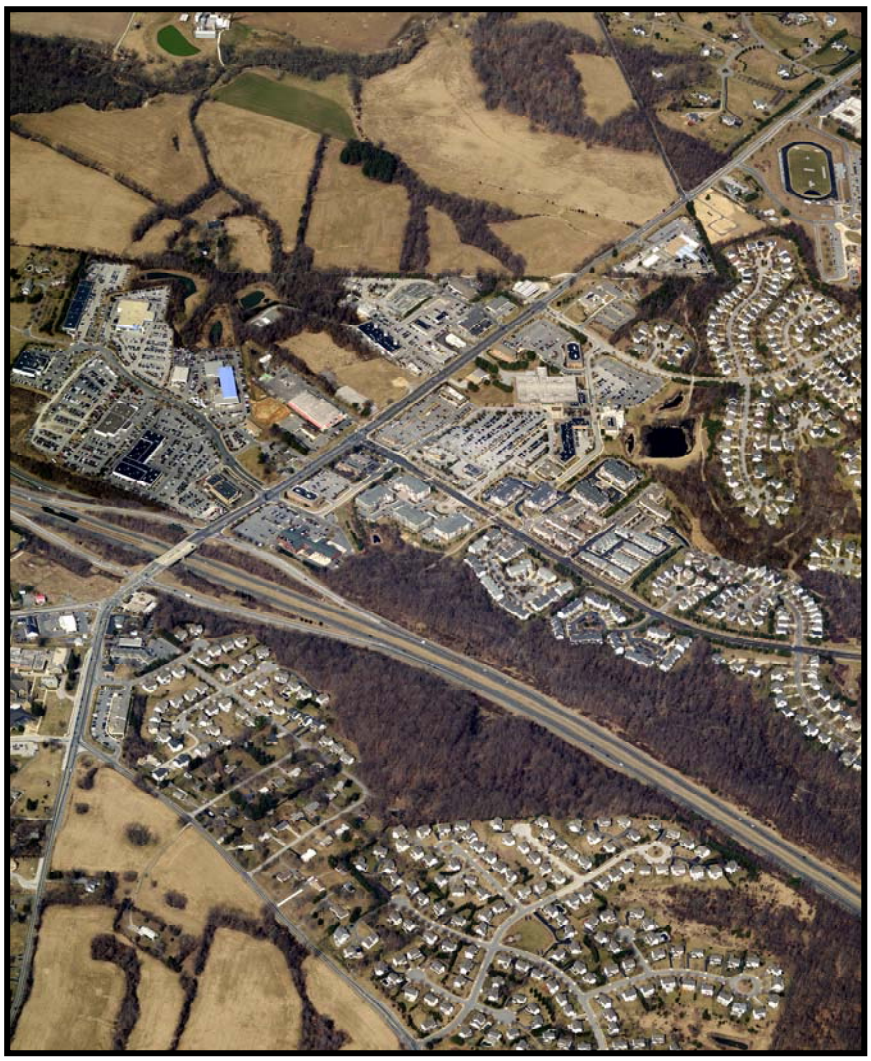
Multimodal Traffic Study and Conceptual Improvements: Clarksville Pike (MD 108)



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HowardCounty maryland

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GLOSSARY

Access Point = An intersection, driveway, or opening on a public street providing entry to a private development or property.

ADA = Americans with Disabilities Act

Adjacent Street Traffic = All traffic with direct access to a development site

ADT = Average Daily Traffic

Arterial = A signalized street that primarily serves through traffic and that secondarily provides access to abutting properties, with signal spacing of 2.0 miles or less.

At-Grade Intersection = The location at which two roadways cross and join at the same vertical elevation; access through the intersection may be controlled by traffic signals or stop/yield signs

Background Conditions = Conditions affecting the performance of the transportation network not directly related to the subject development over a designated time period, such as growth in existing traffic volumes, other planned, approved or current developments in the study area, and planned improvements to the transportation network

Capacity = The maximum sustainable flow rate at which vehicles or persons reasonably can be expected to traverse a point or uniform segment of a roadway during a specified time period under given roadway, geometric, traffic, environmental, and control conditions, usually expressed as vehicles per hour.

Collector = A roadway with no control of access linking residential communities with the arterial system

Cycle Length = The time period required for one complete sequence of traffic signal indications

Delay = The additional time experienced by a roadway user, typically motorists as a result of constrained movements and deviation from ideal or free flow travel speeds

Generator = A land use that attracts vehicle, pedestrian or other modes of traffic

Highway Capacity Manual = A publication of the National Academy of Sciences Transportation Research Board that provides a collection of the state-of-the-art techniques for estimating the capacity and determining the level of service for transportation facilities, first published in the 1950's and most recently published in 2010.

Internally Captured Trip = A trip originating and destined for different land uses within the same development but not traveling on a public street

Level of Service (LOS) = A qualitative measure describing operational conditions within a traffic stream, based on service measures such as speed, travel time, freedom to maneuver, traffic interruption, comfort and convenience.

Modal Split = The percentage of people using a particular means of transport, such as auto, transit, or walking, to make a trip

Multi-modal = A transportation facility for different types of users, modes or vehicles.

Pass-by Trip = An intermediate stop on the way from an origin to a primary trip destination without a route diversion. Pass-by trips are attracted from traffic passing the site on an adjacent street or roadway that offers direct access to the development.

Peak Hour = The one-hour period of greatest utilization of a transportation facility; weekdays normally have two peaks, one in the morning and one in the afternoon

Phase = A portion of a traffic signal cycle allocated to any traffic movement or combination of traffic movements receiving the right-of-way during one or more intervals

Split-Phased Mode = A type of signal control where all movements from one side street at a time move concurrently

Split = the amount of time dedicated to a single phase (movement) in a signal cycle, which typically includes green, yellow and all-red intervals.

Trip/ Trip End = A single or one-direction movement by any mode of travel with the origin or destination (exiting or entering) inside the study development.

Total Trips = The total of all trips entering plus all trips exiting a site during a designated time.

Travel Time = the average speed of a traffic stream computed as the length of the highway segment divided by the average travel time of the vehicles traversing the segment

95th Percentile Queue Length = the maximum back of queue with 95th percentile traffic volumes

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I. INTRODUCTION

As part of the County's goal to enhance pedestrian and bicycle access through the Clarksville Pike (MD 108) corridor, this study will evaluate short-term Complete Street preliminary engineering concepts and develop refined long-term land use and traffic forecasts, roadway design elements and non-motorized network improvements.

Phase I, the short-term (year 2016) assessment, will focus on developing short-term improvements to provide contiguous and enhanced pedestrian and bicycle access through the corridor. This phase of the study will be done in accordance with current SHA Access Manual and Roadway Design standards, and will not evaluate any major changes to the existing roadway footprint (e.g. curb relocation or travel lane configuration changes).

Phase II, year 2035, will develop a long-term vision for the Clarksville commercial core to define a multi-modal transportation system, and specifically roadway design elements and right-of-way needs for Clarksville Pike (MD 108).

II. EXISTING CONDITIONS

II.A. Study Area Transportation Network

Land Use

Retail properties with direct access to MD 108 abound in Clarksville between Guilford Road and Sheppard Lane, while intersecting streets serve residential areas just behind the retail frontage. East of Sheppard Lane is a high school, elementary school, and residential neighborhood.

Roadway Network

MD 108 is a state-maintained roadway with varying functional classifications and number of lanes throughout the study area. The ADT ranges from approximately 15,000 vehicles to 20,000 vehicles depending on the section of the study area. West of MD 32, MD 108 is a two-lane, other principal arterial with a two-way center left turn lane and no roadway lighting. Between MD 32 and Linden Linthicum Lane, MD 108 is a four-lane, minor arterial with two lanes in each direction and a center two-way left turn lane. East of Linden Linthicum Lane, MD 108 remains classified as a minor arterial but narrows to two lanes. Roadway lighting is only provided at signalized intersections east of MD 32. The speed limit is 35 mph west of Linden Linthicum Lane. Just east of Linden Linthicum Lane the speed limit rises to 45 mph. Existing cross sections of MD 108 are included in **Appendix C**.

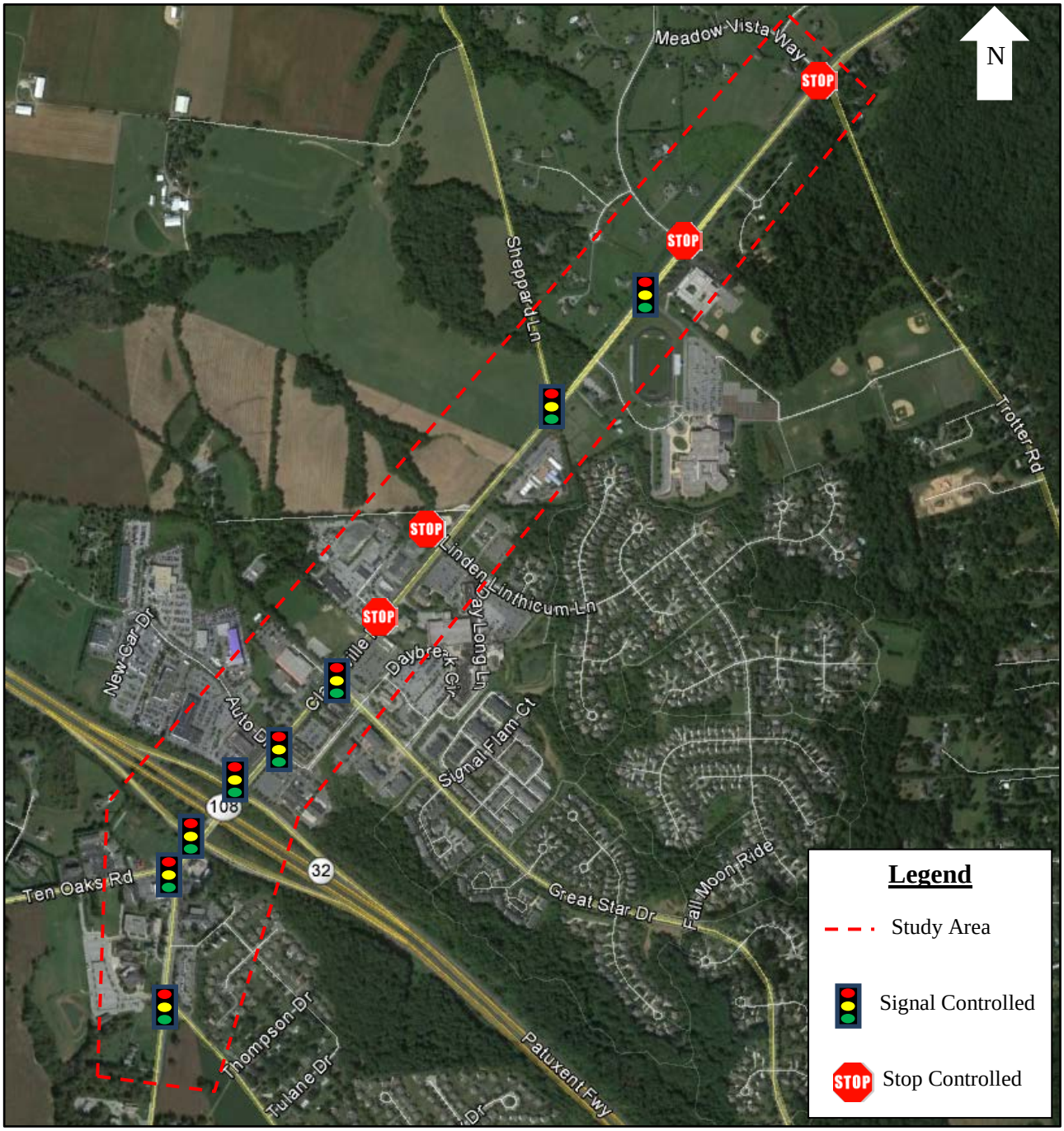
The MD 108 corridor serves a wide variety of transportation needs for travelers in Howard County. Many commuters use the corridor to access MD 32 or U.S. 29 and points farther east. Significant commuter traffic combined with local traffic from residential streets and commercial access points combine to create conditions that may overburden the roadway capacity at key times of day and intersection locations and inhibit pedestrians or bicycles from utilizing the limited existing non-motorized infrastructure.

The following is the list of intersections included in this Study:

1. MD 108 at Church Entrance/Guilford Road
2. MD 108 at Ten Oaks Road/Gas Station
3. MD 108 at MD 32 Eastbound Ramps
4. MD 108 at MD 32 Westbound Ramps
5. MD 108 at Auto Drive / Signal Bell Lane
6. MD 108 at Great Star Drive
7. MD 108 at Clarksville Square Drive
8. MD 108 at Linden Linthicum Lane
9. MD 108 at Sheppard Lane
10. MD 108 at High School Egress
11. MD 108 at Broad Meadow Lane / Elementary School Driveway
12. MD 108 at Meadow Vista Way / Trotter Road

Figure 1 shows the study area map including the local roadway network and study intersections.

Figure 1: Study Area



Pedestrian/Bicycle Infrastructure and Gaps

Close proximity of residential and commercial land uses along the corridor, as well as the robust trail network in the River Hill neighborhood create demand for walking and biking trips. However, existing walking and bicycling facilities are currently not well connected with the commercial land uses along MD 108.

Table 1 details the existing pedestrian amenities by intersection and **Figure 2** maps the existing pedestrian amenities located throughout the corridor.

From the table and graphics it can be seen that the following pedestrian infrastructure gaps exist:

- No sidewalks along MD 108 east of Clarksville Square Drive.
- No sidewalks along MD 108 between Signal Bell Lane and Great Star Drive.
- West of Signal Bell Lane sidewalks run along MD 108 but with breaks and on alternating sides of the road.
- Only three crosswalks exist across MD 108 including the east leg of MD 108 at MD 32 eastbound ramps, the west leg of MD 108 at Signal Bell Lane, and the east leg of MD 108 at Great Star Drive. This leaves long stretches of the MD 108 study area without any designated pedestrian crossings.

A share-the-road bicycle facility currently exists along MD 108 between Ten Oaks Road and the River Hill High School Egress, and a bike lane exists on Great Star Drive. No designated bicycle facilities west of Ten Oaks Road or east of the River Hill High School egress presently exist.

Proposed bicycle facilities noted in the County's draft Bicycle Master Plan include the following improvements:

- Constructing a shared use path on the north side of MD 108 between Great Star Drive and Trotter Road.
- Extending the existing MD 108 share-the-road bike facility with paved and striped shoulders from Ten Oaks Road to west of Guilford Road and from River Hill High School to east of Trotter Road.
- The following intersecting roads also have proposed bicycle facilities connecting to MD 108:
    - Trotter Road – paved and striped shoulder
    - River Hill High School egress – share-the-road
    - Sheppard Lane – shared roadway
    - MD 32 (north of Maryland 108) – paved and striped shoulder
    - Ten Oaks Road – paved and striped shoulder
    - Guilford Road – paved and striped shoulder

Figure 3 shows the existing and proposed bicycle facilities in the study area.

Table 1: Pedestrian Amenities

Pedestrian Amenities						
Intersection	Side-walks	Marked Crosswalks	Pedestrian Signals?	Push Buttons To Cross?	Mainline Pedestrian Refuge?	Curb Ramps
	(leg of intersection)					(corner)
MD-108 at Guilford Rd.	Missing east leg and south of west leg	None	No	No	No	Missing northeast and southwest corner
MD-108 at Wake Forest Rd.	Missing east leg	None	n/a	n/a	No	None
MD-108 at Ten Oaks Rd.	Missing north leg	None	No	No	No	Missing northwest corner
MD-108 at MD 32 South On/Off Ramp	Missing west of north leg	North, east, and south	Yes	Yes	No	All
MD-108 at MD 32 North On/Off Ramp	All	North and south	Yes	Yes	No	All
MD-108 at Auto Dr./Signal Bell Ln.	Missing east of south leg	North and west	Yes	Yes	No	All
MD-108 at Great Star Dr.	Missing south side of west leg	East and south	Yes	Yes	No	All
MD-108 at Linden Linthicum Ln.	Missing north leg and west of south leg	None	n/a	n/a	No	All
MD-108 at Sheppard Ln.	None	None	n/a	n/a	No	None
MD-108 at High School Entrance	None	None	n.a	n/a	No	None
MD-108 at Elementary School Entrance	None	None	n/a	n/a	No	None
MD-108 at Broad Meadow Lane	None	None	n/a	n/a	No	None
MD-108 at Meadow Vista Way/ Trotter Rd	None	None	n/a	n/a	No	None

Figure 2: Existing Pedestrian Amenities

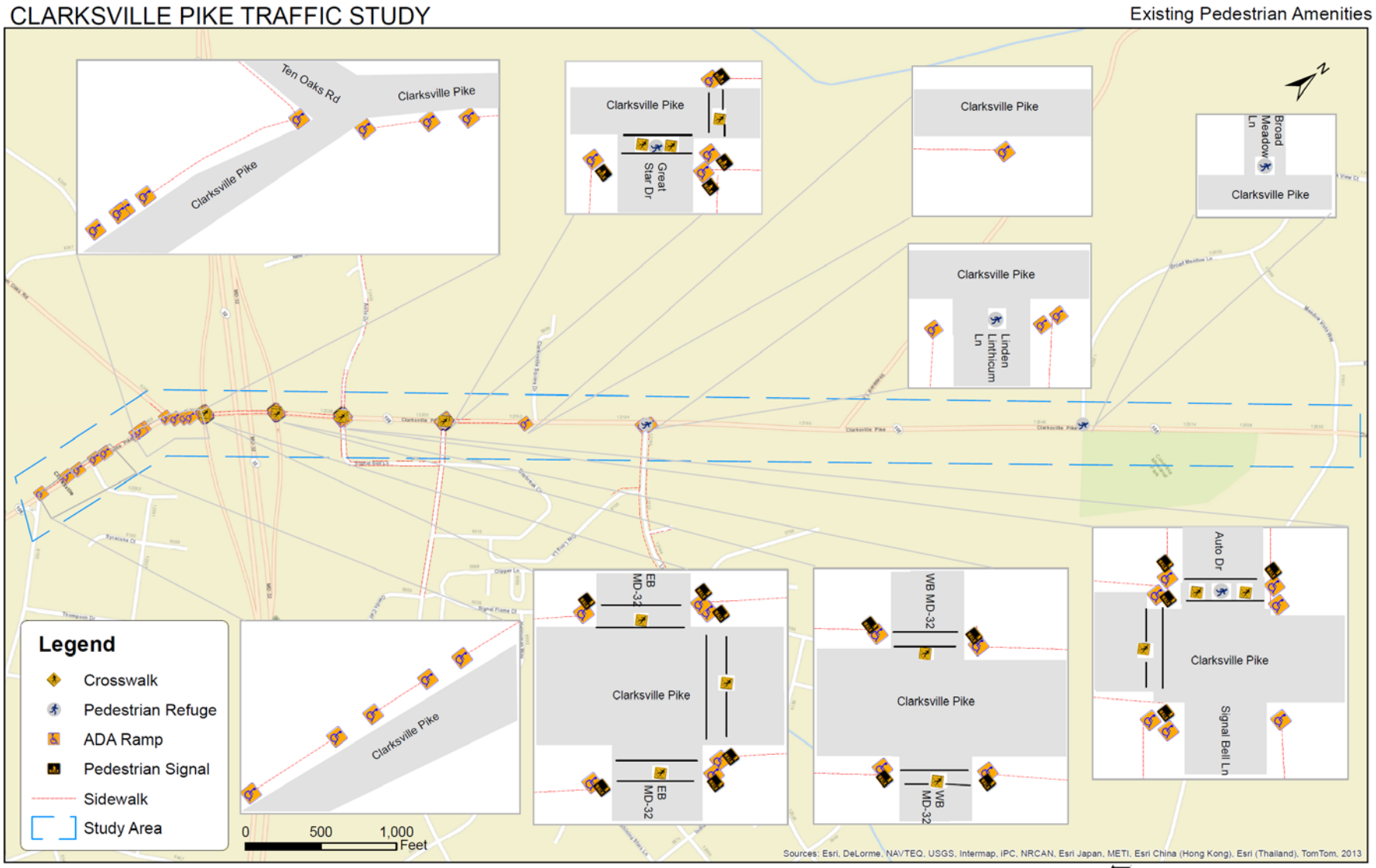


Figure 3: Existing and Proposed Bicycle Facilities

II.B. Traffic Operations

Traffic Counts

Turning movement counts for vehicles were based off of several recent traffic studies and data available on the SHA Internet Traffic Monitoring System (ITMS) website. The turning movement counts were assembled from the following:

- Turning movement counts on MD 108 between Auto Drive/Signal Bell Lane and Sheppard Lane were collected in November 2011 as part of the "Clarksville Traffic Study" by Sabra, Wang & Associates, Inc.
- The counts used for the MD 32 ramps and Ten Oaks Road intersection were pulled from the SHA ITMS website and collected in December 2012.
- MD 108 at Meadow Vista Way/Trotter Road had a count on the SHA I-TMS website from October 2010.
- Volumes from Synchro files provided by SHA.
- For this study, supplemental counts were performed during the peak hours (7-8 AM and 4:30-5:30 PM) in February 2014 to fill in the remaining intersections.

Volumes were conservatively balanced between intersections by rounding up throughout the network. The lane configurations and traffic controls are included in **Figure 4** and detailed in **Appendix A** (including photos). The total traffic volumes for the AM and PM peak hours are included in **Figure 5** and **Figure 6,** respectively. The turning movement counts by type are included in **Appendix B**.

Field Observations

A traffic engineer observed the corridor during the AM (7-9 AM) and PM (3:45-5:45 PM) peak periods on Thursday, February, 6, 2014, specifically focusing on driver behavior, traffic patterns, geometry, and overall traffic operations. The following summarizes the observations:

AM Peak Hour:

- From the Sheppard Lane intersection, queuing in the eastbound direction on MD 108 extended beyond the River Hill Garden Center site entrance and on occasion extended back to Linden Linthicum Lane. These queues occurred consistently between 7-7:30 AM but completely dissipated once school started.
- Eastbound queuing on MD 108 at Sheppard Lane caused left turn lane blockage at Sheppard Lane. A vehicle was observed driving in the opposing vehicle lane to jump the queue.
- Queuing in the westbound direction on MD 108 was observed extending through the River Hill High School Egress signal a couple times. These queues also only occurred prior to school starting.
- Queuing from the River High School entrance was observed to extend back onto MD 108 once during the AM peak period.
- Recurring residual queuing (e.g. failure to clear during the green signal indication) occurred throughout the study period at Ten Oaks Road.

Figure 4: Lane Configuration and Traffic Control

Figure 4 (Continued): Lane Configuration and Traffic Control

Figure 5: AM Peak Hour Volumes

Figure 5 (Continued): AM Peak Hour Volumes

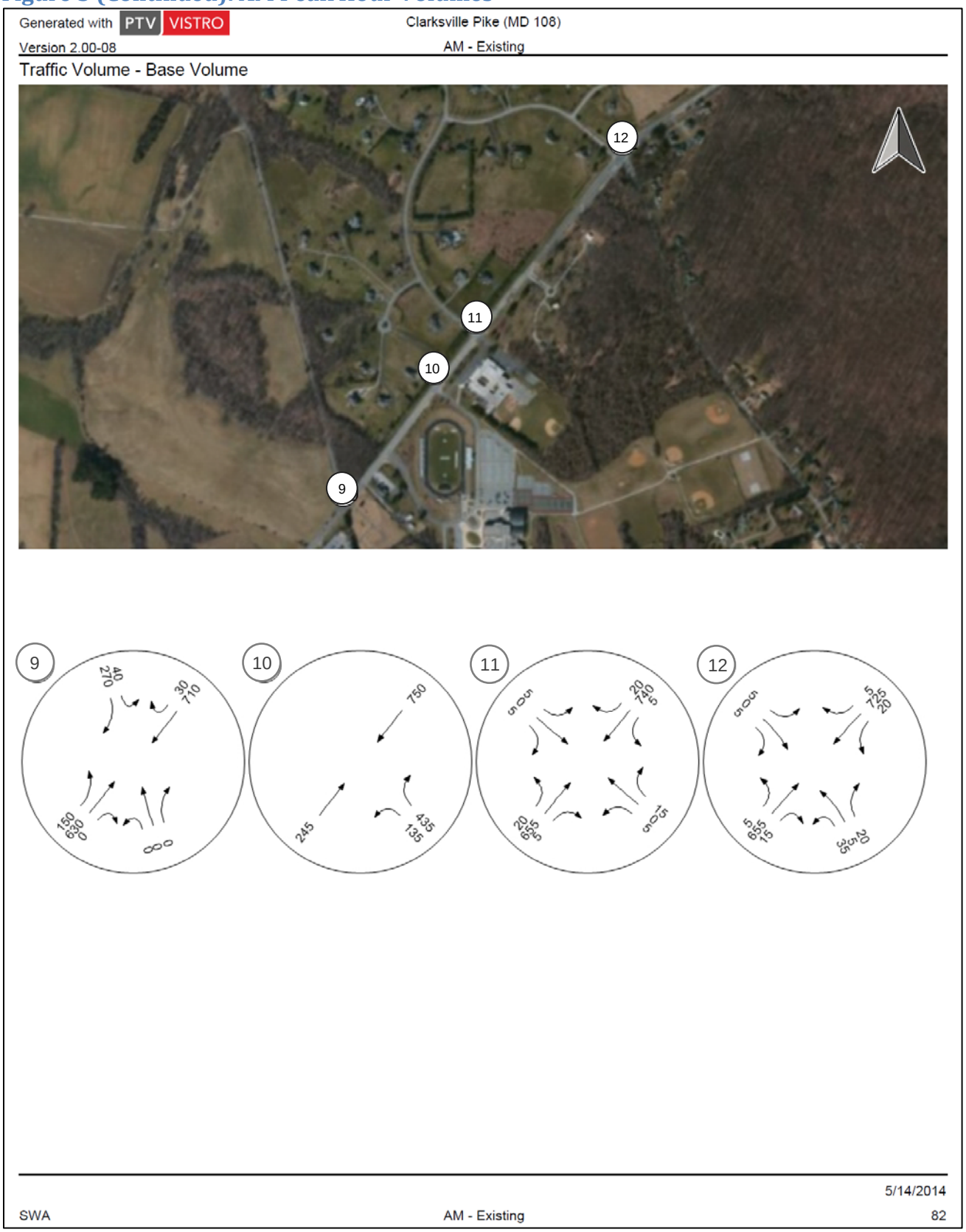


Figure 6: PM Peak Hour Volumes

Figure 6 (Continued): PM Peak Hour Volumes

PM Peak Hour:

- A couple of times queuing on eastbound MD 108 was observed extending from the traffic signal at Ten Oaks Road to well beyond the Guilford Road traffic signal.
- Several times eastbound MD 108 queues extended from the MD 32 eastbound ramps signal through Ten Oaks Road.
- All westbound lanes on MD 108 queued from the Ten Oaks Road intersection through the MD 32 westbound ramps intersection multiple times. This caused traffic to back up on MD 108 and the westbound MD 32 off ramps.
- The westbound left turn lane on MD 108 at the MD 32 eastbound ramps was observed to overflow through the MD 32 westbound ramps intersection once.
- Overflow of the westbound left turn lane was observed once on MD 108 at Linden Linthicum Lane.

Capacity Analysis

All study intersections were coded into a Synchro network to perform capacity analysis. Synchro™ is a deterministic and macroscopic signal analysis computer software program that models street networks and traffic signal systems. Geometric data such as number of lanes, lane configuration, storage lengths, tapers, and distances between intersections were input into Synchro. Additionally, existing signal timings and phasing were obtained from the Maryland State Highway Administration and coded into a Synchro traffic model along with existing traffic volumes. Intersection capacity analyses were performed using the industry standard National Academy of Sciences Transportation Research Board's Highway Capacity Manual (HCM) methodology for all study intersections. Performance measures of effectiveness include level of service (LOS), volume-to-capacity (v/c) ratio, and average vehicle delay. Key performance measures are defined as follows:

Level of Service (LOS) is a qualitative measure describing operational conditions of an intersection or any other transportation facility. LOS measures the quality of traffic service, and may be determined for intersections, roadway segments, or arterial corridors on the basis of delay, congested speed, volume to capacity (v/c) ratio, or vehicle density by functional class. At intersections, LOS is a letter designation that corresponds to a certain range of roadway operating conditions. The levels of service range from 'A' to 'F', with 'A' indicating the best operating conditions and 'F' indicating the worst, or a failing, operating condition.

The volume-to-capacity ratio (v/c ratio) is the ratio of current flow rate to the capacity of the intersection. This ratio is often used to determine how sufficient capacity is on a given roadway. Generally speaking, a ratio of 1.0 indicates that the roadway is operating at capacity. A ratio of greater than 1.0 indicates that the facility is operating above capacity as the number of vehicles exceeds the roadway capacity.

Delay (Control delay) is the portion of delay attributed to traffic signal operation for signalized intersections. Control delay (overall delay) can be categorized into deceleration delay, stopped delay, and acceleration delay.

Table 2 shows each Level of Service and their corresponding delay values for signalized and unsignalized intersections.

Table 2: Intersection Level of Service Delay Ranges

	Signalized intersections	Unsignalized intersections
Level of service	**Delay range (sec)**	**Delay range (sec)**
A	≤10	≤10
B	>10 and ≤20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	>80	>50

Synchro™ implements Highway Capacity Manual 2000 methods of analysis. **Table 3** summarizes the HCM analysis performed under existing traffic conditions. **Appendix G** contains the existing HCM reports.

The results of the existing conditions capacity analysis indicate that all signalized intersections operate with a LOS D or better during both the AM and PM peak hours. All overall v/c ratios are less than 0.80 during both the AM and PM peak hours as well.

The unsignalized intersections of MD 108 at Linden Linthicum Lane and MD 108 at Meadow Vista Way/ Trotter Road fail during both the AM and PM peak hours. MD 108 at Linden Linthicum Lane is over capacity with a v/c ratio well over 1.0, while MD 108 at Meadow Vista Way/Trotter Road operates with a v/c ratio well under 1.0 even though the delay causes a failing level of service.

Queuing was assessed using SimTraffic. SimTraffic is a microscopic and stochastic simulation computer software program that pairs with Synchro and can output queue lengths. Five 60 minute simulations with 10 minute seeding intervals were run for each peak hour. The most significant queues were observed in the eastbound direction on Ten Oaks Road at MD 108. Queues on this approach reached over 3,000 feet (~120 vehicles).

Table 3: Existing Intersection Capacity Analysis Results

Measures of Effectiveness				
Intersection/Approach	Existing Baseline - AM (PM)			
	LOS	Delay / Veh (sec)	Volume / Capacity Ratio	95th % Queue SimTraffic
MD 108 at Church Entrance/Guilford Road	*A (A)*	*7.4 (7.7)*	*0.45 (0.57)*	*NBTR - 132' (NBTR - 302')*
MD 108 at Ten Oaks Road/Gas Station	*C (D)*	*23.6 (38.4)*	*0.67 (0.69)*	*EBLT - 3438' (EBLT - 3578')*
MD 108 at MD 32 EB Ramps	*C (C)*	*23.2 (22.5)*	*0.76 (0.77)*	*SBT - 429' (SBT - 572')*
MD 108 at MD 32 WB Ramps	*C (C)*	*20.4 (31)*	*0.5 (0.68)*	*WBR - 333' (WBLT - 570')*
MD 108 at Auto Drive/Firehouse	*A (B)*	*8.3 (16)*	*0.31 (0.42)*	*NBTR - 162' (SBT - 174')*
MD 108 at Hardware Store/Great Star Drive	*B (D)*	*16.7 (37.4)*	*0.42 (0.78)*	*NBTR - 174' (WBLT - 421')*
MD 108 at Clarksville Square Drive[1]	*C (C)*	*17.9 (19.8)*	*0.02 (0.17)*	*EBR - 48' (EBL - 66')*
MD 108 at Linden Linthicum Lane[1]	*F (F)*	*>500 (>500)*	*2.35 (>5.00)*	*WBR - 71' (WBR - 557')*
MD 108 at Sheppard Lane	*A (A)*	*9.3 (7.6)*	*0.58 (0.69)*	*NBT - 242' (NBT - 571')*
MD 108 at High School Egress	*B (A)*	*14.4 (5.1)*	*0.63 (0.60)*	*SBT - 413' (NBT - 151')*
MD 108 at Broad Meadow Lane / Elementary School Driveway[1]	*D (E)*	*26.4 (45.8)*	*0.06 (0.11)*	*WBLTR - 47' (EBLTR - 37')*
MD 108 at Meadow Vista Way / Trotter Road[1]	*F (F)*	*56.4 (79.0)*	*0.48 (0.72)*	*WBLT - 72' (WBLT - 63')*

1 - Stop controlled intersection. Level of service, v/c ratio, and delay reported for stop controlled movements only.

III. SHORT-TERM IMPROVEMENTS (PHASE 1)

The goal of the short-term, Phase I, improvements to the MD 108 corridor is to make it possible to walk or bike from end to end of the study corridor. There is impetus to do this holistically rather than piece by piece as each property is redeveloped, which would take a much longer time period to implement.

III.A. Complete Streets Elements

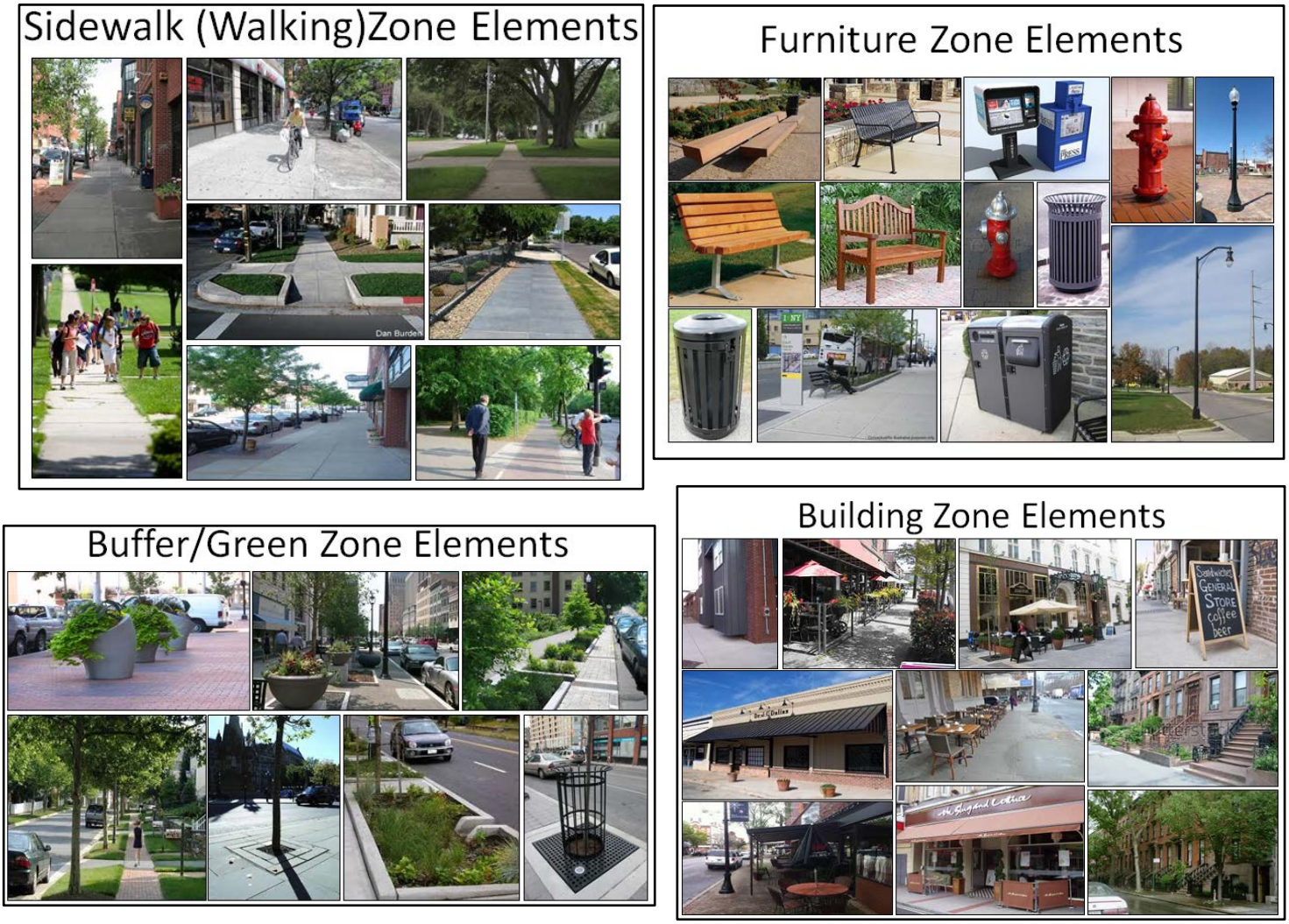
Complete Streets is a nationally recognized term referring to streets and sidewalks that are designed, operated and maintained to enable safe and convenient access and travel for all users – pedestrians, bicyclists, transit riders, and people of all ages and abilities, as well as freight and motor vehicle drivers. Complete streets also foster a sense of place in the public realm and incorporate streetscaping, street furniture, and green features including trees, landscaping and, in some cases, low impact development stormwater features. Smart Growth America and Maryland State Highway Administration's (SHA) *Complete Streets Policy* provide guidance on Complete Streets. Complete Streets are composed the following public realm elements:

- Sidewalk Zone - This area is reserved primarily for a paved sidewalk to carry pedestrians and provide access to transit and to adjacent land uses. In urban and suburban areas, the expectation is to provide sidewalks on both sides of the street.
- Furniture Zone – This zone is the area of the sidewalk between the walking zone and curb. It provides a buffer from traffic and provides a space for street furniture and other amenities. (e.g. benches, lighting) Signs, benches, fire hydrants, street and pedestrian light poles, and utility poles are also included in the furniture zone. The elements found in this zone can enhance the pedestrian environment, but also narrow the walking zone and can limit pedestrian mobility and comfort. Accordingly, these elements typically overlap with the buffer/green zone.
- Buffer / Green Zone – This zone is generally a landscaped area between the street pavement (or curb) and the sidewalk. Normally a minimum of 4 to 6 feet is provided to allow space for street trees. Within a high-density urban area, the green zone may be hardscaped with trees in planters. There is opportunity for bio-infiltration, bio-retention and rain gardens in this zone.
- Building Zone – This zone is the area outside of the street right of way (ROW) where public or private property is located or may be planned in the future. Since it is outside of the street ROW, the types of street elements in this area can vary widely. It includes architectural elements such as steps, bay windows, or planters and commercial activities such as sidewalk cafes that intrude into the sidewalk. These elements can enhance the pedestrian environment, but also narrow the walking zone and limit accessibility.
- Parking Zone – This zone is typically an 8 to 10 foot wide section allowing for parallel parking adjacent to traffic flow. Parallel parking should be limited to corridors with lower speed limits (35mph or lower). It is a paved area and the gutter can be included as part of this zone without increasing the width of the parking zone. This zone can also be used as a bus pullout, or can serve as an extension of the green zone when providing bulb-outs to protect parking and improve pedestrian accommodations. Other functions for this zone include: loading and unloading, taxi/passenger drop offs and valets.

- Bicycle Zone – This is an area reserved for a designated bicycle R.O.W. adjacent to the motor vehicle lane. Width is typically 4 to 6 feet of pavement. When placed adjacent to a parking zone, the bike lane should be 5 to 6 feet wide. If separate bicycle lanes cannot be accommodated, shared lanes are allowed if the outside vehicular lanes are 14 feet or when travel speeds are 35 mph and below.
- Motor Vehicle Zone – This zone is generally considered the paved travel way of a street. It includes travel lanes, turn lanes and tapers, and channelized or striped pavement areas, and, in some circumstances, the gutter pans. The recommendation for the lane width is 10 to 12 feet.
- Median Zone – A median zone typically provides a landscaped buffer between traffic moving in opposing directions. It can also be used as a pedestrian refuge in some contexts. Most two-lane streets do not have a median. It typically includes street trees and shrubbery. Hardscaping may be provided at narrow points and at specified crossing points to facilitate pedestrian use. At those crossing points, landscaping and limbs should be maintained to allow visibility for the pedestrian and motorist.

Example photos of each element are shown in **Figure 7**.

Figure 7: Public Realm Elements



III.B. Design Improvement Alternative 1

Alternative 1 involves the minimum amount of improvements needed to make it possible to walk or bike from end to end of the Clarksville Pike corridor.

Design

Under Alternative 1, a multi-use path is proposed on the north side of MD 108 between Guilford Road and Meadow Vista Way / Trotter Road. The multi-use path will be 10' wide and will connect many of the broken or non-existent sidewalk links along MD 108. Where sidewalks already exist, they will be widened to match the path cross section. Additional crosswalks across MD 108 will be added at Guilford Road, Ten Oaks Road, MD 32 westbound ramps, Great Star Drive, Sheppard Lane, and the River Hill High School exit. A crosswalk is also proposed across the south leg of the MD 108 at Auto Drive / Signal Bell Lane intersection. All intersection / driveway crossings will be

upgraded to be ADA compliant, with adjusted cross-slopes for level bicycle crossings, and have marked crosswalks as part of this Alternative. Pedestrian signals will be installed at all signalized intersection crossings if they are not already present.

Bicycle access along state highways is typically provided via a designated bike lane or shoulder use as per the SHA Access Manual and Roadway Design standards. However, a design waiver may be needed under this Alternative since shoulders aren't provided and bicycle access will be provided on the mixed-use path adjacent to the roadway. A bicycle lane or shoulder was not included since it would be difficult and expensive to move back the existing curb.

Table 4 shows a preliminary cost estimate of this Alternative and **Appendix D** contains 30% design plans.

Example shared sidewalk/ bike lane pavement treatment at driveway aprons

Impacts

Utilities were avoided wherever possible. When not possible to completely avoid utilities, the path was widened slightly to account for the utility obstruction. At this time, there are no plans for any utility relocation.

There are several locations where an easement would be needed on the north side of MD 108 to allow space for the path construction. The locations and width are the following:

- In front of the dwelling and garage between Wake Forest Road and the Bank of America Entrance, 12 to 24 feet of additional easement is needed.
- East of the MD 32 in front of the Future Antwerpen Toyota dealer, 0 to 10 feet of additional easement is needed.
- Just east of Auto Drive, 0 to 10 feet of additional easement is needed.
- Between Sandy Spring Bank and Pizza Hut, 7 to 13 feet of additional easement is needed.
- In front of Pizza Hut, an additional 9 feet of easement is needed.
- East of Great Star Drive, 0 to 2 feet of additional easement is needed.
- In front of PNC Bank and Dogtopia, an additional 2' to 6' of easement is needed.
- An additional 3 to 10 feet of easement is needed just east of Freestate Gas Station.

III.C. Design Improvement Alternative 2

Alternative 2 involves enhancing the mixed-use path with a sidewalk on the south side as well as several progressive treatments of pedestrian and bicycle crossings. Although changes to the existing roadway footprint are not intended to be part of the short-term assessment, the operational deficiencies noted in the June 2012 "Clarksville Traffic Study" were included in this Alternative. These include the installation of a signal at Linden Linthicum Lane as well as widening of eastbound MD 108 east of Linden Linthicum Lane.

Design

Under Alternative 2, the multi-use path on the north side of MD 108 is proposed as described in Alternative 1. In addition, missing sidewalk links between Guilford Road and the Clarksville Elementary School are proposed to make a continuous sidewalk on the south side of MD 108. The south side sidewalk will include ADA ramps and marked crosswalks at all intersection / driveway crossings. Pedestrian signals will be installed at all signalized intersection crossings if they are not already present.

The proposed sidewalk on the south side will require an approximately 250 feet long retaining wall east of Linden Linthicum Lane. This retaining wall is required due to the hill in front of the Linden Linthicum United Methodist Church.

This Alternative will propose two eastbound lanes between Linden Linthicum Lane and the River Hill High School Entrance. The second through lane will end at the River Hill High School entrance as a right-turn only lane.

Several progressive treatments are included in this Alternative including:

- Bike Box - A Bike Box provides a space placed ahead of the vehicular stop bar allowing cyclists to wait in front of motorists at intersections. The Bike Box extends the entire width of the lanes from the center line to the curb, which allows cyclists to make left turn movements or clear the intersection before motor vehicle traffic. Bike boxes are proposed at Guilford Road, Ten Oaks Road, Signal Bell Lane, Great Star Drive, and Linden Linthicum Lane.

- Pedestrian Warning Beacons - The MUTCD recommends using pedestrian warning beacons as supplemental emphasis to warning signs, and states that warning beacons that are actuated by pedestrians, bicyclists, or other road users may be used as appropriate to provide additional warning to vehicles approaching a crossing or other location. A pedestrian warning beacon is proposed east of Clarksville Square.

Intersection specific improvements include:

- A crosswalk across MD 108 at Guilford Road, Ten Oaks Road, MD 32 westbound ramps, Sheppard Lane, and the River Hill High School exit.
- A crosswalk across MD 108 with pedestrian signage and a median refuge island at Wake Forest Road.
- Stamped asphalt crosswalks on both mainline crossings of MD 108 at the intersections of Auto Drive/Signal Bell Lane, Great Star Drive, and Linden Linthicum Lane.
- A bike box for the northbound approach of Signal Bell Lane, Great Star Drive, and Linden Linthicum Lane at MD 108.
- A crosswalk across MD 108 with pedestrian signage, overhead pedestrian warning beacons with push buttons, and a median refuge island just east of Clarksville Square Drive.
- Install new signal at the intersection of MD 108 at Linthicum Lane.

Bicycle access along state highways is typically provided via a designated bike lane or shoulder use as per the SHA Access Manual and Roadway Design standards. However, a design waiver may be needed under this Alternative since shoulders aren't provided and bicycle access will be provided on

the mixed-use path adjacent to the roadway. A bicycle lane or shoulder was not included since it would be difficult and expensive to move back the existing curb.

Appendix D contains preliminary engineering plans for Alternative 2.

Impacts

Utilities were avoided wherever possible as in Alternative 1. Additional easement acquisitions on the north side of MD 108 would also be the same as in Alternative 1. In Alternative 2 several additional easements on the south side of MD 108 would be needed to accommodate the proposed sidewalk.

These easements on the south side of MD 108 include:

- An additional 8 to 12 feet of easement is needed in front of Still Point Wellness Spa.
- An additional 17 feet of easement is needed in front of Hillmuth Automotive.
- In front of the orthodontist office just west of Ten Oaks Road, an additional 20 feet of easement is needed.
- In front of the cemetery and Lufti's Spa across from Sheppard Lane, an additional 3 to 8 feet of easement is needed.

As mentioned above in under the design section, the proposed sidewalk on the south side will require an approximately 250 feet long retaining wall east of Linden Linthicum Lane.

III.D. Alternative Cost Comparison

Preliminary cost estimates were developed for short-term improvements, Alternative 1 and Alternative 2. **Table 4** below shows the costs for each alternative. **Appendix F** contains detailed cost estimates for each alternative.

Table 4: Preliminary Cost Estimate for Alternatives

Cost Estimate Comparison	
Alternative	**Cost Estimate**
Alternative 1	$1,062,000
Alternative 2	$1,864,723

IV. LONG-TERM IMPROVEMENTS (PHASE II)

Phase II, year 2035, will develop a long-term vision for the Clarksville commercial core to define a multi-modal transportation system, and specifically roadway design elements and right-of-way needs for Clarksville Pike (MD 108). The ultimate build concept will provide longer term solutions to traffic congestion on MD 108 and may take some time to implement due to right-of-way acquisition, property redevelopment, etc.

V. FUTURE CONDITIONS

The future conditions will discuss the development and results of short-term year 2016, short-term year 2016 with Alternative 2 improvements, long-term year 2035, and long-term year 2035 with ultimate build improvements.

V.A. Land Use Forecasts

Along the corridor, there are numerous pending (e.g. site plans in the formal development review and permitting process) or potential (e.g. outside of the current zoning) developments that were included to create a worst case traffic forecast. These developments will directly affect operations within the MD 108 corridor. Forecast years 2016 and 2035 were used for the short-term and long-term forecasts, respectively. **Figure 8** shows the 2016 and 2035 proposed land uses.

Developments included in the 2016 potential future land-use include:

Commons Phase I: This development will include 31,000 SF of specialty retail space and a 7,000 SF high turnover sit down restaurant. This development will be located on the former Gateway School site and will be assumed to use the previous Gateway School entrance as a full-movement access point.

Auto Dealership Expansion: The auto dealership will increase 20,000 SF in size. It will be located on the northwest quadrant of the intersection of MD 108 at Auto Drive. Access to the site is assumed via Auto Drive.

Pizza Hut Site Retail: On the Pizza Hut site, 7,000 SF of specialty retail space is forecasted. All vehicles entering/exiting the study network are projected to do so through the existing Pizza Hut entrance.

Single Family Dwellings: MD 108 West of Study Area: West of the study area on MD 108, a total of 50 single family dwelling units are proposed in separate subdivision plans.

Single Family Dwellings: Sheppard Lane North of Study Area: North of the study area on Sheppard Lane, a total of 160 single family dwelling units are proposed in separate subdivision plans.

Single Family Dwellings: Trotter Road South of Study Area: South of the study area on Trotter Road, a total of 25 single family dwelling units are proposed in separate subdivision plans.

Additional developments included in the 2035 potential future land-use include:

Commons Phase II: As part of phase II, this development is assumed to add a 20,000 SF supermarket and 15,000 SF of office space.

Ten Oaks Park and Ride: The Ten Oaks Park and Ride is assumed to add 250 spaces. Access to the lot is assumed through Signal Bell Lane.

Single Family Dwellings: MD 108 / Guilford Road South of Study Area: On the southwest quadrant of MD 108 and Guilford Road, 200 single family dwelling units are proposed. Access to these dwelling will be assumed to be a split between MD 108 and Guilford Road.

Funeral Home: MD 108 / Guilford Road: On the north side of MD 108 a 10,000 SF funeral home is proposed. The funeral home is assumed to have direct access to MD 108.

Village Center: Village Center is located on the south side of MD 108 between Great Star Drive and Linden Linthicum Lane. It is assumed to include 50,000 SF of specialty retail and 100 apartment units. Access to the apartments is assumed to be via Linden Linthicum Lane and access to the specialty retail center is assumed to be via Great Star Drive.

Retail: Corner of MD 108 / Ten Oaks Road: On the north side of MD 108, east of Ten Oaks Road and west of MD 32 eastbound ramps, 25,000 SF of specialty retail space is forecasted. Access to this site will be assumed to be via Ten Oaks Road.

A summary of the land use forecasts is shown in **Table 5**.

Table 5: Preliminary Cost Estimate for Alternatives

Clarksville Pike (MD 108) Corridor Planning Study			
Development Year	**Development**	**Name/County Site Plan ID**	**SHA Access Permit Reference Number**
2016	50 Single Family Homes	Multiple SDPs	
2016	20K SF Auto Dealership	Antwerpen Hyundai/SDP-14-061	14APHO014XX
2016	Pizza Hut Site - 7K SF Retail	Retail Building on Clarksville Pizza Hut Property/SDP-11-037, Retail Office Building on Pizza Hut Property/ ECP-11-009	
2016	Clarksville Commons Phase 1	Clarksville Commons/SDP-13-079, Clarksville Commons/ECP-13-062	11APHO018XX
2016	160 Single Family Units	Multiple SDPs	
2016	25 Single Family Units	Multiple SDPs	
2035	10K SF Funeral Home	Donaldson Funeral Home/SDP-14-059	
2035	200 Single Family Unit Subdivision	n/a	
2035	25K SF Retail	n/a	
2035	Ten Oaks Park and Ride 250 Spaces	n/a	
2035	Clarksville Commons Phase 2	n/a	
2035	Village Center - 50 K SF Retail	n/a	
2035	Village Center - 100 Apartments	n/a	

V.B. Traffic Forecasts

Growth in Existing Traffic Volumes

Growth of mainline through traffic on MD 108 was assumed to be 3% per year for the short-term, 2016, forecasts. Volumes were grown by 3% per year from the year 2014 to 2016. For forecast years beyond 2016, a growth rate for mainline traffic on MD 108 was calculated using the Baltimore Region Travel Model, Version 4.3 with Round 8 Demographic Inputs, developed by the Baltimore Metropolitan Council, June 2013. Volumes from 2010 and 2035 were extracted from the model. The 2010 and 2035 volumes on MD 108 were then compared and an average annual growth percentage was calculated. This resulted in a growth rate of approximately 1.5% per year, which was used to grow the baseline 2016 through volumes on MD 108 to long-term forecast year 2035.

Once the baseline 2016 and 2035 volumes were developed, trip generation and assignment was developed for all local speculative land uses. The volumes generated from the short-term and long-

term local speculative land uses were added to the baseline 2016 and 2035 volumes, respectively, to develop the future 2016 and 2035 volumes.

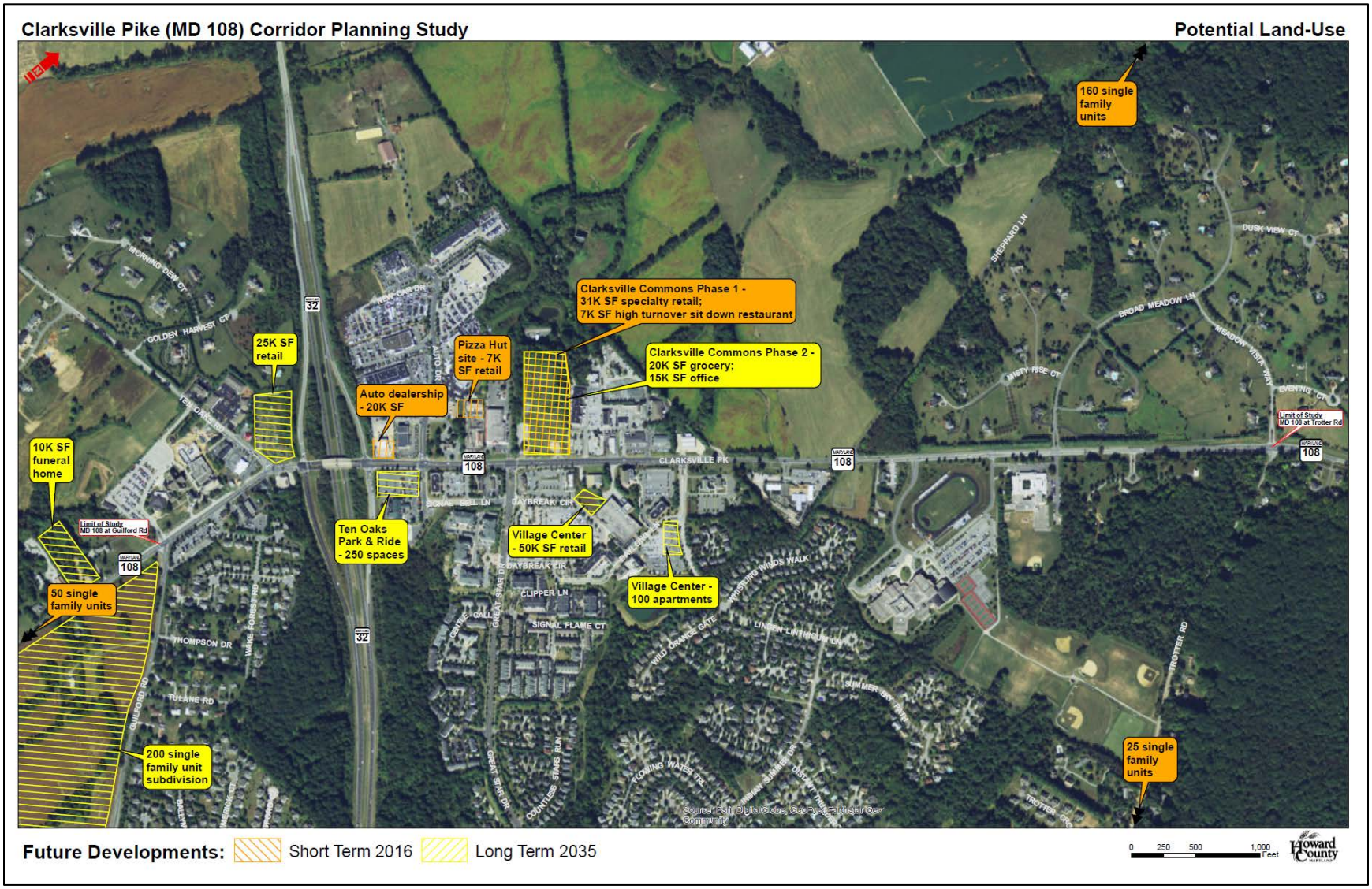
Development Traffic Forecasts

The methodology for projecting future traffic, specifically development-generated traffic, is based on a standard four-step travel demand forecasting process. The four steps include 1) trip generation 2) modal choice/discounts 3) trip distribution, and 4) trip assignment. Each of these steps is discussed in more detail below.

Trip Generation

Projecting the number of new vehicular trips generated by proposed developments is the most critical aspect of assessing traffic impact. The objective of a trip generation analysis is to forecast the number of new trips that will begin or end at a proposed land use. A primary source for data on vehicular trip generation is the *Trip Generation Handbook* published by the Institute of Transportation Engineers. The *Handbook* compiles data from over 5,500 surveys of trip rates at hundreds of specific types of land uses such as recreational, residential, commercial, office, institutional, and industrial throughout the country. The data is sorted by various time periods such as morning and evening peak hour, and plotted against independent variables for specific land uses such as square feet of commercial space, number of hotel rooms, number of dwelling units, etc. The data is presented in graphical format with weighted averages, and fitted curve linear regression equations, where enough data is available.

Figure 8: 2025 Potential Land Use



Using the ITE Trip Generation Manual, 9th Edition (2012) peak hour trip generation rates were determined based on the future land uses. The average number of vehicle trip ends and percentage of entering and exiting volumes were calculated. Land use categories 090 – Park-and-Ride Lot with Bus Service, 210 – Single-Family Detached Housing, 220 – Apartment, 710 – General Office Building, 826 – Specialty Retail Center, 841 – Automobile Sales, 850 – Supermarket, 912 – Drive-in Bank, 932 – High-Turnover (Sit-Down) Restaurant, and 934 – Fast-Food Restaurant with Drive-Through Window were selected. A funeral home is also proposed, but there is no land use code in the ITE Trip Generation Manual. A vast majority of traffic generated by a funeral home would occur during non-peak hours, therefore, very little impact to MD 108 is expected.

Modal Choice / Discounts

Several site-specific factors can reduce the number of new personal vehicular trips generated by a new development or land use. These include the 1) the availability of alternative modes of transportation such as sidewalks, bicycle facilities, and public transportation; 2) the effect of pass-by traffic which includes vehicles already on the roadway network making an intermediate stop on the way from an origin to a primary trip destination without a route diversion, and 3) the effect of internally captured trips composed of traffic originating and destined for different land uses within the same development that do not travel on the external public roadway network. As an initial forecasting assumption, it was assumed that there were no modal choice discounts due to the limited number of pedestrian/bicycle facilities currently available as well as lack of public transit. There was also not assumed to be any internal capture.

The effect of pass-by traffic is quantified from data available in *Trip Generation Handbook.* For certain developments, primarily retail and service-oriented land uses, the traffic entering and exiting the site may be significantly different than the total number of new personal vehicle trips added to the roadway network. The difference between the total entering and exiting traffic and new vehicle trips - pass-by traffic – can range from 20% to 60%, but averages around 34%. The variance is largely dependent on the specific type(s) of retail or service uses and size of the development. A graphical illustration of pass-by traffic is shown in **Figure 9**.

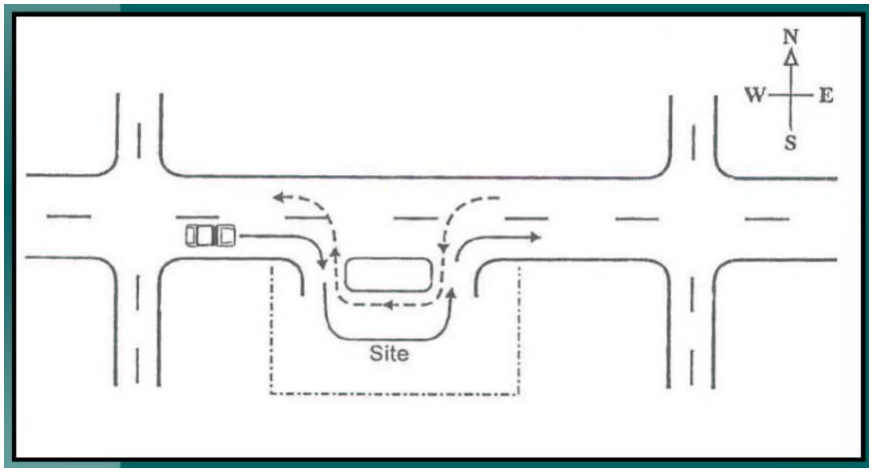


Figure 9: Illustration of Pass-By Traffic

The projected short-term (2016) and long-term (2035) trip generation is summarized in **Table 5** and **Table 6**.

The proposed short-term developments are projected to generate, after applicable reduction factors, 750 new vehicular trips during the AM peak hour and 585 new vehicular trips during the PM peak hour. In the long-term, an additional 1,000 AM peak hour vehicular trips and 876 PM peak hour vehicular trips are projected from new developments.

Trip Distribution

Distribution to each proposed development was assumed based on existing traffic patterns, land uses within the site, and access points to the site and are shown in **Figure 10**.

Trip Assignment: Total Future (2016) Traffic Volumes

Future 2016 traffic volumes were obtained by adding the existing traffic volumes, growth on MD 108 to year 2016, and traffic generated by short-term developments in the study area, including pass-by trips. The total net new trips for the AM and PM peak hours are shown in **Figure 11** and **Figure 12**. The total year 2016 volumes for the AM and PM peak hours are shown in **Figure 13** and **Figure 14**.

Trip Assignment: Total Future (2035) Traffic Volumes

Future 2035 traffic volumes were obtained by adding the 2016 traffic volumes, growth on MD 108 to year 2035, and traffic generated by long-term developments in the study area, including pass-by trips. The total net new trips for the AM and PM peak hours are shown in **Figure 15** and **Figure 16**. The total year 2035 volumes for the AM and PM peak hours are shown in **Figure 17** and **Figure 18**.

Table 5: Projected Short-Term (2016) Trip Generation

Short-Term (2016)						
Land Use	Size	Independent Variable	AM Peak Hour		PM Peak Hour	
			Entry	Exit	Entry	Exit
Commons Phase I						
826 - Specialty Retail Center	31	1000 Sq. Feet Gross Leasable Area	102	110	37	47
Pass-by			0	0	0	0
Non-pass-by			102	110	37	47
932 - High-Turnover (Sit-Down) Restaurant	7	1000 Sq. Feet Gross Floor Area	42	34	41	28
Pass-by			0	0	18	12
Non-pass-by			42	34	23	16
Total			144	144	78	75
Total Pass-by			0	0	18	12
Total Non-pass-by			144	144	60	63
Land Use	Size	Independent Variable	AM Peak Hour		PM Peak Hour	
			Entry	Exit	Entry	Exit
Auto Dealership						
841 - Automobile Sales	20	1000 Sq. Feet Gross Floor Area	29	9	25	37
Pass-by			0	0	0	0
Non-pass-by			29	9	25	37
Total			29	9	25	37
Total Pass-by			0	0	0	0
Total Non-pass-by			29	9	25	37
Land Use	Size	Independent Variable	AM Peak Hour		PM Peak Hour	
			Entry	Exit	Entry	Exit
Pizza Hut Site Retail						
826 - Specialty Retail Center	7	1000 Sq. Feet Gross Leasable Area	23	25	8	11
Pass-by			0	0	0	0
Non-pass-by			23	25	8	11
Total			23	25	8	11
Total Pass-by			0	0	0	0
Total Non-pass-by			23	25	8	11
Land Use	Size	Independent Variable	AM Peak Hour		PM Peak Hour	
			Entry	Exit	Entry	Exit
MD 108 West of Study Area						
210 - Single-Family Detached Housing	50	Dwelling Units	11	34	35	21
Pass-by			0	0	0	0
Non-pass-by			11	34	35	21
Total			11	34	35	21
Total Pass-by			0	0	0	0
Total Non-pass-by			11	34	35	21
Land Use	Size	Independent Variable	AM Peak Hour		PM Peak Hour	
			Entry	Exit	Entry	Exit
Sheppard Lane North of Study Area						
210 - Single-Family Detached Housing	160	Dwelling Units	31	91	101	59
Pass-by			0	0	0	0
Non-pass-by			31	91	101	59
Total			31	91	101	59
Total Pass-by			0	0	0	0
Total Non-pass-by			31	91	101	59
Land Use	Size	Independent Variable	AM Peak Hour		PM Peak Hour	
			Entry	Exit	Entry	Exit
Trotter Road South of Study Area						
210 - Single-Family Detached Housing	25	Dwelling Units	7	20	19	11
Pass-by			0	0	0	0
Non-pass-by			7	20	19	11
Total			7	20	19	11
Total Pass-by			0	0	0	0
Total Non-pass-by			7	20	19	11
Grand Totals						
Total			**245**	**323**	**266**	**214**
Total Pass-by			**0**	**0**	**18**	**12**
Total Non-pass-by			**245**	**323**	**248**	**202**

Table 6: Projected Long-Term (2035) Trip Generation

Long-Term (2035)						
Land Use	Size	Independent Variable	AM Peak Hour		PM Peak Hour	
			Entry	Exit	Entry	Exit
Commons Phase II						
850 - Supermarket	20	1000 Sq. Feet Gross Floor Area	42	26	121	116
Pass-by			0	0	44	41
Non-pass-by			42	26	77	75
710 - General Office Building	15	1000 Sq. Feet Gross Floor Area	37	5	16	79
Pass-by			0	0	0	0
Non-pass-by			37	5	16	79
Total			79	31	137	195
Total Pass-by			0	0	44	41
Total Non-pass-by			79	31	93	154
Land Use	**Size**	**Independent Variable**	**AM Peak Hour**		**PM Peak Hour**	
			Entry	**Exit**	**Entry**	**Exit**
Ten Oaks Park and Ride						
090 - Park-and-Ride Lot with Bus Service	250	Parking Spaces	137	37	39	117
Pass-by			0	0	0	0
Non-pass-by			137	37	39	117
Total			137	37	39	117
Total Pass-by			0	0	0	0
Total Non-pass-by			137	37	39	117
Land Use	**Size**	**Independent Variable**	**AM Peak Hour**		**PM Peak Hour**	
			Entry	**Exit**	**Entry**	**Exit**
Guilford / MD 108 Subdivision						
210 - Single-Family Detached Housing	200	Dwelling Units	38	112	123	73
Pass-by			0	0	0	0
Non-pass-by			38	112	123	73
Total			38	112	123	73
Total Pass-by			0	0	0	0
Total Non-pass-by			38	112	123	73
Land Use	**Size**	**Independent Variable**	**AM Peak Hour**		**PM Peak Hour**	
			Entry	**Exit**	**Entry**	**Exit**
Guilford / MD 108 Funeral Home						
Funeral Home	10	1000 Sq. Feet Gross Floor Area	No Land Use Code in ITE Trip Generation Manual 9th Edition. Vast majority of traffic generated by Funeral Home would occur during non-peak hours.			
Land Use	**Size**	**Independent Variable**	**AM Peak Hour**		**PM Peak Hour**	
			Entry	**Exit**	**Entry**	**Exit**
Village Center						
826 - Specialty Retail Center	50	1000 Sq. Feet Gross Leasable Area	164	178	60	76
Pass-by			0	0	0	0
Non-pass-by			164	178	60	76
220 - Apartment	100	Dwelling Units	11	42	47	26
Pass-by			0	0	0	0
Non-pass-by			11	42	47	26
Total			175	220	107	102
Total Pass-by			0	0	0	0
Total Non-pass-by			175	220	107	102
Land Use	**Size**	**Independent Variable**	**AM Peak Hour**		**PM Peak Hour**	
			Entry	**Exit**	**Entry**	**Exit**
Corner of Ten Oaks / 108 - Retail						
826 - Specialty Retail Center	25	1000 Sq. Feet Gross Leasable Area	82	89	30	38
Pass-by			0	0	0	0
Non-pass-by			82	89	30	38
Total			82	89	30	38
Total Pass-by			0	0	0	0
Total Non-pass-by			82	89	30	38
Grand Totals						
Total			**511**	**489**	**436**	**525**
Total Pass-by			**0**	**0**	**44**	**41**
Total Non-pass-by			**511**	**489**	**392**	**484**

Figure 10: Trip Distribution Percentages

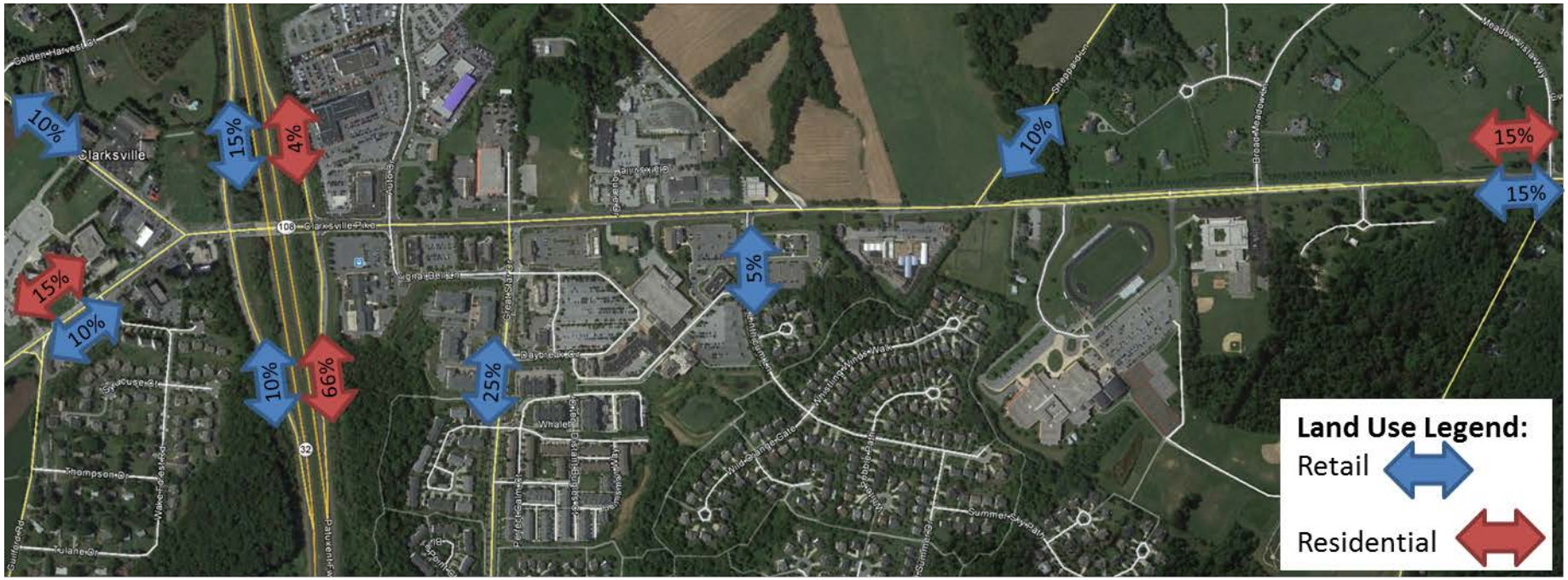


Figure 11: 2016 Short-term AM Net New Trips

Figure 11 (Continued): 2016 Short-term AM Net New Trips

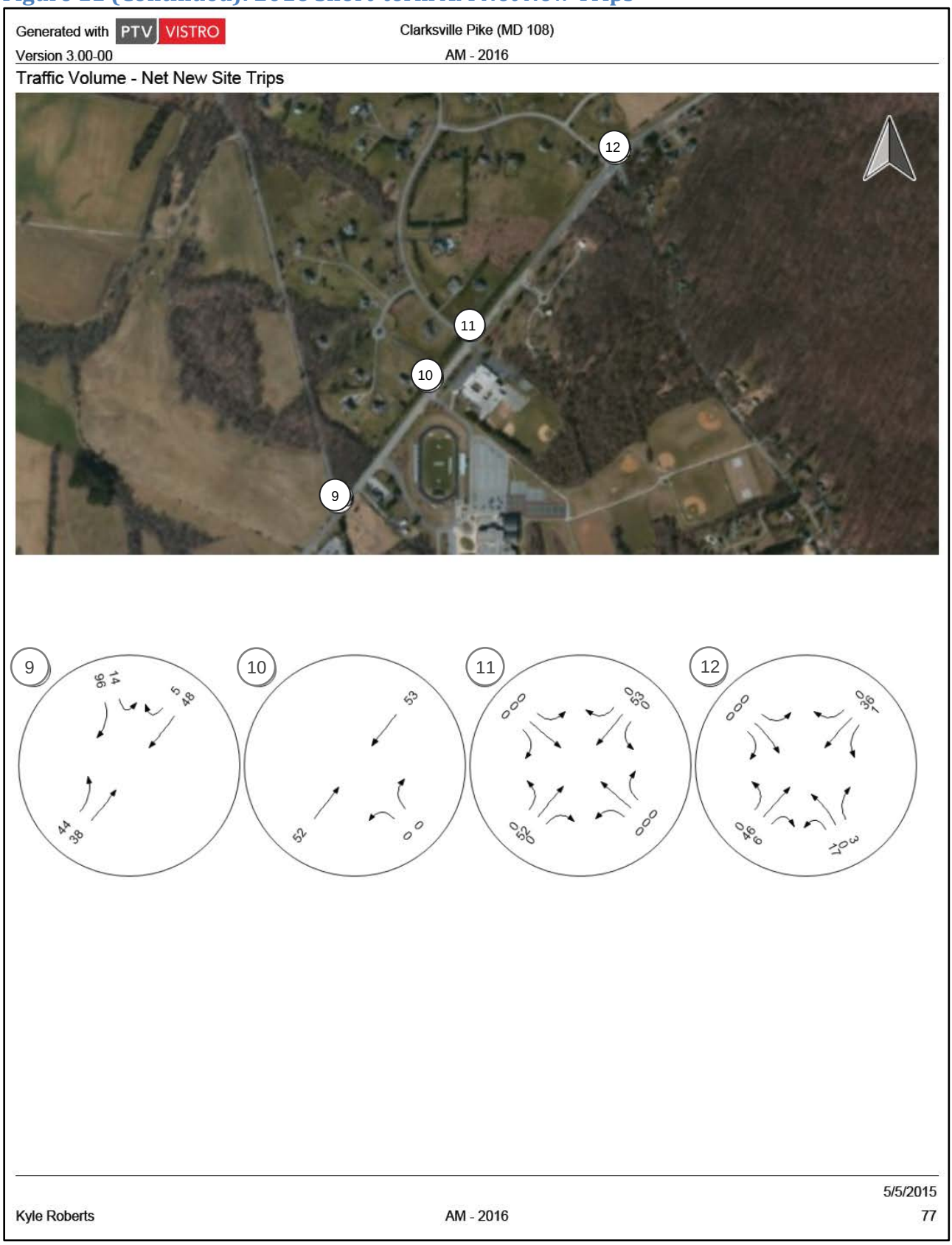


Figure 12: 2016 Short-term PM Net New Site Trips

Figure 12 (Continued): 2016 Short-term PM Net New Site Trips

Figure 13: Short-term AM Future 2016 Volumes

Figure 13 (Continued): Short-term AM Future 2016 Volumes

Figure 14: Short-term PM Future 2016 Volumes

Figure 14 (Continued): Short-term PM Future 2016 Volumes

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Clarksville Pike (MD 108)
PM - 2016

Traffic Volume - Future Total Volume

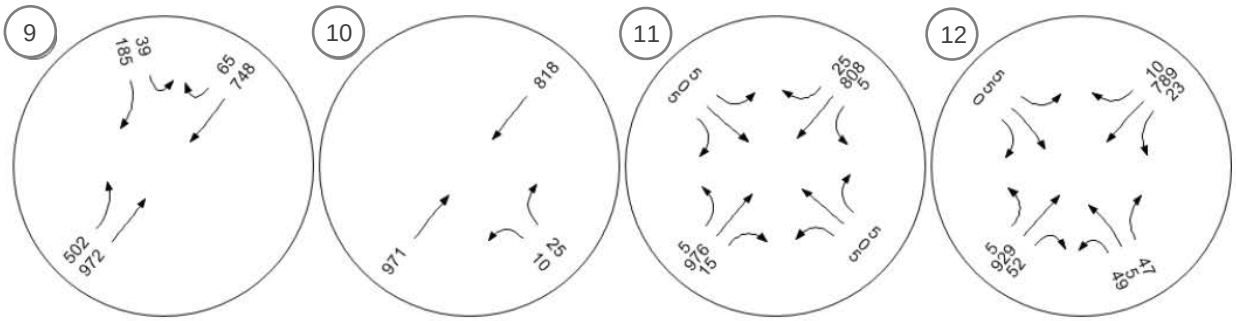

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Figure 15: 2035 Long-term AM Net New Site Trips

Figure 15 (Continued): 2035 Long-term AM Net New Site Trips

Figure 16: 2035 Long-term PM Net New Site Trips

Figure 16 (Continued): 2035 Long-term PM Net New Site Trips

Figure 17: Long-term AM Future 2035 Volumes

Figure 17 (Continued): Long-term AM Future 2035 Volumes

Figure 18: Long-term PM Future 2035 Volumes

Figure 18 (Continued): Long-term PM Future 2035 Volumes

V.C. Future Traffic Operations

Future Capacity Analysis without Improvements

A capacity analysis was performed with the total future short-term (2016) and long-term (2035) volumes without any additional roadway capacity improvements. As discussed in the existing conditions, a Synchro™ model implementing Highway Capacity Manual 2000 methods was used to perform the analyses. The results of the 2016 and 2035 future capacity analysis are summarized in **Table 7** and **Table 8**, respectively. Detailed future HCM reports are included in **Appendix G**.

Table 7: Future Short-term (2016) Intersection Capacity Analysis Results

Measures of Effectiveness				
Intersection/Approach (Storage Length, in feet)	2016 - AM (PM)			
	LOS	Delay / Veh (sec)	Volume / Capacity Ratio	95th % Queue SimTraffic
MD 108 at Church Entrance/Guilford Road	*A (A)*	*7.6 (9.4)*	*0.51 (0.67)*	*NBTR - 297' (NBTR - 535')*
MD 108 at Ten Oaks Road/Gas Station	*C (C)*	*25.3 (31.6)*	*0.76 (0.74)*	*EBLT - 3604' (EBLT - 3300')*
MD 108 at MD 32 EB Ramps	*C (C)*	*31.7 (34.9)*	*0.91 (0.93)*	*SBT - 582' (SBT - 531')*
MD 108 at MD 32 WB Ramps	*C (C)*	*20.3 (32.9)*	*0.63 (0.76)*	*SBT - 414' (WBL - 623')*
MD 108 at Auto Drive/Firehouse	*A (B)*	*7.7 (15.7)*	*0.41 (0.51)*	*SBT - 177' (NBT - 456')*
MD 108 at Hardware Store/Great Star Drive	*B (D)*	*16.8 (43.1)*	*0.58 (0.89)*	*NBTR - 317' (WBLT - 432')*
MD 108 at Clarksville Square Drive[1]	*C (C)*	*23.4 (23.1)*	*0.03 (0.2)*	*EBR - 48' (EBL - 73')*
MD 108 at Linden Linthicum Lane[1]	*F (F)*	*>500 (>500)*	*>5.00 (>5.00)*	*WBR - 81' (WBLT - 678')*
MD 108 at Sheppard Lane	*B (C)*	*18.2 (24.2)*	*0.75 (0.81)*	*WBT - 498' (WBT - 451')*
MD 108 at High School Egress	*B (A)*	*16.5 (5.1)*	*0.7 (0.66)*	*SBT - 479' (SBT - 211')*
MD 108 at Broad Meadow Lane / Elementary School Driveway[1]	*D (F)*	*35 (72.2)*	*0.08 (0.17)*	*SBTR - 241' (WBLTR - 34')*
MD 108 at Meadow Vista Way / Trotter Road[1]	*F (F)*	*205.1 (339.4)*	*1.05 (1.41)*	*WBLT - 88' (WBLT - 121')*

1 - Stop controlled intersection. Level of service, v/c ratio, and delay reported for stop controlled movements only.

During the future short-term year 2016, all signalized intersections would operate with a LOS D or better during both the AM and PM peak hour. The unsignalized intersections of MD 108 at Linden Linthicum Lane and Meadow Vista Way / Trotter Road fail during both the AM and PM peak hours with v/c ratios well over 1.0. The intersection of MD 108 at Broad Meadow Lane / Elementary School Driveway fails due to the delay but operates with a v/c ratio well under 1.0.

Table 8: Future Long-term (2035) Intersection Capacity Analysis Results

Measures of Effectiveness				
Intersection/Approach (Storage Length, in feet)	2035 - AM (PM)			
	LOS	Delay / Veh (sec)	Volume / Capacity Ratio	95th % Queue SimTraffic
MD 108 at Church Entrance/Guilford Road	*B (E)*	*13.1 (58.4)*	*0.73 (0.99)*	*NBTR - 454' (NBTR - 448')*
MD 108 at Ten Oaks Road/Gas Station	*F (F)*	*113.4 (157.5)*	*1.26 (1.42)*	*EBLT - 3428' (EBLT - 3529')*
MD 108 at MD 32 EB Ramps	*E (F)*	*70.7 (98)*	*1.18 (1.17)*	*SBT - 566' (SBT - 625')*
MD 108 at MD 32 WB Ramps	*C (D)*	*25.8 (37.8)*	*0.85 (0.96)*	*WBLT - 702' (WBLT - 579')*
MD 108 at Auto Drive/Firehouse	*B (C)*	*14.8 (30.9)*	*0.66 (0.79)*	*NBT - 447' (NBTR - 435')*
MD 108 at Hardware Store/Great Star Drive	*C (F)*	*28.1 (93.6)*	*0.83 (1.13)*	*SBTR - 358' (WBLT - 363')*
MD 108 at Clarksville Square Drive[1]	*E (E)*	*39.4 (36.5)*	*0.05 (0.3)*	*EBR - 281' (NBT - 123')*
MD 108 at Linden Linthicum Lane[1]	*F (F)*	*>500 (>500)*	*>5.00 (>5.00)*	*WBR - 631' (WBLT - 594')*
MD 108 at Sheppard Lane	*E (E)*	*69 (58.4)*	*1.07 (1.01)*	*SBL - 505' (EBT - 485')*
MD 108 at High School Egress	*E (C)*	*66.3 (25.3)*	*1.05 (0.97)*	*SBT - 428' (SBT - 491')*
MD 108 at Broad Meadow Lane / Elementary School Driveway[1]	*F (F)*	*156.5 (473.6)*	*0.51 (0.73)*	*SBTR - 623' (SBTR - 814')*
MD 108 at Meadow Vista Way / Trotter Road[1]	*F (F)*	*>500 (>500)*	*3.66 (>5.00)*	*WBLT - 618' (WBLT - 628')*

1 - Stop controlled intersection. Level of service, v/c ratio, and delay reported for stop controlled movements only.

By year 2035 without any improvements, all but four of the study intersections operate with a LOS F or v/c ratio greater than 1.0 during at least either the AM or PM peak hour.

Future Capacity Analysis with Improvements

Short-term: 2016

The goal of Phase I was to focus on developing short-term improvements to provide contiguous and enhanced pedestrian and bicycle access through the corridor. Therefore, Alternative 1 did not contain any capacity changes.

Alternative 2 of Phase I included some additional pedestrian and bicycle facilities/treatments as well as addressing key operational deficiencies noted in the June 2012 "Clarksville Traffic Study". The results of the 2016 Alternative 2 future capacity analysis are summarized in **Table 9**. Detailed future 2016 Alternative 2 HCM reports are included in **Appendix G**.

The intersection of MD 108 at Linden Linthicum Lane is most improved by the Alternative 2 traffic improvements. The previously unsignalized intersection with only one eastbound through lane is upgraded to a signalized intersection with two eastbound through lanes in this alternative. This improves the LOS from a LOS F during both the AM and PM peak hours to a LOS A during the AM peak hour and LOS B during the PM peak hour.

Long-term Ultimate Build Concept: 2035

As shown in the future long-term year 2035 capacity analyses without improvements (Table 8), the combination of expected regional growth and local growth oversaturates the MD 108 corridor. The oversaturated conditions of the long-term year 2035 capacity analyses were used to determine an Ultimate Build concept which would address most of the operational deficiencies along MD 108.

Under the 2035 Ultimate Build concept, several roadway footprint changes in addition to all items detailed under Alternative 2 would need to be constructed to provide additional vehicle capacity. These additional improvements, which would fully extend the 5-lane section west to Guilford Road and east to Sheppard Lane, include:

- Widening the eastbound approach of MD 108 500' prior to Guilford Road for an additional eastbound through lane.
- Widening eastbound and westbound MD 108 between Wake Forest Road and the eastbound MD 32 ramps for an additional through lane in each direction.
- An additional westbound through lane on MD 108 between Sheppard Lane and the farm driveway just east of Freestate Gas Station. The second westbound lane will require conversion of the channelized westbound right turn lane from MD 108 to Sheppard Lane to a shared through-right lane.
- Medians on MD 108 would be installed at some areas where left-turns are to be discouraged or where there is unused space. These locations include:
    - East and west of the River Hill High School exit
    - Between the Clarksville Centre entrance and Dogtopia's exit
    - Between Auto Drive/Signal Bell Lane and Great Star Drive
    - Just east of the westbound MD 32 ramps

Detailed Ultimate Build concept plans are included in **Appendix E.** The results of the 2035 Ultimate Build future capacity analysis are summarized in **Table 10** and detailed future 2035 Ultimate Build HCM reports are included in **Appendix G**.

Table 9: Future Short-term (2016) with Alt 2 Improvements Intersection Capacity Analysis Results

Measures of Effectiveness				
Intersection/Approach (Storage Length, in feet)	2016 - AM (PM) with Alt 2 Improvements			
	LOS	Delay / Veh (sec)	Volume / Capacity Ratio	95th % Queue SimTraffic
MD 108 at Church Entrance/Guilford Road	*A (A)*	*7.6 (9.6)*	*0.51 (0.67)*	*NBTR - 178' (NBTR - 520')*
MD 108 at Ten Oaks Road/Gas Station	*C (C)*	*25.3 (31.6)*	*0.76 (0.74)*	*EBLT - 3379' (EBLT - 3463')*
MD 108 at MD 32 EB Ramps	*C (C)*	*31.7 (30.8)*	*0.91 (0.89)*	*SBT - 581' (SBT - 584')*
MD 108 at MD 32 WB Ramps	*C (C)*	*20.3 (31.7)*	*0.63 (0.75)*	*SBT - 428' (WBLT - 597')*
MD 108 at Auto Drive/Firehouse	*A (B)*	*7.7 (15.7)*	*0.41 (0.51)*	*NBTR - 190' (NBTR - 315')*
MD 108 at Hardware Store/Great Star Drive	*B (D)*	*16.8 (43.6)*	*0.58 (0.9)*	*NBTR - 330' (WBLT - 427')*
MD 108 at Clarksville Square Drive[1]	*C (C)*	*17.4 (19.8)*	*0.02 (0.17)*	*EBR - 47' (EBL - 211')*
MD 108 at Linden Linthicum Lane[1]	*A (B)*	*9.5 (17)*	*0.65 (0.75)*	*NBTR - 114' (NBTR - 280')*
MD 108 at Sheppard Lane	*B (C)*	*17.2 (23.2)*	*0.73 (0.81)*	*WBT - 502' (EBT - 527')*
MD 108 at High School Egress	*B (A)*	*16.5 (5.1)*	*0.7 (0.66)*	*SBT - 473' (NBT - 164')*
MD 108 at Broad Meadow Lane / Elementary School Driveway[1]	*D (F)*	*35 (72.2)*	*0.08 (0.17)*	*SBTR - 234' (WBLTR - 36')*
MD 108 at Meadow Vista Way / Trotter Road[1]	*F (F)*	*205.1 (339)*	*1.05 (1.41)*	*WBLT - 126' (WBLT - 94')*

1 - Stop controlled intersection. Level of service, v/c ratio, and delay reported for stop controlled movements only.

Table 10: Future Long-term (2035) Ultimate Build Intersection Capacity Analysis Results

Measures of Effectiveness				
Intersection/Approach (Storage Length, in feet)	2035 Ultimate Footprint - AM (PM)			
	LOS	Delay / Veh (sec)	Volume / Capacity Ratio	95th % Queue SimTraffic
MD 108 at Church Entrance/Guilford Road	*A (A)*	*9.3 (8.5)*	*0.69 (0.66)*	*NBT - 249' (NBT - 514')*
MD 108 at Ten Oaks Road/Gas Station	*C (D)*	*26.4 (48.5)*	*0.71 (0.75)*	*EBLT - 3194' (EBLT - 3109')*
MD 108 at MD 32 EB Ramps	*D (D)*	*44.2 (46.2)*	*1.05 (0.97)*	*SBT - 623' (SBT - 621')*
MD 108 at MD 32 WB Ramps	*C (D)*	*26.6 (43.1)*	*0.84 (0.96)*	*SBTR - 387' (WBL - 609')*
MD 108 at Auto Drive/Firehouse	*B (C)*	*15.7 (28.7)*	*0.66 (0.77)*	*NBTR - 280' (NBTR - 439')*
MD 108 at Hardware Store/Great Star Drive	*C (E)*	*23.5 (69.3)*	*0.78 (1.03)*	*WBLT - 408' (SBTR - 417')*
MD 108 at Clarksville Square Drive[1]	*C (D)*	*21.5 (26.4)*	*0.02 (0.23)*	*EBR - 212' (EBR - 277')*
MD 108 at Linden Linthicum Lane[1]	*B (D)*	*18.7 (47.1)*	*0.84 (1.04)*	*SBTR - 202' (NBTR - 222')*
MD 108 at Sheppard Lane	*B (B)*	*19 (18.3)*	*0.76 (0.78)*	*WBT - 420' (EBT - 385')*
MD 108 at High School Egress	*C (B)*	*32.6 (13.4)*	*0.95 (0.92)*	*WBL - 579' (SBT - 281')*
MD 108 at Broad Meadow Lane / Elementary School Driveway[1]	*F (F)*	*156.5 (473.6)*	*0.51 (0.73)*	*SBTR - 265' (SBTR - 160')*
MD 108 at Meadow Vista Way / Trotter Road[1]	*F (F)*	*>500 (>500)*	*3.66 (>5.00)*	*WBLT - 491' (WBLT - 571')*

1 - Stop controlled intersection. Level of service, v/c ratio, and delay reported for stop controlled movements only.

The results of the long-term 2035 Ultimate Build capacity analysis show that all intersections operate with a LOS E or better during both the AM and PM peak hours with the following exceptions:

- The unsignalized intersections of MD 108 at Broad Meadow Lane/ Elementary School Driveway and MD 108 at Meadow Vista Way/Trotter Road fail during both peak hours. The v/c ratios at MD 108 at Broad Meadow Lane/ Elementary School Driveway are well under 1.0 while the v/c ratios at MD 108 at Meadow Vista Way/ Trotter Road are well over 1.0.

- Although all other intersections operate with a LOS E or better during the AM and PM peak hour, the overall v/c ratio at three of those intersections is just over 1.0. Those intersections are MD 108 at MD 32 EB ramps during the AM peak hour, MD 108 at Hardware Store/Great Star Drive during the PM peak hour, and MD 108 at Linden Linthicum Lane during the PM peak hour.

VI. SUMMARY OF FINDINGS

The following summarizes the findings based on the data and analyses above:

Pedestrian and Bike Network Gaps and Barriers

Notable pedestrian infrastructure gaps are:

- No sidewalks along MD 108 east of Clarksville Square Drive.
- No sidewalks along MD 108 between Signal Bell Lane and Great Star Drive.
- West of Signal Bell Lane sidewalks run along MD 108 but with breaks and on alternating sides of the road.
- Only three crosswalks exist across MD 108 leaving long stretches of the MD 108 study area without any nearby pedestrian crossings.

Notable bicycle facilities gaps include:

- No bike facilities west of Ten Oaks Road.
- No bike facilities east of the River Hill High School egress.
- Quality of bicycle facilities not accommodating for all use types.

Traffic Operations Deficiencies

Existing

- The unsignalized intersections of MD 108 at Linden Linthicum Lane and MD 108 at Meadow Vista Way/ Trotter Road fail during both the AM and PM peak hours.
- All signalized intersections operate with a LOS D or better during both the AM and PM peak hours.

2016

- All signalized intersections would operate with a LOS D or better during both the AM and PM peak hour.
- The unsignalized intersections of MD 108 at Linden Linthicum Lane and Meadow Vista Way / Trotter Road fail during both the AM and PM peak hours with v/c ratios well over 1.0.
- The intersection of MD 108 at Broad Meadow Lane / Elementary School Driveway fails due to the delay but operates with a v/c ratio well under 1.0.

2016 with Alternative 2 Improvements

- All signalized intersections would operate with a LOS D or better during both the AM and PM peak hour.
- The unsignalized intersection of MD 108 at Meadow Vista Way/Trotter Road fails during both peak hours with v/c ratios much greater than 1.0.

- The intersection of MD 108 at Broad Meadow Lane / Elementary School Driveway fails due to the delay during the PM peak hour but operates with a v/c ratio well under 1.0.

2035

- All but four of the study intersections operate with a LOS F or v/c ratio greater than 1.0 during at least either the AM or PM peak hour.

2035 Ultimate Build

- All intersections operate with a LOS E or better during both the AM and PM peak hours with the following exceptions:
    - The unsignalized intersections of MD 108 at Broad Meadow Lane / Elementary School Driveway and MD 108 at Meadow Vista Way/Trotter Road fail during both peak hours.
    - Although all other intersections operate with a LOS E or better during the AM and PM peak hour, the overall v/c ratio at three of those intersections is just over 1.0.

Land Use Forecasts

- Growth of mainline through traffic on MD 108 was assumed to be 3% per year for the short-term, 2016, forecasts.
- For forecast years beyond 2016, a growth rate for mainline traffic on MD 108 was calculated using the Baltimore Region Travel Model resulting in a growth rate of approximately 1.5% per year.
- It was assumed that there were no modal choice discounts due to the limited number of pedestrian/bicycle facilities currently available as well as lack of public transit.
- No internal capture was assumed.
- Pass-by traffic was discounted according to data available from the *Trip Generation Handbook.*
- Speculative land use forecasts for short-term year 2016 include the following:
    - Commons Phase I
    - Auto Dealership Expansion
    - Pizza Hut Site Retail
    - Single Family Dwellings: MD 108 West of Study Area
    - Single Family Dwellings: Sheppard Lane North of Study Area
    - Single Family Dwellings: Trotter Road South of Study Area
- Additional developments included in the long-term year 2035 potential future land-use include:
    - Commons Phase II
    - Ten Oaks Park and Ride
    - Single Family Dwellings: MD 108 / Guilford Road South of Study Area
    - Funeral Home: MD 108 / Guilford Road
    - Village Center
    - Retail: Corner of MD 108 / Ten Oaks Road
- The proposed short-term developments are projected to generate, after applicable reduction factors, 750 new vehicular trips during the AM peak hour and 585 new vehicular trips during the PM peak hour.

- In the long-term, an additional 1,000 AM peak hour vehicular trips and 876 PM peak hour vehicular trips are projected from new developments.

Community Input

The River Hill Community Association (RHCA) has recently placed an increased importance on complete streets. The River Hill Village Center Community Plan approved in December 2013 lays out an implementation plan for the area and specific pedestrian and bicycle infrastructure requests. RHCA was engaged several times for input throughout this study.

VII. SUPPLEMENTAL ANALYSIS

Although the land use and traffic forecasts assume aggressive growth/market absorption a supplemental analysis of the potential for future traffic diversion or mode shift was performed.

Select Link Analysis

Using the County's travel demand model for year 2010 and year 2035, a select link analysis was performed along MD 108 in the vicinity of the Clarksville commercial core. The analysis probed vehicle trips assigned on the study link to determine the number of vehicles with 'local' origins and destinations. A local trip was defined as a traffic analysis zone within 4 miles of the intersection of MD 108 at Great Star Drive, which could reasonably be assumed to be converted to another mode or route. The results of this analysis are summarized in **Table 11**.

Table 11: Comparison of Existing and Future Local Traffic along MD 108 (Clarksville Pike)

Year 2010			
Zone From/ To	**Local**	**Through**	**Total**
Local	1,798 **(9%)**	2,541 (13%)	4,339 (21%)
Through	2,513 (12%)	13,477 **(66%)**	15,990 (79%)
Total	4,311 (21%)	16,018 (79%)	20,329 (100%)

Year 2035			
Zone From/ To	**Local**	**Through**	**Total**
Local	1,680 **(6%)**	2,940 (11%)	4,620 (17%)
Through	2,874 (11%)	19,020 **(72%)**	21,894 (83%)
Total	4,554 (17%)	21,960 (83%)	26,514 (100%)

In long-term year 2035, the number of through trips is expected to increase and local trips decrease. Through trips are expected to increase roughly 6% from 66% to 72% with an actual increase of 5,500 new trips, while local trips are expected to decrease slightly. The projected

decrease in local traffic represents an increasing use of the road by regional traffic and a limited ability to influence future LOS through local traffic diversion or mode shift.

Bicycle Design Waiver

Maryland State Highway Administration's *Bicycle Policy & Design Guidelines* states that if the mandatory conditions outlined in the manual cannot be provided, a design waiver shall be requested. For the MD 108 corridor, the road width does not allow enough width for on-road bicycle facilities to work. The *Bicycle Policy & Design Guidelines* states that a designated bike lane may not be marked as such when less than 4 feet wide. It was assumed that turn lanes would need to be a minimum of 10' wide, through lanes would need to be a minimum of 11' wide, and at least one through lane (outside) would need to be 12' wide to accommodate trucks. On many sections of MD 108 as shown below in **Table 12**, bikes would have to use the travel lanes as there is not adequate width to add even the minimum 4' bike lane.

Table 12: Bicycle Compatibility on MD 108

MD 108 (Clarksville Pike) Bicycle Compatibility		
MD 108 Segment	**On-Road Compatibility**	**Off-Road Compatibility**
Guilford Road to Wake Forest Road	Narrow 4' wide bike lanes	Proposed 10' wide shared-use path
Wake Forest Road to Bank of America Entrance	Bikes use travel lanes / turn lanes / shoulders	Proposed 10' wide shared-use path (Easement Needed)
Bank of America Entrance to Ten Oaks Road	Narrow 4' wide bike lanes	Proposed 10' wide shared-use path
Ten Oaks Road to EB MD 32 Ramps	Bikes use turn lanes	Proposed 10' wide shared-use path
EB MD 32 Ramps to WB MD 32 Ramps	Bikes use travel lanes	Existing 6' sidewalk
WB MD 32 Ramps to Auto Drive / Signal Bell Lane	Bikes use travel lanes	Proposed 10' wide shared-use path (Easement Needed)
Auto Drive / Signal Bell Lane to Great Star Drive	Bikes use travel lanes	Proposed 10' wide shared-use path (Easement Needed)
Great Star Drive to Linden Linthicum Lane	Bikes use travel lanes	Proposed 10' wide shared-use path (Easement Needed)
Linden Linthicum Lane to Farm Driveway (East of Freestate Gas Station)	Bikes use travel lanes	Proposed 10' wide shared-use path (Easement Needed)
Farm Driveway (East of Freestate Gas Station) to Sheppard Lane	Bikes use travel lanes / turn lanes	Proposed 10' wide shared-use path
Sheppard Lane to River Hill High School Entrance	Bikes use turn lanes	Proposed 10' wide shared-use path
River Hill High School Entrance to River Hill High School Exit	Bikes use shoulders / acceleration lane	Proposed 10' wide shared-use path
River Hill High School Exit to Broad Meadow Lane	Bikes use acceleration lane / turn lane	Proposed 10' wide shared-use path
Broad Meadow Lane to Meadow Vista Way / Trotter Road	Bikes use acceleration lane / turn lane / shoulder	Proposed 10' wide shared-use path

VIII. RECCOMENDATIONS

The following recommendations are suggested for the MD 108 (Clarksville Pike) corridor.

VIII.A. Build Alternative 2 Short Term

In the short-term, it is suggested that the Alternative 2 design be finalized and constructed. Alternative 2 will address deficiencies of the existing pedestrian and bicycle facilities, which currently are not well connected with the commercial land uses along MD 108. In addition, it will address some of the key operational deficiencies of the corridor.

VIII.B. Planning for Ultimate Footprint Year 2035

Planning for the ultimate footprint should begin early so that funding is secured and any interim changes to the corridor will facilitate the Ultimate Build design. Some items that can be implemented in small increments as development occurs along the corridor prior to construction are:

- Medians
- Access controls
- Long-term inter-parcel connectivity and parallel public streets to create a better grid

VIII.C. Funding Strategies

New bicycle and pedestrian enhancements and infrastructure costs may require standalone projects and necessitate federal Transportation Alternatives Program (TAP) or National Recreation Trails Program (NRT) funds and/or a combination of the state programs as detailed below or be smaller parts of other routine maintenance projects.

A description of state managed federal bicycle and pedestrian funding programs are:

Transportation Alternatives Program (TAP)
The TEP Program spends approximately $10 million annually, with applications due March 1 every year. Implementing TEP eligible projects and requires a local match of 50%.

National Recreation Trails Program (NRT)
The Recreational Trails Program (RTP) is a grant program of the U.S. Department of Transportation's Federal Highway Administration (FHWA) that provides funds to States to develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses. The NRT Program within the state receives approximately $1 Million annually in federal funds to assist jurisdictions in developing smaller scale trail head and restoration projects at a cap of $30,000 with federal funds matched at 20%.

A description of each of the state managed state bicycle and pedestrian funding programs are:

Bikeway Retrofit Program
The Bicycle Retrofit Program was created in 2000 in order to integrate bicycling into mainstream transportation facilities and promote a broad-based strategic approach to making communities more bicycle friendly. Projects include bicycle signage installation, removing bicycling obstructions, restriping wider shoulders, as well as reconstructing off-road facilities adjacent to roadways. For this program, a "bicycle retrofit" means an on-road or off-road improvement to bicycle access. Funds can

be utilized for bicycle route signage, replacement of drainage grates that are not bicycle compliant along state roadways, roadway restriping to accommodate bicycle lanes, shoulder rehabilitation and off road bicycle hiker/biker path connections where feasible. As part of this program, SHA is evaluating existing state roads to determine how we can retrofit state roads to better accommodate cyclists.

Sidewalk Retrofit Program

Fund 79 – Sidewalk Retrofit is a Capital Program Fund administered by MDSHA. The program provides funding for construction of sidewalks along State Highways and reconstruction of/replacement of existing sidewalks if it is a part of a revitalization effort in an officially designated urban revitalization area. In order to be considered for this fund, local governments must submit an official request. Projects within Designated Neighborhoods can be funded 100 percent (outside 50 percent). Projects within Priority Funding Areas may be funded 75 percent. Projects within a Priority Funding Area that show substantial public risk or significant impediment to pedestrian access may be funded 100 percent. Local government must acquire the necessary right-of-way, accept maintenance and legal liability. The projects must demonstrate a risk in public safety. All improvements are made ADA compliant. For this program, a "retrofit sidewalk" means a sidewalk that is constructed along a State route (Maryland & U.S. routes other than expressways). The reconstruction or replacement of sidewalks, for the purpose of repair or maintenance, is covered under this program only if it is an essential part of a revitalization effort in an officially designated revitalization area. Only retrofit sidewalk projects along State highways are eligible for funding. Amenities beyond the scope of a basic sidewalk may be eligible for consideration for transportation enhancement funding if the location is in an historic district or a revitalization area. In accordance with State law, the cost for retrofit sidewalks shall be shared equally between the State Highway Administration and the local government. Within designated revitalization areas, a local jurisdiction may request reimbursement for up to 100% of the cost to construct sidewalks.

Guidelines used in selecting retrofit sidewalk projects:

- Location – Sidewalks must be along state highway routes.
- Safety – The project should demonstrate safety benefits to pedestrians. It should reduce the existing or potential pedestrian/vehicle conflicts by providing a separation from vehicular traffic. It should also provide or improve mobility for the general and disabled population.
- Designated Revitalization Areas – Priority should be given to projects that demonstrate that the addition of sidewalks will benefit revitalization by providing access to business, commercial and/or recreational areas that does not currently exist. Highest priority should be given to projects in designated revitalization areas.
- Local Pedestrian Policy and Commitment – The local jurisdiction should show evidence that they are in support of pedestrian facilities. Sidewalks should be included in the local jurisdiction's Master Plan.
- Continuity and Integration – It should be evident that the inclusion of the pedestrian facilities will provide a connection to an existing or proposed pedestrian network, e.g. the sidewalk will help to provide a critical link.
- Pedestrian Traffic – It should be evident that there is either existing or projected pedestrian traffic.

- The support for pedestrian facilities can either be denoted by actual pedestrian counts or by evidence of well-worn paths. The projected use can be based on experience with other similar facilities in similar land use settings.
- Community Support – The project should have the support of the adjacent community that will be potential users of the facility.

ADA Compliance Program
Fund 33 – ADA Retrofit is a Capital Program Fund administered by the Maryland State Highway Administration (MDSHA). The program addresses existing non-compliant elements of the sidewalk system along state roadways not addressed under other programs. The goal is to provide accommodations for persons with disabilities through a commitment to remove barriers that impede free movement for all pedestrians along State roadways.

Pedestrian Access to Transit
Fund 78 – Pedestrian Access to Transit is a Capital Program Fund administered by MDSHA. The primary focus of this program is to provide pedestrian access to transit (bus) stops through the construction of sidewalks. In addition, this program evaluates opportunities to improve pedestrian access to Transit Oriented Development sites that are located along State roadway facilities. Similar to the Sidewalk Retrofit Program, The Pedestrian Access to Transit Program is a dedicated funding source designed to be utilized for projects that will provide better pedestrian access to transit facilities such as metro, MARC or light rail stations, bus depots or other transit centers.

SHA's Safety and Spot Improvement Program
The Safety and Spot Improvement Program addresses projects that improve safety and highway locations with geometric deficiencies. Fund 76 is one component of Maryland's Highway Safety Programs, whose main objective is to reduce the number and severity of crashes in Maryland to the lowest attainable levels. Although the Safety and Spot Improvement Program has a relatively small budget compared to the entire Statewide Transportation Fund, the program is extremely cost effective in terms of reducing injury and fatality-involved crashes on Maryland's highways.

Urban Street Reconstruction
SHA's Urban Street Reconstruction is a system preservation fund that enables rehabilitation through urban areas where pavement and drainage reconstruction can assist in the development of sidewalk with local participation as well as other street furniture, landscaping and urban amenities.

Community Enhancement Program
Fund 84 - Community Safety and Enhancement (CSE) is a Capital Program Fund administered by MSHA. The program provides funding for improvements where the emphasis is on enhancing the existing infrastructure to promote economic revitalization such as resurfacing, reconstructing drainage, curb and gutter, landscaping, signing, parking bays, and lighting. CSE program projects are initiated by a community contacting MDHA requesting assistance addressing traffic issues concerning pedestrians, transit riders, bicyclists and motorists. Projects are selected on technical criteria and ranked by technical need, but part of the eligibility criteria is in the hands of the community as well. The CSE program gives priority to roadway improvements on state highway located in State Designated Neighborhoods within Priority Funding Areas where the improvement

will spur economic revelation, contribute to other revitalization activities and, as the name implies, promote neighborhood conservation.

Formerly known as the Neighborhood Conservation Program, the Community Enhancement Program was established in 1996 as a way to stimulate older communities for economic growth. The projects enhance livability, walkability and often times bicycling in communities. Projects typically include streetscapes and intersection improvements in urbanized areas.

A description of other bicycle and pedestrian funding programs are:

Developer Funding
Developers can fund bicycle and pedestrian improvements (e.g. frontage improvements)

VIII.D. Implementation Strategy

Implementation strategies to make sure both the short-term Alternative 2 and long-term Ultimate Build conditions progress and eventually are constructed are the following:

- Designate the study area as a "Bicycle and Pedestrian Priority Area"
    - This designation means the enhancement of bicycle and pedestrian traffic is a priority and facilitates the targeting of available funds from the State.
    - This designation also allows use of advanced pedestrian and bicycle treatments such as **bike boxes, pedestrian warning beacons, median refuge islands, and colored/ textured crosswalks, narrow lanes, leading pedestrian intervals, and pedestrian lighting.**
- Begin detailed engineering design for Alternative 2
    - The Alternative 2 concept plans need to be developed into detailed engineering design files so that construction can begin.
- Design and construction should allow for the Ultimate Build footprint
    - In order to make sure that the Ultimate Build design does not require the removal of any elements of Alternative 2, the plans should be compared so that Alternative 2 can be considered the first phase of the Ultimate Build design. Therefore, future road widening under the Ultimate Build design would not require the relocation of the adjacent sidewalks, mixed-use paths, utility poles, etc.
- Formalize developer agreements
    - Any restrictions to site access, additional right-of-way required for roadway expansion, etc. need to be agreed upon with the developers. These agreements would be easiest to make changes prior to new construction or during redevelopment.