate it.

Truck Traffic in Residential Neighborhoods Mercer County Planning Division asked DVRPC to investigate complaints about large truck traffic in Mercer Crossings residential neighborhoods, which produces noise and vibrations. DVRPC analyzed whether it was possible to reduce the impacts of the truck traffic.

The study focused on the Transfer Station and Mercer Group due to the large volume of trips at each facility and the existence of opportunities for re-routing trucks bound to and from each facility. Another impetus to study the Transfer Station was the recommendation in the ULI report that it be relocated to facilitate redevelopment.

Four proposals for reducing the impact of truck traffic en route to one or both of the facilities have been researched:

- Establish common gate between Transfer Station and Mercer Group;
- Direct traffic to back gate of Transfer Station, on Stokes Avenue;
- Construct access road on abandoned Johnson Trolley Line right-of-way; and
- Re-open Trenton Industrial Track spur.

None of the improvement strategies, short-term or long-term, appear to offer much promise for reducing the impacts of large truck traffic on residential neighborhoods in Mercer Crossings. It is far more likely that, as the price of fuel increases due to constraints on world petroleum production, one or both of the facilities would move to a railroad spur to reduce their costs.

Chapter 1 – Introduction

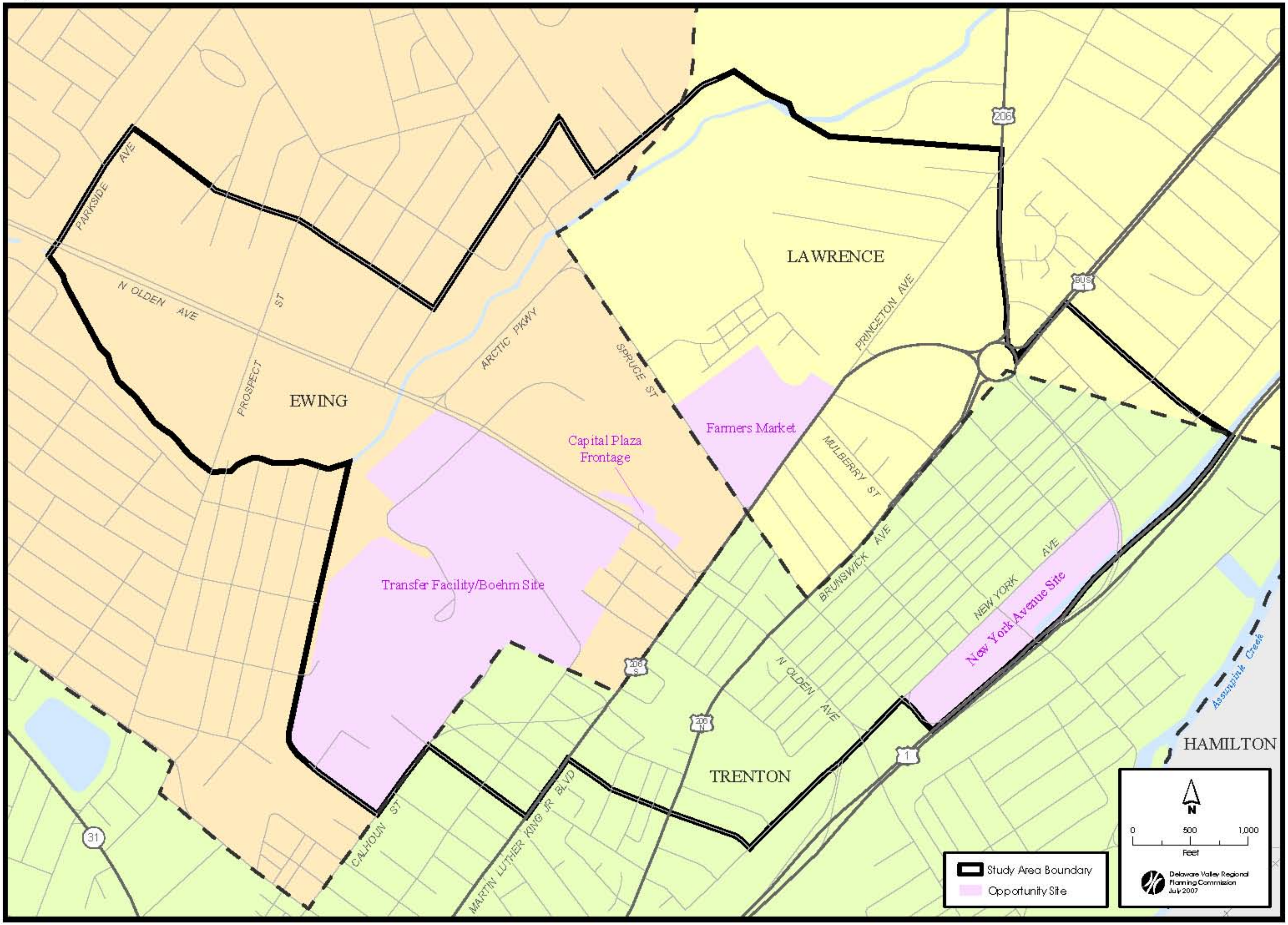
This study builds on a redevelopment visioning process by the Urban Land Institute (ULI) in 2004 for the area around N. Olden Avenue where Ewing Township, Lawrence Township, and Trenton City meet. The ULI recommended "branding" the area as "Mercer Crossings" and described a vision for desirable changes in land use, given form by the creation of an urban street grid in place of underutilized super-parcels.

At the request of Mercer County Planning Division, DVRPC evaluated the ULI recommendations and identified potential strategies to improve connectivity and facilitate redevelopment. The premise of this study is that traffic must flow efficiently if Mercer Crossings is to be successfully redeveloped; and, echoing the ULI study, that it is possible to change the character of Mercer Crossings streets to make them less like highways and more like destinations.

Figure 1 on page 6 shows the study area.

Chapter 2 analyzes performance and safety on N. Olden Avenue between Princeton Avenue and New York Avenue, a section of roadway which is constantly congested. Chapter 3 analyzes Spruce Street, specifically peak hour retail access at the Trenton Farmers Market and Halo Farm, as well as residential access at Tiffany Woods Road. A 4 lane to 3 lane conversion proposed by the ULI is analyzed. Chapter 4 examines the proposed Calhoun Street Extension (CSE), which was the centerpiece of ULI Study's transportation recommendations. The CSE could be constructed as a complete facility extending between Calhoun Street and the intersection of Princeton Avenue and Mulberry Street, or as three separate stand-alone projects. The CSE has been modeled using manual assignment to better understand 1) how much traffic it would attract and 2) how it would advance several goals first identified in the ULI study and later identified by Mercer Crossings stakeholders as desirable. Chapter 5 analyzes the impact of large truck traffic in residential neighborhoods

Figure 1: STUDY AREA



and also researches improvement strategies. Chapter 6 presents the study recommendations, which appear throughout the text, in one location.

Level of Service Analysis

The level of service analysis (LOS) is a common tool for assessment of transportation facilities and is used extensively in this report. For each location, the LOS for existing conditions and potential improvement scenarios is evaluated. When applied as a measure of performance for an entire intersection or a particular component of it, LOS has a precise meaning: the average delay experienced by a vehicle traveling through the intersection or a specific component of it. The exact limits of delay that determine the various LOS categories for a signalized and an unsignalized intersection are displayed in Table 1.

Table 1: LEVEL OF SERVICE (LOS) DESIGNATIONS AND ASSOCIATED DELAYS

Level of Service	Signalized Intersection	Unsignalized Intersection
	Total Delay per Vehicle (seconds/vehicle)	Control Delay per Vehicle (seconds/vehicle)
A (Desirable)	≤ 10	≤ 10
B (Desirable)	> 10 and ≤ 20	> 10 and ≤ 15
C (Desirable)	> 20 and ≤ 35	> 15 and ≤ 25
D (Acceptable)	> 35 and ≤ 55	> 25 and ≤ 35
E (Undesirable)	> 55 and ≤ 80	> 35 and ≤ 55
F (Unsatisfactory)	> 80	> 50

For each of the project intersections, a review of the existing conditions and of the various improvement scenarios was conducted using Synchro traffic signal software. Necessary information for determining delay and LOS measures include: turning movement counts, roadway geometry, signal timing, and actuation plans. The turning movement counts were mostly gathered by DVRPC staff, whereas the signal timing and actuation data were supplied by the relevant municipality, county or state agency. Roadway geometrics were accumulated from both sources.

For signalized intersections, Synchro calculates a control delay and a queue delay. The control delay is calculated by a percentile delay method. This approach uses formulas from the Highway Capacity Manual (HCM) to calculate delay; however, the final delay measure is taken from an average of the 10^{th}, 30^{th}, 50^{th}, 70^{th}, and 90^{th} percentile volume levels. As a result, the calculated delay is a product of the various operating conditions that a signal may actually encounter. The queue delay is utilized whenever two signalized intersections are located within a critical distance to one another. If so, calculations are made to determine the extent to which queue interactions (such as queue spillback and queue blocking) reduce capacity and consequently increase delay.

For an unsignalized intersection, Synchro only utilizes control delay, for which it relies exclusively upon HCM methods.

For the revision of timing plans, Synchro is capable of optimizing intersection splits, cycle lengths, and offsets. These efforts seek to establish a timing plan that provides the most efficient performance that serves a critical volume of vehicles.

Chapter 2 – N. Olden Avenue

N. Olden Avenue is an important Mercer Crossings access route and a regionally significant commuter route. Traffic flows unimpeded on N. Olden Avenue west of Princeton Avenue, where there are two travel lanes by direction. In contrast, east of Princeton Avenue, where there is only one travel lane by direction, the roadway is congested for much of the day. As a result, N. Olden Avenue traffic bound for Mercer Crossings and points west is delayed.

This chapter analyzes performance and safety issues on N. Olden Avenue. The focus of the analysis is the N. Olden Avenue intersections at Princeton Avenue and New York Avenue. Figure 2 on page 10 shows the section of N. Olden Avenue under study.

Roadway Characteristics

Olden Avenue extends from Parkway Avenue in Ewing Township to Whitehorse-Mercerville Road in Hamilton Township. It is classified as a minor arterial. The two lane section of N. Olden Avenue between MLK Boulevard/Princeton Avenue and New York Avenue has a posted speed of 25 miles per hour and carries approximately 22,500 vehicles per day (vpd). It is congested, especially in the westbound direction, for much of the day.

There is on-street parking on both sides of N. Olden Avenue between Princeton Avenue and New York Avenue. Land uses are mostly residential with the exception of the short block between Pennsylvania Avenue and New York Avenue, which includes a 7/11, a Hess service station, and Blakes Hardware. Most of the residences have short setbacks of five to ten feet.

Figure 3 on page 11 shows weekday N. Olden Avenue traffic volume at Brunswick Avenue, eastbound, westbound, and total, by hour.

Figure 2: N. OLDEN AVENUE SUB-CORRIDOR

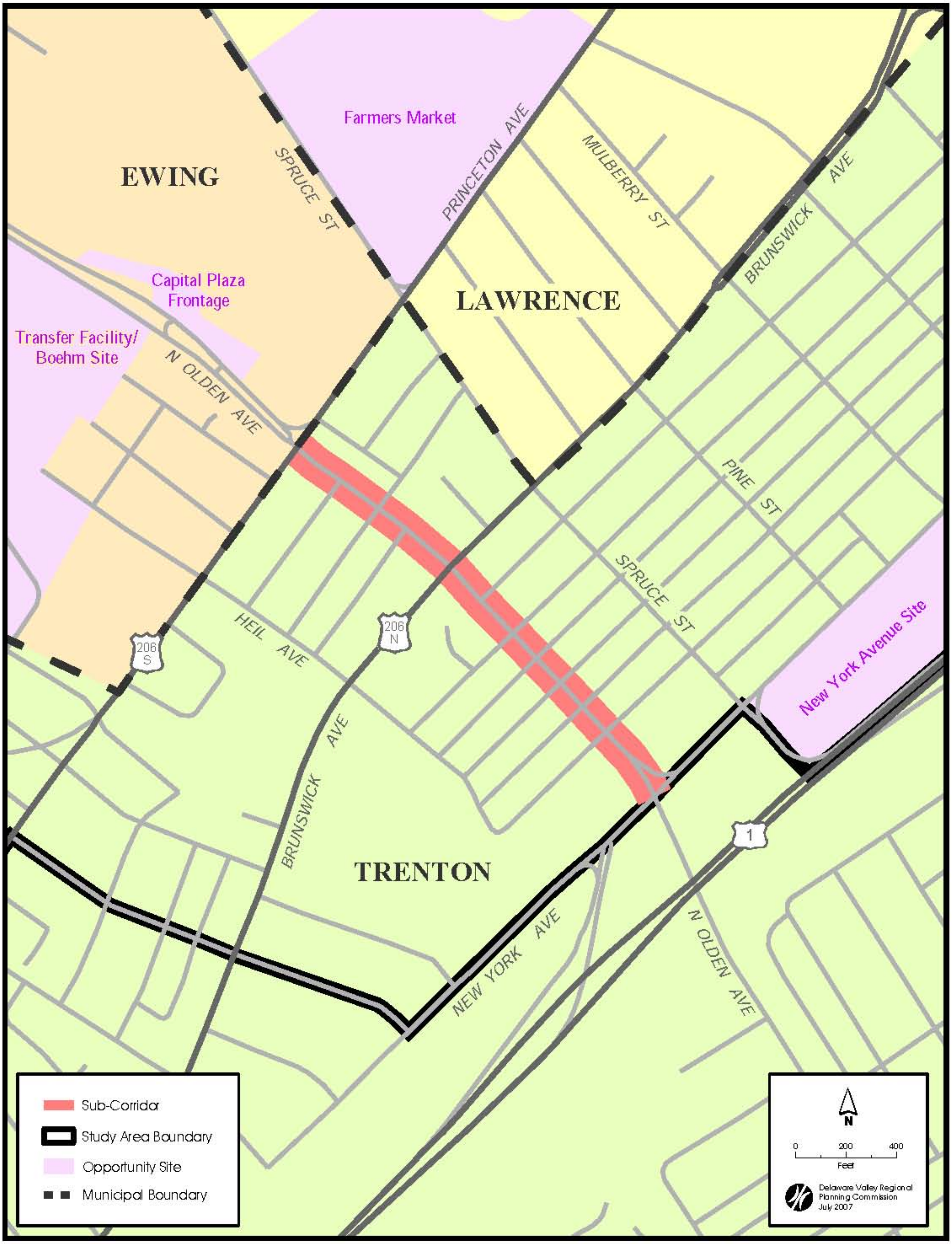
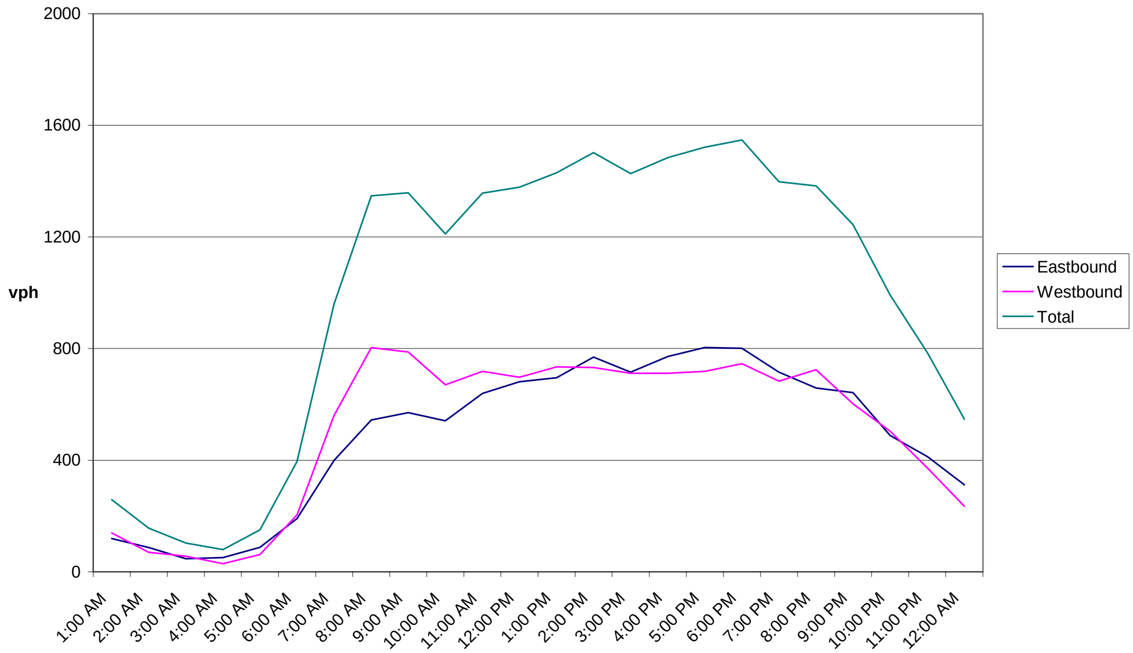


Figure 3: N. OLDEN AVENUE AT BRUNSWICK AVENUE, VEHICLES PER HOUR (vph)



Source: DVRPC, July 2007

Widening N. Olden Avenue to add a second travel lane in each direction is problematic. The existing right-of-way, which is 36 feet, is not wide enough to carry four lanes. The minimum acceptable lane width is 10 feet; therefore, the minimum roadway width needs to be 40 feet. The roadway could not be widened without acquiring additional right-of-way, which would reduce the setbacks of adjacent residential property. Existing on-street parking is also a limiting factor. Removal of on-street parking would be difficult due to the lack of alternate locations for residents to park.

Furthermore, adding two travel lanes would probably not do much to reduce traffic congestion. The unimpeded capacity of each travel lane is approximately 1,825 vehicles per hour (vph) according to calculations using the *Highway Capacity Manual (2000),* a standard transportation reference. The calculations made the following assumptions:

Lane width = 11 feet;
Percentage of heavy vehicles = 7 percent; and
Grade = 2 percent.

However, observations show that actual AM peak hour traffic volume on the westbound lane is 788 vph and PM peak hour traffic volume on the eastbound lane is 801 vph.

Clearly, traffic volume on N. Olden Avenue is well below the capacity of the roadway. Instead, traffic is delayed at the intersections, Princeton Avenue and New York Avenue. The most improvement will come from improving the functionality of these intersections.

N. Olden Avenue/Princeton Avenue Intersection

The issues at this location include the westbound and eastbound intersection approaches and pedestrian safety.

Westbound and Eastbound Intersection Approaches

Description

The westbound intersection approach has two lanes (shared left-turn and through, and shared right-turn and through). The through movements are subject to random bottlenecks. Traffic is obstructed by vehicles parked on N. Olden Avenue next to the intersection approach. On-street parking is allowed at all times except between 8 AM and 10 AM. Traffic is also obstructed by vehicles that queue to turn left. Narrow travel lanes add to the problem.

It is beyond the scope of this study to quantify the effect of these bottlenecks, but it is clear that they reduce throughput.

The eastbound N. Olden Avenue intersection approach has three lanes (designated left-turn, designated through, and shared right-turn and through). The two through lanes merge after Princeton Avenue in Trenton. High speeds and physical geometry create unsafe conditions in the merge area. The posted speed is 40 mph in Ewing and 25 mph in Trenton. The length of the merge area is 150 feet. Beyond there, on-street parking is allowed at all times except between 8 AM and 10 AM. In practice, vehicles park just beyond the merge area.

Findings

Turning movement counts were collected by DVRPC at the N. Olden Avenue/Princeton Avenue intersection in April 2006. Figure 4 on page 14 shows AM and PM peak hour turning movement counts.

Synchro Traffic Analysis Software was used to calculate level of service, a measure of delay. Table 2 on page 15 lists level of service for the N. Olden Avenue/Princeton Avenue intersection under existing conditions using April 2006 data.

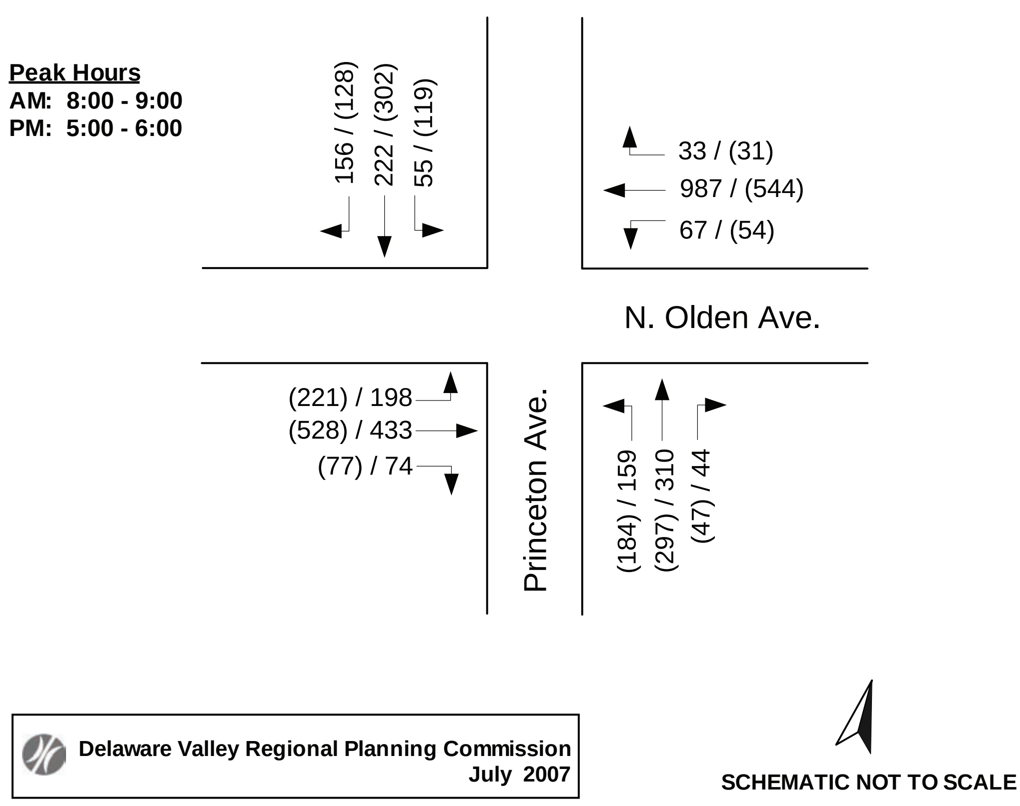
Under existing conditions, intersection performance is LOS D in the AM peak hour and LOS C in the PM peak hour. The worst traffic congestion is on the eastbound N. Olden Avenue intersection approach in the AM peak hour. The performance of the approach is LOS E and average delay is 59 seconds. However, it appears that the Synchro software is under-reporting traffic congestion at the intersection. Synchro does not account for road geometry or other impedances that reduce traffic flow at the intersection. It reads the traffic counts that are input, and if traffic volume is low, it assumes there is no traffic congestion.

Synchro level of service estimates seem to be poorly calibrated particularly for westbound N. Olden Avenue between New York Avenue and Princeton Avenue. Based on several field observations taken during the year, the westbound lane frequently has long queues and vehicles frequently take more than one traffic cycle to clear the intersection. The long queues probably result from the random bottlenecks at the westbound intersection approach identified in the previous section.

Despite occasional miscalculations, Synchro results continue to be useful for testing improvement strategies and they are used in that way in this report.

Figure 4: N. Olden Ave. and Princeton Ave.

Existing Peak Hour Turning Movement Counts AM / (PM)



Delaware Valley Regional Planning Commission
July 2007

TABLE 2
EFFECT OF INTERSECTION IMPROVEMENT,
N. OLDEN AVENUE AND PRINCETON AVENUE
(PEAK HOUR LOS, WITH AVERAGE DELAY PER VEHICLE)

Improvement Scenario	Direction of Travel	Peak AM Hour and Peak PM Hour LOS with Average Delay / Vehicle			
Existing		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	Princeton northbound	C	26	C	27
	Princeton southbound	B	15	C	25
	N. Olden eastbound	E	59	C	24
	N. Olden westbound	C	35	B	16
	Intersection	D	40	C	22
Split Phase		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	Princeton Ave. NB	D	59	C	35
	Princeton Ave. SB	D	37	D	38
	N. Olden Ave. EB	E	48	D	39
	N. Olden Ave. WB	D	37	C	23
	Intersection	D	48	C	32
Move Merge Area		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	Princeton Ave. NB	C	28	C	29
	Princeton Ave. SB	B	16	C	26
	N. Olden Ave. EB	D	54	C	26
	N. Olden Ave. WB	C	32	B	19
	Intersection	D	37	C	24

Source: DVRPC, July 2007

Efforts should be directed at improving the performance of the westbound intersection approach, as follows:

- Prohibit on-street parking within 220 feet of the intersection at all times. This measure would move on-street parking an additional 70 feet back from the intersection approach.

- To improve safety, install a painted median divider (2-3 feet yellow stripe), and skip lines in “box,” to separate eastbound and westbound traffic. These improvements should help drivers negotiate the irregular alignment at the intersection.

Efforts should be directed at improving the safety of the eastbound merge area, as follows:

- Move the merge area to the other side of the intersection west of Princeton Avenue. At the eastbound intersection approach, the existing shared right-turn and through lane would be converted to a right-turn only lane. In the new location, the merge area would provide a safe distance for traffic to merge. To counter long-established driver behavior, an overhead lane control sign should be installed in advance of the intersection.

- Prohibit on-street parking within 220 feet of the intersection in Trenton at all times.

Synchro software was used to analyze the effect of moving the merge area on intersection performance. Based on the results of the analysis, moving the merge area has almost no impact on the performance of the intersection. Average delay actually decreases by three seconds in the AM peak hour; it increases by two seconds in the PM peak hour. Performance stays the same because the existing merge area and the new merge area function the same; the main difference is that the safety hazards are reduced with the new merge area.

A split phase on Princeton Avenue was also tested, but it failed to improve the efficiency of intersection performance; performance actually deteriorated. The reason is that allocation of extra time for the new left-turn phase means there is less time for other traffic movements to be completed during the cycle. As a result, delays for these movements increase, more than cancelling out the benefits of the left-turn phase.

Table 2 on page 15 shows level of service under the two improvement strategies. Figure 5 on page 19 shows the proposed N. Olden Avenue/Princeton Avenue intersection improvements.

Pedestrian Safety

Description

Crosswalks at all intersection approaches are faded. There are functioning pedestrian signals on all four corners but no pedestrian push buttons.

Pedestrians usually cross Princeton Avenue on the north side of N. Olden Avenue, but crossing there is risky due to the unpredictability of turning movements from N. Olden Avenue and the lack of a pedestrian refuge in the middle of the roadway. There is no room to install a pedestrian refuge there. The island for the channelized right-turn lane acts as a refuge but does not solve the problem.

There is also significant pedestrian traffic across N. Olden Avenue on the east side of the intersection. Right-turn movements from northbound MLK Boulevard to eastbound N. Olden Avenue are frequent. When traffic fails to yield, pedestrians are stranded in the middle of N. Olden Avenue.

Findings

Efforts should be directed at improving the safety of pedestrian crosswalks as follows:

- All crosswalks should be repainted.

- The risks that pedestrians face at the northside Princeton Avenue crosswalk could be reduced using one of three strategies:

    1) Add pedestrian phase;
    2) Add lead pedestrian phase; or
    3) Increase length of signal phase for N. Olden Avenue.

Of these, the pedestrian phase would be the most flexible strategy because it could also be requested by pedestrians using the eastside N. Olden Avenue crosswalk. It is unknown whether the signal controllers at the intersection would support these functions. At a minimum, pedestrian push buttons would have to be installed.

Other Issues

Description

Lane markings and stop bars are faded. White arrow pavement markings used to indicate the left-turn lanes on Princeton Avenue. They have completely faded, resulting in some confusion about lane designation.

Findings

- Lane markings and stop bars should be repainted. The white arrows indicating left-turn lanes on Princeton Avenue should also be repainted.

N. Olden Avenue/New York Avenue Intersection

Route 1 carries a lot of traffic bound for the Mercer Crossings area. Traffic from the Route 1 off-ramp and Olden Avenue Bridge merge at the N. Olden Avenue/ New York Avenue intersection. This section analyzes the performance and safety of the Route 1 off-ramp and the intersection.

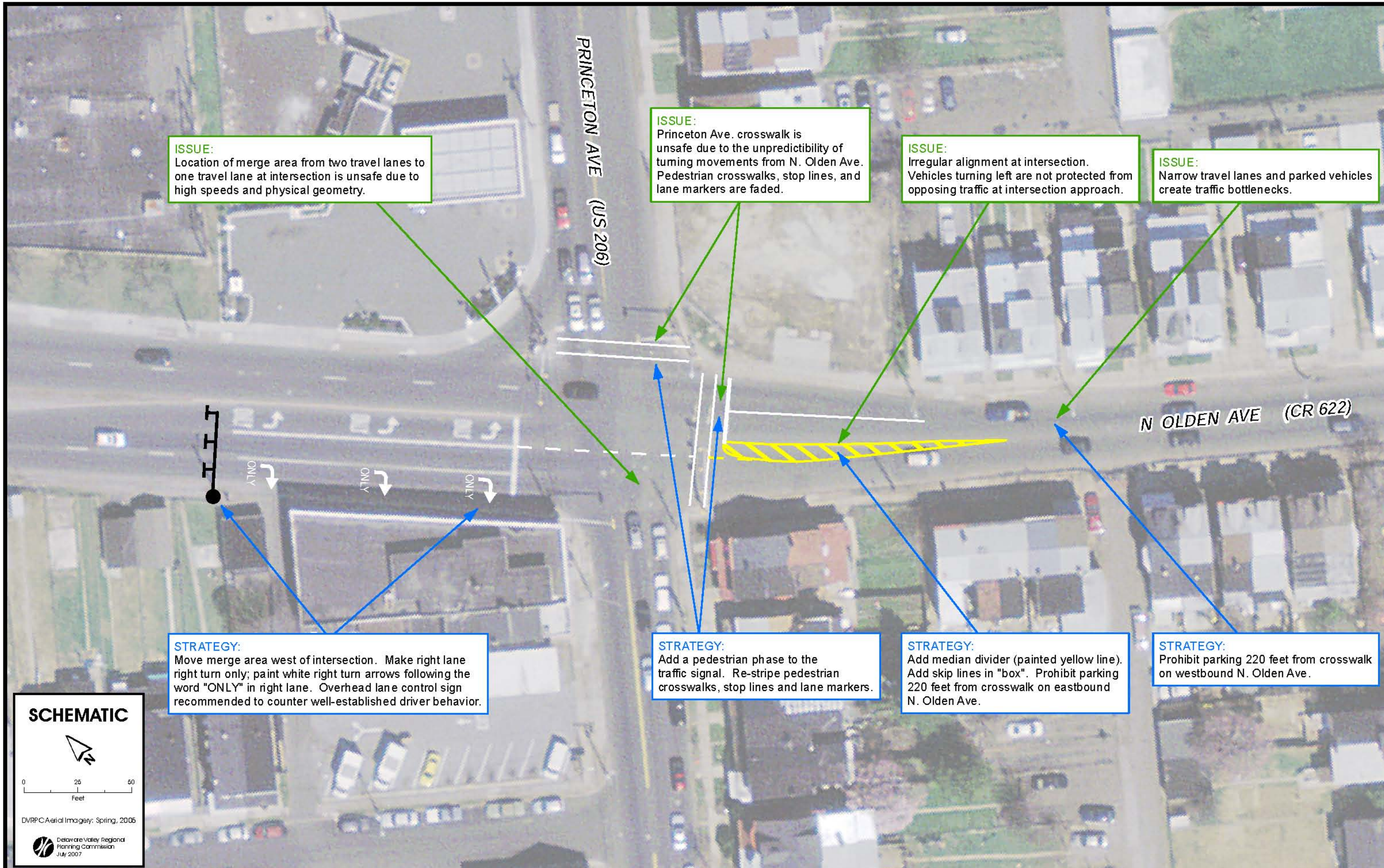
Route 1 Off-Ramp/New York Avenue

Description

The northbound New York Avenue intersection approach has three lanes (designated left-turn, designated through, and designated right-turn). There are approximately 200 through movements and more than 450 left-turn movements at the intersection approach during the AM peak hour and the PM peak hour. The source of much of the traffic is the Route 1 off-ramp. Capacity constraints at the intersection approach, especially for left-turn movements, cause traffic to back up onto the off-ramp. The backups reduce the effective length of the deceleration lane, creating a potential hazard for vehicles exiting Route 1.

The physical geometry of the intersection also constrains capacity. Travel lanes are narrow and the turning radii at all intersection approaches are small. There are two driveways for access to retail establishments on the north side of N. Olden Avenue between New York Avenue and Pennsylvania Avenue and two on the west side of southbound New York Avenue. The retail driveways are

Figure 5: PROPOSED IMPROVEMENTS, N. OLDEN AVENUE AND PRINCETON AVENUE



potential conflict points. In addition, there is a high volume of truck traffic that uses the off-ramp. Trucks take up more space on the road and accelerate more slowly than other vehicles, reducing traffic flow at the intersection.

All these factors impede traffic, reduce the performance of the intersection, and contribute to traffic backups on the off-ramp.

Findings

Traffic counts were collected at the N. Olden Avenue/New York Avenue intersection in April 2006. Figure 6 on page 21 shows AM and PM peak hour turning movement counts.

The data was input into Synchro Traffic Analysis Software, which calculated the performance of the intersection and intersection approaches. Table 3 on page 22 lists level of service for the N. Olden Avenue/New York Avenue intersection under existing conditions using April 2006 data.

The performance of the northbound New York Avenue intersection approach is LOS F during the AM and PM peak hours. Vehicles are delayed more than two minutes. The performance of the westbound N. Olden Avenue intersection approach is LOS E during the AM peak hour and LOS F during the PM peak hour. Vehicles are delayed one to two minutes. The overall performance of the intersection is LOS E during the AM peak hour and LOS E during the PM peak hour. The average delay is more than one minute.

Two improvement strategies were tested using Synchro: Implementing a split phase on New York Avenue and adding a second left-turn lane on northbound New York Avenue. The split phase eliminates conflicts between left-turn movements and through movements by creating a separate phase for each.

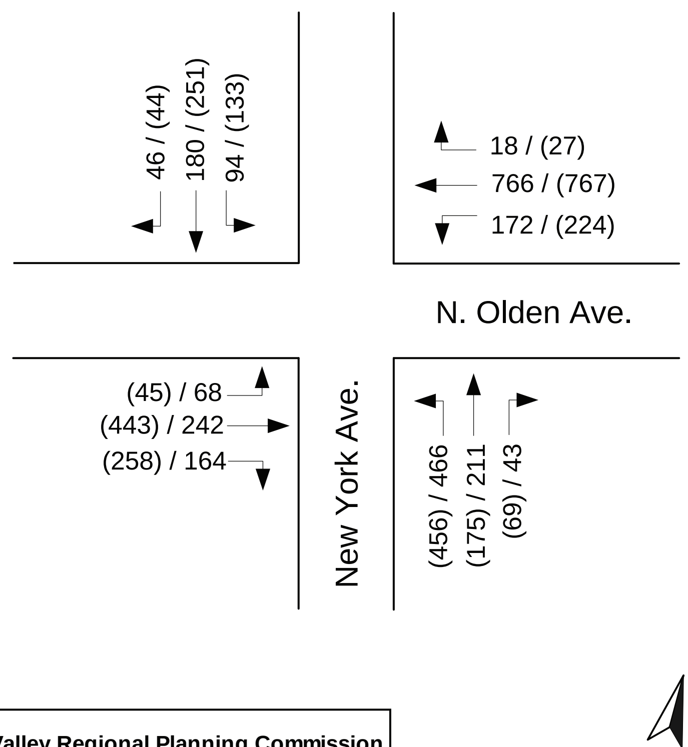
Split Phase

The overall performance of the intersection is significantly worse under the split phase strategy. Although northbound New York Avenue improves, delays on the other three intersection approaches increase significantly compared to existing conditions. The delays on westbound N. Olden Avenue are the worst. During the PM peak hour, average delay on northbound New York Avenue drops from

Figure 6: N. Olden Ave. and New York Ave.

Existing Peak Hour Turning Movement Counts AM / (PM)

Peak Hours
AM: 8:00 - 9:00
PM: 5:00 - 6:00



Delaware Valley Regional Planning Commission
July 2007

SCHEMATIC NOT TO SCALE

TABLE 3
EFFECT OF INTERSECTION IMPROVEMENT,
N. OLDEN AVENUE AND NEW YORK AVENUE
(PEAK HOUR LOS, WITH AVERAGE DELAY PER VEHICLE)

Improvement Scenario	Direction of Travel	Peak AM Hour and Peak PM Hour LOS with Average Delay / Vehicle			
Existing		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	New York northbound	F	120	F	151
	New York southbound	C	34	D	36
	N. Olden eastbound	B	14	C	20
	N. Olden westbound	E	75	F	101
	Intersection	E	71	F	83
Split Phase		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	New York northbound	D	115	F	101
	New York southbound	C	44	E	58
	N. Olden eastbound	C	34	F	107
	N. Olden westbound	F	111	F	198
	Intersection	F	89	F	131
Add Second Left Turn Lane		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	New York northbound	C	21	C	23
	New York southbound	C	31	D	36
	N. Olden eastbound	B	14	C	28
	N. Olden westbound	C	25	C	27
	Intersection	C	22	C	28

Source: DVRPC, July 2007

151 seconds to 101 seconds, but on westbound N. Olden Avenue it nearly doubles, going from 101 seconds to 198 seconds.

Add Left-turn Lane

The addition of a second left-turn lane on northbound New York Avenue dramatically reduces delays at the intersection. The performance of the northbound New York Avenue intersection approach is LOS C during the AM and PM peak hours; average delay per vehicle is approximately 20 seconds. The performance of the westbound N. Olden Avenue intersection approach is LOS C; average delay is approximately 25 seconds. The overall performance of the intersection is LOS C. Average delay is 22 seconds during the AM peak hour and 28 seconds during the PM peak hour.

The simulation results assume westbound N. Olden Avenue has two travel lanes. In reality, it would be necessary to add a second travel lane. Right-of-way is available between New York Avenue and Pennsylvania Avenue, but unless the lane is extended, traffic would have to merge back to one travel lane west of Pennsylvania Avenue. As a result, actual performance may fall short of the simulation. Furthermore, the second travel lane could complicate retail access at the northwest corner of the intersection, the location of 7-11 and Blakes Hardware.

The simulation results also assume that westbound N. Olden Avenue has unlimited capacity. In reality, westbound N. Olden Avenue is backed up for much of the day. The queue extends from Princeton Avenue to Pennsylvania Avenue. Therefore, efforts should first be directed at improving the performance of the N. Olden Avenue/Princeton Avenue intersection. The operation of the N. Olden Avenue/New York Avenue intersection probably depends on it.

Table 3 on page 22 lists level of service at the N. Olden Avenue/New York Avenue intersection under existing conditions and under the two improvement strategies. Figure 7 on page 25 shows the proposed N. Olden Avenue/New York Avenue intersection improvements.

Pedestrian Safety

Description

Crosswalks at three intersection approaches are faded. There are pedestrian push buttons on all four corners but no pedestrian signals.

Pedestrians usually cross New York Avenue on the north side of N. Olden Avenue, but crossing there is risky due to the unpredictability of turning movements from N. Olden Avenue and the lack of a pedestrian refuge in the middle of the roadway. There does not appear to be room to install a pedestrian refuge there. After the traffic signal changes red for N. Olden Avenue, traffic continues to turn left. As a result, there is no break in the traffic for pedestrians. The island for the channelized right-turn lane acts as a refuge but does not solve the problem. Southbound traffic also blocks the crosswalk, causing pedestrians to cross behind vehicles, where they are less visible.

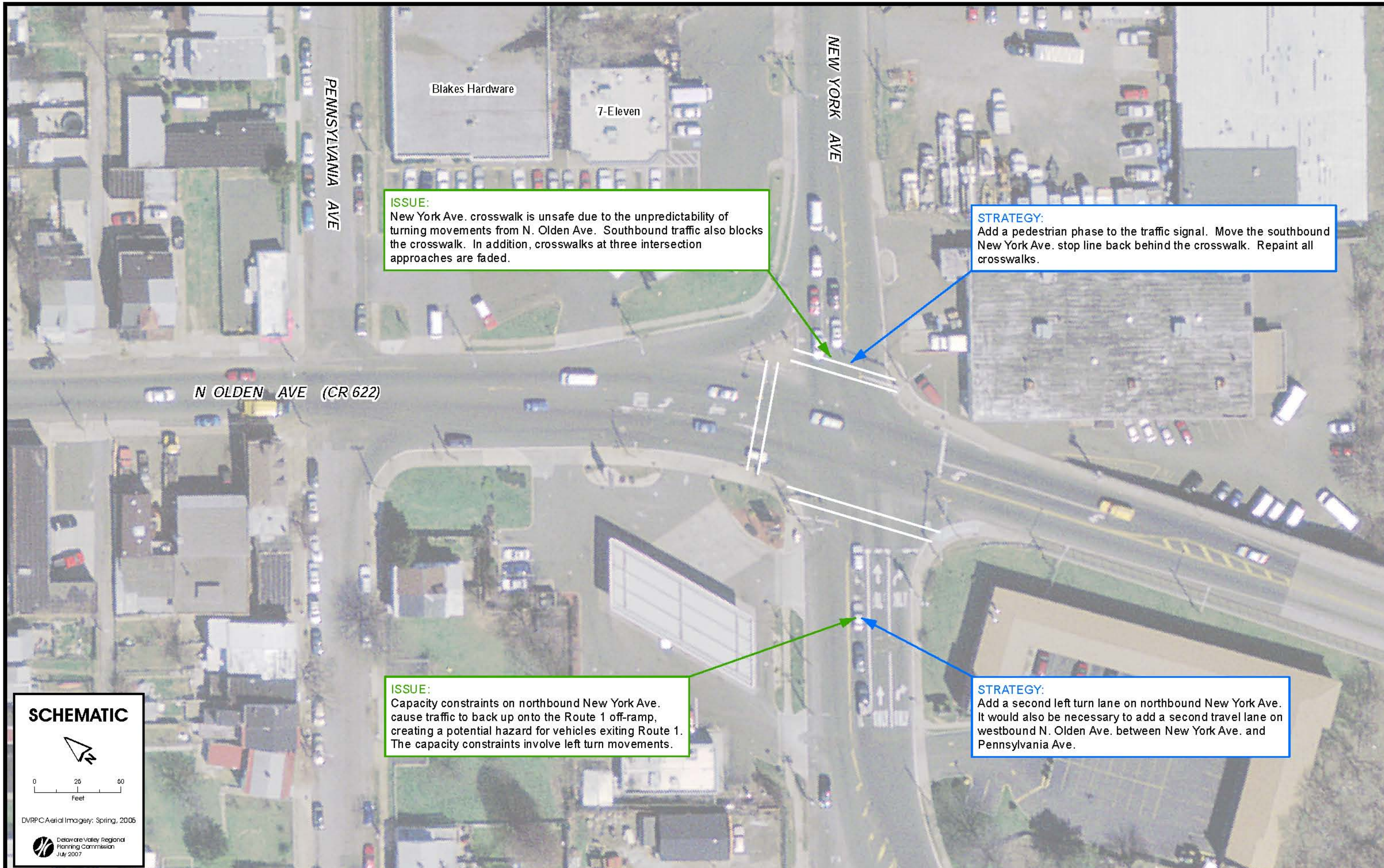
There appears to be no significant pedestrian traffic across N. Olden Avenue.

Findings

Efforts should be directed at improving the safety of the pedestrian crosswalks, especially the northside New York Avenue crosswalk, as follows:

- All crosswalks should be repainted.
- The stop line at the southbound New York Avenue intersection approach should be moved back behind the crosswalk, which would allow pedestrians to cross in front of vehicles, where they would be more visible to traffic.
- A pedestrian phase or a lead pedestrian phase should be added at the northside New York Avenue crosswalk. It is unknown whether the signal controllers at the intersection would support these functions. At a minimum, pedestrian signals would have to be installed.
- If New York Avenue is widened or reconstructed, a median buffer should be installed as a pedestrian refuge on New York Avenue.

Figure 7: PROPOSED IMPROVEMENTS, N. OLDEN AVENUE AND NEW YORK AVENUE



Chapter 3 – Spruce Street

Spruce Street is an important Mercer Crossings access route and a regionally significant commuter route. The Trenton Farmers Market, Halo Farm, Capital Plaza, and other Lawrence and Ewing businesses have driveways on Spruce Street. There are no dedicated turning lanes at retail driveways. With higher traffic volume, retail access may no longer be efficient. Tiffany Woods Road, the only access road for approximately 90 families in the Tiffany Woods neighborhood, is also located on Spruce Street.

The Urban Land Institute recommended a new vision for Spruce Street: To create a destination accessible by all modes of travel, instead of a roadway that primarily serves regional through traffic. This vision has led to a proposal for a 4 lane to 3 lane conversion, commonly called a “road diet”, between Arctic Parkway and Princeton Avenue.

The following analysis looks at performance and safety issues on Spruce Street, as well as the effects of the conversion on regional travel. Figure 8 on page 28 shows the Spruce Street study area.

Roadway Characteristics

Spruce Street extends from New York Avenue in Trenton City to Parkside Avenue in Ewing Township. It is classified as a minor arterial. The four lane section between Arctic Parkway and Princeton Avenue has a posted speed limit of 40 miles per hour and carries approximately 22,200 vehicles per day (vpd).

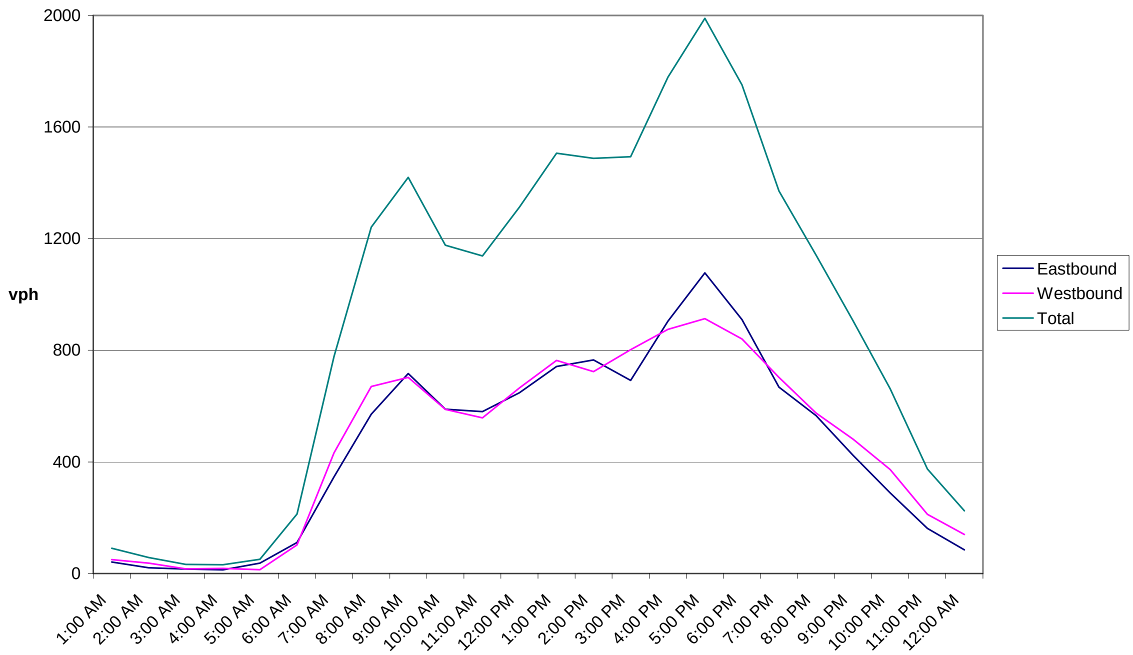
Spruce Street carries traffic bound from roadways north of Mercer Crossings, including Lawrenceville Road, Princeton Pike, and Brunswick Pike. It distributes traffic to N. Olden Avenue (via Arctic Parkway), Prospect Street, Parkside Drive, and Ewingville Road. Traffic in both directions falls off immediately after the AM peak period, but increases steadily during the day. There are almost

Figure 8: SPRUCE STREET SUB-CORRIDOR

50 percent more vehicles on the road in the PM peak period than in the AM peak period. Figure 9 on page 29 shows weekday Spruce Street traffic volume, eastbound, westbound, and total, by hour.

The characteristics of Spruce Street are typical of four lane facilities without dedicated turning lanes at retail driveways. Left-turns from the main road to retail

Figure 9: SPRUCE STREET AT TIFFANY WOODS ROAD, VEHICLES PER HOUR (vph)



Source: DVRPC, July 2007

driveways are made from the left travel lane, impeding through traffic. Traffic turning left out of retail driveways lacks a refuge that would allow it to go halfway. The four travel lanes multiply potential conflict points at retail driveways. They also create line of sight problems for turning traffic because trailing vehicles are hidden from the view of the driver.

There is also no turning lane at Tiffany Woods Road, the only access road for the Tiffany Woods neighborhood.

Existing Conditions

A more detailed analysis of vehicle delay and crash records at Spruce Street retail driveways and at Tiffany Woods Road is presented here.

Vehicle Delay

Delay at retail driveways and at Tiffany Woods Road has been documented in the study, *Traffic Impact Analysis for Wal-Mart*, by Atlantic Traffic and Design Engineers, Inc. The retail driveways include the Trenton Farmers Market and Halo Farm. Data on turning movements in and out of these sites during the weekday evening peak and the Saturday peak was collected in 2004 and 2005. The weekday evening peak was Friday from 4 PM to 6 PM, and the Saturday peak was 11 AM to 2 PM. That data was input into HCS+ Highway Capacity Software, a transportation program that analyzes the performance of intersections, roads, and highways. HCS+ was used to calculate level of service (LOS). Level of service is a measure of average delay per vehicle.

The longest delays are experienced by vehicles attempting to exit retail driveways and Tiffany Woods Road. Most of the delay is due to the difficulty of turning left from the exits. Delays are severe at Tiffany Woods Road. During the weekday evening peak hour, average delay at Tiffany Woods Road is 106 seconds, which is LOS F. During the Saturday peak hour, average delay at Tiffany Woods Road is 34 seconds, which is LOS D. Delays are less of a problem at Halo Farm and the Farmers Market; all the driveways perform at LOS C on weekday evenings and Saturdays.

The *Wal-Mart* study did not analyze the Capital Plaza Spruce Street driveway. Field observations suggest there is significant traffic that uses this driveway.

Table 4 on page 31 lists level of service, with average delay per vehicle, for retail driveway exits and Tiffany Woods Road exit under existing conditions.

Crash Records

Crash data compiled by Lawrence Township indicate that crashes are clustered at the driveways to Halo Farm and the Farmers Market. In the two year period 2003-2004 there were 16 crashes at the Halo Farm driveway and 12 crashes at the Farmers Market driveway. As of August 2005, there had been 8 additional crashes at each location.

TABLE 4
LEVEL OF SERVICE WITH AVERAGE DELAY / VEHICLE, UNSIGNALIZED SPRUCE STREET ACCESS POINTS EXISTING AND TWO SCENARIOS WITH PROPOSED WALMART

Scenario	Access Point	Evening and Saturday Peak Hour LOS with Average Delay / Vehicle			
		Evening Peak		Saturday Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
EXISTING					
	Tiffany Woods Road	F	106	D	34
	Halo Farm	C	21	C	16
	Farmers Market West	C	24	C	17
	Farmers Market East	C	21	C	19
NO BUILD					
	Tiffany Woods Road	F	222	F	69
	Halo Farm	D	29	C	23
	Farmers Market West	D	34	D	26
	Farmers Market East	D	30	D	32
BUILD					
	Tiffany Woods Road	E	37	D	25
	Halo Farm	F	54	D	34
	Farmers Market West	C	25	C	21
	Farmers Market East	D	28	D	24

Source: *Traffic Impact Analysis for Walmart* , September 2005, by Atlantic Traffic & Design Engineers, Inc.

Note: In the original report No Build was called "Build," and Build was called "Build with Mitigation."

Future Conditions

The population of Mercer County in 2005 was approximately 362,090. Between 2005 and 2030, the county is expected to add 36,000 residents. The population of the study area (Ewing Township, Lawrence Township, and Trenton City) in 2005 was approximately 151,388. By 2030, it is projected to grow by almost 10,000. Over the same period, Mercer County employment, which was approximately 214,833 in 2005, is projected to increase by almost 44,000 workers. Study area employment, which was approximately 112,691 in 2005, is projected to increase by almost 17,000. Table 5 lists population and employment forecasts for Mercer County and the study area.

TABLE 5
POPULATION AND EMPLOYMENT GROWTH, 2005-2030
MERCER CROSSINGS STUDY AREA

Municipality	Population 2005[1]	Population 2030[1]	Population 2005-2030 Change Absolute	Population 2005-2030 Change Percent	Employment 2005[1]	Employment 2030[1]	Employment 2005-2030 Change Absolute	Employment 2005-2030 Change Percent
Ewing Township	36,137	38,717	2,580	7.1%	28,031	34,417	6,386	22.8%
Lawrence Township	29,774	33,000	3,226	10.8%	25,524	32,595	7,071	27.7%
Trenton City	85,477	89,126	3,649	4.3%	59,136	62,456	3,320	5.6%
Subtotal Study Area	**151,388**	**160,843**	**9,455**	**6.2%**	**112,691**	**129,468**	**16,777**	**14.9%**
Remainder Mercer County	**210,702**	**237,546**	**26,844**	**12.7%**	**102,142**	**129,350**	**27,208**	**26.6%**
Mercer County Total	**362,090**	**398,389**	**36,299**	**10.0%**	**214,833**	**258,818**	**43,985**	**20.5%**

[1]Forecasted
Source: DVRPC, July 2007

Population and employment growth will increase traffic in Mercer County, but it was beyond the scope of this study to forecast future travel demand on study area roadways. However, the impact of the new Wal-Mart on Spruce Street traffic has been forecast using *Trip Generation (2003)*, a standard transportation reference. The Wal-Mart would be built on the north side of the “T” intersection of Spruce Street and Arctic Parkway. According to the *Traffic Impact Analysis for Wal-Mart*, which was referenced under Existing Conditions, the size of the Wal-Mart is 149,149 square feet and it is classified as a Free-standing Discount Store (Land Use 815). The Wal-Mart will generate 4,178 trips to the store and another 4,178 return trips, daily. Using the same trip assignment assumptions as the Wal-Mart study, that would mean approximately 3,100 additional trips each weekday on Spruce Street between Princeton Avenue and Arctic Parkway.

An increase of 3,100 trips would represent an increase of 14 percent over the current traffic volume on Spruce Street. The Wal-Mart study offers some clues about what this traffic increase would mean for retail access on Spruce Street.

Future Vehicle Delay

Delays at retail driveways, including the Trenton Farmers Market and Halo Farm, and at Tiffany Woods Road, have been analyzed in the study *Traffic Impact Analysis for Wal-Mart*. The analysis includes two future scenarios in which the new Wal-Mart is constructed:

- "No Build" – Spruce Street stays the same, a four lane facility with two travel lanes per direction.
- "Build" – Spruce Street is reconfigured as a three lane facility with one travel lane per direction, plus a center two-way left-turn lane. This is the 4 lane to 3 lane conversion.

No Build

Under No Build, delays at Tiffany Woods Road become much worse compared with existing conditions. The deterioration is striking because there are already long delays at this location. Most of the delay is due to the difficulty of turning left from the exit. During the weekday evening peak hour, average delay at Tiffany Woods Road more than doubles, from 106 seconds to 222 seconds. During the Saturday peak hour, average delay at Tiffany Woods Road doubles from 34 seconds to 69 seconds. Performance falls from LOS D to LOS F.

During both the weekday evening and Saturday peak hours, delays at Halo Farm and the two Farmers Market driveways increase by approximately 10 seconds. Performance falls from LOS C to LOS D.

Build

Under Build, delays at retail driveway exits and Tiffany Woods Road increase somewhat compared with existing conditions. Most of the delay is due to the difficulty of turning left from the exits. There are two exceptions: During the weekday evening peak hour, average delay at Tiffany Woods Road drops from 106 seconds to 37 seconds. Performance improves from LOS F to LOS E. At

Halo Farm, average delay jumps from 21 seconds to 54 seconds. Performance falls from LOS C to LOS F.

The largest impact of Build compared to No Build is at Tiffany Woods Road. During the weekday evening peak hour, average delay at Tiffany Woods Road drops from 222 seconds to 37 seconds. During the Saturday peak hour, average delay at Tiffany Woods Road drops from 69 seconds to 25 seconds. Contrary to the trend, average delay at Halo Farm becomes worse under Build, especially during the weekday evening peak hour, when it increases from 29 seconds to 54 seconds.

As was noted previously, The *Wal-Mart* study did not analyze the Capital Plaza Spruce Street driveway. It is possible that construction of the new Wal-Mart would result in significant delays there as well.

Table 4 on page 31 lists level of service, with average delay per vehicle, for retail driveway exits and Tiffany Woods Road exit under existing conditions, No Build, and Build.

4 Lane to 3 Lane Conversion

The three lane configuration would have two travel lanes, one per direction, with a center two-way left-turn lane. The configuration of the roadway at Princeton Avenue, where there are two left-turn lanes on eastbound Spruce Street, would stay the same. The potential impacts of the conversion are described.

Safety

The three lane configuration improves safety. The source of the benefits is a reduction in conflict points and improved sight distance for turning and crossing traffic. Turning vehicles would be separated from through traffic. This would alleviate conflicts associated with the sudden stops and lane changing that are characteristic of Spruce Street. Vehicles turning from the roadway would also have only one lane of traffic to watch. In addition, the two-way left-turn lane would provide a refuge for crossing traffic from retail exits. An Iowa study[1], citing data from Minnesota and Washington State, concludes that a “20-30% reduction in crashes would be a reasonable estimate” of the impact of a 4 lane to 3 lane conversion.

Bicycle and Pedestrian Amenities

The three lane configuration calms traffic and accommodates a wide shoulder and/or a bicycle lane. It would make right-of-way available to add sidewalks. Raised pedestrian refuges could also be created at intersections given extra right-of-way. The pedestrian refuges and the shorter crossing distance, 3 lanes instead of 4, would make it safer for pedestrians to cross Spruce Street.

Traffic Congestion

The common sense assumption that the loss of one out of two travel lanes by direction should lead to deterioration in traffic flow has not been borne out by the available evidence. Where the traffic on the roadway is less than 20,000 vehicles per day and there are multiple retail driveways, the difference in capacity between the two configurations is minimal. The reason is that under the four lane configuration, the left lane is monopolized by turning vehicles. An Iowa study[1] cites reports from Montana and Iowa: Two traffic engineers overseeing separate lane conversions in Billings and Helena observed no change in traffic flow. Analysis of two proposed lane conversions in Iowa indicated that delay would increase but level of service would stay the same.

[1] *The Conversion of Four Lane Undivided Urban Roadways to Three Lane Facilities*, June 1999, by Thomas M. Welch, P.E. The document is available for download at Context Sensitive Solutions.org.

Improvement Strategies

It appears that the 4 lane to 3 lane conversion proposed for Spruce Street would provide substantial benefits – under the right conditions. The benefits would include improved safety for all road users. In addition, the conversion would create the foundation for a calmer, quieter street. The new character of the street would pay dividends to the parcels that abut it, making them more attractive for redevelopment. All this would be accomplished with minimal impact on traffic flow.

It is questionable whether the right conditions currently exist on Spruce Street to implement a 4 lane to 3 lane conversion. Furthermore, as discussed below, important elements of the future are unknown.

There appears to be a consensus that the upper bound for a successful conversion is 20,000 vehicles per day (vpd).[2] That number should not be treated as a hard and fast rule, but it does suggest the need for rigorous review when traffic volume approaches or exceeds that standard.

Traffic counts collected by DVRPC in April 2006 indicate the traffic volume was approximately 22,200 vpd. Furthermore, that number is expected to increase by approximately 3,100 vpd if the new Wal-Mart is constructed at the intersection of Spruce Street and Arctic Parkway. Travel demand on Spruce Street may also increase in the future due to background population and employment growth in Mercer County.

The risk is that past some point the two travel lanes, one per direction, would fail, an unacceptable result for a regionally significant arterial road.

Therefore, improvements to Spruce Street should be postponed until the effect of the new Wal-Mart is known. Likewise, some of the other unknowns should be dealt with by performing a forecast of future travel demand on Spruce Street. Both a 10 year and a 25 year forecast should be performed.

[2] Huang, H F; Stewart, J R; Zegeer, C V. 2002. Evaluation of Lane Reduction “Road Diet” Measures on Crashes and Injuries. *Transportation Research Record* 1784: 80-90.

Finally, the possibility that the 4 lane to 3 lane conversion would have to be abandoned should be anticipated and contingency plans developed. The previous analysis suggests that two problems require attention:

- High crash rates at the Halo Farm and Farmers Market Spruce Street driveways; and
- Severe delays at Tiffany Woods Road, specifically vehicles attempting to turn left onto Spruce Street from the side of the roadway.

Construction of the new Wal-Mart would increase delays significantly at Tiffany Woods Road due to an increase of traffic on Spruce Street. It is unknown how much, if any, increased traffic would affect crash rates at Halo Farm and the Farmers Market.

The two problem locations are physically separated by two commercial properties on the north side of Spruce Street. Both properties have at least one building and appear to support thriving businesses. Improvement strategies for each problem location are described below.

Halo Farm and Farmers Market

<u>Prohibit left-turns from Spruce Street exits</u>. As part of this strategy, traffic would be re-routed to the “back entrance” of the Farmers Market opposite Mulberry Street or to other Princeton Avenue driveways. Halo Farm and the Farmers Market, which are two separate properties, would have to develop a new common internal circulation plan. The Princeton Avenue driveways could also be improved.

<u>Install traffic signal on Spruce Street</u>. As part of this strategy, Spruce Street driveways would be consolidated or closed. The traffic signal would require storage lanes. The site would require an access road to reach the traffic signal; it would have to be set back from Spruce Street. Halo Farm and the Farmers Market, which are two separate properties, would have to develop a new common internal circulation plan.

The placement of the traffic signal on Spruce Street would be problematic: It could not be too close to the traffic signal at Princeton Avenue. The best location may be opposite the Capital Plaza driveway, which would maximize its benefits by also serving mall traffic.

Tiffany Woods Road

Construct Tiffany Woods Access Road (Arctic Parkway). Tiffany Woods residents would be able to access Spruce Street at a signalized intersection. The access road would run from the Tiffany Woods neighborhood to the traffic signal at Spruce Street/Arctic Parkway via the parcel on the northeast corner of the intersection, which is also the location of the new Wal-Mart.

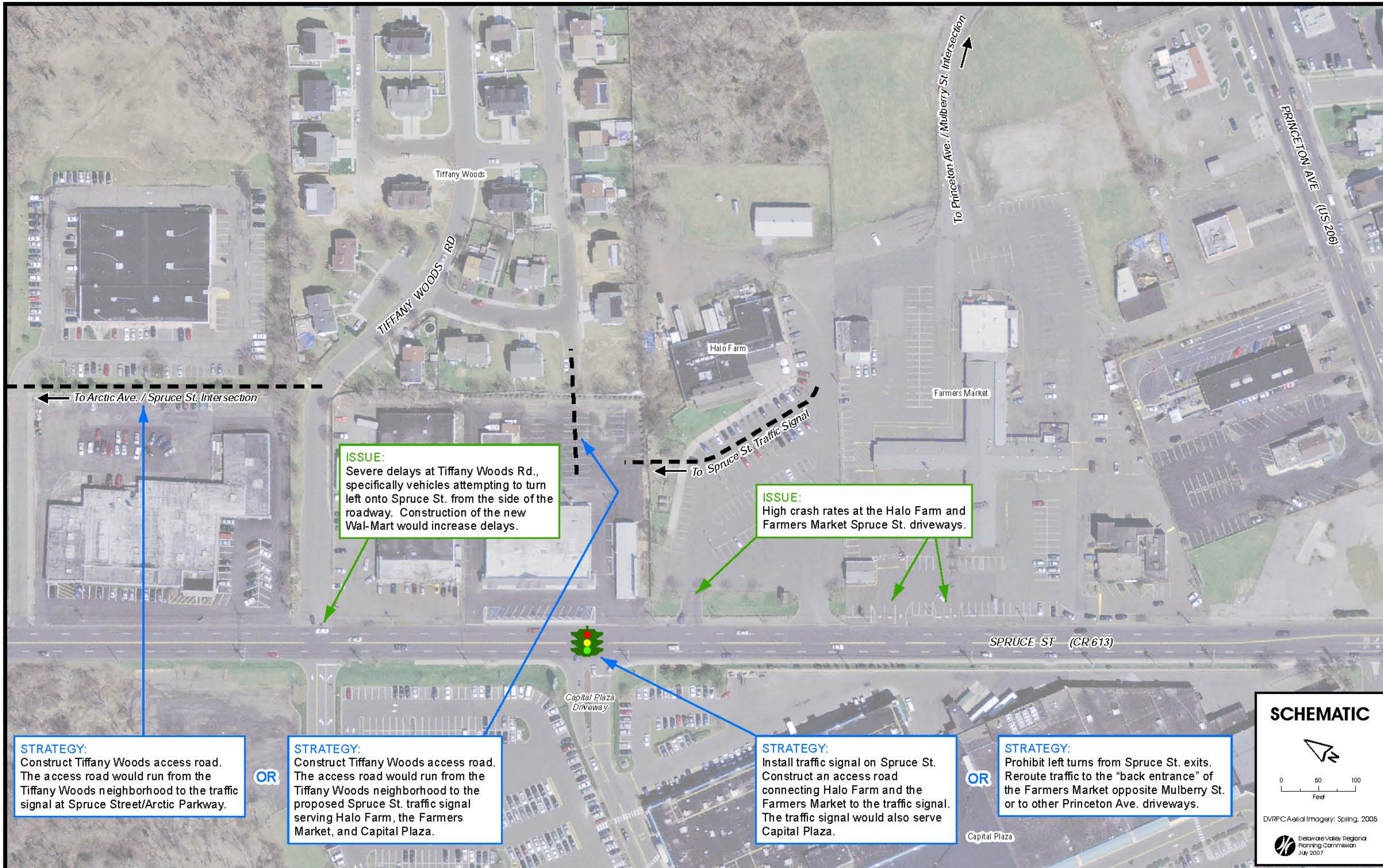
Construct Tiffany Woods Access Road (Capital Plaza Driveway). Tiffany Woods residents would be able to access Spruce Street at a signalized intersection. The access road would run from the Tiffany Woods neighborhood to the proposed Spruce Street traffic signal serving Halo Farm, the Farmers Market, and Capital Plaza.

Preferred Strategy

The preferred strategy combines the traffic signal and access road strategy proposed for Halo Farm and the Farmers Market and the access road proposed for the Tiffany Woods neighborhood, which would provide access to the same traffic signal. The advantage of the preferred strategy is its economy: one traffic signal would serve three locations. In addition, between the two proposed Tiffany Woods access roads, this one is shorter and more direct.

Figure 10 on page 39 shows the proposed Spruce Street improvements.

Figure 10: PROPOSED IMPROVEMENTS, SPRUCE STREET



Chapter 4 – Calhoun Street Extension

The Calhoun Street Extension (CSE) was a central transportation recommendation of the ULI study. Although the study envisioned that the Farmers Market would be moved to the Boehm site, the rationale for the CSE has not changed. The Transfer Station and the adjacent Boehm site divide the neighborhoods of Mercer Crossings from each other and from nearby commercial districts. Dozens of streets dead end at the outside boundary of these properties. The CSE is the last alignment available to begin to tie together Mercer Crossings with an urban street grid.

This chapter analyzes the impact of the CSE on Mercer Crossings. The analysis has two parts. The first part analyzes travel demand: How many vehicles the CSE is likely to attract and how many vehicles it will remove from other facilities. The second part takes a broader view. It analyzes the impact of the CSE on several goals first identified in the ULI study and later identified by Mercer Crossings stakeholders as desirable.

Existing Conditions

Data

To perform the analysis, two types of data were collected in the vicinity of the proposed CSE:

1) Peak period turning movement counts at major intersections,

- Princeton Avenue and N. Olden Avenue
- Princeton Avenue and Mulberry Street
- New York Avenue and N. Olden Avenue
- Princeton Avenue and Spruce Street
- Arctic Parkway and Spruce Street
- Arctic Parkway and N. Olden Avenue, and

2) Daily traffic volume counts on parallel roadways and cross-streets,

- Calhoun Street
- MLK Boulevard
- Princeton Avenue
- N. Olden Avenue
- Spruce Street
- Mulberry Street

Most of the counts were collected by DVRPC in April 2006. Some had been collected previously by Mercer County in 2004 and 2001. Figure 11 on page 43 shows the count locations.

Traffic Patterns

When turning movement data from several intersections is put together, traffic patterns emerge. Figure 12 on page 44 shows AM and PM peak hour turning movement volumes at the Princeton Avenue intersections with Mulberry Street, Spruce Street, and N. Olden Avenue; and the MLK Boulevard intersection with Calhoun Street. The AM peak hour was 8 AM to 9 AM and the PM peak hour was 5 PM to 6 PM. Major travel flows are depicted with green arrows. Counts corresponding to major flows are shown in bold type.

Traffic bound from roadways north of Mercer Crossings converges on Princeton Avenue. On southbound Princeton Avenue, at the intersection with Mulberry Street, there are 900 trips during the AM peak hour and 1,000 trips during the PM peak hour. Much of the traffic is bound for points west of Mercer Crossings. At Spruce Street, approximately 60 percent of the traffic turns right. At N. Olden Avenue, approximately 30 percent of the traffic turns right. Traffic is also bound for points south of Mercer Crossings via Calhoun Street or MLK Boulevard. At Calhoun Street, approximately 70 percent of the traffic turns right. There is a secondary trend of traffic from roadways south of Mercer Crossings, much of which is also bound for points west.

Figure 11: CSE COUNT LOCATIONS

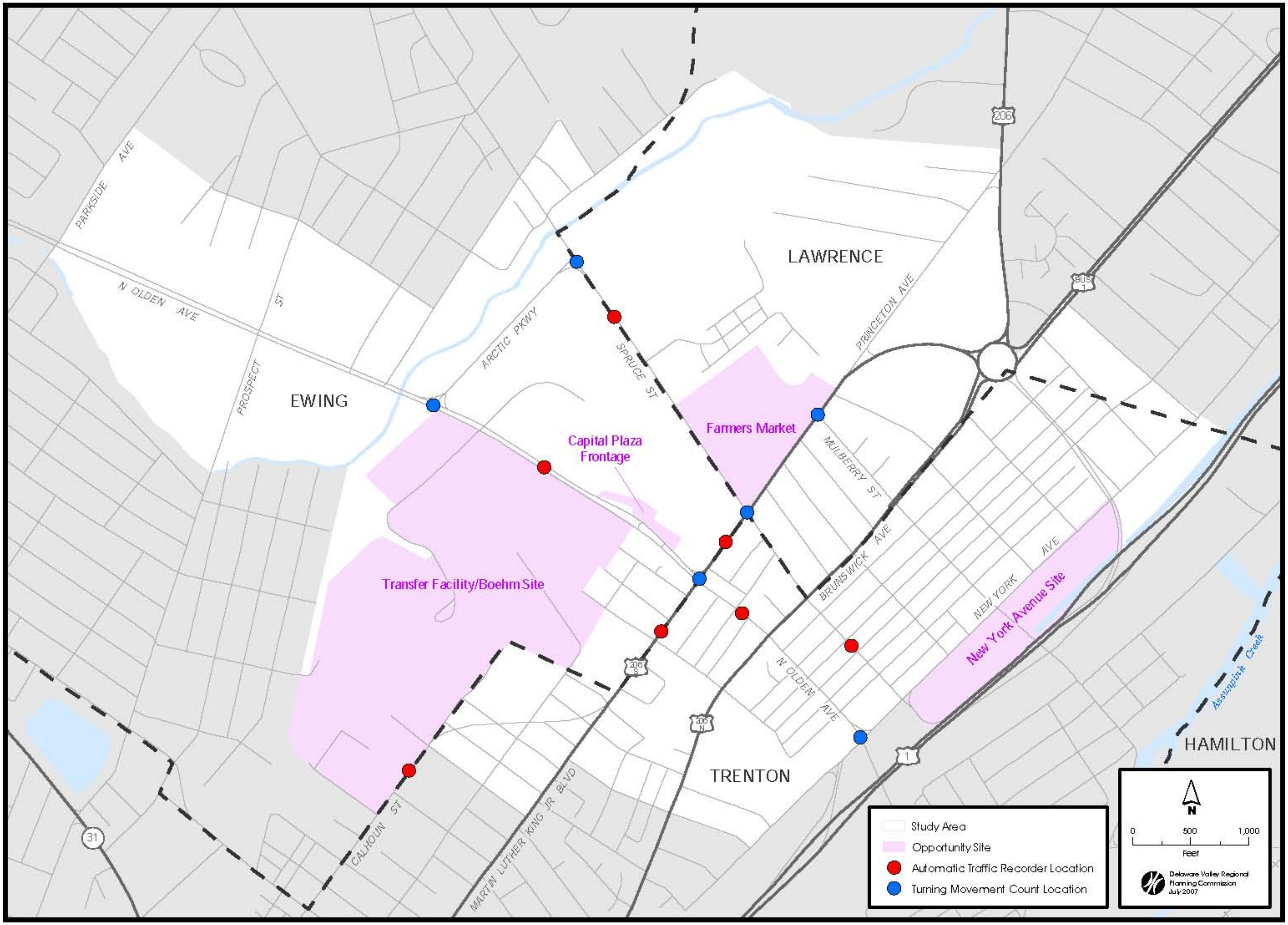
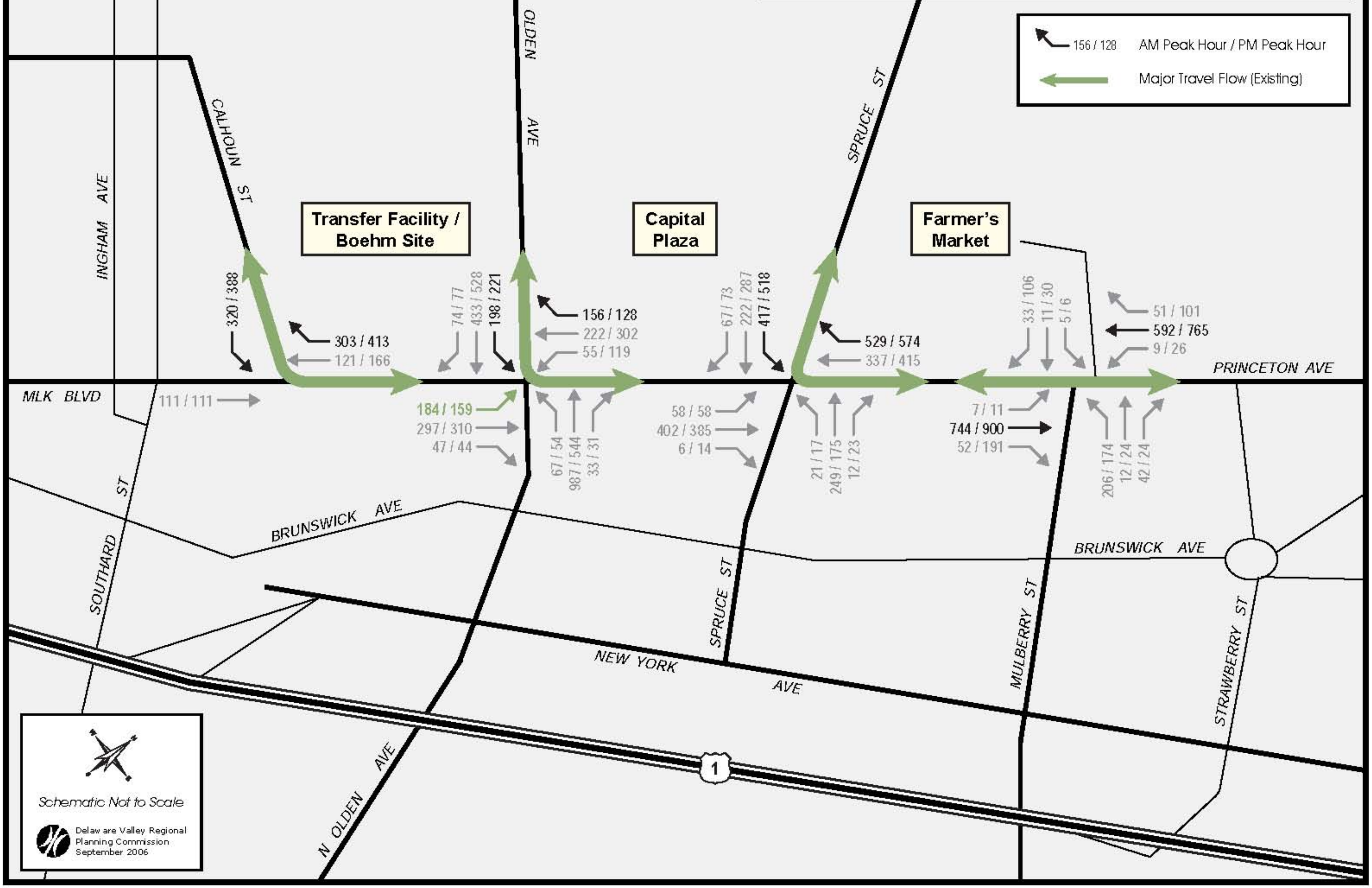


Figure 12: Major Travel Flows, AM and PM Peak Hours Mercer Crossings - MLK Boulevard / Princeton Avenue



Proposed Alignment

Calhoun Street is classified as a minor arterial and extends from the Calhoun Street Bridge to MLK Boulevard south of the Trenton City/Ewing Township line. It follows a southwest-northeast alignment before curving east to meet MLK Boulevard. The Calhoun Street Extension would continue the southwest-northeast alignment across N. Olden Avenue, through the Capital Plaza parking lot, and across Spruce Street. North of Spruce Street, it would curve east to meet Mulberry Street at Princeton Avenue. The section of Calhoun Street that veers off to MLK Boulevard would be closed.

Calhoun Street Extension Scenarios

N. Olden Avenue and Spruce Street divide the proposed CSE alignment into three sections. Each section could have value itself as a stand-alone project. Therefore, each section is analyzed as a separate scenario. The complete alignment, consisting of all three sections combined, could be built as a two-way facility or a one-way facility. Each of these possibilities is also analyzed as a separate scenario. The five scenarios, which are also shown in Figure 13 on page 47, are as follows:

Section 1 Calhoun Street to N. Olden Avenue. Calhoun Street closed at MLK Boulevard.

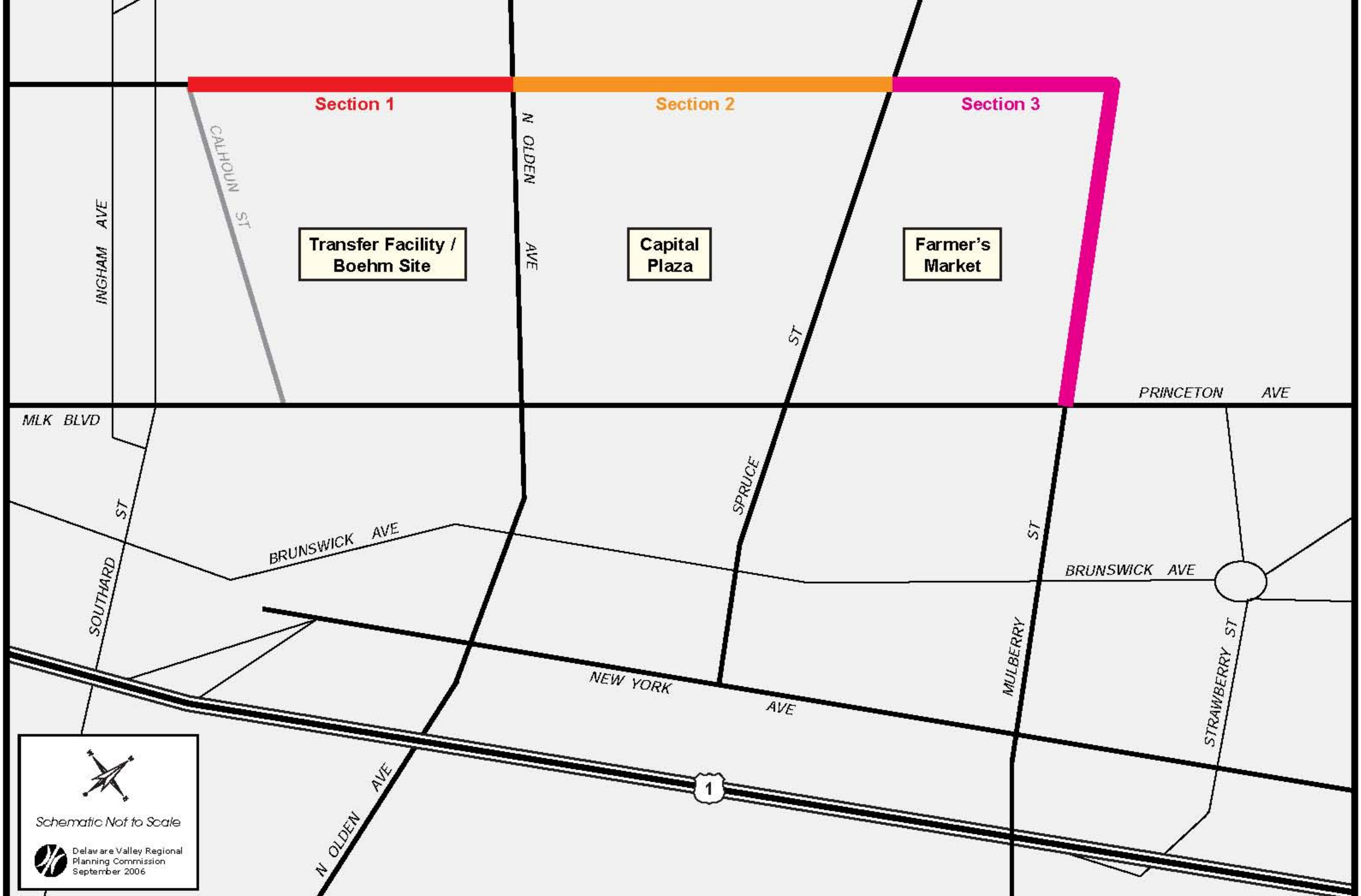
Section 2 N. Olden Avenue to Spruce Street, via the existing Capital Plaza parking lot, which would be reconstructed.

Section 3 Spruce Street to intersection of Princeton Avenue/Mulberry Street. Halo Farm and Trenton Farmers Market relocated closer to Spruce Street.

Combined Two-Way Calhoun Street to intersection of Princeton Avenue/ Mulberry Street. Calhoun Street closed at MLK Boulevard. Capital Plaza parking lot reconstructed. Halo Farm and Trenton Farmers Market relocated closer to Spruce Street.

Combined One-Way Calhoun Street to intersection of Princeton Avenue/ Mulberry Street. Calhoun Street/CSE one-way southbound between Mulberry Street and Southard Street. MLK Boulevard/Princeton Avenue one-way northbound between Southard Street and Mulberry Street. Calhoun Street closed at MLK Boulevard. Capital Plaza parking lot reconstructed. Halo Farm and Trenton Farmers Market relocated closer to Spruce Street.

Figure 13: Calhoun Street Extension (Proposed)



Analysis: Travel Demand

Travel demand was analyzed to determine how many vehicles the CSE is likely to attract, and how many vehicles it will remove from other facilities. The estimate of CSE travel demand was based on an analysis of existing traffic patterns in the vicinity of the proposed right-of-way.

Methodology

To determine travel demand under each scenario, the CSE was added to the local road network and trips manually assigned to it. A detailed description of the traffic assignment procedure is provided in Appendix A.

Results

The product of the traffic assignment procedure is an estimate of CSE travel demand under each scenario. Projected travel demand is reported for the AM peak hour (8 AM – 9 AM) and PM peak hour (5 PM – 6 PM) in both the northbound and southbound directions. A brief explanation of the results is included.

Section 1 Attracts approximately 200 trips southbound and northbound during the AM and PM peak hours. These trips are removed from MLK Boulevard. Most northbound users turn left at N. Olden Avenue. With Calhoun Street closed at MLK Boulevard, traffic shifts to N. Olden Avenue and Southard Street.

Section 2 Attracts no additional traffic above the baseline of mall traffic. Under existing conditions, there is traffic on Arctic Parkway in both directions between N. Olden Avenue and Spruce Street. That route is more attractive than Section 2.

Section 3 Attracts approximately 400 trips southbound and somewhat more than 100 trips northbound during the AM and PM peak hours. These trips are removed from Princeton Avenue and Spruce Street. The northbound number is lower because there is a good alternative. The two turning lanes on Spruce Street at the intersection with Princeton Avenue facilitate left-turns there.

Combined Two-Way Out-performs Section 1 and Section 3, although the same traffic patterns still hold for the most part. The difference is accounted for by through traffic. There are approximately 100 through trips southbound and northbound during the AM and PM peak hours. These trips are removed from MLK Boulevard/Princeton Avenue.

Mulberry Street may attract new trips, reducing traffic congestion on N. Olden Avenue.

Combined One-Way All southbound MLK Boulevard/Princeton Avenue traffic shifts to the CSE. Two travel lanes would probably be required between Mulberry Street and Spruce Street. With Calhoun Street closed at MLK Boulevard, northbound traffic shifts to Southard Street. Southard Street attracts approximately 300 new trips during the AM and PM peak hours.

Mulberry Street may attract new trips, reducing traffic congestion on N. Olden Avenue. Some trips may shift to Brunswick Avenue as a convenient southbound route.

Figures 14 -18 on pages 51 - 55 show AM and PM peak hour traffic volume at selected intersections on, or in the vicinity of, the CSE, under each scenario.

Table 6 on page 50 lists projected daily traffic volume (AADT) on the CSE under each scenario. Daily traffic volume was calculated from peak hour traffic volume using a conversion factor. The conversion factor was based on hourly traffic counts taken on Princeton Avenue in April 2006. By way of comparison, daily traffic volume on Princeton Avenue, MLK Boulevard, and Calhoun Street under existing conditions is also listed.

TABLE 6
PROJECTED DAILY TRAFFIC VOLUME (AADT)
ON CALHOUN STREET EXTENSION AND EXISTING
TRAFFIC VOLUME ON ADJACENT ROADWAYS

Scenario	Description	AADT
Existing		
Princeton Avenue	-	14,100
MLK Boulevard	-	13,200
Calhoun Street	-	9,900
Calhoun Street Extension		
Section1	Calhoun Street to N. Olden Avenue.	5,700
Section 2	N. Olden Avenue to Spruce Street.	0
Section 3	Spruce Street to intersection of Princeton Avenue/Mulberry Street.	7,500
Combined Two-Way	Calhoun Street to intersection of Princeton Avenue/Mulberry Street.	8,200
Combined One-Way	Calhoun Street to intersection of Princeton Avenue/Mulberry Street.	6,900

Source: DVRPC, July 2007

Figure 14: Major Travel Flows, AM and PM Peak Hours Calhoun Street Extension, Section 1

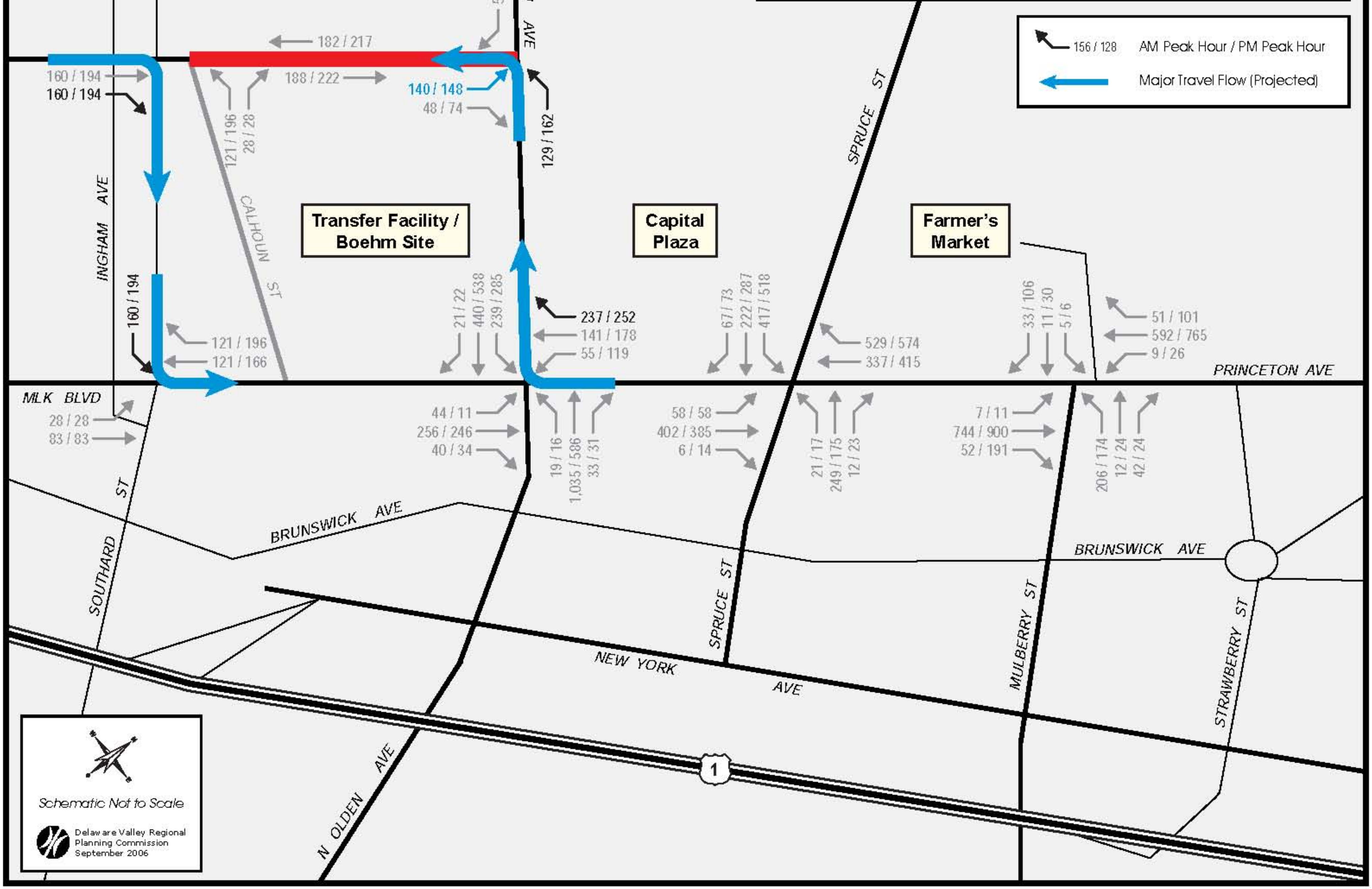


Figure 15: Major Travel Flows, AM and PM Peak Hours Calhoun Street Extension, Section 2

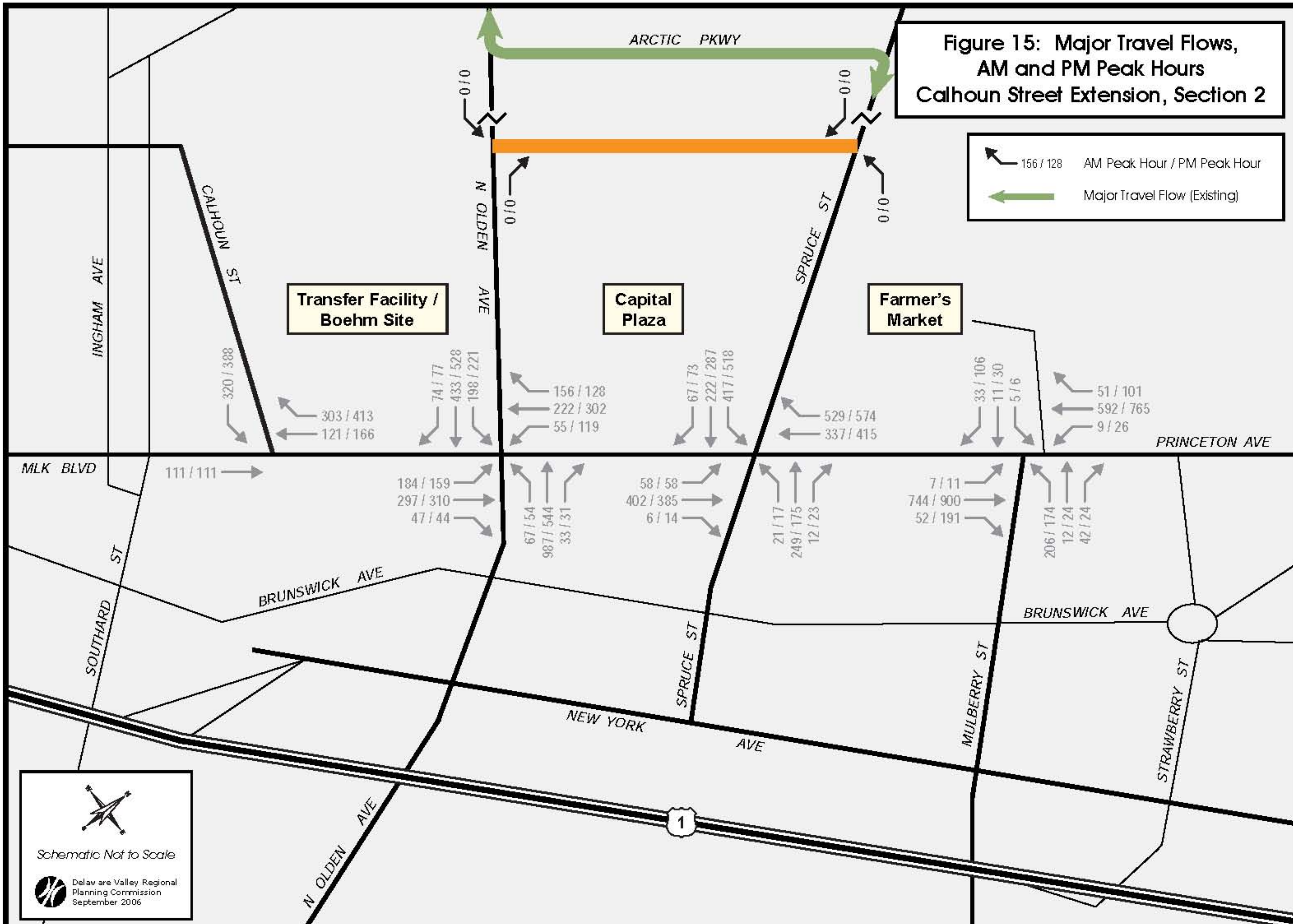
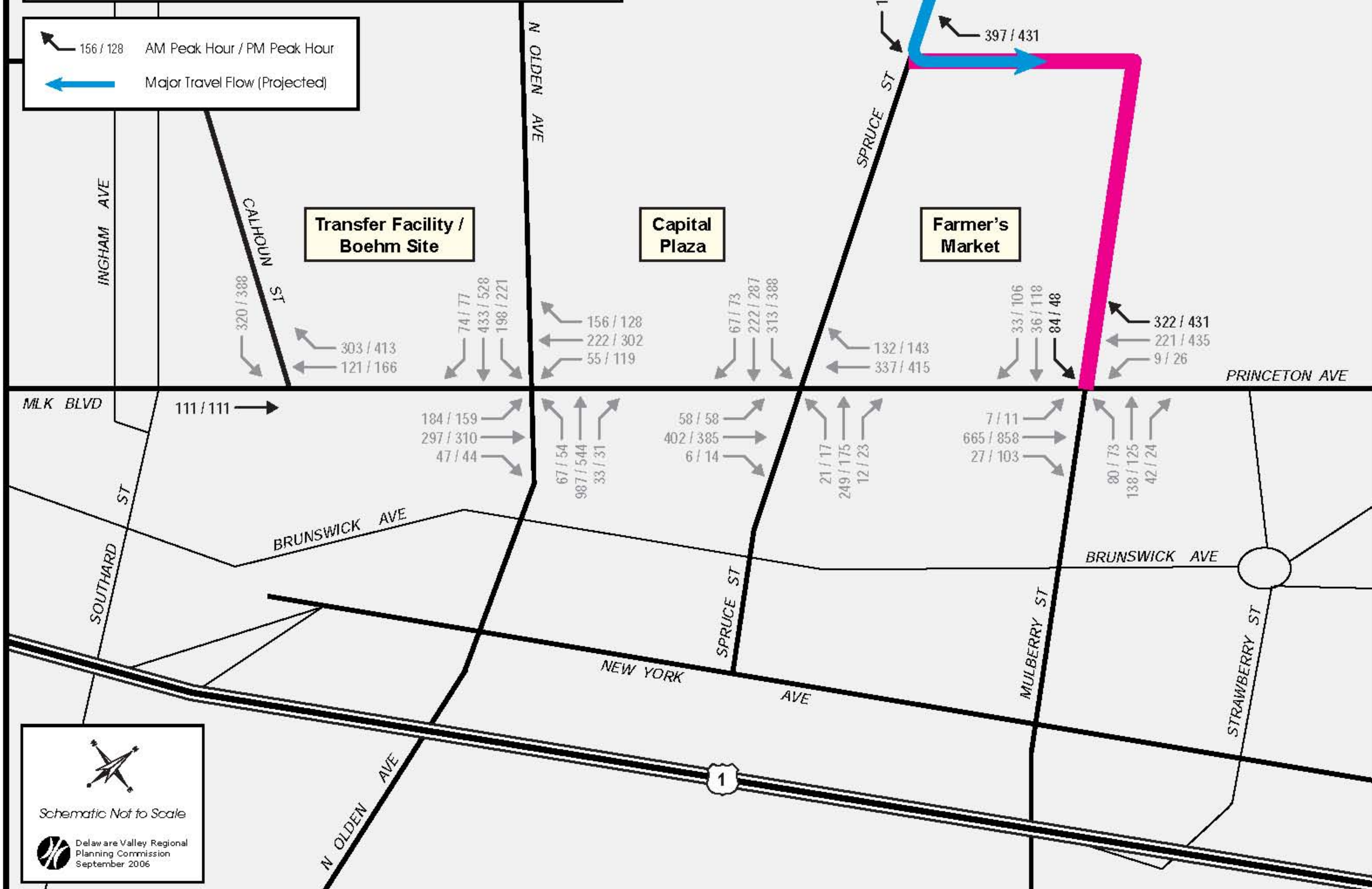


Figure 16: Major Travel Flows, AM and PM Peak Hours Calhoun Street Extension, Section 3



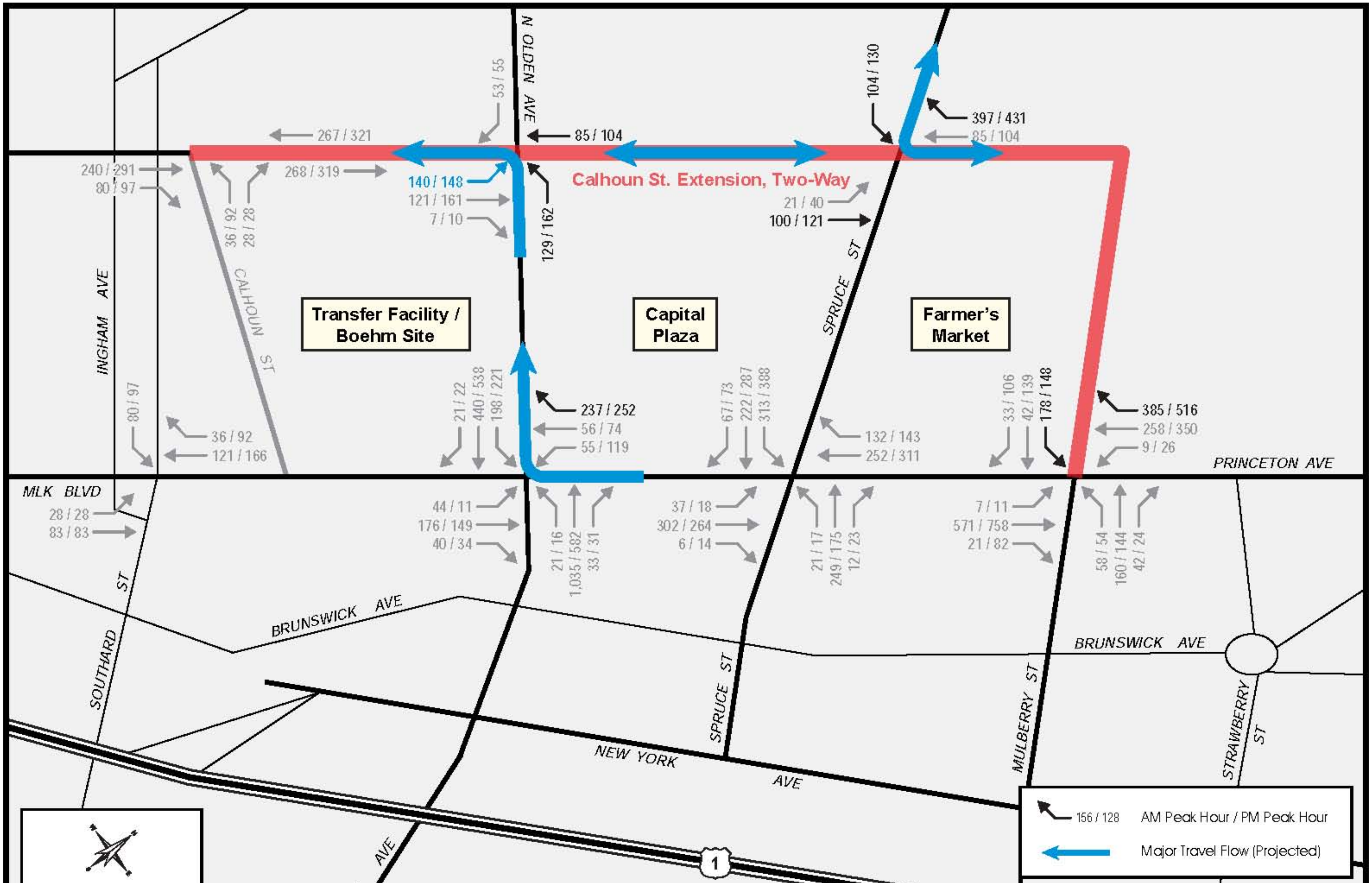


Figure 17: Major Travel Flows, AM and PM Peak Hours
Calhoun Street Extension, Two-Way

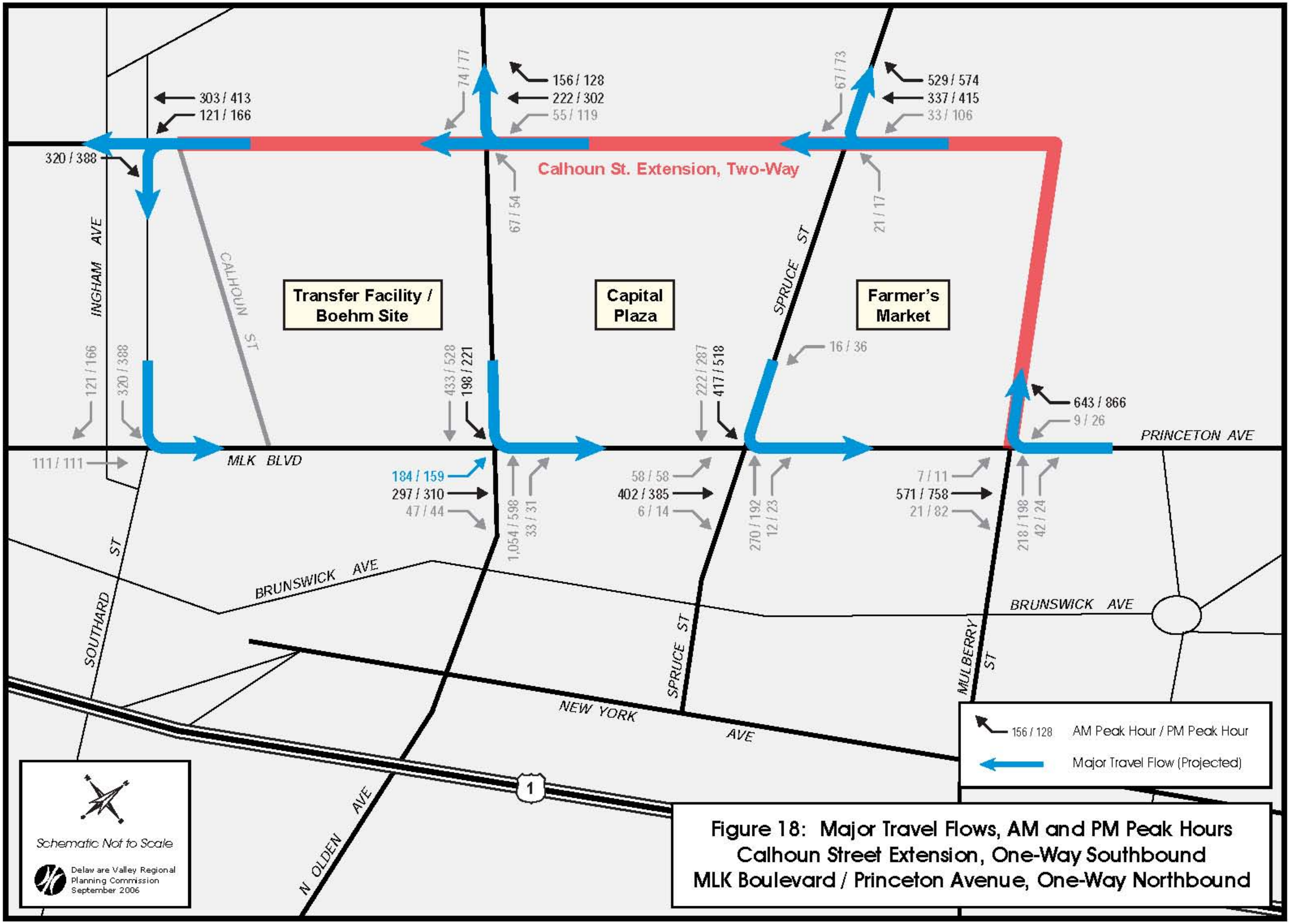


Figure 18: Major Travel Flows, AM and PM Peak Hours
Calhoun Street Extension, One-Way Southbound
MLK Boulevard / Princeton Avenue, One-Way Northbound

Analysis: Project Goals

This section analyzes the impact of the CSE on several goals first identified in the ULI study and later identified by Mercer Crossings stakeholders as desirable. The purpose of the analysis is to identify specific benefits of the CSE; and to determine whether construction of each section of the CSE as a stand-alone project provides the same benefits, or whether those benefits depend on construction of the complete CSE. The goals include:

- Identify opportunities and constraints in the transportation network;
- Improve mobility and access in the area;
- Mitigate truck traffic impacts;
- Enhance bicycle and pedestrian experience; and
- Improve the character of streets in the area.

The discussion of each goal is broken down into problem description and study findings; the latter describes CSE scenarios that have a positive impact on the goal.

Traffic Congestion – N. Olden Avenue

Description

The two lane section of N. Olden Avenue between New York Avenue and Princeton Avenue is backed up for much of the day. Traffic volume on N. Olden Avenue is approaching the capacity of the roadway, but lack of capacity does not appear to be the cause of the backups. Instead, traffic is delayed at the intersections, Princeton Avenue and New York Avenue.

Findings

Combined Two-Way, Combined One-Way North-south traffic is diverted from Princeton Avenue to the CSE, reducing traffic volume at the substandard N. Olden Avenue/Princeton Avenue intersection, which is then re-optimized for N. Olden Avenue. The new high-capacity N. Olden Avenue/CSE intersection moves traffic efficiently. The result is increased traffic flow and reduced traffic congestion on N. Olden Avenue at the intersection with Princeton Avenue.

Table 7 lists level of service for the intersection and intersection approaches at N. Olden Avenue/Princeton Avenue, under existing conditions and selected CSE scenarios.

TABLE 7
EFFECT OF SELECTED CALHOUN STREET EXTENSION SCENARIOS, INTERSECTION OF N. OLDEN AVENUE AND PRINCETON AVENUE (PEAK HOUR LOS, WITH AVERAGE DELAY PER VEHICLE)

Improvement Scenario	Direction of Travel	Peak AM Hour and Peak PM Hour LOS with Average Delay / Vehicle			
Existing		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	Princeton northbound	C	26	C	27
	Princeton southbound	B	15	C	25
	N. Olden eastbound	E	59	C	24
	N. Olden westbound	C	35	B	16
	Intersection	D	40	C	22
Section 1		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	Princeton northbound	B	19	B	18
	Princeton southbound	B	11	B	13
	N. Olden eastbound	D	40	C	23
	N. Olden westbound	E	64	C	24
	Intersection	D	39	B	16
Combined Two-Way		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	Princeton northbound	B	19	B	17
	Princeton southbound	A	7	A	10
	N. Olden eastbound	D	45	C	24
	N. Olden westbound	C	26	B	16
	Intersection	C	31	B	17
Combined One-Way Southbound MLK / Princeton One-Way Northbound		AM Peak		PM Peak	
		LOS	Delay (sec)	LOS	Delay (sec)
	Princeton northbound	C	22	C	22
	Princeton southbound				
	N. Olden eastbound	D	37	C	24
	N. Olden westbound	C	27	B	16
	Intersection	C	30	C	20

Source: DVRPC, July 2007

Access – Boehm Site

Description

There is access to the Trenton Farmers Market and Capital Plaza from multiple driveways on Princeton Avenue, Spruce Street, and N. Olden Avenue. In contrast, access to the Boehm site from major roadways is poor.

Specifically, from the north, the grass median on N. Olden Avenue cuts off the site from the westbound lanes. The closest turnaround for westbound traffic is Arctic Parkway. There is, however, direct access between the site and eastbound N. Olden Avenue. From the south or east, it is possible to reach the Boehm site from Calhoun Street but the route, via New Willow Street and Princess Diana Drive, is indirect. From the west, there is no access from the nearest major roadway, Prospect Street. The Transfer Station acts as a barrier.

Findings

Section 1, Combined Two-Way The alignment traverses the Boehm site, making a direct connection with Calhoun Street. The connection to N. Olden Avenue is improved, especially from the westbound lanes. It also increases the attractiveness of parcels on Princess Diana Drive.

Combined One-Way Same as Complete Two-Way and Section 1, but, by definition, access is limited to one direction, reducing its effectiveness.

The focus of this analysis has been the Boehm site. If the Transfer Station were redeveloped, one possibility would be to access it from the CSE via an east-west connector.

Mobility – Opportunity Sites

Description

An incomplete road network, specifically missing through routes, limits north-south and east-west mobility in Mercer Crossings.

North-South Mobility

North of Calhoun Street, there are no through north-south streets in Mercer Crossings between Prospect Street and Princeton Avenue. As a result, there is no direct route connecting the Boehm site, Capital Plaza, and the Trenton Farmers Market. Ideally, these three opportunity sites would be tied together physically by the street network. Once the individual pieces of economic development are in place, such connections would allow amenities at each site to reinforce each other, to the advantage of Mercer Crossings as a whole.

East-West Mobility

Olden Avenue Bridge is the primary east-west route across Route 1. Mulberry Street, the closest alternate route, terminates at Princeton Avenue. The lack of an alternate route contributes to traffic congestion on the two lane section of N. Olden Avenue between Princeton Avenue and New York Avenue, which is an important Mercer Crossings access route.

Findings

Complete Two-Way New north-south and east-west routes are added in Mercer Crossings. Calhoun Street and Mulberry Street are extended. Both roads make useful connections with Spruce Street and N. Olden Avenue. Travel between the three opportunity sites is easy and direct. Mulberry Street may attract new trips, reducing traffic congestion on N. Olden Avenue.

Complete One-Way New north-south and east-west routes are added in Mercer Crossings. Calhoun Street and Mulberry Street are extended. Both roads make useful connections with Spruce Street and N. Olden Avenue. Mulberry Street may attract new trips, reducing traffic congestion on N. Olden Avenue. However, the one-way alignments on Calhoun Street and Princeton Avenue limit mobility.

Truck Traffic – Impact in Residential Neighborhoods

Description

Large truck traffic in Mercer Crossings residential neighborhoods produces noise and vibrations and has led to complaints from residents. The residential neighborhoods are located adjacent to truck routes on N. Olden Avenue, MLK Boulevard, Princeton Avenue, and Calhoun Street. Two generators of truck trips within Mercer Crossings have been identified: the Mercer County Improvement Authority Transfer Station and Mercer Group International.

Based on data collected by DVRPC on adjacent access roads, approximately 2,000 vehicles use the Transfer Station per week; the arrival and departure are separate trips, so the facility generates approximately 4,000 trips per week. Of these, approximately 1,600 trips, or 40 percent, are large trucks. Mercer Group generates far more traffic than the Transfer Station, approximately 7,000 trips per week, but the number of trips involving large trucks is also approximately 1,600 trips. Those trips represent 22 percent of total trips at the facility.

Several improvement strategies have been researched in this study, but none of them appears to offer much promise for reducing the impacts of large truck traffic on residential neighborhoods in Mercer Crossings.

Findings

Section 1, Combined Two-Way, Combined One-Way Provides an alternate route for large truck traffic bound to and from the Mercer Group facility, drawing it away from residential neighborhoods on MLK Boulevard and Calhoun Street; and also drawing it away from the substandard N. Olden Avenue/Princeton Avenue intersection, which was not designed to accommodate it.

Bicycle and Pedestrian Amenities

Description

Improved bicycle and pedestrian systems are a necessary component of the Mercer Crossings transportation infrastructure. Furthermore, as the ULI study noted, these systems can connect existing neighborhoods and businesses to reduce the need for automobile travel on study area streets.

Existing conditions in Mercer Crossings limit the mobility of bicycles and pedestrians. Four lane roads such as Spruce Street and Princeton Avenue have high traffic volumes and high speeds. They have no median to serve as a pedestrian refuge. They have no bicycle lane or shoulder to protect bicycles.

The ULI study recommended creating bicycle routes from The College of New Jersey to major destinations such as the Trenton Farmers Market; the N. Olden Avenue commercial area; area hospitals; and local recreational facilities. Spruce Street and Princeton Avenue have the potential to be useful links in the Mercer Crossings bicycle system, but existing conditions do not allow them to perform that function.

Findings

Complete Two-Way, Complete One-Way Improves bicycle and pedestrian experience in several ways: Reduces Princeton Avenue traffic volume significantly. After 4 lane to 3 lane conversion, right-of-way is available to improve bicycle and pedestrian amenities. These could include bicycle lanes on Princeton Avenue and pedestrian improvements at the Princeton Avenue/ N. Olden Avenue and Princeton Avenue/Spruce Street intersections.

Princeton Avenue makes useful connections in bicycle system in conjunction with Spruce Street.

Character of Street/Redevelopment

Description

Improving the physical attractiveness of built structures and streets in the study area is key to redevelopment. The ULI study proposed the vision of a "calmer urban street atmosphere." To realize the vision, Mercer Crossings streetscape design should reflect the following urban, traffic-calming aesthetic principles:

- Access management controls;
- Greened tree-planting areas along sidewalks;
- Wider sidewalks;
- Contextual street-lighting fixtures;
- Buried or relocated utilities;
- Intersection design improvements;
- Pedestrian-friendly crosswalks; and
- Traffic controls, such as enhanced crossing signals.

Findings

In general, construction of the CSE would not directly implement these design elements, but it would create conditions in which they could be implemented. Those conditions do not exist now.

Combined Two-Way, Combined One-Way Improves character of street in several ways: Reduces Princeton Avenue traffic volume significantly. 4 lane to 3 lane conversion reduces traffic speeds. After the lane conversion, right-of-way is available for possible use in streetscape improvements and also on-street parking. All these steps would require further investments. They should be implemented with design standards for all new development.

Improving the character of the street could create opportunities for redevelopment that do not exist today, as well as potentially provide a boost to existing businesses.

Summary

The Calhoun Street Extension is the best opportunity to implement the vision of a "calmer urban street atmosphere" proposed in the ULI study. It has the potential to stimulate redevelopment of vacant or under-utilized land at the Boehm site, Capital Plaza, and the Farmers Market.

The CSE would attract traffic because it is a faster route for many trips that are now made on Princeton Avenue. By removing traffic from Princeton Avenue, it would make it possible to consider a 4 lane to 3 lane conversion there.

The proposed CSE has three sections that could be built as stand-alone projects, but the most benefit would come from building the complete alignment, which combines the three sections. However, Lawrence Township has expressed concern about the section north of Spruce Street, which lies within its boundaries.

Therefore, the best means of moving forward may be to concentrate on the section of the CSE south of N. Olden Avenue. Construction of that section as a stand-alone project would increase the attractiveness of the Boehm site and adjacent parcels on Princess Diana Drive. It would also provide an alternate route for large truck traffic, drawing it away from neighborhoods on MLK Boulevard and Calhoun Street, where the noise and vibrations disturb residents, and also drawing it away from the substandard N. Olden Avenue/ Princeton Avenue intersection, which was not designed to accommodate it.

If this section of the CSE is built, the existing section of Calhoun Street between Kirkbride Avenue and MLK Boulevard should be kept open. Closing that section of Calhoun Street (which was part of the original CSE proposal) would be detrimental to traffic flow except if the complete CSE were constructed.

Chapter 5 – Truck Traffic in Residential Neighborhoods

Mercer County Planning Division asked DVRPC to investigate complaints about large truck traffic in Mercer Crossings residential neighborhoods, which produces noise and vibrations. Specifically, to investigate whether it was possible to reduce the impacts of the truck traffic. The residential neighborhoods are located adjacent to truck routes on N. Olden Avenue, MLK Boulevard, Princeton Avenue, and Calhoun Street.

There are two identified truck trip generators: The Mercer County Improvement Authority Transfer Station and Mercer Group International. Other truck traffic contributes to the problem. This includes trucks on delivery to Mercer Crossings locations and through traffic. The study focused on the Transfer Station and Mercer Group due to the large volume of trips at each facility and the existence of opportunities for re-routing trucks bound to and from each facility.

Another impetus to study the Transfer Station was the recommendation in the ULI report that the Transfer Station be relocated to facilitate redevelopment. Although that recommendation has not been accepted by all study area municipalities, there appears to be consensus that it should be treated as a serious proposal deserving of consideration, at least in the long term. The data collected documents some of the costs of maintaining the transfer station in its current location. It should also be noted that both facilities provide an essential service to Mercer County residents and businesses.

Trip generation at the Transfer Station and Mercer Group facilities, including traffic volume and temporal distribution, was analyzed. Several strategies to reduce the impact of truck traffic are presented.

Facilities

Transfer Station

The Transfer Station is located at the intersection of Dover and Stokes Avenues in Ewing Township. The main entrance is on N. Olden Avenue. The Mercer County Improvement Authority contracts with Waste Management to operate the facility. The Transfer Station is a solid waste transfer station only. They may take 1,000 tons of Type 10 solid waste (municipal waste) per day. The facility is authorized to process trash between 6 AM and 10 PM, six days per week. They accept material from New Jersey municipalities that have an account with them. The status of out-of-state haulers is unknown.

Mercer Group

Mercer Group is located at Calhoun Street and Kirkbride Avenue, also in Ewing Township. They have four operations. They are a scrap metal recycler; a solid waste (construction and demolition, or “C&D”) transfer station; and a Class A and a Class B recycler. Class A includes corrugated cardboard. They may take 1,500 tons of C&D per day. The New Jersey Department of Environmental Protection regulates the solid waste and Class B operations. The solid waste operation is permitted to operate 24 hours per day, six days per week. The scrap metal operation is unregulated and may operate 24 hours per day, seven days per week. Mercer Group may pick up from anywhere: all 21 New Jersey counties and out-of-state.

There is some interaction between the two facilities. Concrete, stone, brick, and block collected by the Transfer Station goes to the Class B operation of Mercer Group. Scrap metal collected by the Transfer station goes to the scrap metal operation. Likewise, solid waste residue collected by Mercer Group is put on a transfer trailer and goes to the Transfer Station, where it is weighed and trucked to a landfill.

Data Collection

Based on field observations, there appears to be a constant stream of truck traffic, much of it consisting of large trucks, going in and out of both facilities.

Large trucks are defined in this study as trucks that have three or more axels (a heavy duty dump truck or larger).

To measure traffic volume and the temporal distribution of trips at both facilities, DVRPC collected data on adjacent access roads for a week using an automated traffic device. The device was capable of detecting the types of vehicles that use the facilities. The results have been aggregated and trips involving large trucks have been broken out from total trips by all vehicles.

Traffic Volume and Large Trucks

Approximately 2,000 vehicles use the Transfer Station per week. The arrival and departure are separate trips, so the facility generates approximately 4,000 trips per week. Of these, approximately 1,600 trips, or 40 percent, are large trucks. These consist primarily of municipal trash trucks and transfer trailers. The other 2,400 vehicles are referred to as "non-exempt" vehicles and include, for example, pickup trucks.

Mercer Group generates far more traffic than the Transfer Station, approximately 7,000 trips per week, but the number of trips involving large trucks is also approximately 1,600 trips. Those trips represent 22 percent of total trips at the facility. Figure 19 on page 68 shows trip generation at the Transfer Station and Mercer Group during the week that data was collected.

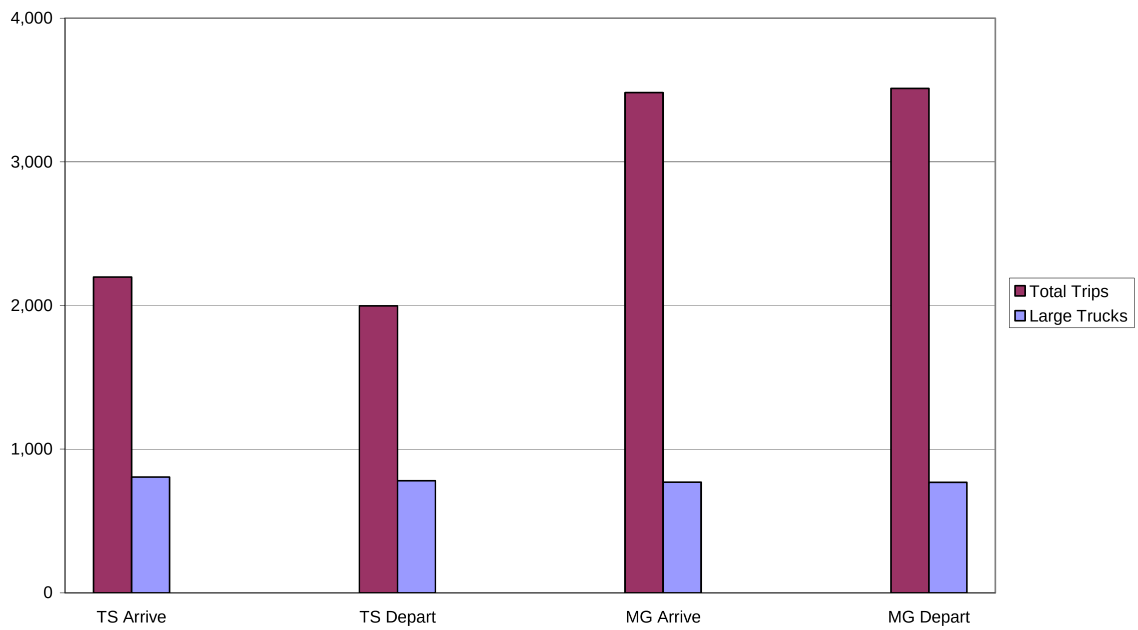
Temporal Distribution of Trips

The data collected on large trucks was analyzed to determine whether the use of the facility followed a pattern. Activity is highest on Monday at Mercer Group and declines steadily during the week. The Transfer Station is somewhat more active Monday through Wednesday, but the distribution of trips is pretty even during the week. Volume falls off significantly on Saturdays at both facilities.

The pattern during the day was more pronounced. Much of the activity at the

Transfer Station is between 6 AM and 3 PM. After 3 PM, activity falls off sharply; and after 6 PM, there are almost no trips. The same temporal distribution is seen

Figure 19: TRANSFER STATION AND MERCER GROUP: ARRIVALS AND DEPARTURES, WEEKLY



Source: DVRPC, July 2007

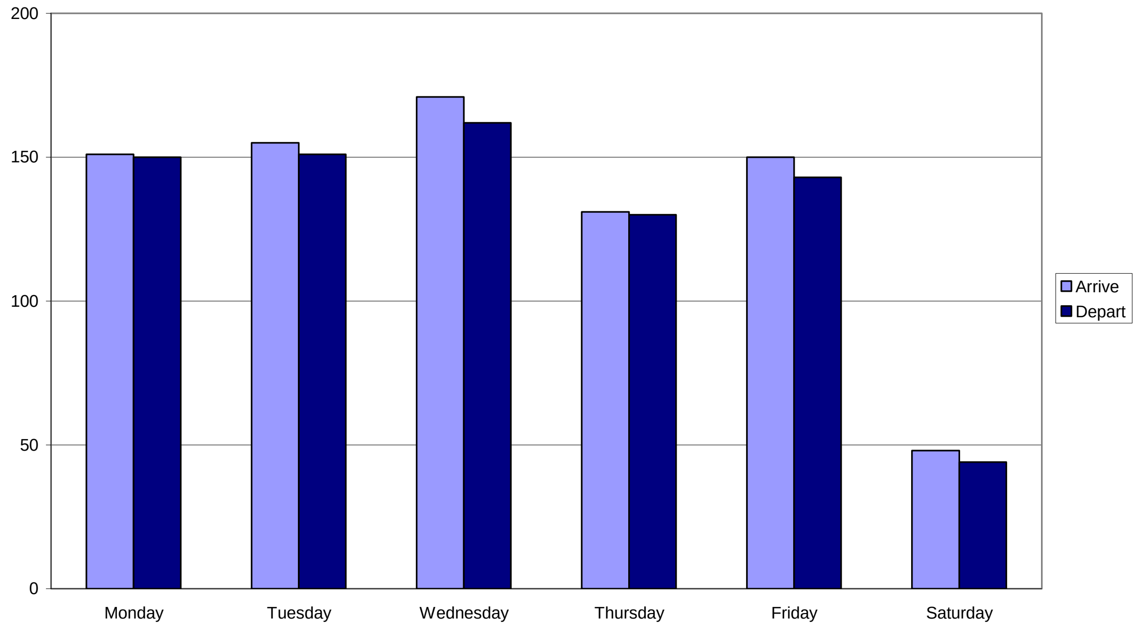
at Mercer Group as well, despite its 24 hour operation. Figures 20 and 21 on page 69 show large truck arrivals and departures broken up by day of week. Figures 22 and 23 on page 70 show large truck arrivals and departures by time of day.

Truck Routes

Within Mercer Crossings, large trucks travel different routes to access the Transfer Station and Mercer Group. The only common element is the section of N. Olden Avenue between New York Avenue, where trucks use the Route 1 on- and off-ramps, and Princeton Avenue. That section of N. Olden Avenue is residential.

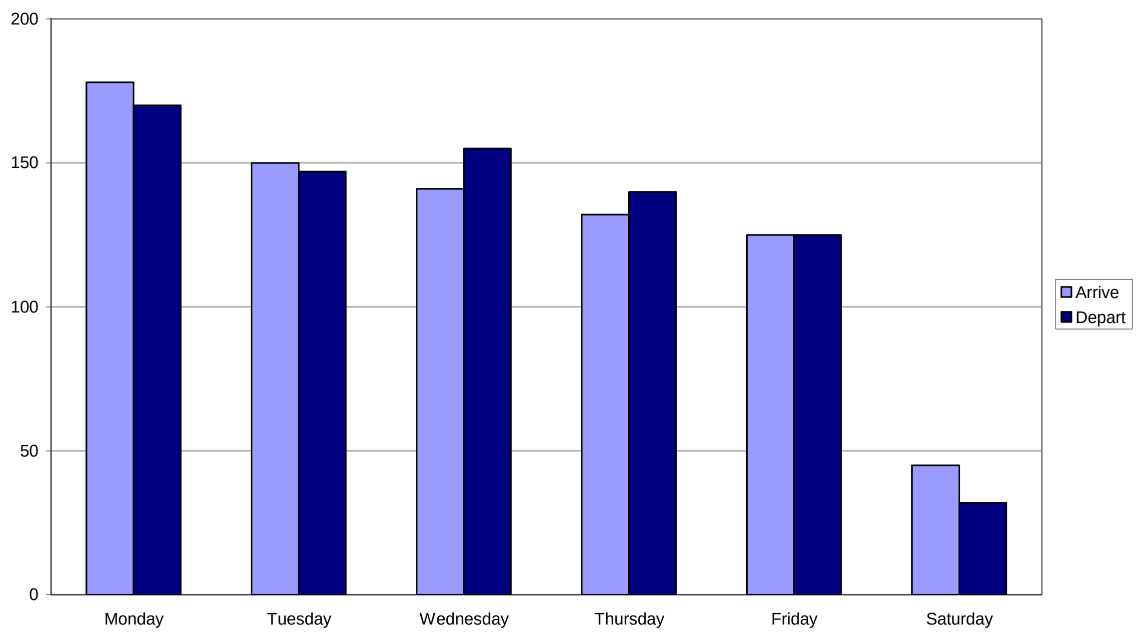
Large trucks bound for the Transfer Station continue on N. Olden Avenue, but the uses are retail between Princeton Avenue and the Transfer Station driveway near Arctic Parkway. However, a small number of large trucks follow Route 31, which also takes them past residential neighborhoods, to N. Olden Avenue and approach the Transfer Station from the west.

Figure 20: TRANSFER STATION: LARGE TRUCKS, ARRIVALS AND DEPARTURES, BY DAY OF WEEK



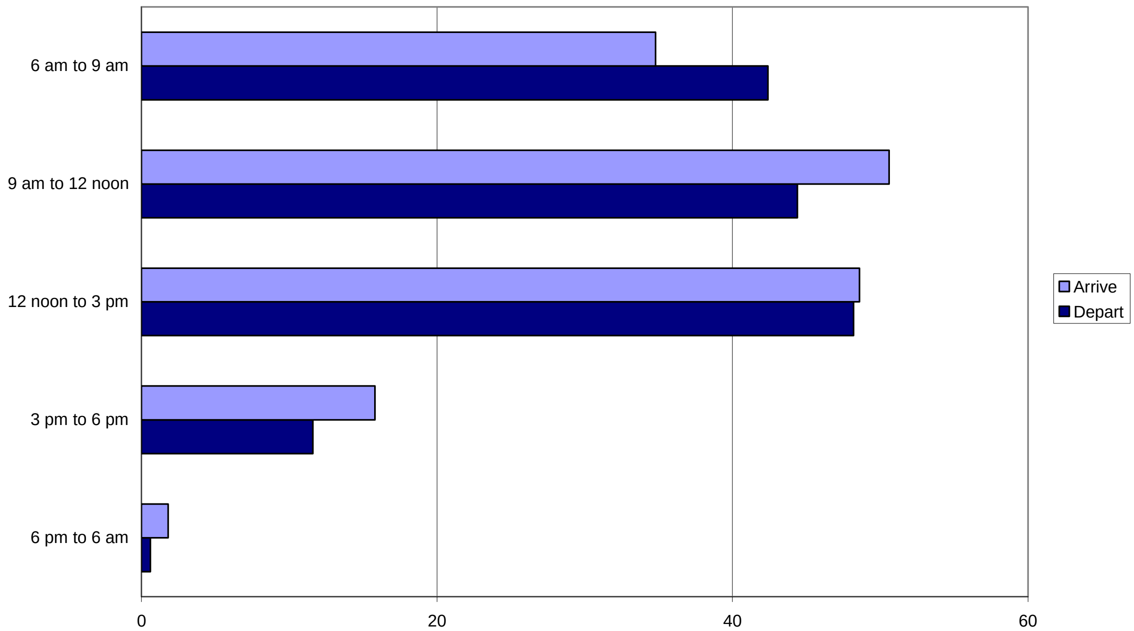
Source: DVRPC, July 2007

Figure 21: MERCER GROUP: LARGE TRUCKS, ARRIVALS AND DEPARTURES, BY DAY OF WEEK



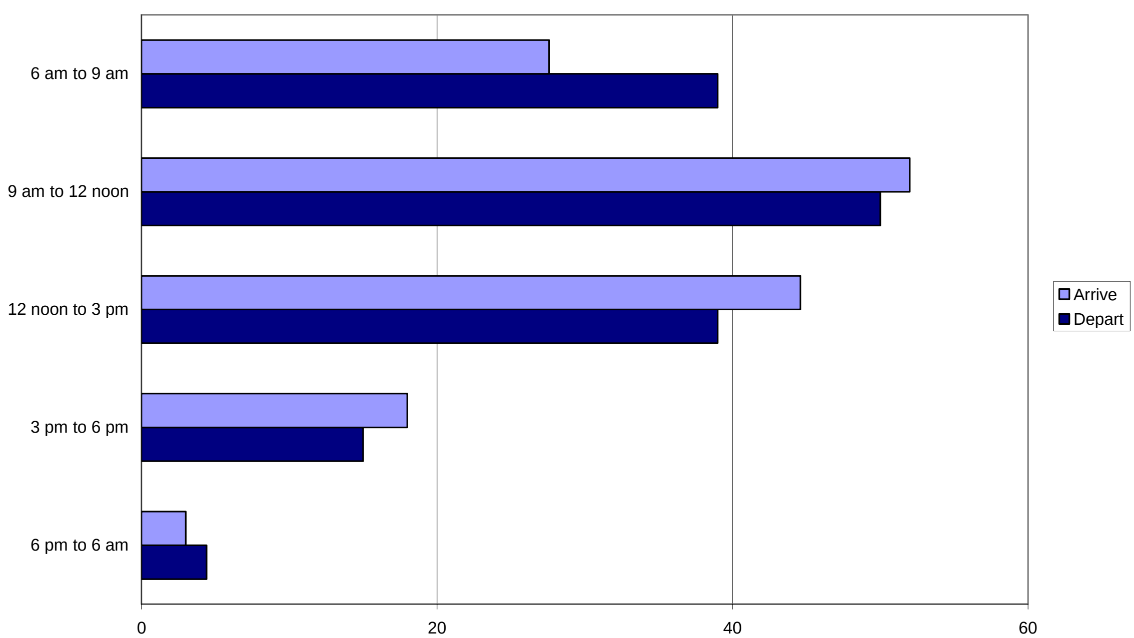
Source: DVRPC, July 2007

Figure 22: TRANSFER STATION: LARGE TRUCKS, ARRIVALS AND DEPARTURES, BY TIME OF DAY (AVERAGE WEEKDAY)



Source: DVRPC, July 2007

Figure 23: MERCER GROUP: LARGE TRUCKS, ARRIVALS AND DEPARTURES, BY TIME OF DAY (AVERAGE WEEKDAY)



Source: DVRPC, July 2007

Large trucks bound for Mercer Group turn left from N. Olden Avenue onto Princeton Avenue, which becomes MLK Boulevard and which they follow to Calhoun Street and then Kirkbride Avenue. There are residential neighborhoods on MLK Boulevard and on Calhoun Street south of Kirkbride Avenue. Approximately 25 percent of large trucks approach Mercer Group from the south, also on Calhoun Street. Figure 24 on page 73 shows Mercer Crossings truck routes.

Improvement Strategies

Four proposals for reducing the impact of truck traffic en route to one or both of the facilities have been researched. A brief description and assessment of each improvement strategy follows.

Common Gate An unknown number of trips generated by each facility are combination trips, also accessing the other facility. These trips are made on the local street network but because the facilities abut each other it has been suggested that a common gate and roadway be constructed to accommodate them. Although it would be physically possible to move between the facilities, Mercer Group has objected because the proposed route would go through their scrap metal operations. Their insurer has informed them that there is a liability issue.

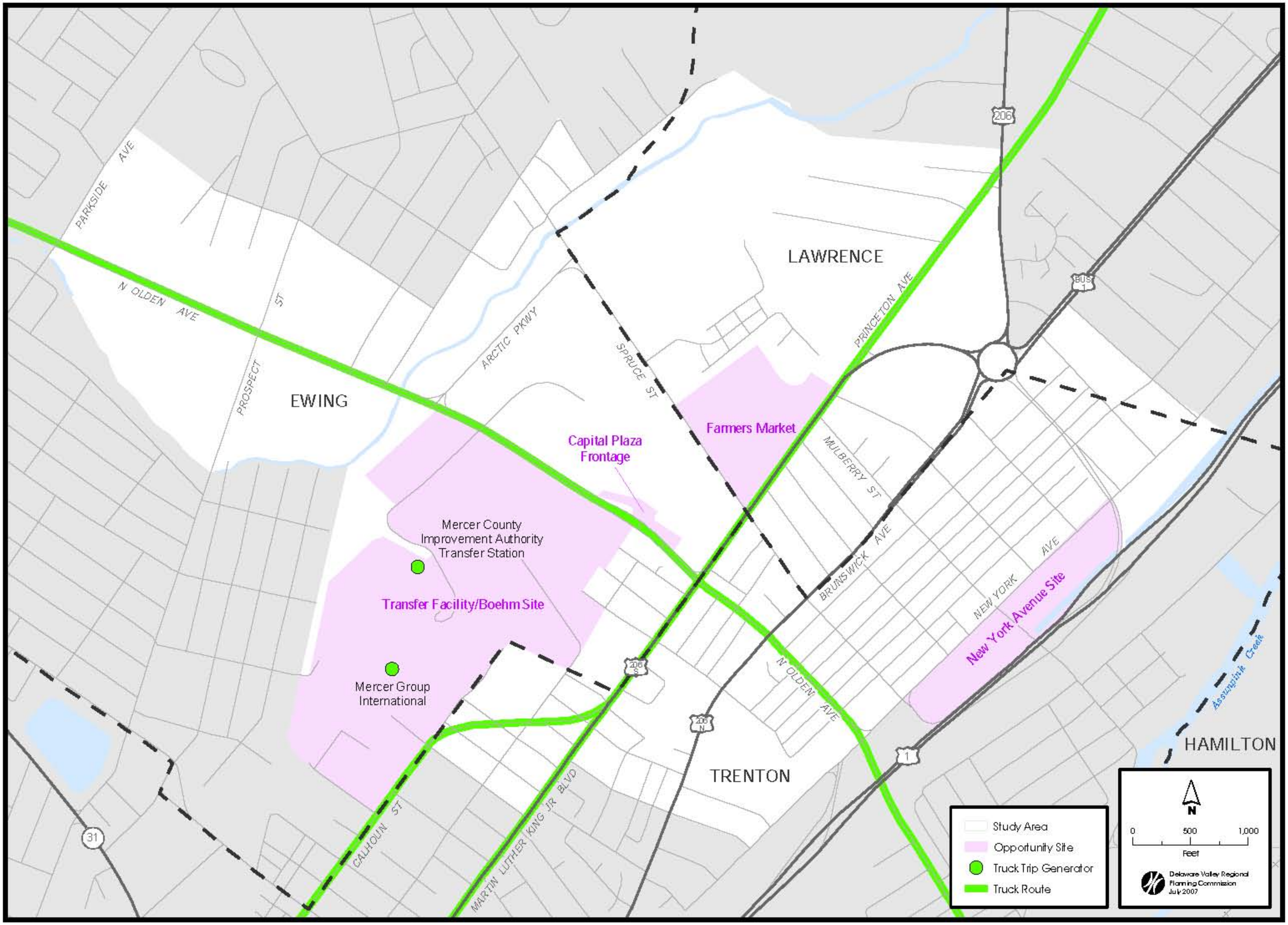
Back Gate There is a back gate on Stokes Avenue that currently provides secondary access to the Transfer Station. It has been suggested that some trips be re-routed to the back gate to provide relief to residents. There are no legal restrictions that would prevent use of the back gate, but there may be practical reasons to avoid it. Stokes Avenue and other local streets that would be on the route are narrow and although most of the uses on the west end of the Transfer Station are commercial, some are residential. Moreover, traffic would continue to pass by the residential neighborhoods on N. Olden Avenue.

Johnson Trolley Line The former Johnson Trolley right of way crosses N. Olden Avenue around 6th Street and runs parallel to the east edge of the Transfer Station property. It has been proposed that the right of way be converted to a road, which would provide alternate access to Mercer Group. A visual survey of the right of way indicates that it crosses a number of lots occupied by different businesses. It is also possible that a car dealership has purchased a section of the right of way outright. The legal status of the right of way is unknown, although it does not appear in an abandoned railroad inventory published in 1997 by DVRPC.

Trenton Industrial Track Spur The Trenton Industrial Track spur right of way runs by Capital Heath Systems, Fuld Campus, crosses MLK Boulevard, and continues south of Father Rocco Park before terminating on the Mercer Group property. A section of the spur has been paved over to construct a parking lot behind the hospital. While freight rail might be an alternative for reducing truck traffic, it would likely handle only a fraction of materials shipments, outbound only, and only to materials processors also on freight lines. In addition, restoring the rail line would require complex cost-sharing agreements, right of way acquisition, and major capital funding. If rail access were desirable, it would be better to relocate one or both facilities to an active rail spur.

None of the improvement strategies, short-term or long-term, appear to offer much promise for reducing the impacts of large truck traffic on residential neighborhoods in Mercer Crossings.

Figure 24: TRUCK TRIP GENERATORS AND TRUCK ROUTES



Chapter 6 – Recommendations

This chapter presents a summary of the Mercer Crossings Transportation Study recommendations. Detailed recommendations are outlined in each chapter of the report. As was noted in the introduction, much of this study is devoted to major Mercer Crossings roadways, specifically to assessing whether they would support redevelopment of Mercer Crossings and, if not, the improvements necessary to move them toward that goal.

N. Olden Avenue To successfully redevelop Mercer Crossings, traffic congestion on N. Olden Avenue between Princeton Avenue and New York Avenue must be reduced. The capacity of the roadway is already taxed and additional traffic could cause it to fail. Most improvement on N. Olden Avenue will come from improving the performance and safety of the Princeton Avenue and New York Avenue intersections.

Princeton Avenue
On westbound N. Olden Avenue, the focus should be improving traffic flow. On eastbound N. Olden Avenue, the focus should be improving the safety of the merge area. In addition, to increase the safety of pedestrians using the northside Princeton Avenue crosswalk, a pedestrian phase should be added to the traffic signal.

New York Avenue
The priority at this intersection should be improving the safety of the Route 1 off-ramp. However, these improvements should be postponed until the work at Princeton Avenue is completed since they depend on improved traffic flow on westbound N. Olden Avenue. To increase the safety of pedestrians using the northside New York Avenue crosswalk, a pedestrian phase should be added to the traffic signal.

Spruce Street Analysis in this study shows that traffic volumes on Spruce Street are now near the threshold for a “road diet” to work without diminishing traffic flow on the segment. While dropping a travel lane in each direction may still have positive effects on safety, it may negatively affect mobility. Before implementing a road diet on this segment, this study recommends that some of the unknowns be dealt with by performing a forecast of future travel demand on Spruce Street. The traffic modeling should include the potentially mitigating effects of driveway access management and additional traffic control.

The most important unknown is the new Wal-Mart. Its effect on Spruce Street traffic should be determined. Finally, the possibility that the proposed road diet would have to be abandoned should be anticipated and contingency plans developed.

Two problems require attention:

- High crash rates at the Halo Farm and Farmers Market Spruce Street driveways; and
- Severe delays at Tiffany Woods Road. Delays are projected to become much worse if the new Wal-Mart is built.

Strategies for dealing with each of these problems have been identified in this report. The preferred strategy is to install a traffic signal that would serve Halo Farm and the Farmers Market. The best location may be opposite the Capital Plaza driveway, which would maximize its benefits by also serving mall traffic. A short access road connecting Tiffany Woods neighborhood and the traffic signal could also be constructed.

Calhoun Street Extension The Calhoun Street Extension is the best opportunity to implement the vision of a “calmer urban street atmosphere” proposed in the ULI study. It has the potential to stimulate redevelopment of vacant or under-utilized land at the Boehm site, Capital Plaza, and the Farmers Market.

The most benefit would come from building the complete alignment. However, Lawrence Township has expressed concern about the section north of Spruce Street, which lies within its boundaries.

Therefore, the best means of moving forward may be to concentrate on the section of the CSE south of N. Olden Avenue. Construction of that section as a stand-alone project would increase the attractiveness of the Boehm site and adjacent parcels on Princess Diana Drive. It would also provide an alternate route for large truck traffic, drawing it away from neighborhoods on MLK Boulevard and Calhoun Street, where the noise and vibrations disturb residents; and also drawing it away from the substandard N. Olden Avenue/ Princeton Avenue intersection, which was not designed to accommodate it.

Truck Traffic in Residential Neighborhoods Four proposals for the diversion of large truck traffic bound for the Transfer Station or Mercer Group facilities have been researched. None of the improvement strategies, short-term or long-term, appear to offer much promise for reducing the impacts of large truck traffic on residential neighborhoods in Mercer Crossings. It is far more likely that, as the price of fuel increases due to constraints on world petroleum production, one or both of the facilities would move to a railroad spur to reduce their costs.

Appendix A – Traffic Assignment Methodology in Calhoun Street Extension Model

The Calhoun Street Extension (CSE) model includes only relevant major streets: Calhoun Street, MLK Boulevard, Princeton Avenue, Arctic Parkway, N. Olden Avenue, Spruce Street, and Mulberry Street. These streets carry the bulk of Mercer Crossings traffic in the vicinity of the proposed CSE alignment.

Two types of data were used in the analysis of the CSE:

1) Peak period turning movement counts at major intersections; and
2) Daily traffic volume counts on parallel roadways and cross-streets.

The count locations are listed in Chapter 4 of this document.

Five CSE scenarios have been modeled. Three scenarios assume that individual sections of the alignment are built as stand-alone projects. The two other scenarios assume that the complete alignment is built. The five scenarios are described in detail in Chapter 4 of this document.

To determine travel demand under each scenario, the CSE was added to the local road network and trips manually assigned to it.

The building blocks of the model are the three sections of the CSE. The individual sections have been analyzed separately. Northbound travel and southbound travel have also been analyzed separately. For each section and direction of travel, two questions were asked:

1) How many vehicles could use the CSE to complete their trips?
2) Of these, how many would?

The answer to the second question was limited to five possibilities: 0 percent, 25 percent, 50 percent, 75 percent, or 100 percent. Manual assignment was based on a qualitative judgment of the relative travel speeds of existing travel routes and the CSE. Although no formal iterative method was followed, traffic was "loaded" onto the CSE in 25 percent increments. After each loading, the relative travel speed of the two routes was re-evaluated to account for the subtraction of traffic from existing routes and the addition of traffic on the CSE.

The complete CSE was modeled as a composite of the individual sections. Then the effect of through trips was factored in. To model through trips, for each direction of travel, the same two questions were asked:

1) How many vehicles could use the CSE to complete their trips?
2) Of these, how many would?

The answer to the second question was again limited to five possibilities:
0 percent, 25 percent, 50 percent, 75 percent, or 100 percent.

Appendix B – SYNCHRO Summary Printouts

Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3355	0	1736	3265	0	0	3434	0	0	3328	0
Flt Permitted		0.869		0.098				0.638			0.806	
Satd. Flow (perm)	0	2925	0	179	3265	0	0	2229	0	0	2699	0
Satd. Flow (RTOR)		4			30			13			140	
Volume (vph)	67	987	33	198	433	74	184	297	47	55	222	156
Lane Group Flow (vph)	0	1182	0	215	551	0	0	574	0	0	471	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		2		1	6			4			8	
Permitted Phases	2			6			4			8		
Total Split (s)	41.0	41.0	0.0	11.0	52.0	0.0	41.0	41.0	0.0	41.0	41.0	0.0
Act Effct Green (s)		37.0		48.0	48.0			37.0			37.0	
Actuated g/C Ratio		0.40		0.52	0.52			0.40			0.40	
v/c Ratio		1.01		1.02	0.32			0.64			0.41	
Control Delay		58.8		90.9	12.9			26.1			15.0	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		58.8		90.9	12.9			26.1			15.0	
LOS		E		F	B			C			B	
Approach Delay		58.8			34.8			26.1			15.0	
Approach LOS		E			C			C			B	

Intersection Summary

Cycle Length: 93

Actuated Cycle Length: 93

Control Type: Semi Act-Uncoord

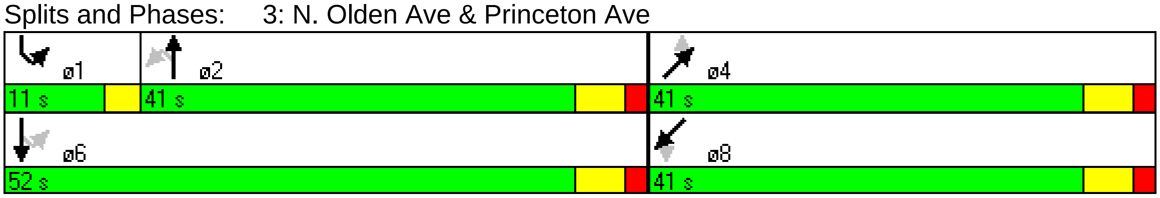
Maximum v/c Ratio: 1.02

Intersection Signal Delay: 39.5 | Intersection LOS: D

Intersection Capacity Utilization 131.1% | ICU Level of Service H

Analysis Period (min) 15

Splits and Phases: 3: N. Olden Ave & Princeton Ave

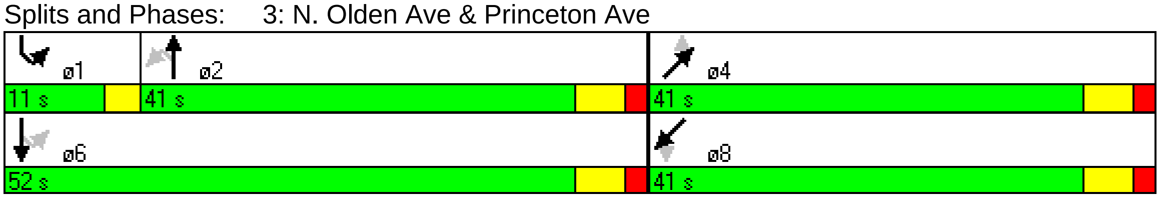


Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3558	0	1805	3532	0	0	3441	0	0	3378	0
Flt Permitted		0.835		0.258				0.602			0.657	
Satd. Flow (perm)	0	2983	0	490	3532	0	0	2103	0	0	2244	0
Satd. Flow (RTOR)		7			26			13			51	
Volume (vph)	54	544	31	221	528	77	159	310	44	119	302	128
Lane Group Flow (vph)	0	684	0	240	658	0	0	558	0	0	596	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		2		1	6			4			8	
Permitted Phases	2			6			4			8		
Total Split (s)	41.0	41.0	0.0	11.0	52.0	0.0	41.0	41.0	0.0	41.0	41.0	0.0
Act Effct Green (s)		37.0		48.0	48.0			37.0			37.0	
Actuated g/C Ratio		0.40		0.52	0.52			0.40			0.40	
v/c Ratio		0.57		0.68	0.36			0.66			0.65	
Control Delay		24.0		24.6	13.5			26.9			24.5	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		24.0		24.6	13.5			26.9			24.5	
LOS		C		C	B			C			C	
Approach Delay		24.0			16.4			26.9			24.5	
Approach LOS		C			B			C			C	

Intersection Summary

Cycle Length: 93
Actuated Cycle Length: 93
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 22.2 Intersection LOS: C
Intersection Capacity Utilization 130.0% ICU Level of Service H
Analysis Period (min) 15

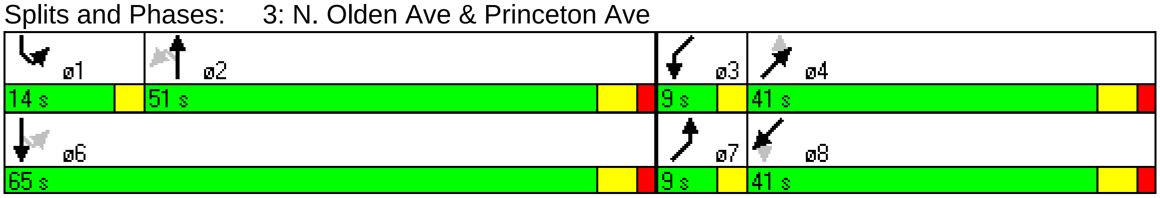
Splits and Phases: 3: N. Olden Ave & Princeton Ave



Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3355	0	1736	3265	0	1770	1825	0	1770	1747	0
Flt Permitted		0.863		0.078			0.252			0.299		
Satd. Flow (perm)	0	2904	0	142	3265	0	469	1825	0	557	1747	0
Satd. Flow (RTOR)		3			25			7			33	
Volume (vph)	67	987	33	198	433	74	184	297	47	55	222	156
Lane Group Flow (vph)	0	1182	0	215	551	0	200	374	0	60	411	0
Turn Type	Perm			pm+pt			pm+pt			pm+pt		
Protected Phases		2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Total Split (s)	51.0	51.0	0.0	14.0	65.0	0.0	9.0	41.0	0.0	9.0	41.0	0.0
Act Effct Green (s)		47.0		61.0	61.0		42.1	37.1		41.9	37.0	
Actuated g/C Ratio		0.41		0.53	0.53		0.37	0.32		0.36	0.32	
v/c Ratio		0.99		1.00	0.32		0.88	0.63		0.24	0.70	
Control Delay		59.0		92.2	15.1		65.2	38.2		24.0	38.9	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		59.0		92.2	15.1		65.2	38.2		24.0	38.9	
LOS		E		F	B		E	D		C	D	
Approach Delay		59.0			36.7			47.6			37.0	
Approach LOS		E			D			D			D	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 115	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.00	
Intersection Signal Delay: 47.7	Intersection LOS: D
Intersection Capacity Utilization 112.1%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 3: N. Olden Ave & Princeton Ave

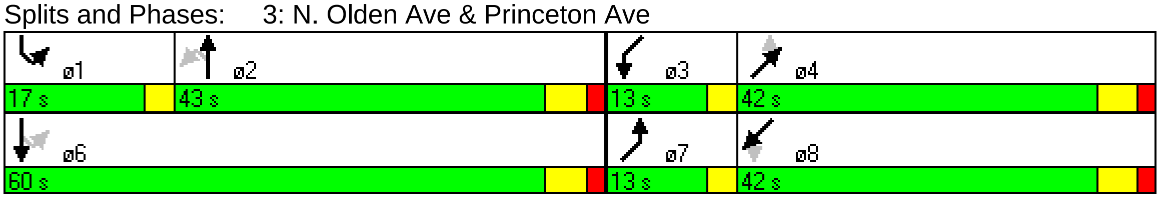


Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3324	0	1736	3272	0	1770	1827	0	1770	1779	0
Flt Permitted		0.825		0.219			0.196			0.296		
Satd. Flow (perm)	0	2753	0	400	3272	0	365	1827	0	551	1779	0
Satd. Flow (RTOR)		5			20			7			20	
Volume (vph)	54	544	31	221	528	77	159	310	44	119	302	128
Lane Group Flow (vph)	0	684	0	240	658	0	173	385	0	129	467	0
Turn Type	Perm			pm+pt			pm+pt			pm+pt		
Protected Phases		2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Total Split (s)	43.0	43.0	0.0	17.0	60.0	0.0	13.0	42.0	0.0	13.0	42.0	0.0
Act Effct Green (s)		37.8		53.8	53.8		47.2	38.5		46.2	38.0	
Actuated g/C Ratio		0.34		0.48	0.48		0.42	0.34		0.41	0.34	
v/c Ratio		0.74		0.72	0.42		0.66	0.61		0.41	0.76	
Control Delay		38.5		31.2	19.4		33.3	35.8		23.0	41.5	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		38.5		31.2	19.4		33.3	35.8		23.0	41.5	
LOS		D		C	B		C	D		C	D	
Approach Delay		38.5			22.6			35.0			37.5	
Approach LOS		D			C			C			D	

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 112.5
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 32.4 — Intersection LOS: C
Intersection Capacity Utilization 109.6% — ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 3: N. Olden Ave & Princeton Ave

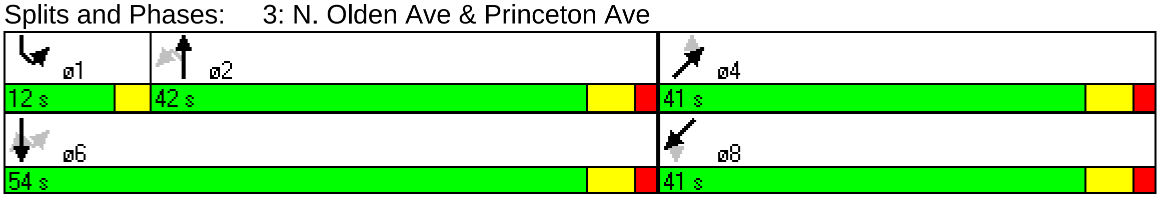


Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3355	0	1736	1743	1568	0	3434	0	0	3328	0
Flt Permitted		0.883		0.095				0.636			0.799	
Satd. Flow (perm)	0	2972	0	174	1743	1568	0	2222	0	0	2675	0
Satd. Flow (RTOR)		4				80		13			135	
Volume (vph)	67	987	33	198	433	74	184	297	47	55	222	156
Lane Group Flow (vph)	0	1182	0	215	471	80	0	574	0	0	471	0
Turn Type	Perm			pm+pt		Perm	Perm			Perm		
Protected Phases		2		1	6			4			8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	42.0	42.0	0.0	12.0	54.0	54.0	41.0	41.0	0.0	41.0	41.0	0.0
Act Effct Green (s)		38.0		50.0	50.0	50.0		37.0			37.0	
Actuated g/C Ratio		0.40		0.53	0.53	0.53		0.39			0.39	
v/c Ratio		0.99		0.96	0.51	0.09		0.66			0.42	
Control Delay		53.7		74.4	17.1	3.0		27.6			16.0	
Queue Delay		0.0		0.0	0.0	0.0		0.0			0.0	
Total Delay		53.7		74.4	17.1	3.0		27.6			16.0	
LOS		D		E	B	A		C			B	
Approach Delay		53.7			31.7			27.6			16.0	
Approach LOS		D			C			C			B	

Intersection Summary

Cycle Length: 95
Actuated Cycle Length: 95
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 37.1	Intersection LOS: D
Intersection Capacity Utilization 131.1%	ICU Level of Service H
Analysis Period (min) 15

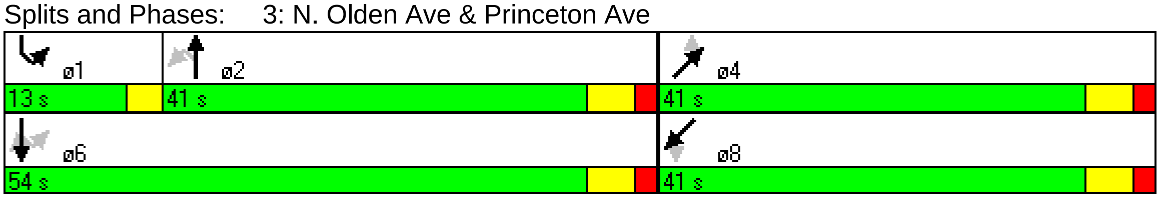
Splits and Phases: 3: N. Olden Ave & Princeton Ave



Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3324	0	1736	1743	1568	0	3441	0	0	3378	0
Flt Permitted		0.852		0.253				0.599			0.652	
Satd. Flow (perm)	0	2843	0	462	1743	1568	0	2092	0	0	2227	0
Satd. Flow (RTOR)		6				84		12			49	
Volume (vph)	54	544	31	221	528	77	159	310	44	119	302	128
Lane Group Flow (vph)	0	684	0	240	574	84	0	558	0	0	596	0
Turn Type	Perm			pm+pt		Perm	Perm			Perm		
Protected Phases		2		1	6			4			8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	41.0	41.0	0.0	13.0	54.0	54.0	41.0	41.0	0.0	41.0	41.0	0.0
Act Effct Green (s)		37.0		49.7	49.7	49.7		37.0			37.0	
Actuated g/C Ratio		0.39		0.52	0.52	0.52		0.39			0.39	
v/c Ratio		0.61		0.67	0.63	0.10		0.68			0.66	
Control Delay		25.9		22.7	19.8	2.9		28.5			26.0	
Queue Delay		0.0		0.0	0.0	0.0		0.0			0.0	
Total Delay		25.9		22.7	19.8	2.9		28.5			26.0	
LOS		C		C	B	A		C			C	
Approach Delay		25.9			19.0			28.5			26.0	
Approach LOS		C			B			C			C	

Intersection Summary	
Cycle Length: 95	
Actuated Cycle Length: 94.7	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.68	
Intersection Signal Delay: 24.2	Intersection LOS: C
Intersection Capacity Utilization 130.0%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 3: N. Olden Ave & Princeton Ave

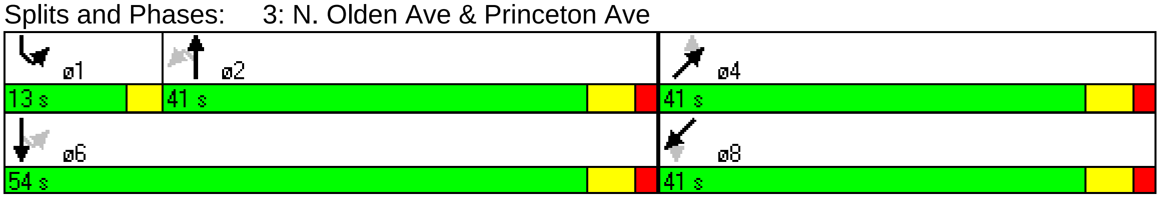


Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3399	0	1736	3297	0	0	3430	0	0	3153	0
Flt Permitted		0.938		0.098				0.836			0.852	
Satd. Flow (perm)	0	3191	0	179	3297	0	0	2891	0	0	2708	0
Satd. Flow (RTOR)		4			8			25			258	
Volume (vph)	21	1035	33	198	440	21	44	176	40	55	56	237
Lane Group Flow (vph)	0	1184	0	215	501	0	0	282	0	0	379	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		2		1	6			4			8	
Permitted Phases	2			6			4			8		
Total Split (s)	41.0	41.0	0.0	13.0	54.0	0.0	41.0	41.0	0.0	41.0	41.0	0.0
Act Effct Green (s)		37.0		50.0	50.0			37.0			37.0	
Actuated g/C Ratio		0.39		0.53	0.53			0.39			0.39	
v/c Ratio		0.95		0.89	0.29			0.25			0.31	
Control Delay		45.2		56.7	12.9			18.5			7.2	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		45.2		56.7	12.9			18.5			7.2	
LOS		D		E	B			B			A	
Approach Delay		45.2			26.0			18.5			7.2	
Approach LOS		D			C			B			A	

Intersection Summary

Cycle Length: 95
Actuated Cycle Length: 95
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 31.3 Intersection LOS: C
Intersection Capacity Utilization 123.2% ICU Level of Service H
Analysis Period (min) 15

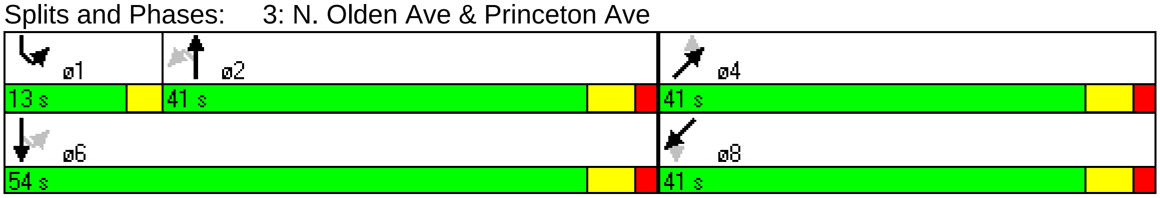
Splits and Phases: 3: N. Olden Ave & Princeton Ave



Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3578	0	1805	3586	0	0	3437	0	0	3196	0
Flt Permitted		0.932		0.253				0.922			0.793	
Satd. Flow (perm)	0	3338	0	481	3586	0	0	3178	0	0	2568	0
Satd. Flow (RTOR)		6			6			31			274	
Volume (vph)	16	582	31	221	538	22	11	149	34	119	74	252
Lane Group Flow (vph)	0	684	0	240	609	0	0	211	0	0	483	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		2		1	6			4			8	
Permitted Phases	2			6			4			8		
Total Split (s)	41.0	41.0	0.0	13.0	54.0	0.0	41.0	41.0	0.0	41.0	41.0	0.0
Act Effct Green (s)		37.0		49.7	49.7			37.0			37.0	
Actuated g/C Ratio		0.39		0.52	0.52			0.39			0.39	
v/c Ratio		0.52		0.64	0.32			0.17			0.41	
Control Delay		23.7		21.1	13.3			16.5			9.8	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		23.7		21.1	13.3			16.5			9.8	
LOS		C		C	B			B			A	
Approach Delay		23.7			15.5			16.5			9.8	
Approach LOS		C			B			B			A	

Intersection Summary	
Cycle Length: 95	
Actuated Cycle Length: 94.7	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay: 16.9	Intersection LOS: B
Intersection Capacity Utilization 130.0%	ICU Level of Service H
Analysis Period (min) 15	

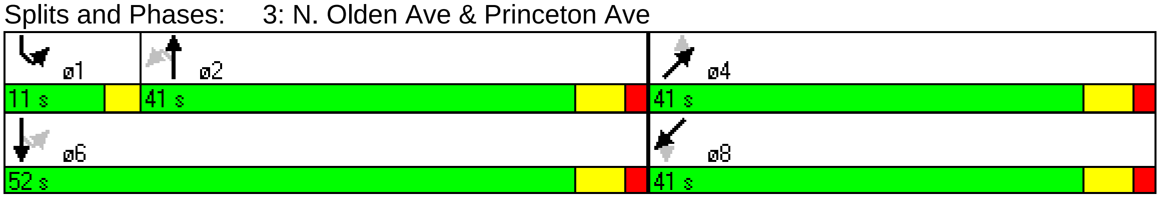
Splits and Phases: 3: N. Olden Ave & Princeton Ave



Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3400	0	1736	3297	0	0	3458	0	0	3230	0
Flt Permitted		0.940		0.098				0.842			0.853	
Satd. Flow (perm)	0	3199	0	179	3297	0	0	2929	0	0	2771	0
Satd. Flow (RTOR)		4			8			18			222	
Volume (vph)	19	1035	33	239	440	21	44	256	40	55	141	237
Lane Group Flow (vph)	0	1182	0	260	501	0	0	369	0	0	471	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		2		1	6			4			8	
Permitted Phases	2			6			4			8		
Total Split (s)	41.0	41.0	0.0	11.0	52.0	0.0	41.0	41.0	0.0	41.0	41.0	0.0
Act Effct Green (s)		37.0		48.0	48.0			37.0			37.0	
Actuated g/C Ratio		0.40		0.52	0.52			0.40			0.40	
v/c Ratio		0.93		1.24	0.29			0.31			0.38	
Control Delay		40.4		163.2	13.2			19.2			11.0	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		40.4		163.2	13.2			19.2			11.0	
LOS		D		F	B			B			B	
Approach Delay		40.4			64.4			19.2			11.0	
Approach LOS		D			E			B			B	

Intersection Summary	
Cycle Length: 93	
Actuated Cycle Length: 93	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.24	
Intersection Signal Delay: 39.2	Intersection LOS: D
Intersection Capacity Utilization 127.4%	ICU Level of Service H
Analysis Period (min) 15	

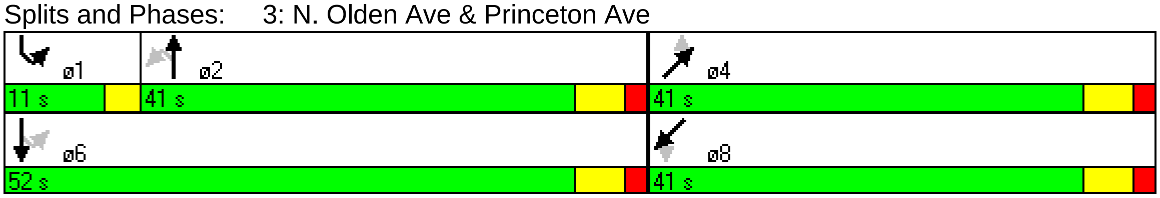
Splits and Phases: 3: N. Olden Ave & Princeton Ave



Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3578	0	1805	3586	0	0	3469	0	0	3259	0
Flt Permitted		0.933		0.256				0.928			0.770	
Satd. Flow (perm)	0	3341	0	486	3586	0	0	3225	0	0	2537	0
Satd. Flow (RTOR)		7			6			18			274	
Volume (vph)	16	586	31	285	538	22	11	246	34	119	178	252
Lane Group Flow (vph)	0	688	0	310	609	0	0	316	0	0	596	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		2		1	6			4			8	
Permitted Phases	2			6			4			8		
Total Split (s)	41.0	41.0	0.0	11.0	52.0	0.0	41.0	41.0	0.0	41.0	41.0	0.0
Act Effct Green (s)		37.0		48.0	48.0			37.0			37.0	
Actuated g/C Ratio		0.40		0.52	0.52			0.40			0.40	
v/c Ratio		0.52		0.89	0.33			0.24			0.51	
Control Delay		22.7		44.7	13.6			18.2			12.5	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		22.7		44.7	13.6			18.2			12.5	
LOS		C		D	B			B			B	
Approach Delay		22.7			24.1			18.2			12.5	
Approach LOS		C			C			B			B	

Intersection Summary	
Cycle Length: 93	
Actuated Cycle Length: 93	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.89	
Intersection Signal Delay: 20.2	Intersection LOS: C
Intersection Capacity Utilization 130.0%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 3: N. Olden Ave & Princeton Ave

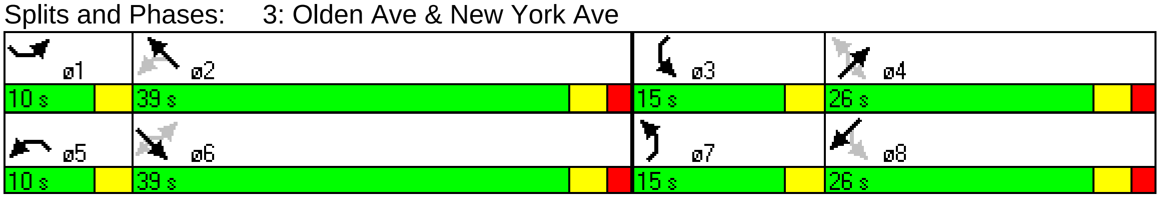


Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1711	1801	1583	1711	1855	0	1711	1863	1636	1770	1807	0
Flt Permitted	0.114			0.505			0.420			0.450		
Satd. Flow (perm)	205	1801	1583	909	1855	0	756	1863	1636	838	1807	0
Satd. Flow (RTOR)			178		2				47		14	
Volume (vph)	68	242	164	172	766	18	466	211	43	94	180	46
Lane Group Flow (vph)	74	263	178	187	853	0	507	229	47	102	246	0
Turn Type	pm+pt		Perm	pm+pt			pm+pt		Perm	pm+pt		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6		6	2			4		4	8		
Total Split (s)	10.0	39.0	39.0	10.0	39.0	0.0	15.0	26.0	26.0	15.0	26.0	0.0
Act Effct Green (s)	40.7	35.1	35.1	41.5	35.5		30.5	20.0	20.0	24.3	16.6	
Actuated g/C Ratio	0.48	0.41	0.41	0.49	0.42		0.36	0.24	0.24	0.29	0.20	
v/c Ratio	0.38	0.35	0.23	0.37	1.10		1.28	0.52	0.11	0.31	0.67	
Control Delay	16.6	19.6	3.8	14.3	88.5		169.3	33.3	9.0	20.3	39.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	16.6	19.6	3.8	14.3	88.5		169.3	33.3	9.0	20.3	39.2	
LOS	B	B	A	B	F		F	C	A	C	D	
Approach Delay		13.7			75.2			119.9			33.6	
Approach LOS		B			E			F			C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 84.8
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.28
Intersection Signal Delay: 71.0 Intersection LOS: E
Intersection Capacity Utilization 96.6% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 3: Olden Ave & New York Ave



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1711	1801	1583	1711	1853	0	1711	1863	1636	1770	1822	0
Flt Permitted	0.121			0.239			0.307			0.530		
Satd. Flow (perm)	218	1801	1583	430	1853	0	553	1863	1636	987	1822	0
Satd. Flow (RTOR)			280		2				75		9	
Volume (vph)	45	443	258	224	767	27	456	175	69	133	251	44
Lane Group Flow (vph)	49	482	280	243	863	0	496	190	75	145	321	0
Turn Type	pm+pt		Perm	pm+pt			pm+pt		Perm	pm+pt		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6		6	2			4		4	8		
Total Split (s)	11.0	37.0	37.0	11.0	37.0	0.0	15.0	27.0	27.0	15.0	27.0	0.0
Act Effct Green (s)	38.8	33.1	33.1	41.3	34.3		32.5	21.8	21.8	28.2	19.5	
Actuated g/C Ratio	0.45	0.38	0.38	0.48	0.40		0.38	0.25	0.25	0.33	0.23	
v/c Ratio	0.25	0.70	0.36	0.79	1.17		1.40	0.41	0.16	0.36	0.77	
Control Delay	15.2	30.0	4.0	35.7	119.4		218.5	30.4	7.6	19.7	43.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	15.2	30.0	4.0	35.7	119.4		218.5	30.4	7.6	19.7	43.6	
LOS	B	C	A	D	F		F	C	A	B	D	
Approach Delay		20.1			101.0			150.7			36.2	
Approach LOS		C			F			F			D	

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 86.6

Control Type: Semi Act-Uncoord

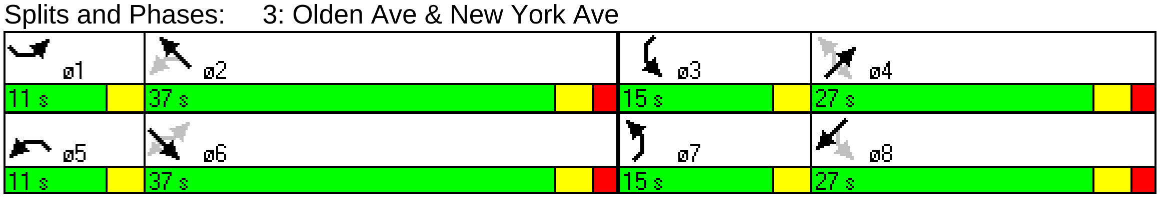
Maximum v/c Ratio: 1.40

Intersection Signal Delay: 82.6 Intersection LOS: F

Intersection Capacity Utilization 99.8% ICU Level of Service F

Analysis Period (min) 15

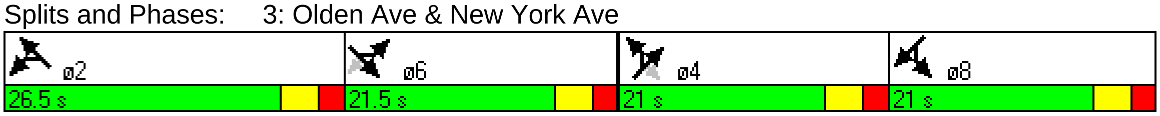
Splits and Phases: 3: Olden Ave & New York Ave



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1711	1801	1583	0	3497	0	1625	1734	1636	1770	1807	0
Flt Permitted	0.950				0.991		0.950	0.980		0.950		
Satd. Flow (perm)	1711	1801	1583	0	3497	0	1625	1734	1636	1770	1807	0
Satd. Flow (RTOR)			178		2				47		13	
Volume (vph)	68	242	164	172	766	18	466	211	43	94	180	46
Lane Group Flow (vph)	74	263	178	0	1040	0	352	384	47	102	246	0
Turn Type	Split		Perm	Split			Split		Perm	Split		
Protected Phases	6	6		2	2		4	4		8	8	
Permitted Phases			6						4			
Total Split (s)	21.5	21.5	21.5	26.5	26.5	0.0	21.0	21.0	21.0	21.0	21.0	0.0
Act Effct Green (s)	16.2	16.2	16.2		22.6		17.1	17.1	17.1	15.3	15.3	
Actuated g/C Ratio	0.19	0.19	0.19		0.26		0.20	0.20	0.20	0.18	0.18	
v/c Ratio	0.23	0.79	0.41		1.15		1.11	1.13	0.13	0.33	0.75	
Control Delay	32.8	52.0	8.1		111.1		118.6	124.7	10.6	34.9	47.8	
Queue Delay	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	32.8	52.0	8.1		111.1		118.6	124.7	10.6	34.9	47.8	
LOS	C	D	A		F		F	F	B	C	D	
Approach Delay		34.1			111.1			115.1			44.0	
Approach LOS		C			F			F			D	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 87.2	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.15	
Intersection Signal Delay: 88.8	Intersection LOS: F
Intersection Capacity Utilization 83.5%	ICU Level of Service E
Analysis Period (min) 15	

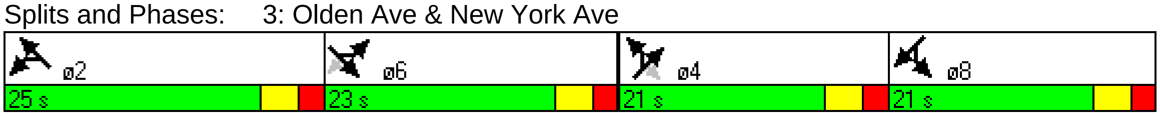
Splits and Phases: 3: Olden Ave & New York Ave



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1711	1801	1583	0	3486	0	1625	1729	1636	1770	1822	0
Flt Permitted	0.950				0.989		0.950	0.977		0.950		
Satd. Flow (perm)	1711	1801	1583	0	3486	0	1625	1729	1636	1770	1822	0
Satd. Flow (RTOR)			265		3				75		9	
Volume (vph)	45	443	258	224	767	27	456	175	69	133	251	44
Lane Group Flow (vph)	49	482	280	0	1106	0	329	357	75	145	321	0
Turn Type	Split		Perm	Split			Split		Perm	Split		
Protected Phases	6	6		2	2		4	4		8	8	
Permitted Phases			6						4			
Total Split (s)	23.0	23.0	23.0	25.0	25.0	0.0	21.0	21.0	21.0	21.0	21.0	0.0
Act Effct Green (s)	19.0	19.0	19.0		21.0		17.0	17.0	17.0	17.0	17.0	
Actuated g/C Ratio	0.21	0.21	0.21		0.23		0.19	0.19	0.19	0.19	0.19	
v/c Ratio	0.14	1.27	0.52		1.36		1.07	1.09	0.20	0.43	0.91	
Control Delay	30.1	172.6	8.7		198.3		108.9	113.3	9.3	37.0	67.3	
Queue Delay	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	30.1	172.6	8.7		198.3		108.9	113.3	9.3	37.0	67.3	
LOS	C	F	A		F		F	F	A	D	E	
Approach Delay		107.4			198.3			101.1			57.8	
Approach LOS		F			F			F			E	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.36	
Intersection Signal Delay: 130.5	Intersection LOS: F
Intersection Capacity Utilization 98.3%	ICU Level of Service F
Analysis Period (min) 15	

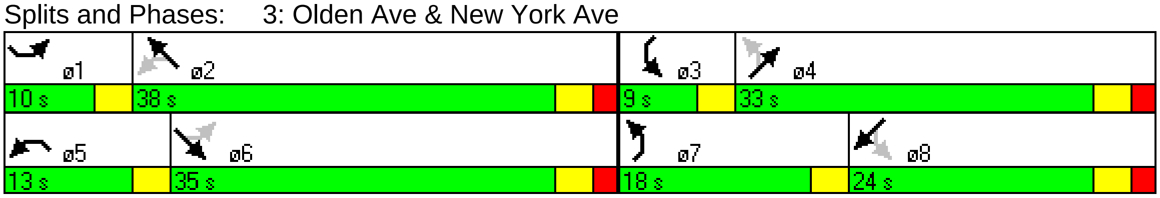
Splits and Phases: 3: Olden Ave & New York Ave



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1711	3213	0	1711	3525	0	3319	1814	0	1770	1807	0
Flt Permitted	0.207			0.383			0.326			0.590		
Satd. Flow (perm)	373	3213	0	690	3525	0	1139	1814	0	1099	1807	0
Satd. Flow (RTOR)		178			3			12			13	
Volume (vph)	68	242	164	172	766	18	466	211	43	94	180	46
Lane Group Flow (vph)	74	441	0	187	853	0	507	276	0	102	246	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6			2			4			8		
Total Split (s)	10.0	35.0	0.0	13.0	38.0	0.0	18.0	33.0	0.0	9.0	24.0	0.0
Act Effct Green (s)	28.0	22.3		32.5	24.6		30.9	21.9		20.1	15.0	
Actuated g/C Ratio	0.38	0.30		0.44	0.33		0.42	0.30		0.27	0.20	
v/c Ratio	0.30	0.40		0.45	0.73		0.61	0.51		0.30	0.65	
Control Delay	15.9	13.5		16.6	26.2		18.9	25.1		18.7	36.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	15.9	13.5		16.6	26.2		18.9	25.1		18.7	36.4	
LOS	B	B		B	C		B	C		B	D	
Approach Delay		13.9			24.5			21.1			31.2	
Approach LOS		B			C			C			C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 74.1	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 22.3	Intersection LOS: C
Intersection Capacity Utilization 64.4%	ICU Level of Service C
Analysis Period (min) 15	

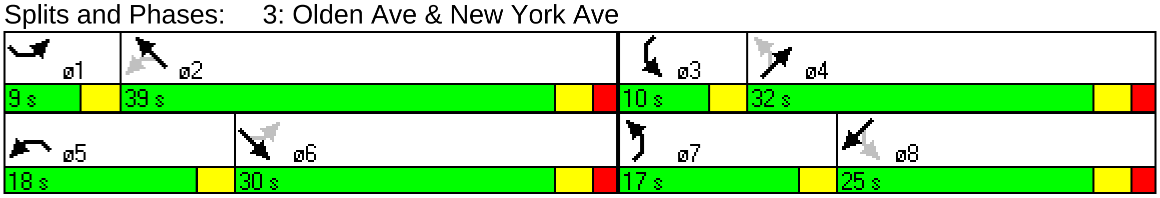
Splits and Phases: 3: Olden Ave & New York Ave



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1711	3233	0	1711	3522	0	3319	1785	0	1770	1822	0
Flt Permitted	0.258			0.141			0.227			0.596		
Satd. Flow (perm)	465	3233	0	254	3522	0	793	1785	0	1110	1822	0
Satd. Flow (RTOR)		130			4			23			9	
Volume (vph)	45	443	258	224	767	27	456	175	69	133	251	44
Lane Group Flow (vph)	49	762	0	243	863	0	496	265	0	145	321	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6			2			4			8		
Total Split (s)	9.0	30.0	0.0	18.0	39.0	0.0	17.0	32.0	0.0	10.0	25.0	0.0
Act Effct Green (s)	26.5	21.5		36.3	27.7		33.2	23.5		23.7	17.8	
Actuated g/C Ratio	0.34	0.27		0.46	0.35		0.42	0.30		0.30	0.23	
v/c Ratio	0.21	0.78		0.75	0.70		0.70	0.48		0.38	0.77	
Control Delay	15.4	29.0		31.7	25.3		22.1	25.1		20.4	43.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	15.4	29.0		31.7	25.3		22.1	25.1		20.4	43.1	
LOS	B	C		C	C		C	C		C	D	
Approach Delay		28.2			26.7			23.1			36.0	
Approach LOS		C			C			C			D	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 78.9	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.78	
Intersection Signal Delay: 27.6	Intersection LOS: C
Intersection Capacity Utilization 75.1%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 3: Olden Ave & New York Ave



Title of Report: ***MERCER CROSSINGS TRANSPORTATION STUDY***

Publication No.: 07039

Date Published: April 2008

Geographic Area Covered:
Ewing Township, Lawrence Township, and Trenton City in Mercer County, New Jersey.

Key Words:
4 lane to 3 lane conversion, access, access management, bicycle lane, bicycle route, Calhoun Street Extension, crosswalk, intersection approach, local road network, merge area, mobility, off-ramp, on-street parking, opportunity site, pedestrian phase, pedestrian refuge, redevelopment, solid waste transfer station, split phase, traffic calming, traffic congestion, travel demand, trip generator, truck route.

ABSTRACT: This report documents a transportation study of Mercer Crossings, an economically depressed area located at the intersection of Trenton City, Ewing, and Lawrence. Transportation improvements that would support redevelopment of Mercer Crossings have been identified and analyzed. The study topics derive, in part, from the recommendations of a previous Urban Land Institute study, *Mercer County New Jersey: A Strategy for Redevelopment*, and have been formulated in close consultation with Mercer County Planning Division, which chairs the study advisory committee.

The transportation improvements considered reflect both a traditional focus on efficient traffic movement and a non-traditional concern with transformation of streetscapes. On N. Olden Avenue, intersection improvements to increase the performance and safety of the roadway have been proposed. On Spruce Street, a 4 lane to 3 lane conversion, i.e., road diet, has been evaluated. A proposed new facility, the Calhoun Street Extension (CSE), which is designed to improve the connectivity of the local street network, has also been analyzed. Travel demand on the CSE is modeled using manual traffic assignment. Its other impacts are delineated. Finally, large truck traffic in Mercer Crossings residential neighborhoods is investigated. Data on traffic volume and temporal distribution of trips have been collected at two major trip generators in the study area and several alternate routes are researched.

.

Delaware Valley Regional Planning Commission
190 North Independence Mall West
8th Floor
Philadelphia, PA 19106-1520
Phone: 215-592-1800
Fax: 215-592-9125
Internet: www.dvrpc.org

Staff Contact: Robert Berger
Direct Phone: 215-238-2845
E-Mail: rberger@dvrpc.org

DELAWARE VALLEY
REGIONAL PLANNING
COMMISSION

190 N. Independence Mall West
8th floor
Philadelphia, PA 19106-1520
215-592-1800
www.dvrpc.org