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OCTOBER 2016

MIDDLETOWN ROAD CORRIDOR TRANSPORTATION EVALUATION

DERRY TOWNSHIP
DAUPHIN COUNTY, PENNSYLVANIA

HRG Project No. R002484.0481

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TRANSPORTATION EVALUATION

DERRY TOWNSHIP
DAUPHIN COUNTY, PA

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EXECUTIVE SUMMARY

Existing Conditions

Middletown Road is classified as an Urban Minor Arterial with an average daily traffic volume of approximately 15,000 vehicles per day with approximately 7% trucks. The 85th percentile travel speed varies between 42 and 44 mph.

Future Conditions

With considerable growth potential along and surrounding the corridor, future traffic volumes along Middletown Road could increase by approximately 50-60%, to a future ADT between 23,000 and 25,000 vehicles per day.

With the anticipated increase in traffic volumes along Middletown Road, we anticipate the following impacts:

- The roadway will begin functioning as a Regional/Principal Arterial, a classification which typically operates at slightly higher travel speeds and often has two through lanes in each direction.
- Difficulty experienced at unsignalized access points will be exacerbated during peak times and beyond the peak times. Providing additional signalized intersections along the corridor could help develop traffic platoons with gaps through the unsignalized access points, but significant delays are still anticipated.
- It is anticipated that the signalized intersections with low side-street traffic volumes can continue to operate efficiently with one through lane in each direction along Middletown Road; however, these intersections will be near capacity. As development pressures increase the side street traffic, the signalized intersections will rapidly deteriorate without additional through lane capacity along Middletown Road.
- Access points along the corridor that do not have left turn lanes are anticipated to create backups along Middletown Road and the potential for rear-end crashes may increase.

Potential Mitigation Measures

In order to accommodate the anticipated future development along the corridor, the following considerations are suggested:

- New access points should generally provide left turn lanes and consider right turn lanes on Middletown Road.
- New, unsignalized access points should be discouraged; where feasible, new access points should be signalized, or access should be encouraged via an existing signalized location. Where new, unsignalized access points are necessary, consideration should be given to restrict left turns onto Middletown Road.

- When completing traffic evaluations for developments that propose new signalized access points or developments that significantly increase the side street traffic at existing signalized intersections (ie, >50 peak hour trips), special considerations should be given to the traffic analysis. The Township should consider passing an ordinance that requires the evaluation to include:
    - Anticipated future traffic volumes along Middletown Road
    - Potential dual left turn lanes along Middletown Road
    - Potential dual through lanes along Middletown Road
    - Potential left, right, and through lanes along the side street approaches to Middletown Road
    - Analysis of the Middletown Road corridor and traffic progression along the corridor
- Geometric improvements should be considered at the intersection of Middletown Road and Route 322 Eastbound Exit Ramp / Service Road. It is noted that the bridge across Route 322 may be a physical constraint when evaluating improvements at this intersection. Any significant land development along the corridor should consider impacts to this intersection.
- A center left turn lane should be considered along the corridor.
- In lieu of a center left turn lane, it may be appropriate to provide a raised, landscaped median along the corridor to restrict left turns to focused locations. For interconnected developments, the placement of a median with specific entrance locations could result in traffic signal warrants being satisfied at non-signalized intersections. If a median is constructed, any breaks in the median should provide a left turn area and adequate space for U-turns.
- The existing traffic signals at Swatara Creek Road, Locust/Kaylor and Deer Run/Stoverdale operate effectively due to the relatively low volume of side street traffic.
    - Even with projected future corridor traffic volumes, these signals may continue to operate effectively, though they will approach capacity.
    - As additional development (residential and commercial) increase along the corridor, side street traffic will be increased. Signalized intersections with moderate to heavy side street traffic should consider dual through lanes in both directions along Middletown Road. However, it is not desirable to have a varying cross section along Middletown Road (ie, the roadway should not be widened for additional through lanes at one intersection, then immediately taper back to one through lane). If a need is identified for dual through lanes, consideration should be given to widen Middletown Road to a five-lane cross section, extending the roadway characteristics from the PA 283 interchange area to the north. The five-lane cross sections should extend through the critical signalized intersections before tapering back to two or three lanes prior to the Route 322 interchange. Alternately, consideration could be given to extend the five-lane section through the Route 322 interchange; however, this would have significant expense due to the Route 322 bridge and would have significant impact on Hummelstown Borough.
- Any future widening between Stoverdale Road and Kaylor Road should strive to provide shoulders along the west side of Middletown Road.

Table i: Summary of Potential Improvements (See Exhibits 2, 3 and 4 for graphic representation)		
Short-Term Considerations	**Potential Improvement**	**Suggested Action**
	Improve Sight Distance at Colonial Way and Southpoint Drive	Trim trees and/or remove vegetation
	Consider Deer Crossing Signs	Petition Game Commission
	Restripe dedicated left turn lanes as a center left turn lane	Explore feasibility with PennDOT and pursue Highway Occupancy Permit
	Signalize Southpoint Drive; improve traffic progression	Consider feasibility and funding options; consider turn restrictions at other locations
	Plan for new roadways (Road A, Wood Road, etc.)	Identify new roadway locations on Official Map
	Seek planning and funding sources for Mid-Term and Long-Term Improvements	Prepare Problem Statement for TCRPC
	Incorporate Traffic Impact Study / New Access point parameters for future traffic evaluations	Adopt Ordinance Amendment
	Incorporate access management principles, including restrictions on access location and spacing	Adopt Ordinance Amendment
	Improve interconnectivity between existing and/or new developments	Evaluate potential locations to focus traffic at desired locations; Add to Official Map
	Reserve ROW for future widening	Add to Official Map Secure ROW through the LD Process
Mid-Term Considerations	**Potential Improvement**	
	Consider right turn lane at Southpoint Drive	
	Consider geometric improvements at the Route 322 Eastbound Exit Ramp / Service Road	
	Consider center left turn lane or boulevard median with left turn lanes at critical access points and U-turn locations	
	Construct Road A or relocate Wood Road; provide left and right turn lanes at new intersection	
	Signalize Road A or relocated Wood Road; coordinate with other signals to provide progressive traffic movement	
Long-Term Considerations	**Potential Improvement**	
	Consider re-classification of the roadway as a Regional Principal Arterial	
	Widen Middletown Road to a five-lane cross section	
	Shift roadway east to provide shoulders from Locust/Kaylor to Southpoint	

MIDDLETOWN ROAD CORRIDOR
TRANSPORTATION EVALUATION

INTRODUCTION

Middletown Road (SR 2003) has grown in traffic volume and significance over the past several decades and is the primary connector from Middletown and PA 283 to Hershey approximately 2.3 miles in length. The roadway also provides access to US 322, Hummelstown, and Lower Dauphin School District property. Middletown Road is classified as an Urban Minor Arterial (see definition below) with an average daily traffic volume of approximately 15,000 vehicles per day. The speed limit along the corridor is posted at 35 mph between Swatara Creek Road and Route 322. The long-term access management trends from development along the corridor has resulted in a high density of unsignalized / signalized intersections and driveways for this classification of roadway. Turn lanes are provided at several major intersections along the corridor.

Due to the high traffic volumes and speeds, local residents have expressed difficulty attempting to access Middletown Road from unsignalized intersections or driveways. Concerns have specifically been noted at the following unsignalized locations:

- Middletown Road and Gramercy Place (both intersections)
- Middletown Road and Wood Road (SR 2006)
- Middletown Road and Southpoint Drive
- Middletown Road and Joann Avenue

In order to assist motorists turning onto the corridor, signalization would be the most impactful improvement; however, in order to install a new traffic signal at unsignalized locations, traffic signal warrants must be satisfied. Due to the large number of intersections, relatively low side street traffic volumes are generated at the existing unsignalized intersections/driveways; therefore, most locations would not likely meet signal warrants, with the potential exception of the intersections with Wood Road and Southpoint Drive. Accordingly, adding traffic signals to the Middletown Road corridor is not a viable solution to address this problem at all locations. Secondarily, improving traffic progression along Middletown Road could allow vehicles to travel in platoons along Middletown Road and thus create more opportunities for vehicles along the side streets and driveways to enter Middletown Road. Currently, most of the Middletown Road Corridor is not coordinated. The need for coordination has been considered in this evaluation.

This evaluation assesses the existing safety and mobility along the corridor and suggests potential improvements. This includes an evaluation of signal timing and progression, as well as a conceptual evaluation of turn lane warrants at locations along the corridor.

In addition to the existing concerns, further growth and roadway improvements along the corridor will alter the characteristics of the roadway's performance in the future. Multiple developments are planned

near or around the corridor, in Derry Township and Londonderry Township. This traffic evaluation considers, at a high level, the impact of the imminent improvements and developments. With consideration to the unknown nature of the potential future developments, the evaluation does not specifically analyze their effect on future conditions. However, the evaluation identifies principles and parameters for future consideration as the potential developments materialize.

With these scenarios in mind, the corridor evaluation considered potential improvements as follows which are depitced in that attahced Exhibits:

- Short-Term – Improvements that can be implemented within one to three years.
- Mid-Term – Improvements anticipated within five to ten years.
- Long-Term – Improvements anticipated within ten to twenty years.

EXISTING CONDITIONS EVALUATION

The existing conditions evaluation was conducted based on current operating conditions, with consideration to several improvement projects currently underway or planned for construction:

- 777 Middletown Road Development – Planned Sheetz and retail development located on the east side of Middletown Road, between Wood Road and Stoverdale Road. This development has proposed a new driveway along Middletown Road that will provide left-in, right-in and right-out access. Both left and right turn lanes are proposed at this driveway. Additional roadway improvements planned by this developer include the realignment of Stoverdale Road and the construction of a dedicated left turn lane along Stoverdale Road. Site construction is underway.
- PennDOT Improvement Project – There is a PennDOT improvement project planned at the intersection of Middletown Road and the Route 322 Eastbound Ramp/Service Road. This project will install a northbound right turn lane from Middletown Road onto the Service Road. Construction for this project is underway.

Exhibit 1 depicts the existing conditions along the corridor.

Roadway Classification

All state roadways are identified as urban or rural and functionally classified by PennDOT as either an arterial, collector, or local road. Further, the arterials are separated into principal arterials and minor arterials. Middletown Road is a state-owned roadway (SR 2003) classified by PennDOT as an Urban Minor Arterial. **Urban Minor Arterials place more emphasis on land access (compared to a principal arterial) while offering lower traffic mobility and intracommunity continuity**[(1)]. The local resident concerns with the Middletown Road traffic are consistent with this type of classification that emphasizes convenience of access over efficient traffic mobility, especially as through traffic volumes increase.

PennDOT's *Smart Transportation Guidebook* [(2)] provides further descriptions of roadway functions when contemplating the surrounding land use context. Using this criteria, the roadway functions as a Suburban Neighborhood Community Arterial which generally provides access for low-density residential communities (one-quarter to 2-acre lots or garden apartments), schools, churches, recreational facilities and limited stores and offices. Suburban Neighborhood Community Arterials typically carry ADTs of 5,000 to 25,000 vehicles per day with speeds between 30 mph and 35 mph. Intersection spacing is typically 300' to 1,320'.

Table 1: Existing Roadway Characteristics

Functional Characteristic	Suburban Neighborhood Community Arterial	Middletown Road Existing Conditions
Average Daily Traffic	5,000 to 25,000	14,000 to 15,000
Travel Speeds	30 mph to 35 mph	35 mph to 45 mph
Intersection Spacing	300 ft. -1,230 ft.	***200 ft. – 900 ft.***
Lane and Shoulder Width	10' – 12' lane w/ 4' – 8' shoulders	12' lane w/ 8'-10' shoulders

Access Spacing

As indicated in the table above, the existing access spacing along Middletown Road is less than desirable for this classification of roadway. This leads to numerous access points with difficulty entering Middletown Road. With fewer access points, more traffic would utilize each individual access point, creating the need for additional signalization and improved access. However, due to the numerous access locations, most entry points do not have sufficient traffic to warrant signalization.

Traffic Volumes

Twenty-four hour traffic counts were taken at the following locations along Middletown Road:

- 125 feet north of Wood Road
- 525 feet south of Locust Lane

Middletown Road has a current ADT of approximately 14,000 to 15,000 vehicles per day, with slightly heavier traffic volumes near the northern end of the corridor. For comparison purposes, the following table provides the ADT of comparable roadway segments within Derry Township. Most notable is the section along Route 322 which has both a similar ADT and truck percentage.

Table 2: Existing Traffic Volumes

Road Name and Corridor Location	Current ADT	Truck %
Middletown Road from Hummelstown to Londonderry Township	*14,000 to 15,000*	*7%*
Route 39 from Township Line to Hersheypark Drive	14,000	6%
Route 322 from 422 Split to Cocoa Avenue (SR 0743)	15,000 to 16,000	5% to 6%
Route 422 from Cocoa Avenue to Township Line	16,000	3%
Fishburn Road from Cocoa Avenue to Bachmanville Road	15,000	4%
Fishburn Road from Bachmanville Road to Township Line	11,000	8%

Traffic Composition

Approximately 7% of the daily traffic along Middletown Road is considered "truck" traffic. "Truck" traffic includes buses, small, 2-axle, 6-tire trucks, and larger trucks. Although the overall truck percentage is consistent with other regional roadways, large trucks (3+ axles) account for only 2% of the daily traffic along Middletown Road. The following table provides a breakdown of the existing vehicle classification.

Table 3: Average Daily Traffic Composition

Vehicle Type	Vehicles per day	Percentage
Passenger cars	13950	93%
Buses	150	1%
2-axle, 6-tire trucks	600	4%
3+ axle trucks	300	2%
Total	**15000**	**100%**

Triple Crown Services, a subsidiary of Norfolk Southern, operates a truck trailer parking/transfer facility alongside Norfolk Southern's Rutherford Intermodal Facility, which has recently undergone renovation and expansion. All construction associated with this project has been completed and no further expansion is anticipated at this time. This facility is located off of Route 322, west of the Middletown Road corridor. Several Triple Crown trucks have been observed along the Middletown Road corridor, presumably traveling between Route 322 and PA 283. A traffic impact study was completed in February 2012 for the Triple Crown Services Facility Relocation[9], which included traffic counts at the transfer facility driveway. Based on these traffic counts approximately 40 truck trips per day along Middletown Road are attributable to this development or about 13% of the large truck volume on the roadway.

Travel Speeds

Speed data was obtained at two locations along the corridor. Though the speed data fluctuates slightly depending on direction and location, the speed data indicated that motorists are generally traveling within 10 mph of the posted 35 mph speed limit. Travel speeds along the corridor are summarized in the following table. Based on the travel speeds, the existing posted speed limit of 35 mph is appropriate.

Table 4: Travel Speeds

Posted Speed Limit	35 mph
Average Speed	36 - 39 mph
85th Percentile Speed *	42 - 44 mph
10-mph Pace Speed **	36 - 45 mph

* Speed which 15% of vehicles exceed

** 10-mph range that includes most vehicles

Roadway Geometrics

Middletown Road generally consists of 12-foot travel lanes and 8-foot to 10-foot shoulders, which is consistent with the standards identified in PennDOT's *Smart Transportation Guidebook* for this classification of roadway. The primary exception is located along the west side of Middletown Road, between Stoverdale Road and Kaylor Road – in this area, the southbound through lane is a curbed 14-foot lane without a separate shoulder. Though a 14-foot curbed lane is acceptable based on the standards for this classification of roadway, it would be desirable to provide consistent shoulders along the corridor to accommodate bicyclists and broken-down vehicles.

Sight Distance

Sight distance was evaluated at several intersections and driveways along the corridor. Most locations provide adequate sight distance; however, the removal of vegetation at the following locations would help improve sight lines for traffic waiting to turn onto Middletown Road:

- Middletown Road and Colonial Way
- Middletown Road and Southpoint Drive

Signing and Pavement Markings

Signing and pavement markings along the corridor were reviewed. Regulatory and warning signing is placed appropriately along the corridor, with a few minor exceptions (see Crash Data section below).

Pavement markings are placed appropriately along the corridor, with a few minor exceptions.

Traffic Signals

Traffic signals are currently located at the following locations:

- Middletown Road and Route 322 Eastbound Ramp
- Middletown Road and Locust Lane / Kaylor Road (coordinated)
- Middletown Road and Deer Run Drive / Stoverdale Road (coordinated)
- Middletown Road and Swatara Creek Road

Typically, all signals within one-quarter mile of each other should be coordinated and signals between one-quarter and one-half mile should consider coordination. The existing signals are appropriately interconnected, as the signal at Locust Lane / Kaylor Road is interconnected and coordinated with the signal at Deer Run Drive / Stoverdale Road. The signal at Swatara Creek Road is coordinated with the adjacent signals in Londonderry Township to the south.

Turn Lane Review

Turn lanes are provided at several major intersections along the corridor as identified in the table below. The existing geometry for the turn lanes (taper lengths, lane widths and lengths) is appropriate for this roadway.

Table 5: Existing Turn Lanes

Intersection Location	Left Turn Lanes	Right Turn Lanes	Adequate length, width and tapers?
Gramercy Place (North)	Northbound	Southbound	Yes
Gramercy Place (South)	Northbound	Southbound	Yes
Deer Run Drive/Stoverdale Road	Both	Southbound	Yes
Deer Run Drive / Stoverdale Road to Colonial Way	Center Left Lane	None	Yes
Colonial Way	Northbound	None	Yes
Locust Lane / Kaylor Road	None	Northbound	Yes
Turkey Hill	None	Northbound	Yes
Swatara Creek Road (SR 2004)	Northbound	None	Yes

Crash Data

Crash data for the corridor was obtained from PennDOT in order to review the details of the crashes and determine the presence of any crash trends or emerging crash trends. PennDOT maintains crash records for "reportable" accidents, which include any crash that requires a vehicle to be towed or that results in an injury. A crash trend is defined as five (5) or more crashes of the same nature in a twelve-month period within the most recent three-year period. This review indicated that there were no existing crash trends along the corridor.

Additionally, HRG compared the crash rates along this corridor with the crash rates along other corridors with similar roadway and traffic characteristics. This evaluation determined that the crash rate along this corridor is less than the average crash rate along similar roadways within Pennsylvania:

Table 6: Crash Rate Summary

Roadway Characteristics	Pennsylvania Average Crash Rate *	Middletown Road Actual Crash Rate *
Undivided urban roadway >40' width and ADT >10,000	2.3	1.1

* Crash rates based on reportable crashes per million vehicle-miles traveled

Though the crashes along the corridor are less than the statewide homogenous average, the crash data review revealed the following noteworthy items:

- There were several rear-end accidents, particularly between Grove Street and Echo Street, that may be eliminated with the addition of a center left turn lane;
- There are several collisions with deer, particluarly near the southern end of the corridor that lack warning signs.

The crash data obtained from PennDOT are not included in the appendices. The crash data is confidential pursuant to 75 Pa. C.S. § 3754 and 23 U.S.C. § 409 and may not be published, repoduced, released, or discussed without the written permission of PennDOT.

Signalized Capacity Analysis

The capacity of an intersection, as identified in the Highway Capacity Manual[4], is evaluated using a set of procedures to estimate the traffic-carrying ability of a facility over a range of defined operational conditions. The capacity investigation uses **Levels of Service** (LOS) to describe the operational conditions. Levels of Service are assigned letter designations "A" through "F," with "A" being the most desirable operating conditions. LOS "D" is generally considered acceptable in an urban area. LOS "E" and "F" are considered deficient. The LOS criteria for signalized intersections are shown in the table below.

Table 7: Signalized Intersections – LOS Criteria		
Level of Service	**Average Control Delay (sec/veh)**	**Expected Delay to Minor Street Traffic**
A	< 10	Very low delay. Occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all.
B	> 10 and ≤ 20	Occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A.
C	> 20 and ≤ 35	Higher delays result from fair progression and/or long cycle lengths. Individual cycle failures may begin to appear in this level. Significant numbers of vehicles stop although many still pass through the intersection without stopping.
D	> 35 and ≤ 55	Longer delays may result from unfavorable progression, long cycle lengths and/or high volume to capacity (v/c) ratios. Many vehicles stop and the proportion of vehicles not stopping declines.
E	> 55 and ≤ 80	Considered the limit of acceptable delay, these high delay values generally indicate poor progression, long cycle lengths and high v/c ratios. Individual cycle failures are frequent occurrences.
F	> 80	Considered unacceptable to most drivers, this condition often occurs with over-saturation. It may also occur at high v/c ratios below 1.00 with many individual cycle failures.

Peak hour traffic counts and capacity analyses were performed at the following intersections using Synchro, Version 8 software[5]:

- Middletown Road and Locust Lane / Kaylor Road – Overall Level of Service B during AM and PM peak hours.
- Middletown Road and Deer Run Drive / Stoverdale Road – Overall Level of Service B during the AM peak hour and Level of Service A during the PM peak hour.

The evaluation was performed for existing (2016) conditions. The analysis indicates that the existing traffic signals both operate at acceptable levels of service for all movements, due largely to the relatively minor side street volume and large signalized intersection spacing.

Though not explicitly analyzed, peak hour delays have been noted at the intersection of Middletown Road and the Route 322 Eastbound Exit Ramp / Service Road, particularly during the afternoon peak along the northbound approach of Middletown Road and the westbound approach of the Service Road. This is likely attributable to the lack of a left turn lane along Middletown Road and the relatively high volume of side street traffic, compared to other signals along Middletown Road. PennDOT has a current project to install a northbound right turn lane along Middletown Road, which should help the operation of the intersection. Additionally, it is likely that delays from this intersection result in an increase in traffic along Wood Street, as motorists seek alternate east-west routes.

Traffic Signal Progression

Due to the high volume of traffic along Middletown Road, turning left from side streets and driveways can be difficult, particularly during the peak hours. Adjusting the traffic progression along a corridor can be a useful tool to help facilitate turning maneuvers from unsignalized side streets and driveways within a traffic signal system. However, along Middletown Road, the side street traffic is minimal, resulting in longer green times along Middletown Road. These longer green times result in a good level of service at the signalized intersections, but do not allow for platoons of traffic to develop. Additionally, with only two traffic signals in coordination with one another, the opportunity for platooned traffic is minimal.

Traffic Signal Warrants

As noted above, it can be difficult to turn left from side streets and driveways onto Middletown Road, particularly during the peak hours. In order to assist motorists turning onto the corridor, signalization would be the most impactful improvement; however, in order to install a new traffic signal at unsignalized locations, traffic signal warrants as identified in *PennDOT Publication 212*[7] and the *Manual on Uniform Traffic Control Devices*[6] must be satisfied to ensure that there is enough side-street traffic demand to justify stopping the through vehicles. For the purposes of this evaluation, we selected two locations for consideration of warrants, based on the land uses they serve and the anticipated likelihood of satisfying warrants. The preliminary evaluation indicates the following:

- Middletown Road and Wood Road – traffic signal warrants are likely satisfied
- Middletown Road and Southpoint Drive – traffic signalization may be possible

Refer to the "Traffic Signalization" section below for further discussion on potential traffic signalization.

FUTURE CONSIDERATIONS

Potential Future Developments

There are a number of future developments anticipated along or near the Middletown Road corridor that will have a significant impact on the future traffic operations. As these developments come to fruition, it will be critical to consider the impact along the entire corridor and implement improvements holistically with an overall corridor plan to accommodate anticipated future traffic volumes.

Developments that have received plan approval include:

- 777 Middletown Road Development – Proposed Sheetz and retail development, as discussed in the "Pending Improvements" section above.
- The Pointe – Planned residential development, as an extension of the Deer Run development. Traffic would access Middletown Road via Deer Run Drive.
- Muscalus Apartments – Planned apartments, located along the west side of Middletown Road, between Gramercy Place and Grove Street. Access is planned directly along Middletown Road.

Additional potential developments within the Township include:

- Gateway Mixed Use – Planned residential and office development located immediately south of Route 322, abutting Bullfrog Valley Road and extending west of Waltonville Road. This development is anticipated to include a significant residential component, as well as an office component to support the Hershey Medical Center. However, for purposes of the traffic projections, it was assumed that this would be developed entirely as an office park, which is more intensive than the residential uses. New roadway infrastructure is contemplated with this project, including the relocation of the Service Road between Middletown Road and Waltonville Road, and a potential new roadway to the south between Middletown Road and Bullfrog Valley Road.
- Ricker Development – Primarily vacant land located between the NPI retail property and the Gateway Mixed Use development. For study purposes, this was assumed to be developed entirely as an office park, though a less-intensive residential use is anticipated.
- NPI Retail Development – Potential shopping center development, located along the east side of Middletown Road, between Wood Road and Grove Street. This development is anticipated to establish a new, signalized access point along Middletown Road, directly across from the southern Gramercy Place intersection. This development may also include a connection to or relocation of Wood Road.
- Mixed Use Development – Potential mixed-use development located behind the Turkey Hill, south of Kaylor Road, anticipated to include a grocery store and an office building.
- Zell Townhomes – Potential townhome development located along the east side of Middletown Road, near Swatara Creek Road.

Additional potential developments located outside the Township include:

- School Heights Village – Potential mixed-use development located in Londonderry Township, near Route 230 and Deodate Road.
- Lytle Farms – Potential mixed-use development located in Londonderry Township, along Route 230 immediately east of Middletown Borough.
- Vine Street Retail – Potential retail development located in Londonderry Township, along the east side of Vine Street immediately south of the PA 283 interchange.
- Schoolhouse Retail – Potential retail development located in Londonderry Township, along Schoolhouse Road.

Note that a new zoning ordinance is currently being developed by Derry Township, impacting the following potential developments:

- Gateway Mixed Use
- Ricker Development
- NPI Retail Development
- Turkey Hill Mixed Use Development

For comparative purposes, HRG considered development of these properties under both the existing and proposed zoning ordinances. Additionally, it is unlikely that all of the development potential identified above will be realized within the next 20-25 years. Accordingly, the traffic projections have been reduced by a factor of 25% to represent a more realistic development forecast.

Roadway Network Alterations

Several roadway alterations are contemplated in conjunction with the land development projects identified above. These considerations include:

- A private connection between Wood Road and Stoverdale Road, constructed in conjunction with the 777 Middletown Road development
- Relocation of the Service Road between Middletown Road and Waltonville Road
- A new roadway (Road A) extending from Middletown Road (opposite from Gramercy Place) to Bullfrog Valley Road
- Relocation of Wood Road to intersect Road A or intersecting Middletown Road opposite from Gramercy Place
- At least one new signal is anticipated to be installed along the corridor, located at the southern intersection of Gramercy Place; signalization could also be considered at the intersection of Southpoint Drive

Future Traffic Volumes

The anticipated traffic associated with each potential development has been identified and distributed along the Middletown Road corridor. The potential impact of each development is summarized in the below table:

Table 8: Future Traffic Projections

Development		Existing Zoning	Proposed Zoning
		Approx. ADT	Approx. ADT
Existing Traffic		*14,800*	*14,800*
Imminent Approved Development	777 Middletown Road	1,500	1,500
	The Pointe	300	300
	Muscalus Apartments	100	100
Parcels Potentially Affected by Re-Zoning	Gateway Mixed Use (east of Waltonville)	1,500	3,000 *
	Gateway Mixed Use (west of Waltonville)	100	1,300 *
	Ricker Development	100	300 *
	NPI Retail (King Property)	4,000	3,500
	Mixed Use behind Turkey Hill	1,800	1,800
	Zell Townhomes	100	100
Potential Development Outside the Township	School Heights Village	500	500
	Lytle Farms	700	700
	Vine Street Retail	400	400
	Schoolhouse Retail	100	100
Future Traffic (Assuming full development of potential)		**26,000**	**28,400**
Future Traffic (Assuming 75% of development potential)		**23,200**	**25,000**

* Proposed Zoning projection based on full development as an office park; preliminary site plans indicate residential uses, which are less intensive.

As shown in the table above, traffic along Middletown Road would be expected to increase drastically. If approximately 75% of the above development occurs, future traffic volumes along Middletown Road are anticipated to increase by approximately 50-60%, to a future ADT between 23,000 and 25,000 vehicles per day.

Table 9: Future Roadway Characteristics

Functional Characteristic	Suburban Neighborhood Community Arterial	Middletown Road Future Conditions
Average Daly Traffic	5,000 to 25,000	***23,000 to 25,000***
Travel Speeds	30 mph to 35 mph	35 mph to 45 mph
Intersection Spacing	300 ft. -1,230 ft.	***200 ft. – 900 ft.***
Lane and Shoulder Width	10’ – 12’ lane w/ 4’ – 8’ shoulders	11’ lane w/ 8’ shoulders

Transportation Infrastructure

Under existing conditions, Middletown Road is appropriately classified as a minor arterial and functions as a Suburban Neighborhood Community Arterial. Unsignalized access points along the corridor can experience difficulty when turning left onto Middletown Road. Most signalized intersections along the corridor generally operate efficiently, particularly due to the relatively low-volume side street approaches. However, the intersection with the Route 322 Eastbound Exit Ramp / Service Road has a higher side street demand and experiences peak hour delays.

With the current land use projections, the anticipated future traffic volumes will near the threshold for a Suburban Neighborhood Community Arterial, regardless of the zoning changes currently under consideration. Additionally, as shown in Table 9, the existing access spacing is less than desirable – leading to numerous access points with difficulty accessing the roadway. With the anticipated increase in traffic volumes along Middletown Road, we anticipate the following impacts:

- The roadway will begin functioning as a Regional/Principal Arterial, which typically operates at slightly higher travel speeds and often has two through lanes in each direction.
- Difficulty experienced at unsignalized access points will be exacerbated during peak times and beyond the peak times. Providing additional signalized intersections along the corridor could help develop traffic platoons with gaps through the unsignalized access points, but significant delays are still anticipated.
- It is anticipated that the signalized intersections with low side-street traffic volumes can continue to operate efficiently with one through lane in each direction along Middletown Road; however, these intersections will be near capacity, even with low side-street volumes. As development pressures increase the side street traffic, the signalized intersections will rapidly deteriorate without additional through lane capacity along Middletown Road.
- Access points along the corridor that do not have left turn lanes are anticipated to create backups along Middletown Road and the potential for rear-end crashes may increase.

Future Considerations

In order to accommodate the anticipated future development along the corridor, the following considerations are suggested:

- New access points should generally provide left turn lanes and consider right turn lanes on Middletown Road.
- New, unsignalized access points should be discouraged; where feasible, new access points should be signalized, or access should be encouraged via an existing signalized location. Where new, unsignalized access points are necessary, consideration should be given to restrict left turns onto Middletown Road.
- When completing traffic evaluations for developments that propose new signalized access points or developments that significantly increase the side street traffic at existing signalized intersections (ie, >50 peak hour trips), special considerations should be given to the traffic analysis. The Township should consider passing an ordinance that requires the evaluation to include:

    - Anticipated future traffic volumes along Middletown Road
    - Potential dual left turn lanes along Middletown Road
    - Potential dual through lanes along Middletown Road
    - Potential left, right, and through lanes along the side street approaches to Middletown Road
    - Analysis of the Middletown Road corridor and traffic progression along the corridor
- Geometric improvements should be considered at the intersection of Middletown Road and Route 322 Eastbound Exit Ramp / Service Road. It is noted that the bridge across Route 322 may be a physical constraint when evaluating improvements at this intersection. Any significant land development along the corridor should consider impacts to this intersection.
- A center left turn lane should be considered along the corridor.
- In lieu of a center left turn lane, it may be appropriate to provide a raised, landscaped median along the corridor to restrict left turns to focused locations. For interconnected developments, the placement of a median with specific entrance locations could result in traffic signal warrants being satisfied at non-signalized intersections. If a median is constructed, any breaks in the median should provide a left turn area and adequate space for U-turns.
- The existing traffic signals at Swatara Creek Road, Locust/Kaylor and Deer Run/Stoverdale operate effectively due to the relatively low volume of side street traffic.
    - Even with projected future corridor traffic volumes, these signals may continue to operate effectively, though they will approach capacity.
    - As additional development (residential and commercial) increase along the corridor, side street traffic will be increased. Signalized intersections with moderate to heavy side street traffic should consider dual through lanes in both directions along Middletown Road. However, it is not desirable to have a varying cross section along Middletown Road (ie, the roadway should not be widened for additional through lanes at one intersection, then immediately taper back to one through lane). If a need is identified for dual through lanes, consideration should be given to widen Middletown Road to a five-lane cross section, extending the roadway characteristics from the PA 283 interchange area to the north. The five-lane cross sections should extend through the critical signalized intersections before tapering back to two or three lanes prior to the Route 322 interchange. Alternately, consideration could be given to extend the five-lane section through the Route 322 interchange; however, this would have significant expense due to the Route 322 bridge and would have significant impact on Hummelstown Borough.
- Any future widening between Stoverdale Road and Kaylor Road should strive to provide shoulders along the west side of Middletown Road.

POTENTIAL IMPROVEMENTS

Based on the evaluation of the existing and projected future traffic and roadway conditions, several potential improvements have been identified and are summarized in the matrix at the end of this section. Further, there potential improvements are classified as follows:

- Short-Term – Improvements that can be implemented within one to three years (See exhibit 2).
- Mid-Term – Improvements anticipated within five to ten years (See exhibit 3).
- Long-Term – Improvements anticipated within ten to twenty years (See exhibit 4).

Roadway Classification

Under existing land use conditions, Middletown Road is appropriately classified as a minor arterial and functions as a Suburban Neighborhood Community Arterial. However, in the Mid- to Long-Term scenarios (with development of the commercial tracts and the addition of connector roadways), driven by the existing land use conditions along the corridor, the roadway will begin to function more as a Suburban Neighborhood Regional/Principal Arterial, which typically operates at slightly higher travel speeds and often has two through lanes in each direction. Under the current land use scenarios, roadway improvements should be planned commensurate with the anticipated maturation of the roadway's function and associated traffic volumes.

Table 10: Regional Arterial Roadway Characteristics

Functional Characteristic	Suburban Neighborhood Regional/ Principal Arterial	Middletown Road Future Conditions
Average Daly Traffic	10,000 to 40,000	23,000 to 25,000
Travel Speeds	35 mph to 40 mph	35 mph to 45 mph
Intersection Spacing	660 ft. – 1,230 ft.	***200 ft. – 900 ft.***
Lane and Shoulder Width	11' – 12' lane w/ 8' – 10' shoulders	11' lane w/ 8' shoulders

Access Management

Access management is the proactive management of vehicular access points to land adjacent to roadways. Good access management promotes safe and efficient use of the transportation network by providing access/driveway spacing, safe turn lanes, etc. and minimizes the conflict points. As noted previously, the existing access spacing along Middletown Road is less than desirable for a Suburban Neighborhood Community Arterial, resulting in numerous unsignalized access points. A Suburban Neighborhood Regional / Principal Arterial would ideally have even further distance between access locations, as shown in the table above. Moving forward the following access management measures are suggested:

- New access points should be discouraged, unless they align with an existing access point to create a four-leg intersection.
- Minimum access spacing should be identified along the corridor.
- Turn restrictions could be considered at some of the existing access points (via a median or other treatment) in order to encourage signalization at other key locations and minimize left turn conflict points.

- Evaluate potential locations for interconnectivity between developments on the west side of Middletown Road to focus traffic at signalized intersections or to create warrants at new locations (complete in conjunction with left turn restrictions at other intersections).
- By ordinance incorporate Traffic Impact Study / New Access point parameters for future traffic evaluations
- By ordinance incorporate access management principles, including restrictions on access location and spacing

Roadway Cross Section

In the short term, it may be beneficial to re-stripe the dedicated left turn lanes at the unsignalized intersections (Gramercy Place, Southpoint Drive and Colonial Way) as center left turn lanes. A center left turn lane can help vehicles turning left onto Middletown Road by providing a striped refuge area within the center lane. This enables entering traffic to wait for a gap in the southbound traffic stream, then cross into the center left turn lane and wait for a gap in the northbound traffic (this is referred to as a two-stage left turn maneuver). This option should be discussed with PennDOT.

In the mid-term extending the short-term center left turn lane should be considered along the corridor or portions thereof. Alternatively, it may be appropriate to consider a raised, landscaped median along the corridor to restrict left turns/U-turns to signalized access points. If a median is constructed, any other breaks in the median should provide a left turn area and adequate space for U-turns.

In the long term, in conjunction with commercial development along and around the corridor, a five-lane cross section should be considered through the critical signalized intersections before tapering back to two or three lanes prior to the Route 322 interchange. Additionally, it may be appropriate to extend the five-lane section through the Route 322 interchange. The five lane section is consistent with the performance characteristics of a Regional/Principal Arterial functional classification.

Widening between Stoverdale Road and Kaylor Road could be done to the east in order to minimize impact to the existing properties and develop a shoulder along the west side of Middletown Road. This will help to provide consistent shoulders throughout the corridor.

Turn Lane Evaluation

Based on the traffic volumes, travel speeds, and truck percentages, turn lane warrants were considered along the corridor, in accordance with PennDOT criteria[3]. Based on these traffic parameters, the following thresholds were identified for turn lanes along Middletown Road:

- A left turn lane should be considered at locations that have approximately 10-15 left turning vehicles per hour.
- A right turn lane should be considered at locations that have approximately 40 right turning vehicles per hour.

Using this criteria and engineering judgement, the following table summarizes locations where turn lanes could be considered.

Table 11: Potential Turn Lane Locations		
Intersection Location	**Left Turn Lane Warranted**	**Right Turn Lane Warranted**
Indian Echo Caverns	Yes	No
Echo Street	Yes	No
Wood Street	Yes	Yes
Southpoint Drive	Existing	Yes
Dartmouth Street	Possibly	No
Allegheny Valley School driveway	Yes	No

Considering the proximity of the left turn lanes, and locations of other driveways along the corridor, a center left turn lane would be appropriate at the following locations:

- From Pear Court to Gramercy Place (northern intersection)
- From Locust Lane / Kaylor Road to the Allegheny Valley School driveway

Safety Improvements

Vegetation removal and/or tree trimming along the corners at the following intersections should be considered:

- Middletown Road and Colonial Way
- Middletown Road and Southpoint Drive

A Deer Crossing sign could be considered along the southern end of the corridor; however, locations for these signs are determined by the Game Commission. Derry Township could request that the Game Commission consider this location.

Multi-Modal Considerations

With consideration to the existing residential uses and future/pending retail uses, all roadway improvements should be constructed in a manner conducive to multi-modal mobility. There is a currently planned multi-modal path crossing at the intersection with Gramercy Place. All signalized intersections along the corridor should provide crosswalks. Shoulders along Middletown Road should be wide enough to facilitate bicycle traffic and bus stops.

Traffic Signalization

Traffic Signal Progression

Due to the existing signal spacing, it would not provide much benefit to coordinate the signals along the entire corridor at this time; however, as additional intersections are signalized, there will be an opportunity to extend the coordinated system. Additional signalized intersections, combined with increased side street traffic, would provide more defined traffic platoons and may increase the gaps in traffic between the platoons.

New Traffic Signals

Peak hour traffic counts were conducted at the following intersections to preliminarily evaluate traffic signal warrants[6, 7] and determine if signalization may be feasible:

- Middletown Road and Wood Road – Likely Warranted: The traffic data indicate that a traffic signal would likely be warranted at the intersection with Wood Road. However, the geometrics of the existing intersection (lack of turn lanes and difficulty widening the road) make signalization at its current location undesirable. With the development of the 777 Middletown Road development, a connection between Wood Road and Stoverdale Road will be developed. This will alleviate some of the pressure from Wood Road, though no new signal is required. Because of these considerations, signalization is not appropriate in its current location. In the future, Road A may be constructed to connect from Middletown Road to Bullfrog Valley Road. If this connection is made, this will further alleviate the traffic volumes along Wood Road. In conjunction with the Road A construction (or under a separate project), Wood Road may be relocated to the north to intersect Middletown Road at a new intersection across from Gramercy Place. If relocated, it would be appropriate to signalize the intersection at this location.

- Middletown Road and Southpoint Drive – Possibly Warranted: The traffic volumes at Southpoint Drive did not indicate that signalization would be warranted under current conditions based purely on traffic volumes. However, traffic is close to the warrants, and it is possible that traffic is avoiding this intersection since it is difficult to enter Middletown Road from this unsignalized intersection; if signalized, more traffic may re-direct towards this intersection. Additionally, signalization of this intersection could be considered in order to aid traffic progression along the corridor and help alleviate some delay at unsignalized access points. If signalization is pursued at this intersection, the feasibility should be discussed with PennDOT and additional traffic data collection and analysis would be required.

Table 12: Summary of Potential Improvements (See Exhibits 2, 3 and 4 for Graphic Representation)		
Short-Term Considerations	**Potential Improvement**	**Suggested Action**
	Improve Sight Distance at Colonial Way and Southpoint Drive	Trim trees and/or remove vegetation
	Consider Deer Crossing Signs	Petition Game Commission
	Restripe dedicated left turn lanes as a center left turn lane	Explore feasibility with PennDOT and pursue Highway Occupancy Permit
	Signalize Southpoint Drive; improve traffic progression	Consider feasibility and funding options; consider turn restrictions at other locations.
	Plan for new roadways (Wood Road, Road A, etc.)	Identify new roadway locations on Official Map
	Seek planning and funding sources for Mid-Term and Long-Term Improvements	Prepare Problem Statement for TCRPC
	Incorporate Traffic Impact Study / New Access point parameters for future traffic evaluations	Adopt Ordinance Amendment
	Incorporate access management principles, including restrictions on access location and spacing	Adopt Ordinance Amendment
	Improve interconnectivity between existing and/or new developments	Evaluate potential locations to focus traffic at desired locations; Add to Official Map
	Reserve ROW for future widening	Add to Official Map Secure ROW through the LD Process
Mid-Term Considerations	**Potential Improvement**	
	Consider right turn lane at Southpoint Drive	
	Consider geometric improvements at the Route 322 Eastbound Exit Ramp / Service Road	
	Consider center left turn lane or boulevard median with left turn lanes at critical access points and U-turn locations	
	Construct Road A or relocate Wood Road; provide left and right turn lanes at new intersection	
	Signalize Road A or relocated Wood Road; coordinate with other signals to provide progressive traffic movement	
Long-Term Considerations	**Potential Improvement**	
	Consider re-classification of the roadway as a Regional Principal Arterial	
	Widen Middletown Road to a five-lane cross section	
	Shift roadway east to provide shoulders from Locust/Kaylor to Southpoint	

LIST OF REFERENCES

1. A Policy on Geometric Design of Highways and Streets, 6th Edition, American Association of State Highway and Transportation Officials, Washington D.C., 2011.

2. Smart Transportation Guidebook, PennDOT & NJDOT, March 2008.

3. Traffic Engineering Manual, PennDOT Publication 46, February 2012.

4. 2010 Highway Capacity Manual, Transportation Research Board, Washington D.C., 2010.

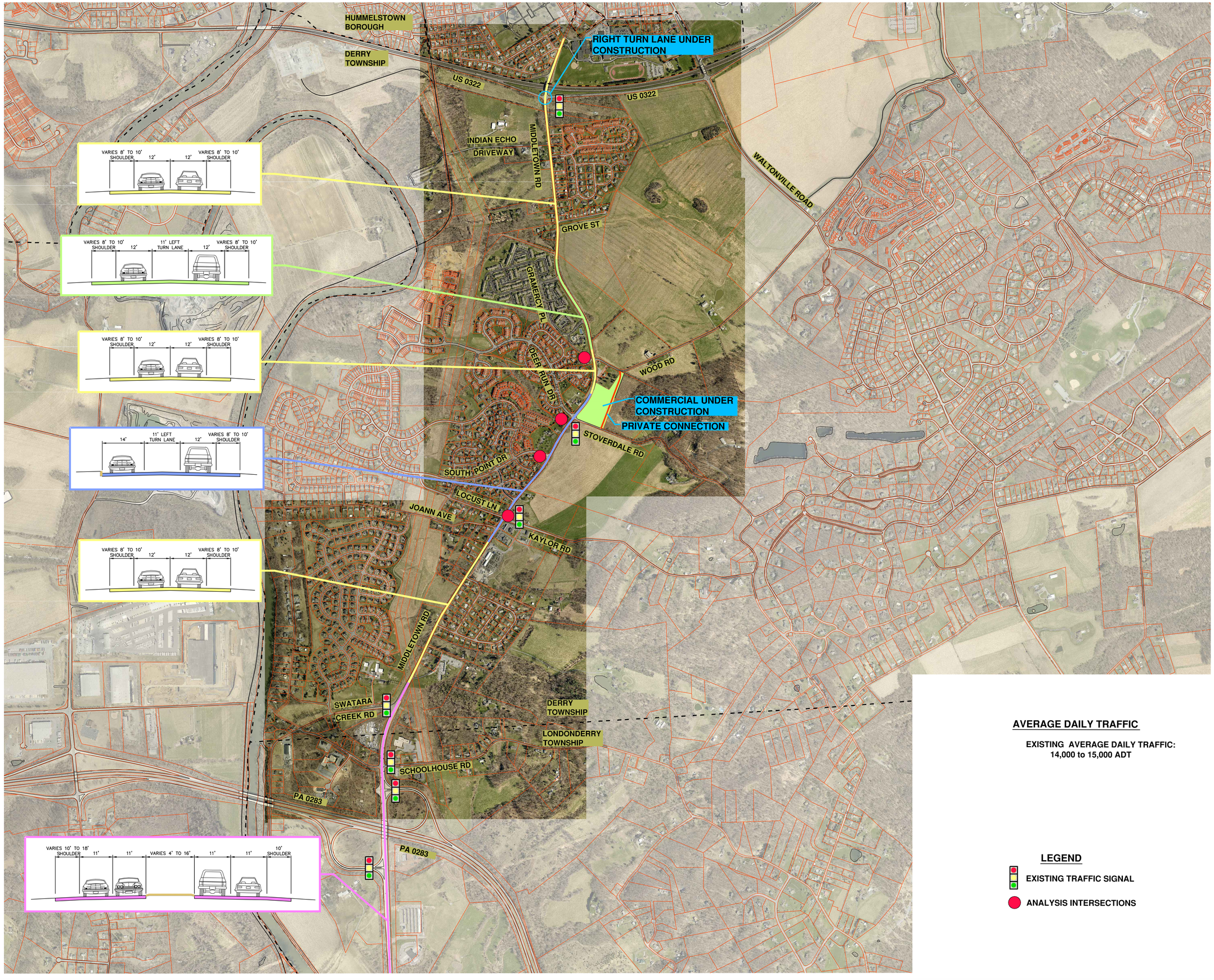
5. SYNCHRO 8.0, Traffic Signal Coordination Software, Transportation Research Board, Washington D.C., 2013.

6. Manual on Uniform Traffic Control Devices, 2009 Edition, Federal Highway Administration, December 2009.

7. Official Traffic Control Devices, PennDOT Publication 212, March 2006.

8. Access Management Manual, Transportation Research Board, Washington D.C., 2003.

9. "Traffic Impact Study for Triple Crown Services Facility Relocation at NS Rutherford Intermodal", Clough Harbour Associates, Albany, NY, February 2012



AVERAGE DAILY TRAFFIC

EXISTING AVERAGE DAILY TRAFFIC:
14,000 to 15,000 ADT

LEGEND

- EXISTING TRAFFIC SIGNAL
- ANALYSIS INTERSECTIONS

NO.	DATE	BY

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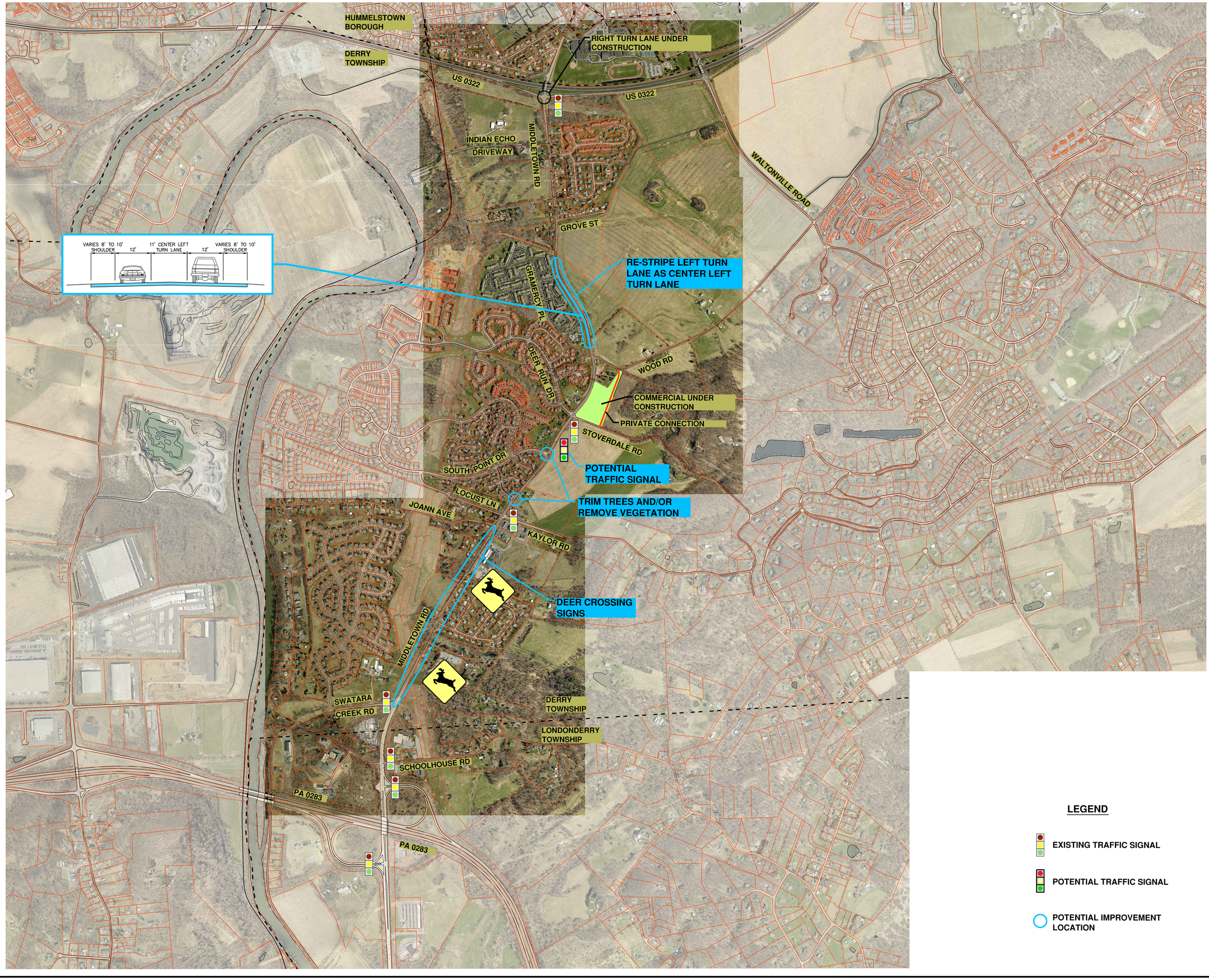
EXHIBIT 1
MIDDLETOWN ROAD CORRIDOR - EXISTING CONDITIONS

DERRY TOWNSHIP | DAUPHIN COUNTY | PENNSYLVANIA

PROJ. MGR.	EJS
DESIGN	JBL
CADD	JBL
CHECKED	
SCALE	1" = 500'
DATE	AUG 2016

DRAWING NO. 1
SHEET NO. 1 OF 4
PROJECT 002484.0437



LEGEND

- EXISTING TRAFFIC SIGNAL
- POTENTIAL TRAFFIC SIGNAL
- POTENTIAL IMPROVEMENT LOCATION

NO.	DATE	BY

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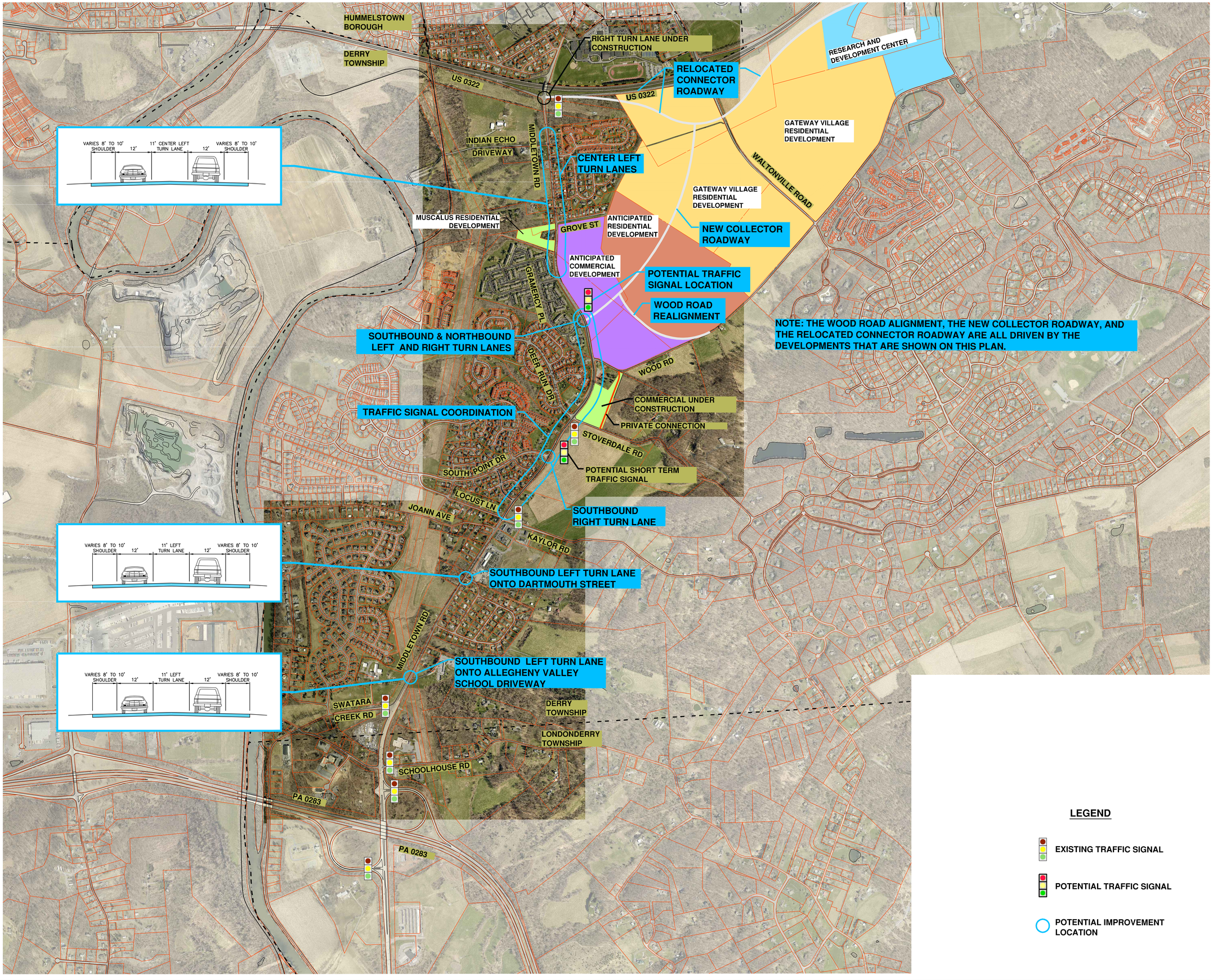
EXHIBIT 2
MIDDLETOWN ROAD CORRIDOR - SHORT-TERM IMPROVEMENTS

DERRY TOWNSHIP | DAUPHIN COUNTY | PENNSYLVANIA

PROJ. MGR.	EJS
DESIGN	JBL
CADD	JBL
CHECKED	
SCALE	1" = 500'
DATE	AUG 2016

DRAWING NO. 2
SHEET NO. 2 OF 4
PROJECT 002484.0437



NO.		DATE	BY

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EXHIBIT 3
MIDDLETOWN ROAD CORRIDOR - MID-TERM IMPROVEMENTS
DERRY TOWNSHIP DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR.	EJS
DESIGN	JBL
CADD	JBL
CHECKED	
SCALE	1" = 500'
DATE	AUG 2016

DRAWING NO. 3
SHEET NO. 3 OF 4
PROJECT 002484.0437

HUMMELSTOWN BOROUGH

DERRY TOWNSHIP

US 0322

RIGHT TURN LANE UNDER CONSTRUCTION

RELOCATED CONNECTOR ROADWAY

US 0322

RESEARCH AND DEVELOPMENT CENTER

GATEWAY VILLAGE RESIDENTIAL DEVELOPMENT

WALTONVILLE ROAD

INDIAN ECHO DRIVEWAY

MIDDLETOWN RD

GATEWAY VILLAGE RESIDENTIAL DEVELOPMENT

MUSCALUS RESIDENTIAL DEVELOPMENT

GROVE ST

ANTICIPATED RESIDENTIAL DEVELOPMENT

POTENTIAL COLLECTOR ROADWAY

ANTICIPATED COMMERCIAL DEVELOPMENT

GRAMERCY PL

POTENTIAL MID-TERM TRAFFIC SIGNAL LOCATION

WOOD ROAD REALIGNMENT

DEER RUN DR

WOOD RD

COMMERCIAL UNDER CONSTRUCTION

PRIVATE CONNECTION

STOVERDALE RD

SOUTH POINT DR

ANTICIPATED SIGNAL FROM SHORT / MID TERM IMPROVEMENTS

LOCUST LN

JOANN AVE

KAYLOR RD

MIDDLETOWN RD

SWATARA CREEK RD

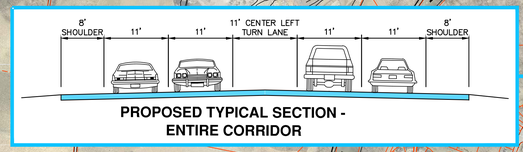
DERRY TOWNSHIP

LONDONDERRY TOWNSHIP

SCHOOLHOUSE RD

PA 0283

PA 0283



PROPOSED TYPICAL SECTION - ENTIRE CORRIDOR

AVERAGE DAILY TRAFFIC

ANTICIPATED AVERAGE DAILY TRAFFIC: 25,000 TO 26,000 ADT

LEGEND

- EXISTING TRAFFIC SIGNAL
- POTENTIAL TRAFFIC SIGNAL
- POTENTIAL IMPROVEMENT LOCATION

NO.	DATE	BY

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EXHIBIT 4
MIDDLETOWN ROAD CORRIDOR - LONG-TERM CONDITIONS

DERRY TOWNSHIP | DAUPHIN COUNTY | PENNSYLVANIA

PROJ. MGR.	EJS
DESIGN	JBL
CADD	JBL
CHECKED	
SCALE	1" = 500'
DATE	AUG 2016

DRAWING NO. 4
SHEET NO. 4 OF 4
PROJECT 002484.0437