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MEMORANDUM: US 29 BRT TSP

To:	Joana Conklin, Montgomery County DOT
From:	James A. Bunch, SWAI
Subject:	Planning Level US 29 BRT Transit Signal Priority Analysis
Date:	March 30, 2018

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1 Introduction

Transit Signal Priority (TSP) can provide both potential travel time savings and improved reliability to the US 29 BRT service. The purpose, goals, and needs for TSP within the US 29 corridor are:

Purpose:
Help maintain consistent transit vehicle flows and travel times for BRT Service while reducing delays due to stops at traffic signals.
Goal:
Improve expected Transit Travel Times for travelers using the BRT system through improving reliability and reducing delays without undo negative impacts to the overall transportation system performance or other travelers.
Need:
Select 15 intersections for TSP equipment installation
TSP activation by time period will be determined during operations

In April 2016 Montgomery County submitted its TIGER Grant Application that included Transit Signal Priority (TSP), one of the key components of the BRT operations along the corridor (16). The planning level TSP analysis included in the submittal was based upon the County's and Maryland SHA TSP Concept of Operations, and the initial TSP evaluations done for the full Countywide RTS system (5, 6, 7, 8, 9,10). This memorandum provides an update and refinements to the TSP concepts and plans that have occurred through the completion of the US 29 BRT 35% design. Highlights of changes accounted for include:

- Updates to the County's Advanced Transportation Management System software and hardware
- Evolving GTT Opticom Transit Signal Priority hardware and software to incorporate headway based conditional priority, and licensing options
- Potential changes to the Montgomery County Ride On Automated Vehicle Location Computer Aided Dispatch system (currently ORBCAD)
- Refinements to the US 29 BRT station locations and service plans
- Implementation of the MD 355 Ride On extRa TSP (the first within Montgomery County's modernized Advanced Transportation Management System (ATMS))

The memorandum also updates the list of signalized intersections along the corridor and provides initial rankings/feedback on potential locations to enable for TSP (installation of the TSP roadside equipment and communication systems/networks).

1.1 What is Transit Signal Priority

This section provides a refresher for readers not familiar with TSP or its concepts (see References 2, 9, 11 for further information).

Transit Signal Priority (TSP): a Planning and Implementation Handbook defines TSP as "an operational strategy that facilitates the movement of transit vehicles (usually those in service), either buses or streetcars (including BRT and LRT), through traffic-signal controlled intersections (11). Overall TSP can either be Passive or Active. Passive Priority simply adjusts the signal system to favor transit speeds and service patterns. Active Priority provides priority treatment to a specific transit vehicles following

detection and subsequent priority request activation. Figure 1 provides the conceptual elements for implementing Active Priority. These are[1]:

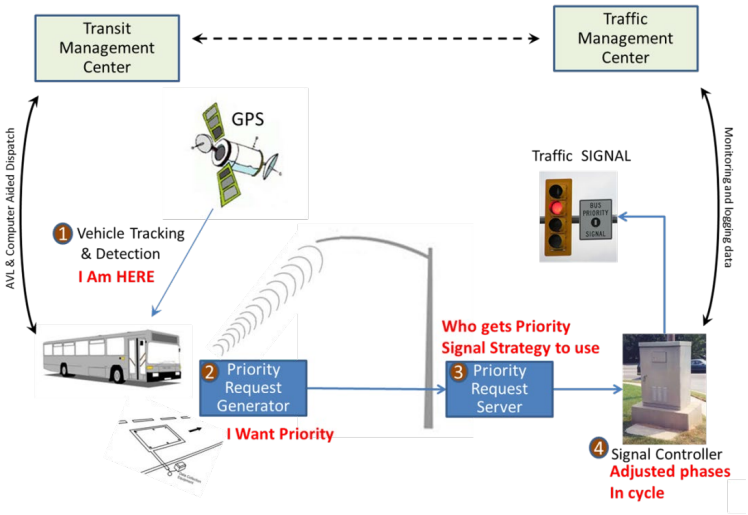


Figure 1 Conceptual Elements of Active Transit Signal Priority

1. **Vehicle Tracking and Detection**. Determines where a vehicle is and when it likely to cross the signalized intersection. Some systems also include capturing when the vehicle has passed through the intersection and no longer needs priority.
2. **Priority Request Generator (PRG)**. As a transit vehicle approaches an intersection the PRG determines if it should request priority or not.
3. **Priority Request Server (PRS)**. Determines which vehicle will be granted its priority request when multiple requests have been received. It then determines the signal priority strategy (see below) to send to the traffic signal controller for implementation. Note, that if minimum walk times cannot be met, if there is no available "slack" time within the cycle from other phases then a priority request, or insufficient time has passed since the last grant of a TSP request (lock out period), a request may not be granted by the PRS.
4. **Signal Controller**. Implements the signal priority strategy it receives from the PRS by adjusting the available phases within the signal cycle.

Once it receives a priority request the PRS selects which signal priority strategy to implement based upon where the signal is within its cycle and when the transit vehicle is expected to arrive at the intersection. While there are other types, the Signal Priority Strategies provided for within the Montgomery County system include:

- **Green Extension**: As a transit vehicle approaches near the end of the green time in its direction of travel, the green time for that phase is extended to allow it to pass.
- **Early Green**: As a transit vehicle approaches a red light in its direction of travel, phases are adjusted for other movements to reduce the time that the transit vehicle sits at the intersection.

Active TSP can also be unconditional or conditional.

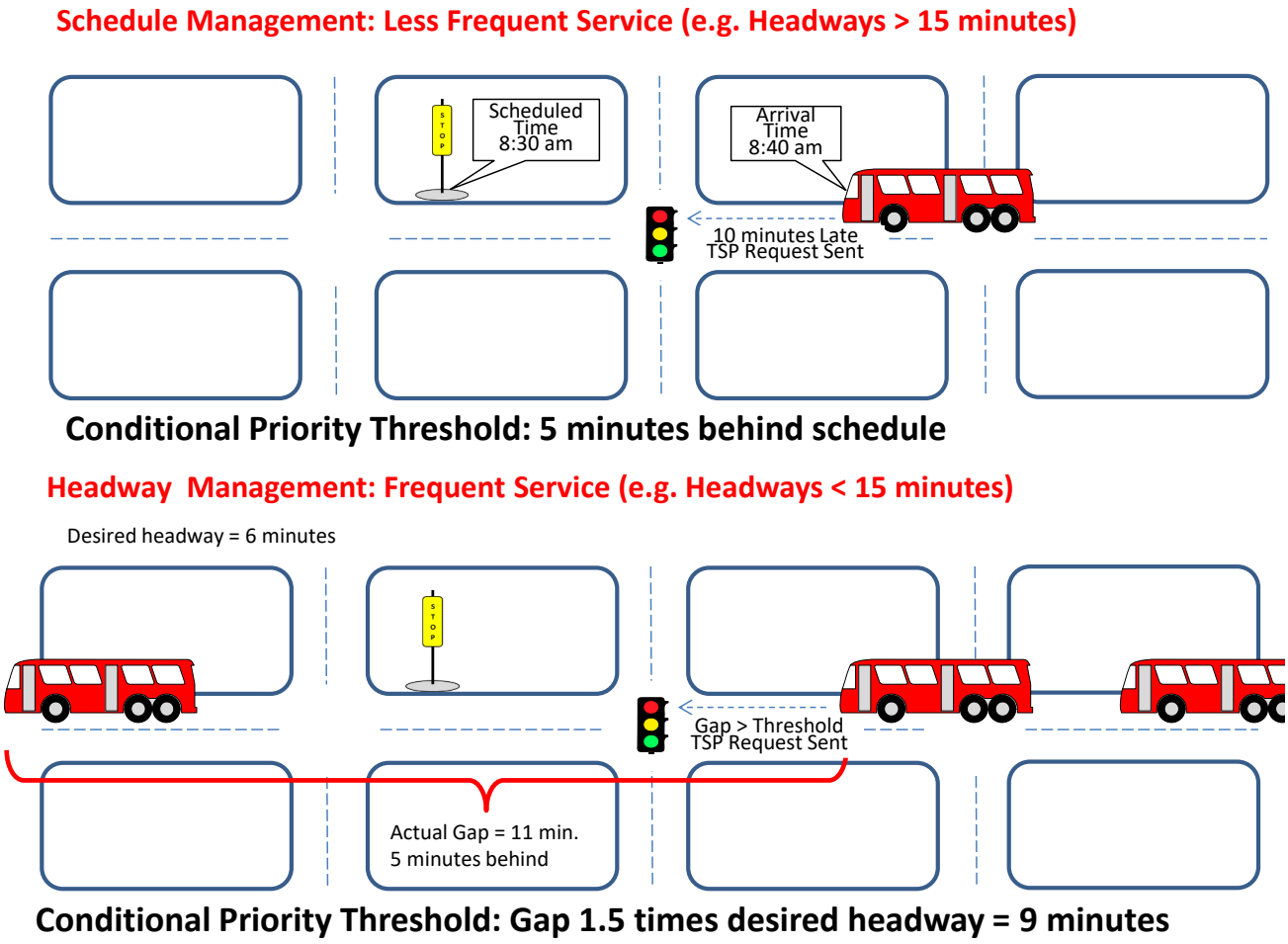
- Systems with **unconditional priority** send a priority request every time an eligible (equipped) vehicle approaches.
- Systems with **conditional priority** determine whether to make a TSP request based on set criteria such as schedule adherence (is the vehicle late), passenger loading, the direction of

[1] Figure 1 provides a logical diagram of the functions for TSP. Real world systems may differ, and may combine the functions of the PRS, PRG, and controller in varying configurations, sometimes in separate boards within the cabinet or even in the traffic controller itself.

travel, type of service (express versus local), or are the doors open/closed. If the vehicle meets the thresholds, a priority request is generated and sent. Modern TSP systems Implement Conditional TSP. Conditional priority factors include schedule adherence, passenger loading, direction, time of day and/or type of transit service (e.g. local, express, BRT, LRT).

Montgomery County is only considering Active Conditional Priority for implementation in the US 29 BRT system.

How conditional priority may be implemented depends to a large degree on whether the service is to be operated based upon schedule or headway management. Schedule based systems provide schedules for specific time points along each route, and a vehicle is "On Time" when it is within the Agency's On Time Performance Criteria which for Ride On is Never Early and no later than 5 minutes. Research has found that for infrequent service (headways greater than 10 to 15 minutes), passengers time their arrivals based upon the schedule, and schedule on time performance is very important to riders. For frequent service (headways of 15 minutes or less) passengers don't schedule their arrivals and reliability of the headway becomes important in order to avoid bus bunching and crowding. More and more agencies are therefore providing headway based frequent service routes (e.g. every x minutes). Figure 2 shows the difference between the two, and how TSP may be used to support either. Note, that headway based control requires that each vehicle obtain information on when the previous vehicle passed each signal with TSP along the corridor. This has been difficult to implement in the field, however, GTT Opticom is now offering new hardware and software that provides for this need.



Source: RTS Task Force Presentation (Sabra Wang & Assoc. 2014)

Figure 2 Schedule versus Headway Based Conditional Priority

1.2 Montgomery County ATMS System.

Any TSP system implemented within Montgomery County must integrate with the Advanced Transportation Management System (ATMS) and its signal operations. Currently the ATMS manages the day-to-day operations of the ~850 traffic signals in the County. Approximately 65% (~550) are owned by the Maryland State Highway Administration, with the remainder (~300) owned by the County. The City of Rockville manages ~40 signals in addition to the ~850 managed by the TMC. Even though the Maryland State Highway Administration (SHA) owns the signals that are located along state routes the Montgomery County Department of Transportation (MCDOT) operates SHA and County signals and is responsible for the TSP timing plans.

The Traffic Signal System Modernization (TSSM) project completed in 2012 converted the ATMS to a modern distributed system that:

- Utilizes a high-speed fiber network to monitor signal system operations in real time.
- Provides a modern distributed signal control system with TSP Ready Econolite ASC/3 controllers.
- Incorporates a custom traffic operations and advanced transportation management software system.

The result is a modern traffic management system that can monitor and update the performance of any signal across the county in real time. In addition to the TSP specific roadside equipment, activation of TSP within the Econolite AC3 controller at a specific traffic signal only requires the purchase and installation of a TSP Data Key (a onetime cost of approximately $400 per TSP intersection).

Note that within this system, the Maryland SHA provides the signal design and initial phasing and reviews/approves modifications to operations for the signals that it owns. Consequently, MCDOT will coordinate with SHA on the overall signal timing and TSP on the portions of the BRT service patterns along State routes (e.g. US 29). Additional details on the ATMS include:

- The central management ATMS management software is a custom system developed by Siemens for the County and written around Commercial Off The Shelf (COTS) products (GIS, databases). Consequently, each new upgrade to system components (such as the Econolite controller firmware now at Version 2.65.30), or new special feature (such as special TSP signal strategies) must be thoroughly tested and validated.
- The Ride On transit and Montgomery County traffic operations centers are currently co-located at the County's Transportation Management Center (TMC) in Gaithersburg Maryland. While they are co-located they currently have little database integration.
- The TMC monitors system status and can adjust parameters in real time.
- An internet protocol communications infrastructure is used which provides for direct communications with wayside equipment, for such things as log retrieval and configuration modification. The communication network is a hybrid communication plant utilizing existing fiber and copper cable plants to provide broadband IP communication to all traffic signals operated by the ATMS.
- Montgomery County operates and maintains most MDSHA signals in Montgomery County as part of a longstanding maintenance agreement.
- Ride On Central Communications interfaces directly with WMATA or MTA by phone/fax/email no data connections today.

- Currently, preemption for emergency vehicles is provided by hardwire activation of preemption request at station house entrances along County roads. There is no provision for preemption for emergency or other vehicles once they are en route.
- For security reasons, the signals currently do NOT communicate with systems outside of the Montgomery County network.

1.3 Benefits of TSP

TSP has the potential to provide travel time savings and improve reliability and variance in travel times from trip to trip. This can in turn provide the opportunity to reduce scheduled run times and improve customer perceptions of service reliability, leading to increased ridership. It can also help to reduce vehicle requirements, and environmental impacts (reduced emissions). The ability to provide more reliable service and reduce bus "bunching" may be the most significant feature for the US 29 BRT service.

Note that the effectiveness and potential benefits of TSP depend greatly on the causes of delay in a particular corridor or situation. TSP focuses on reducing traffic signal delay which on average represents about 15% of a vehicle's trip time in mixed flow conditions (2). Causes of signal delay may include: Accommodating side-street traffic, Special phases (e.g. left-turns only), Pedestrians Crossing, and Volume-related delay (queues). Other causes of delay include dwell time (passenger boardings/alightings, fare collection, and acceleration/deceleration and traffic delay (congestion and general friction) (15). Note, that as rapid transit reduces the other causes of delay by providing exclusive guideways, off board fare collection, and quick boarding (low floors, multiple doors), the percentage of delay due to signals increases. Also, early systems that implemented unconditional TSP often reported additional impacts and potential delays to the parallel and crossing general traffic flows. However, modern conditional TSP systems have been found to reduce these negative impacts by focusing on requesting and granting TSP when it is needed to bring specific vehicles back within their planned headways or schedules .

Benefits of of TSP are well documented through simulation and actual evaluations (1, 2, 3, 11, 12,13, 14). Some highlights are:

- Travel Time Savings:
  - Range from 2 to 18 % in North America, with typical reductions from 8 to 12 %
  - Los Angeles MTA: 7.5 % time reduction due to TSP in 2 BRT corridors
  - Chicago: 15% travel time savings for buses in the Cermak Road TSP Corridor
  - New York City: 17 % travel time savings along a 2.3 mile Victory Blvd in Staten Island
- Reduced Bus Delay at Signals
  - Los Angeles, 35% delay reduction at intersections with TSP
- Oakland: San Pablo Avenue Corridor buses saved 5 seconds per TSP intersection

The ability of conditional TSP to provide these benefits while minimizing the impacts to crossing street delays has also been documented.

- In an Orlando simulation study BRT and Conditional TSP "significantly improved travel times, average speed and average total delay per vehicle".. "with only minor impacts on crossing street delays"(1).

- In Salt Lake City Utah: Conditional TSP is estimated to reduce travel times 15%. The results showed that TSP has minor negative impact on side-street traffic and no impact or minor positive impact on main traffic (12).

An additional noteworthy observation is that it may also take some time after startup to fine tune/tweak the TSP parameters within a corridor (up to a year) to realize the above benefits. Never-the-less recent implementations of TSP in the Washington DC/Baltimore region are starting to measure and document the impacts they are observing:

- Baltimore MTA Baltimore Link TSP: Initial results were stated in Mass Transit Magazine (November 7th 2017) online as "*With transit signal priority alone, we are seeing time savings of up to 21 percent on some downtown corridors in the morning. Combined with 5.5 miles of dedicated bus lanes in downtown Baltimore, certain routes are seeing a time savings of up to 25 percent, fulfilling BaltimoreLink's promise of faster, more reliable transit."*
- Montgomery County's MD 355 BRT TSP: Montgomery County DOT assessed the result of implementing TSP along MD 355 to the parallel general traffic in order better understand the changes and ensure that there were no significant negative impacts to traffic. *They found "corridor travel times for general vehicular traffic were reduced by 8%-10% during the AM peak period, and 10%-13% during the PM peak period. Stopped delay (measurement of delay while stopped at traffic signals) was reduced by 24%-33%. Average travel speed along the corridor increased by 1.0 to 2.5 MPH"(November, 2017).*
- District of Columbia 16th Street TIGER Grant TSP (16th street and other corridors): The District DOT initially set very conservative parameters (such as a 10 minute lockout period), they are now in a period of refining the parameters in each corridor in order to increase TSP benefits, but most significantly they have found no noticeable negative impacts to general traffic due to TSP (internal email correspondence in 2017).

These results are promising and the US 29 BRT TSP will incorporate lessons learned from these implementations in its final design.

1.4 TSP in Montgomery County

Transit Signal Priority is not a new concept in Montgomery County. TSP was deployed to all Ride On buses in the 1990's as part of an early centralized traffic control system that depended on continual real time communications both to/from each signalized intersection and transit vehicle. In this early system "late" vehicles would be identified and requests for TSP sent to each signal along their route. Consistent and reliable communications turned out to be a problem in this system. The County's decentralized ATMS made this obsolete.

Since the implementation of the ATMS, the County has planned for new modern TSP through the development of a Concept of Operations, a Countywide TSP implementation plan for Ride On services, and an initial exploration of how TSP for the Countywide Rapid Transit System (RTS) (2,6, 7, 8, 9).

A TSP technology pilot test was undertaken in 2013 at three traffic signals and with five buses which successfully tested modern TSP roadside and bus hardware. It found that TSP in the decentralized system was technically feasible, but could not assess transit benefits due to the dispersed nature of the thee traffic signals and the limited implementation on just 5 buses.

These past projects paved the way for the MD 355 Ride On extRa (BRT) TSP implementation which started in the fall of 2017. This is the first implementation of TSP within Montgomery County's

modernized ATMS system and consists of TSP at 30 traffic signals and on 17 Ride On extRa buses along MD 355. It provides for Early Green and Extended Green priority treatment, and includes a 3 phase lockout period. Parameters for this system continue to be adjusted and initial evaluations are ongoing (see previous benefits section).

The US 29 BRT TSP will be the second modern TSP implementation within Montgomery County and will build upon lessons learned from MD 355.

2 US 29 BRT Corridor

2.1 BRT Service

The applicability/desirability of TSP at any particular intersection depends on the BRT service pattern and the type of Right of Way (ROW) that the BRT operates over as it goes through each signalized intersection. The BRT buses will run north and south along US 29 and local streets in existing travel lanes and shoulders along the 14-mile corridor. For approximately five miles on US 29, between MD 198 (near the Burtonsville Park and Ride) and Tech Road, BRT buses can operate on the existing outside shoulders when encountering congestion. Where no outside shoulder is available south of Tech Road along US 29 and along Lockwood Drive, Stewart Lane, Briggs Chaney Road, and Castle Boulevard, BRT buses will run solely in existing general travel lanes.

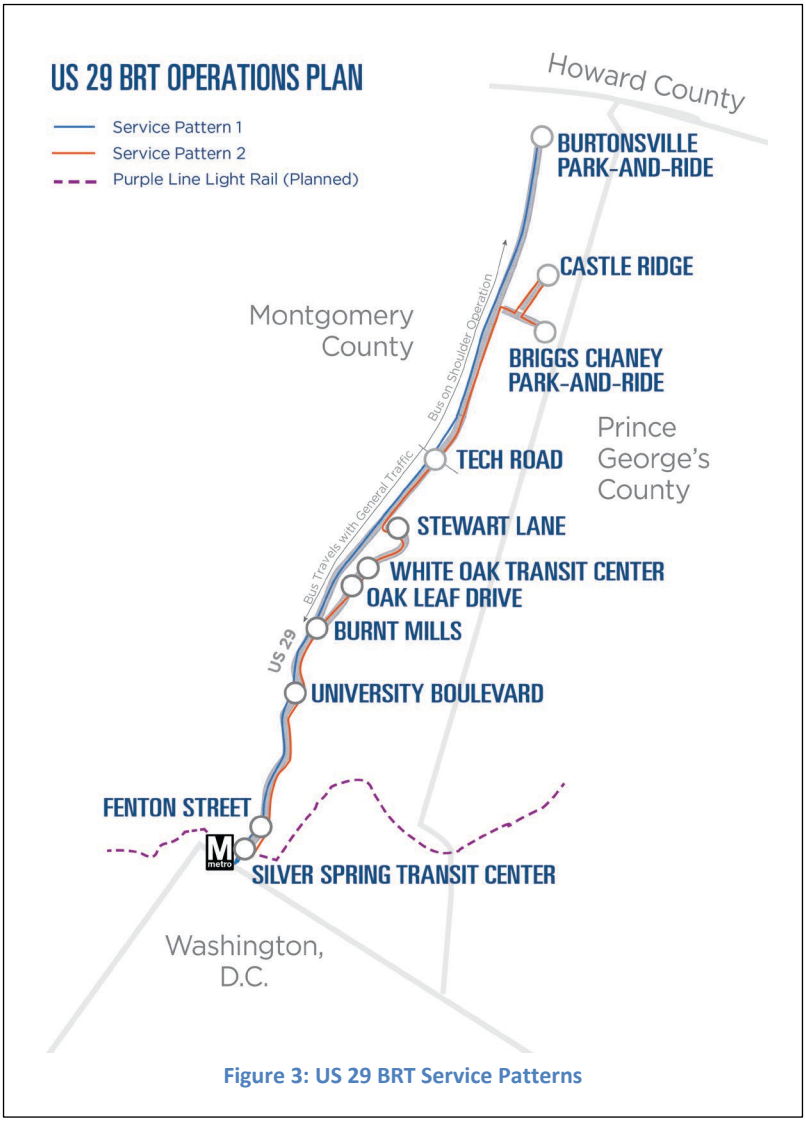


Figure 3: US 29 BRT Service Patterns

The US 29 Bus Rapid Transit project inlcudes two BRT service patterns along the corridor. The first service pattern will run from the Briggs Chaney park and ride to the Silver Spring Transit Center via Briggs Chaney Road, Castle Boulevard, Stewart Lane, and Lockwood Drive. The second service pattern will run from the Burtonsville park and ride to the Silver Spring Transit center almost exclusively on US 29. Per the preliminary Service Plan, buses on both routes would operate with 15-minute headways, serving shared stations every 7.5 minutes during peak periods and every 15 off peak periods.

Figure 3 shows each service pattern as well as BRT station locations along the corridor.

2.2 Signals

The two US 29 BRT service patterns will pass through a combined 33 signalized intersections shown in Figure 4 (Note, that the a,b, designations reflect different service BRT service patterns through the intersection. The TIGER Grant call for the implementation of TSP (based upon the budget and costs at the time). Consequently, the 33 study intersections listed in Table 1 were evaluated for TSP acceptability and ranked based on the selection criteria discussed in Section 3.2.1 of this memo. The AM peak hour cycle lengths are also included in Table 1 to show how long it takes to complete each signal cycle. Note, that in the 35% design effort, two new intersections (32, 33) were added in order to address necessary rerouting in and out of the Silver Spring Transit Center due to planned redesign of the Gene Lynch Park and the 2nd Avenue/Wayne Avenue Bike Lanes.

Table 1: Study Intersections

#	Intersection	AM Cycle Length (sec)
1	US 29 @ Blackburn Rd	180
2	US 29 @ Green Castle Rd	180
3	US 29 @ Fairland Rd	180
4	US 29 @ Musgrove Rd	180
5	US 29 @ Tech Rd	180
6	US 29 @ Industrial Pkwy	180
7-a	US 29 @ Stewart Ln Slip	150
7-b	US 29 @ Stewart Ln Slip	150
8-a	US 29 @ Stewart Ln	150
8-b	US 29 @ Stewart Ln	150
9	US 29 @ Prelude Dr	180
10	US 29 @ Burnt Mills Ave	180
11-a	US 29 @ Lockwood Dr	180
11-b	Lockwood Dr @ US 29	180
12	US 29 @ Burnt Mills Shopping Center	180
13	US 29 @ Southwood Ave	180
14	US 29 @ University Blvd WB	180
15	US 29 @ University Blvd EB	180
16	US 29 @ Franklin Ave	150
17	US 29 @ Sligo Creek Pkwy	150
18	US 29 @ Dale Dr	150
19	US 29 @ Spring St	135
20	US 29 @ Fenton St	135
21	US 29 @ Georgia Ave	135
22	Colesville Rd @ 2nd Ave	150
23	2nd Ave @ Ramsey Ave	75
24	MD 198 @ US 29 NB Ramps	120
25	Briggs Chaney Rd @ US 29 SB Ramps	150
26	Briggs Chaney Rd @ US 29 NB Ramps	150
27	Briggs Chaney Rd @ Outlet Dr	75
28-a	Briggs Chaney Rd @ Auto Dr/Castle Blvd	150
28-b	Briggs Chaney Rd @ Auto Dr/Castle Blvd	150
29	Briggs Chaney Rd @ Gateshead Manor Way	150
30	Lockwood Dr @ White Oak S.C.	90
31	Lockwood Dr @ MD 650	200
32	Wayne Avenue @ Dixon Avenue	75
33	Wayne Avenue @ Georgia Avenue	135

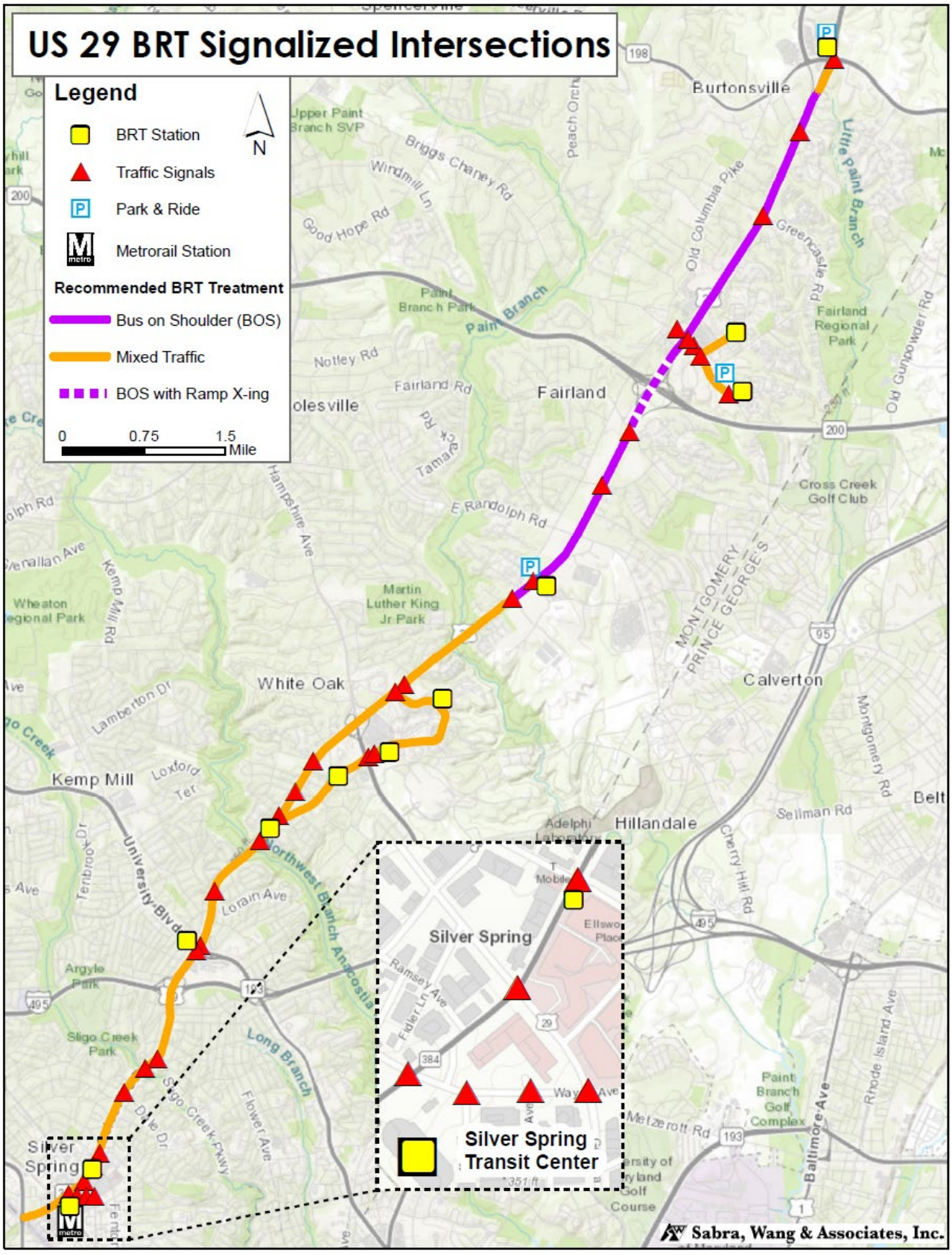


Figure 4: Signalized Intersection Locations

3 TSP Systems for US 29

3.1 Technology Components and Systems

The Countywide TSP Concept of Operations for implementing TSP within current operations and systems was developed as part of this effort. Significant recommendations include:

- **Distributed[2] TSP Architecture**
- **TSP Technology Components**
  - Signal Controller: Econolite ASC/3 traffic controller which controls the signal phasing, length of the priority phase, and time out periods.
  - TSP System: GTT Opticom GPS/TSP system and equipment which provides the requests from the vehicles, receives the requests at the roadside, and forwards a TSP request to the ASC/3 traffic controller which determines which TSP strategy to implement.
  - Transit AVL/CAD: Monitors the transit vehicle performance and schedule adherence and provides communication between the transit vehicle and the transit operations center (Currently OrbCAD AVL/CAD system but likely to be replaced by new Ride On procurement).

A distributed TSP system architecture utilizing the installed Econolite ASC/3 controllers and other improvements that were part of the TSSM and has now been implemented for the MD 355 BRT corridor is recommended. For the US 29 BRT additional equipment (model 4010 vehicle kit and model 764 roadside phase selector) for implementing headway based conditional priority is needed. Figure 5 provides a diagram of the recommended TSP Architecture. Some major features are:

- The roadside phase selector and antennae sends out information on when the last registered route vehicle eligible for TSP passed by its location.
- Onboard equipment receives the last vehicle information and uses GPS to monitor the vehicle location, and calculate the headway gap (time since last registered vehicle) or on time performance (the AVL/CAD currently provided by OrbCAD, but may be replaced through a new procurement). When the bus is late or the gap between vehicles is too large a priority request is generated and broadcast using an onboard radio transceiver. The onboard radio also broadcasts "I am here" beacons so that its presence is observed at the roadside even if it is not sending a request for priority.
- The request is received by the wayside antennae
- The GTT Opticom Spread Spectrum GPS/TSP Priority Request Server (PRS) determines if the vehicle is in range and when it will arrive at the intersection. It then determines if priority is to be granted to a specific vehicle and if so notifies the ASC/3 controller. The PRS also resolves competing priority requests (currently first come first served).
- The ASC/3 controller checks to see if it is in lockout (see below: time needed to allow the traffic system to recover after a TSP request is granted) due to a previous request, determines which priority signal strategy to apply (currently extended or early green) and then implements the priority signal strategy if possible.

[2] Where roadside and/or vehicle on board equipment control the operations of the intersection and TSP decisions independently. The system continues to function even if communications with the operations center is interrupted. The operations center monitors the system performance, provides new operating parameters, and can override individual locations if so desired.

- Both traffic and transit log information are stored for later analysis. The controller logs that a request was received. This data can currently be viewed only via the front panel or by serial upload to a laptop in the street. Transit performance data on where the vehicles stopped and dwell times is stored within the AVL/CAD system.
- It is possible to verify which transit bus vehicle number made the priority request, and if that bus was late. Also, based on the time stamp from the emitter request it can be determined if the signal was green or red during the priority call, or if the bus made a near side stop to board and alight passengers. However, it is currently not possible to determine which TSP pattern was executed. Integrating these separate monitoring functions would be a necessary step to fully evaluate TSP operations.
- While collocated, real time information is not currently shared between the transit and traffic operations centers.
- The recommended TSP operating parameters from the study include:
  - Conditional Priority: TSP will be requested when the gap between vehicles is greater than a to be determined threshold, or during certain times of the day when the buses are running more than 5 minutes behind schedule.
  - Request Service: A TSP request will be granted on a first come first served basis (no special consideration to direction, corridor, operator, or type of service).
  - Safety Constraints: A TSP request will be granted only when it can be accommodated safely within the traffic signal controller phases at the intersection. A TSP request will not be granted if it violates a pedestrian walk request at an intersection.
  - TSP signal options: Priority signal options are extended green and early green.
  - Priority Lockout: Once priority is granted at an intersection the signal cannot grant another request (i.e. the lockout period) until the system recovers coordination (currently three cycles). It is recommended that this be reevaluated during the Final Design phase of the project.

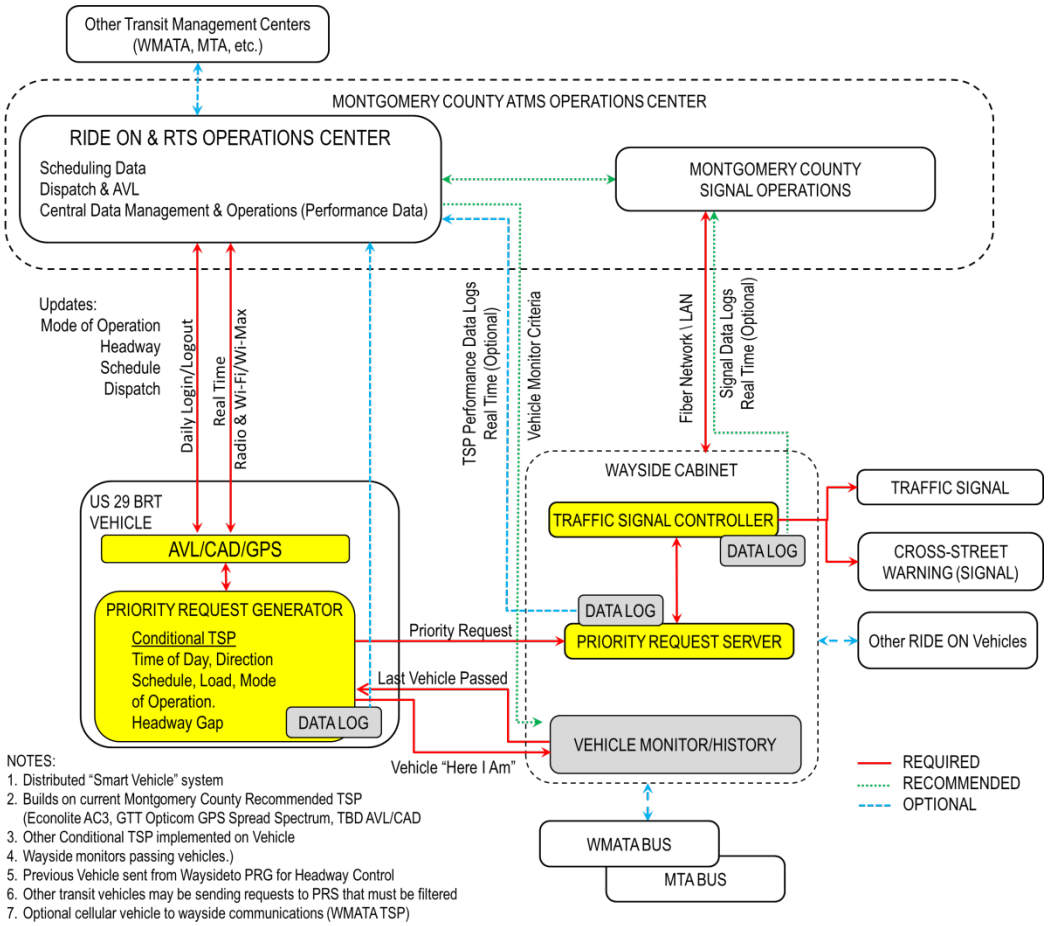


Figure 5 System Architecture for US 29 BRT TSP operations

Note also, that Montgomery County is exploring implementation of Adaptive Signal Control at some significant intersections/corridors within the County (where it will be implemented and which system will be used has not yet been determined). TSP has been found to work with Adaptive Signal Controls but may require some adjustment in operating parameters to optimize performance.

For the MD 355 Ride On extRa service that deployed TSP in 2017, the planned Purple Line, and the Corridor Cities Transit Way, only the premium high priority BRT and LRT service in their corridors can make TSP requests or be granted TSP priority treatments in order to maintain their headways/schedules. Within the US 29 corridor it is therefore also assumed that only US 29 BRT vehicles will be able to make TSP requests, or be granted TSP priority treatments.

3.2 TSP Intersection Selection

3.2.1 Selection Criteria

In order to maximize the cost-effectiveness of outfitting buses and signal controllers with TSP equipment the deployment of TSP should be focused on locations where deploying TSP will not cause unsafe conditions, and also be likely to provide benefits to the BRT service throughout the day. Allocating TSP resources to signalized intersections that meet criteria for longer periods during the day would better allow TSP technology to deliver maximum benefits to transit vehicles and minimize disruption to other modes of travel. In order to determine which locations among the 33 signalized intersections along the US 29 BRT Routes identified in the TIGER Grant application may be considered for TSP deployment the ranking/selection criteria and process first developed and approved by the SHA and Montgomery County DOT for the Countywide Transit Signal Priority Phase III: Corridor and Intersection Priority Ranking and Selection study (8) were used as a foundation[3]. The process was expanded to consider all day service, and incorporate reliability improvements (not just likely travel time savings).

As shown in Figure 6, this process is carried out in two steps. First, a set of mandatory feasibility traffic operations criteria based upon safety (there is slack time after minimum walk times are met for each intersection crossing), and likely intersection disruption (the intersection is not already over capacity: V/C ration < 1), for each time period of the day (AM Peak, PM peak, Off peak), Second, where TSP is feasible a secondary set of seven weighting factors based on geometry, and traffic and transit operations would be used to determine prioritization of TSP deployment. It should be noted these screening and weighting criteria are location-specific criteria intended to address the justification for deploying TSP hardware at each signalized intersection. This does not mean that TSP will be enabled/active for all time periods and directions throughout the day once the US 29 BRT is operational. Ongoing conditions and performance will be monitored during operations to determine whether to allow TSP requests to be granted for specific time periods, directions, and even specific vehicles or service types. For example TSP may be turned off at specific intersections during the AM peak hour when the intersection is over capacity, or at other times of extreme congestion due to an incident or special event, etc.. However, TSP may then be turned back on to help improve headway adherence and reliability during other time periods.

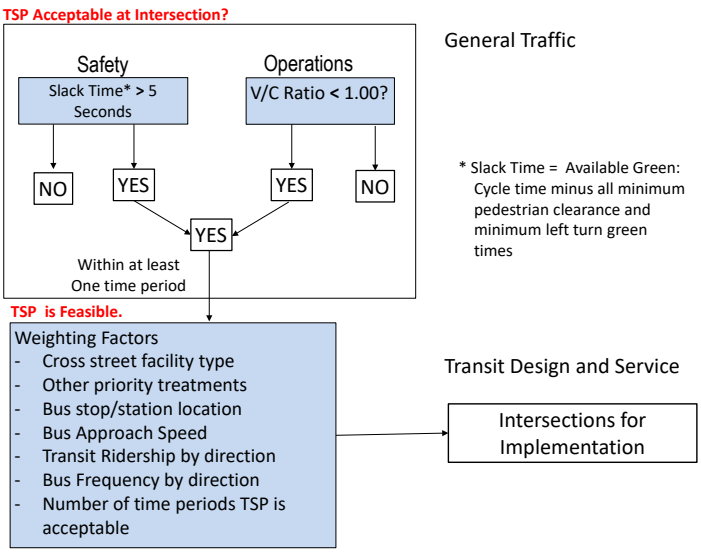


Figure 6: Intersection Selection TSP Flow Chart

A more detailed description of the process and criteria is provided below:

[3] The process / criteria have been modified/updated for the Montgomery County Rapid Transit System (RTS) (full system) (9), the MTA US 29 BRT Corridor Study, the Corridor City Transitway, and Purple Line TSP assessments.

Mandatory feasibility criteria include:

- Volume-to-capacity ratio: This measure is defined as the ratio of the traffic volume to capacity. Capacity is the maximum hourly rate at which vehicles can reasonably be expected to proceed through an intersection under prevailing roadway, traffic, and control conditions. A V/C ratio at or above 1.00 indicates that an intersection operates at or beyond its capacity. The V/C ratio is an indicator of where mobility might be an issue due to roadways having traffic volumes that exceed their capacity. For the purposes of TSP, **V/C ratios less than 1.00** were required for an intersection to be eligible to grant TSP during a particular time period. At greater than 1.00, the intersection is operating above capacity and the opportunities to grant TSP requests may be limited.
- Slack Time: Slack time is defined as the additional time in a cycle that is more than the minimum split times for the phases at the intersection. Minimum split times for a particular phase may include required clearances for minimum vehicle green, yellow and all-red vehicle clearances, pedestrian WALK and FLASHING DON'T WALK clearances. If slack exists, this time can be reallocated from one phase to another phase, for example to provide TSP by extending the mainline green time and shortening the side street green. Slack time for TSP can typically be taken from the conflicting and/or left-turn phases. The minimum slack time needed in a signal cycle during any weekday peak hour to satisfy this mandatory criteria is **at least 5 seconds**, provided that minimum pedestrian clearances for the conflicting phases, and minimum splits for the left-turn (7 seconds of green + yellow + all-red) are all met.

Weighting factors include:

- Cross-Street Facility Type: This factor considers whether or not the intersecting roadway at a signalized intersection is a primary facility (e.g. major highway or principal arterial). If the intersecting facility is not a principal arterial it is more likely that TSP will be beneficial as side street traffic operations can be disrupted temporarily.
- Bus Stop Location: This factor considers whether or not the bus stop location is a near-side (before the stop line) or far-side (after the stop line). For TSP-only applications (e.g. not combined with any other priority treatments) a far-side stop is preferable due to dwell time variability and to avoid false calls for TSP.
- Presence of Other Priority Treatments: This factor considers the presence of other priority treatments for transit vehicles such as a queue jump or dedicated lane. The combination of TSP with these other investments can significantly improve travel time reliability and reduce signal related delay for buses over the provision of TSP alone.
- Parallel Buses per Peak Hour: Bus routes running parallel to BRT service may receive secondary benefits from the additional green time provided by the granted TSP requests. The number of parallel buses was used as an indicator of the amount of possible secondary benefits. The total number of parallel buses during each peak hour was ranked low (0-9 buses per hour), medium (10-19 buses per hour), and high (>20 buses per hour).
- Conflicting Buses per Hour: While it has been found that conditional TSP does not create noticeable delays for side street general purpose traffic, there will be instances where granting a TSP request on US 29 may cause crossing bus routes to miss a green window due to the reduction in green time with granted TSP requests. This can cause following buses to catch up and lead to bus bunching etc. Therefore, the number of conflicting buses was used as an indicator of the amount of possible disruptions. The total number of parallel buses during each peak hour was ranked low (0-9 buses per hour), medium (10-19 buses per hour), and high (>20 buses per hour).

- Parallel Daily Bus Ridership: Bus ridership on bus routes running parallel to BRT service may receive secondary benefits from the additional green time provided by the granted TSP requests. The daily parallel bus ridership was used as an indicator of the amount of possible secondary benefits. The total number of parallel buses during each peak hour was ranked low (0-999 riders per day), medium (1000-1999 riders per day), and high (>2000s rider per day).
- Average Peak Hour Bus Speed on Approach: Based on AVL data, the average bus speed on each link approach can be used as a good indicator of current transit operations. Although influences other than signal delay such as dwell time and stop locations may also reduce bus speeds, when compared to average vehicle speeds a larger speed differential can indicate a greater benefit of TSP in improving bus travel time reliability. A maximum 10 mph average bus speed threshold was set for satisfying this weighting factor.

3.2.2 Results

This section describes the results of the ranking analysis using the factors and process described in the last section. The process and preliminary results were presented to the US 29 CAC meeting #13 group in July 2017. At those meetings additional feedback was requested on both the weighting factors used and potential intersections to include/avoid for TSP instrumentation. Four and ½ intersections were found to not meet the mandatory safety and LOS criteria for any time period during the day (US 29 at Lockwood was eligible for the turn onto Lockwood drive, but not for the US 29 through movements). The ranking analysis for the remaining intersections is described below, followed by a summary of the feedback received.

Ranking based upon weighting factors

Applying the methodology to the 33 signalized intersections located along the US 29 BRT corridor results in a total of 29 intersections meeting the mandatory TSP criteria during at least 1 weekday peak hour. Table 2 summarizes the mandatory criteria results of the screening for all 33 intersections.

Table 2: Mandatory TSP Selection Criteria Summary

TSP Acceptability Factors (2020)

#	Intersection	Movement NB/SB Bus	Total Available Green Time (sec)						Volume to Capacity Ratio		
			AM		MD		PM				
			NB	SB	NB	SB	NB	SB	AM	MD	PM
1	US 29 @ Blackburn Rd	NBT/SBT									
2	US 29 @ Green Castle Rd	NBT/SBT									
3	US 29 @ Fairland Rd	NBT/SBT									
4	US 29 @ Musgrove Rd	NBT/SBT									
5	US 29 @ Tech Rd	NBT/SBT									
6	US 29 @ Industrial Pkwy	NBT/SBT									
7-a	US 29 @ Stewart Ln Slip	NBT/SBT									
7-b	US 29 @ Stewart Ln Slip	WBR/SBT									
8-a	US 29 @ Stewart Ln	NBT/SBT									
8-b	US 29 @ Stewart Ln	NA/SBL	NA		NA		NA				
9	US 29 @ Prelude Dr	NBT/SBT									
10	US 29 @ Burnt Mills Ave	NBT/SBT									
11-a	US 29 @ Lockwood Dr	NBT/SBT									
11-b	Lockwood Dr @ US 29	NA/WBL	NA		NA		NA				
12	US 29 @ Burnt Mills Shopping Center	NBT/SBT									
13	US 29 @ Southwood Ave	NBT/SBT									
14	US 29 @ University Blvd WB	NBT/SBT									
15	US 29 @ University Blvd EB	NBT/SBT									
16	US 29 @ Franklin Ave	NBT/SBT									
17	US 29 @ Sligo Creek Pkwy	NBT/SBT									
18	US 29 @ Dale Dr	NBT/SBT									
19	US 29 @ Spring St	NBT/SBT									
20	US 29 @ Fenton St	NBT/SBT									
21	US 29 @ Georgia Ave	NBT/SBT									
22	Colesville Rd @ 2nd Ave	WBR/SBL									
23	2nd Ave @ Ramsey Ave	NBL/EBR									
24	MD 198 @ US 29 NB Ramps	NBL/NA		NA		NA		NA			
25	Briggs Chaney Rd @ US 29 SB Ramps	NA/WBR	NA		NA		NA				
26	Briggs Chaney Rd @ US 29 NB Ramps	NBR/WBT									
27	Briggs Chaney Rd @ Outlet Dr	NA/WBT	NA		NA		NA				
28-a	Briggs Chaney Rd @ Auto Dr/Castle Blvd	EBL/SBR									
28-b	Briggs Chaney Rd @ Auto Dr/Castle Blvd	SBL/WBR									
29	Briggs Chaney Rd @ Gateshead Manor Way	EBL/SBR									
30	Lockwood Dr @ White Oak S.C.	NBT/SBT									
31	Lockwood Dr @ MD 650	NBT/SBT									
32	Wayne Avenue @ Dixon Avenue	EBT/NA		NA		NA		NA			
33	Wayne Avenue @ Georgia Avenue	EBL/NA		NA		NA		NA			

NB - Northbound, SB - Southbound
EB - Eastbound, WB - Westbound
T - Through
L - Left
R - Right
Available Green Time = 5 - 20sec
Available Green Time > 20sec
Available Green Time < 5sec
VCR < 1.00
VCR => 1.00

Results from the mandatory criteria evaluation indicate that the following intersections do not have adequate slack time to grant TSP requests during any period of an average weekday (AM Peak, Midday, PM Peak):

- US 29 at Blackburn Road
- US 29 at Lockwood Drive Southbound (Northbound is eligible)
- US 29 at Burnt Mills Avenue
- Lockwood Drive at White Oak Shopping Center
- Wayne Avenue at Dixon Avenue

After determining the feasibility of TSP at each intersection, using the mandatory criteria, the intersections were ranked based on the weighting factors to show the relative likelihood that they will provide significant TSP benefits to transit without significant negative impacts to traffic operations. Weighting factors were first assigned points based on the perceived value of each factor compared to one another. Factors received 0 points for being undesirable and relatively more points as they became more desirable. For example, crossing a major highway received 0 points because of its undesirability, an arterial 1 point, and a business/industrial or Residential street 2 points. A sensitivity analysis was performed assigning equal points to each factor to determine the impact of variable weighting and the robustness of the evaluation results.

Table 3 shows the points assigned for each of the weighting factors under both the original and sensitivity analyses.

Table 3: Ranking Criteria Points

Cross Street Functional Classification		
Classification	Points	
	Original	Sensitivity
Major Highway	0	0
Arterial	1	0
Business/Industrial	2	1
Risdential/Other	2	1

Conflicting Buses per Hour		
Range	Points	
	Original	Sensitivity
High	0	0
Medium	1	0
Low	2	1
None	2	1

Stop Location		
Location	Points	
	Original	Sensitivity
Near Side	0	0
No Stop	1	1
Far Side	2	1

Parallel Daily Bus Ridership		
Range	Points	
	Original	Sensitivity
High	2	1
Medium	1	1
Low	0	0

Other Priority Treatments		
Treatment	Points	
	Original	Sensitivity
Bus on Shoulder	3	1
None	0	0

Bus Approach Speed		
Speed	Points	
	Original	Sensitivity
< 10 mph	2	1
> 10mph	0	0

Parallel Buses per Hour		
Range	Points	
	Original	Sensitivity
High	2	1
Medium	1	1
Low	0	0

The number of time periods that TSP is acceptable was also incorporated into the weighting by assigning a multiplier for each time period (AM peak period =1, Midday = 0.5, PM peak period=1). The weighted scores for time period are first summed. Each is then multiplied by its period factor, and all three are then summed for a final score. Consequently, If an intersection did not meet the mandatory criteria for 1 or both of the peak periods, it would not have a high score relative to other intersections that are eligible for TSP operations for a greater portion of the day.

Based upon the ranking criteria points initial rankings were carried out. Table 4 and Table 5 summarize the intersections weighting results using the original weighting factor points and the points assigned in the sensitivity analysis, respectively. Results from the analyses indicate the top 15 intersections are consistently represented as the top 15 in both sets. Weighting Criteria for each peak and direction are provided in Appendix 1.

Table 4: Intersection Ranking Results

Rank	Intersection	ID	Movement NB/SB Bus	Points
1	US 29 @ Fenton St	20	NBT/SBT	47
2	US 29 @ Dale Dr	18	NBT/SBT	45
3	US 29 @ Spring St	19	NBT/SBT	44.5
4	US 29 @ Fairland Rd	3	NBT/SBT	44
5	US 29 @ Stewart Ln Slip	7-a	NBT/SBT	43.5
		7-b	WBR/SBT	38.5
6	US 29 @ Franklin Ave	16	NBT/SBT	36.5
7	US 29 @ Stewart Ln	8-a	NBT/SBT	35
		8-b	NA/SBL	11.5
8	US 29 @ Georgia Ave	21	NBT/SBT	32
9	Briggs Chaney Rd @ Auto Dr/Castle Blvd	28-1	EBL/SBR	28.5
		28-2	SBL/WBR	17
10	US 29 @ Tech Rd	5	NBT/SBT	26
11	Briggs Chaney Rd @ US 29 NB Ramps	26	NBR/WBT	25
12	Briggs Chaney Rd @ Gateshead Manor Way	29	EBL/SBR	25
13	US 29 @ Musgrove Rd	4	NBT/SBT	22
14	2nd Ave @ Ramsey Ave	23	NBL/EBR	21.5
15	US 29 @ University Blvd EB	15	NBT/SBT	20.5
16	Colesville Rd @ 2nd Ave	22	WBR/SBL	19
17	US 29 @ Southwood Ave	13	NBT/SBT	18
18	US 29 @ Industrial Pkwy	6	NBT/SBT	18
19	US 29 @ University Blvd WB	14	NBT/SBT	17
20	Wayne Ave @ Georgia Ave	32	NBT/SBT	16
21	Lockwood Dr @ MD 650	31	NBT/SBT	14.5
22	Briggs Chaney Rd @ US 29 SB Ramps	25	NA/WBR	12.5
23	Briggs Chaney Rd @ Outlet Dr	27	NA/WBT	12.5
24	US 29 @ Lockwood Dr	11-b	NA/WBL	12
		11-a	NBT/SBT	0
25	US 29 @ Prelude Dr	9	NBT/SBT	10
26	US 29 @ Sligo Creek Pkwy	17	NBT/SBT	8
27	MD 198 @ US 29 NB Ramps	24	NBL/NA	7.5
28	US 29 @ Green Castle Rd	2	NBT/SBT	7
29	US 29 @ Burnt Mills Shopping Center	12	NBT/SBT	7
Intersections not meeting the mandatory criteria were not ranked.				

Table 5: Intersection Ranking Results - Sensitivity Analysis

Rank	Intersection	ID	Movement NB/SB Bus	Points
1	US 29 @ Stewart Ln Slip	7-a	NBT/SBT	26
		7-b	WBR/SBT	22
2	US 29 @ Fairland Rd	3	NBT/SBT	24
3	US 29 @ Dale Dr	18	NBT/SBT	24
4	US 29 @ Spring St	19	NBT/SBT	23
5	US 29 @ Fenton St	20	NBT/SBT	22.5
6	US 29 @ Stewart Ln	8-a	NBT/SBT	22
		8-b	NA/SBL	7
7	US 29 @ Franklin Ave	16	NBT/SBT	21.5
8	US 29 @ Georgia Ave	21	WBR/SBT	20
9	Briggs Chaney Rd @ Auto Dr/Castle Blvd	28-1	EBL/SBR	17.5
		28-2	SBL/WBR	9
10	US 29 @ Tech Rd	5	NBT/SBT	15
11	Briggs Chaney Rd @ US 29 NB Ramps	26	NBR/WBT	15
12	2nd Ave @ Ramsey Ave	23	NBR/EBR	13
13	Briggs Chaney Rd @ Gateshead Manor Way	29	EBL/SBR	13
14	US 29 @ Musgrove Rd	4	NBT/SBT	12
15	US 29 @ University Blvd EB	15	NBT/SBT	11
16	Colesville Rd @ 2nd Ave	22	WBR/SBL	10.5
17	US 29 @ Industrial Pkwy	6	NBT/SBT	10.5
18	US 29 @ Southwood Ave	13	NBT/SBT	10
19	Wayne Ave @ Georgia Ave	32	EBL/NA	10
20	US 29 @ University Blvd WB	14	NBT/SBT	8.5
21	Lockwood Dr @ MD 650	31	NBT/SBT	8.5
22	Briggs Chaney Rd @ US 29 SB Ramps	25	NA/WBR	7.5
23	Briggs Chaney Rd @ Outlet Dr	27	NA/WBT	7.5
24	US 29 @ Prelude Dr	9	NBT/SBT	7
25	US 29 @ Lockwood Dr	11-b	NA/WBL	6
		11-a	NBT/SBT	0
26	US 29 @ Sligo Creek Pkwy	17	NBT/SBT	5
27	MD 198 @ US 29 NB Ramps	24	NBL/NA	5
28	US 29 @ Green Castle Rd	2	NBT/SBT	3
29	US 29 @ Burnt Mills Shopping Center	12	NBT/SBT	3.5
Intersections not meeting the mandatory criteria were not ranked.				

Stakeholder Feedback

The final set of intersections chosen for TSP will also be influenced by stakeholder feedback on general concerns and additional weighting factors along with intersections that may be included/avoided for TSP implementation. Concerns were raised on whether there will be impacts to general traffic either on US 29 or its cross streets. The initial experience within Montgomery County along the MD 355 extRa routes and by other TSP implementations around the country does not seem to bear this out. (see the benefits discussion).

There was also some feedback regarding additional concerns and criteria to consider. Pedestrian safety and how to detect pedestrian requests to cross was a prime concern. This is captured in the mandatory criteria to ensure minimum safe walk times a strong focus on safety may be warranted in the final intersection designs and TSP locations. As explained in the CAC meetings, signals are also set to always give pedestrian calls the highest priority (when they are received) providing the full minimum walk time.

The CAC committee feedback locations suggested intersections that were either ranked high in our analysis (e.g. Fairland and US 29), or did not meet minimum slack time in the AM and PM peaks and therefore had low scores/poor ranking (e.g. Burnt Mills Shopping CTR). Interestingly, there was conflicting feedback on intersections South of New Hampshire Avenue with some suggesting TSP and others raising concerns.

Analysis Summary

When, looking at the overall ranking and sensitivity analysis. Intersections that are viable during all time periods, or enter/exit the major US 29 corridor also seem to rank high. It is interesting to note that under both weighting schemes the signals in Downtown Silver Spring rank high and will likely provide significant benefits from TSP deployment. Locations that did not meet the mandatory safety (minimum slack time) and operations (VC<1) criteria throughout the day did not score high and were therefore ranked low. Stakeholder feedback provided insights to the importance of safety, and some additional thoughts to be aware of in the next phase of planning/implementation but did not change the conclusions.

Again, it is important to note, that an initial ranking was carried out based upon the information/ assumptions that exist at this time. As final design and operations planning are conducted and testing/implementation of the system approaches many additional factors may influence the final selection of intersections to instrument and enable for TSP. Consequently the final set of TSP intersections to implement will be determined during operations planning. Based upon lessons learned from the MD 355 TSP implementation, reallocating TSP deployments before or after opening day is relatively easy and a low cost endeavor, so this should not be a major hurdle.

Some other considerations to incorporate into the next phase that may influence the final TSP location include:

- Spill back congestion from a downstream location during parts of the day (i.e. University and US 29).
- Maximum potential delay to a transit vehicle if it is stopped by a red phase. Locations with very high cycle times, or very small available green times for the BRT vehicle movements have the potential to cause significant delay if the transit vehicle does not make the light. This not only increases delay but causes additional bus bunching and increases unreliability.
- Heavy pedestrian movements

- Excessive turning movements/delays

Based upon the above, the design/phasing of intersections that do not meet the mandatory minimum slack time or V/C ration criteria could possibly be reassessed (e.g. Burnt Mills Shopping Center, Sligo Creek Parkway) for the potential to extend their eligibility to additional time periods throughout the day. Likewise, specific delays related to entering/exiting the Silver Spring Transit Center may cause Wayne Ave @ Georgia and US 29 @ 2nd/Wayne Ave to be reassessed for inclusion. Last, since they are so close together US 29 and University Blvd EB and US 29 @ University Blvd WB should either be both included or excluded. Our initial recommendation is to not instrument either unless additional improvements are made to reduce the spillback from the I-495 ramps and also to take into account operation of the new BRT stations at Four Corners.

4 Next Steps

The next steps recommended to carry out the TSP for the US 29 BRT as it moves from 35% Design to Final Design and implementation are:

- Finalize opening day intersections with TSP locations and define initial operations parameters that incorporate:
  - Final station/stop locations,
  - Headway based scheduling and conditional TSP
  - Final US 29 BRT service plans
  - Final Local/Feeder bus operations
  - Evolving technology for signals/systems and bus operations within the corridor and operations centers .
- Monitor the MD 355 Ride On extRa TSP, implementation and its operation, the WMATA TSP within the District, and the Baltimore MTA TSP implementation for impacts and lessons learned
- Consider increasing the number of intersections instrumented with TSP, since the cost is lower than originally anticipated.
- Explore relaxing current assumptions/constraints for TSP within the corridor (e.g. other services to request TSP such as the WMATA Z Lines and MTA Commuter buses, potential of Adaptive Signal Controls, lockout periods, etc.)

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Appendix 1 Weighting Factor Scores by Time Period

AM Peak - Southbound Service

#	Intersection	Movement SB Bus	TSP Acceptable?	Cross-Street Functional Class	Bus Stop Location	Other Priority Treatments	Parallel Buses per Hour	Conflicting Buses per Hour	Parallel Daily Bus Ridership	Bus Approach Speed < 10mph?
1	US 29 @ Blackburn Rd	SBT	No	Residential Primary	No Stop	Bus on Shoulder	Medium	None	Low	No
2	US 29 @ Green Castle Rd	SBT	No	Arterial	No Stop	Bus on Shoulder	Medium	None	Low	No
3	US 29 @ Fairland Rd	SBT	Yes	Arterial	No Stop	Bus on Shoulder	Medium	None	Medium	No
4	US 29 @ Musgrove Rd	SBT	Yes	Arterial	No Stop	Bus on Shoulder	Medium	None	Medium	No
5	US 29 @ Tech Rd	SBT	Yes	Arterial	Near Side	None	Medium	None	Medium	No
6	US 29 @ Industrial Pkwy	SBT	No	Arterial	No Stop	None	Medium	Low	Medium	No
7-a	US 29 @ Stewart Ln Slip	SBT	Yes	Other	No Stop	None	High	Low	High	Yes
7-b	US 29 @ Stewart Ln Slip	SBT	Yes	Other	No Stop	None	High	Low	High	Yes
8-a	US 29 @ Stewart Ln	SBT	Yes	Arterial	No Stop	None	Medium	None	Medium	Yes
8-b	US 29 @ Stewart Ln	SBL	Yes	Arterial	No Stop	None	Low	High	Medium	Yes
9	US 29 @ Prelude Dr	SBT	No	Other	No Stop	None	Medium	Low	Medium	No
10	US 29 @ Burnt Mills Ave	SBT	No	Other	No Stop	None	Medium	None	Medium	No
11-a	US 29 @ Lockwood Dr	SBT	No	Arterial	No Stop	None	Medium	Low	Medium	No
11-b	Lockwood Dr @ US 29	WBL	Yes	Arterial	No Stop	None	Low	High	High	Yes
12	US 29 @ Burnt Mills Shopping Center	SBT	No	Other	Near Side	None	High	None	High	Yes
13	US 29 @ Southwood Ave	SBT	Yes	Other	No Stop	None	High	None	High	No
14	US 29 @ University Blvd WB	SBT	No	Major Highway	Near Side	None	High	Medium	High	No
15	US 29 @ University Blvd EB	SBT	No	Major Highway	No Stop	None	High	Medium	High	Yes
16	US 29 @ Franklin Ave	SBT	Yes	Residential Primary	No Stop	None	High	Low	High	No
17	US 29 @ Sligo Creek Pkwy	SBT	No	Other	No Stop	None	High	Low	High	No
18	US 29 @ Dale Dr	SBT	Yes	Arterial	No Stop	None	High	Low	High	No
19	US 29 @ Spring St	SBT	Yes	Arterial	No Stop	None	High	None	High	No
20	US 29 @ Fenton St	SBT	Yes	Arterial	Near Side	None	High	None	High	Yes
21	US 29 @ Georgia Ave	SBT	Yes	Major Highway	No Stop	None	High	High	High	Yes
22	Colesville Rd @ 2nd Ave	SBL	No	Arterial	No Stop	None	High	High	High	Yes
23	2nd Ave @ Ramsey Ave	EBR	No	Business	No Stop	None	High	High	High	Yes
24	MD 198 @ US 29 NB Ramps	-	-	-	-	-	-	-	-	-
25	Briggs Chaney Rd @ US 29 SB Ramps	WBR	Yes	Other	No Stop	None	Low	None	Low	No
26	Briggs Chaney Rd @ US 29 NB Ramps	WBT	Yes	Other	No Stop	None	Low	Low	Low	No
27	Briggs Chaney Rd @ Outlet Dr	WBT	Yes	Other	No Stop	None	Low	None	Low	No
28-a	Briggs Chaney Rd @ Auto Dr/Castle Blvd	SBR	Yes	Industrial	No Stop	None	Low	Low	Low	No
28-b	Briggs Chaney Rd @ Auto Dr/Castle Blvd	WBR	No	Industrial	No Stop	None	Low	Medium	Low	No
29	Briggs Chaney Rd @ Gateshead Manor Way	SBR	Yes	Other	No Stop	None	Low	Medium	Low	No
30	Lockwood Dr @ White Oak S.C.	SBT	No	Other	Near Side	None	Low	None	High	Yes
31	Lockwood Dr @ MD 650	SBT	No	Major Highway	No Stop	None	Low	High	High	Yes
32	Wayne Ave @ Dixon Ave	-	-	-	-	-	-	-	-	-
33	Wayne Ave @ Georgia Ave	-	-	-	-	-	-	-	-	-
	NB - Northbound, SB - Southbound	T - Through					Low: 1 - 9	Low: 1 - 9	Low: 1 - 999	
	EB - Eastbound, WB - Westbound	L - Left					Med: 10 - 19	Med: 10 - 19	Med: 1000 - 1999	
		R - Right					High: 20+	High: 20+	High: 2000+	

MD Peak - Southbound Service

#	Intersection	Movement SB Bus	TSP Acceptable?	Cross-Street Functional Class	Bus Stop Location	Other Priority Treatments	Parallel Buses per Hour	Conflicting Buses per Hour	Parallel Daily Bus Ridership	Bus Approach Speed < 10mph?
1	US 29 @ Blackburn Rd	SBT	No	Residential Primary	No Stop	Bus on Shoulder	Low	None	Low	No
2	US 29 @ Green Castle Rd	SBT	Yes	Arterial	No Stop	Bus on Shoulder	Low	None	Low	No
3	US 29 @ Fairland Rd	SBT	Yes	Arterial	No Stop	Bus on Shoulder	Low	None	Medium	No
4	US 29 @ Musgrove Rd	SBT	Yes	Arterial	No Stop	Bus on Shoulder	Low	None	Medium	No
5	US 29 @ Tech Rd	SBT	Yes	Arterial	Near Side	None	Low	None	Medium	No
6	US 29 @ Industrial Pkwy	SBT	No	Arterial	No Stop	None	Low	Low	Medium	No
7-a	US 29 @ Stewart Ln Slip	SBT	Yes	Other	No Stop	None	Low	Low	High	No
7-b	US 29 @ Stewart Ln Slip	SBT	Yes	Other	No Stop	None	Low	Low	High	No
8-a	US 29 @ Stewart Ln	SBT	Yes	Arterial	No Stop	None	Low	None	Medium	No
8-b	US 29 @ Stewart Ln	SBL	Yes	Arterial	No Stop	None	Low	High	Medium	No
9	US 29 @ Prelude Dr	SBT	Yes	Other	No Stop	None	Low	None	Medium	No
10	US 29 @ Burnt Mills Ave	SBT	No	Other	No Stop	None	Low	None	Medium	No
11-a	US 29 @ Lockwood Dr	SBT	No	Arterial	No Stop	None	Low	Low	Medium	No
11-b	Lockwood Dr @ US 29	WBL	Yes	Arterial	No Stop	None	Low	High	High	No
12	US 29 @ Burnt Mills Shopping Center	SBT	Yes	Other	Near Side	None	Low	None	High	No
13	US 29 @ Southwood Ave	SBT	No	Other	No Stop	None	Low	None	High	No
14	US 29 @ University Blvd WB	SBT	Yes	Major Highway	Near Side	None	Low	Low	High	No
15	US 29 @ University Blvd EB	SBT	Yes	Major Highway	No Stop	None	Low	Low	High	No
16	US 29 @ Franklin Ave	SBT	Yes	Residential Primary	No Stop	None	Low	Low	High	No
17	US 29 @ Sligo Creek Pkwy	SBT	Yes	Other	No Stop	None	Medium	Low	High	No
18	US 29 @ Dale Dr	SBT	Yes	Arterial	No Stop	None	Medium	None	High	No
19	US 29 @ Spring St	SBT	Yes	Arterial	No Stop	None	Medium	None	High	No
20	US 29 @ Fenton St	SBT	Yes	Arterial	Near Side	None	Medium	None	High	No
21	US 29 @ Georgia Ave	SBT	Yes	Major Highway	No Stop	None	Medium	High	High	No
22	Colesville Rd @ 2nd Ave	SBL	No	Arterial	No Stop	None	High	High	High	No
23	2nd Ave @ Ramsey Ave	EBR	No	Business	No Stop	None	High	High	High	No
24	MD 198 @ US 29 NB Ramps	-	-	-	-	-	-	-	-	-
25	Briggs Chaney Rd @ US 29 SB Ramps	WBR	Yes	Other	No Stop	None	Low	None	Low	No
26	Briggs Chaney Rd @ US 29 NB Ramps	WBT	Yes	Other	No Stop	None	Low	None	Low	No
27	Briggs Chaney Rd @ Outlet Dr	WBT	Yes	Other	No Stop	None	Low	None	Low	No
28-a	Briggs Chaney Rd @ Auto Dr/Castle Blvd	SBR	Yes	Industrial	No Stop	None	Low	Low	Low	No
28-b	Briggs Chaney Rd @ Auto Dr/Castle Blvd	WBR	Yes	Industrial	No Stop	None	Low	Low	Low	No
29	Briggs Chaney Rd @ Gateshead Manor Way	SBR	Yes	Other	No Stop	None	Low	Low	Low	No
30	Lockwood Dr @ White Oak S.C.	SBT	No	Other	Near Side	None	Low	None	High	No
31	Lockwood Dr @ MD 650	SBT	Yes	Major Highway	No Stop	None	Low	Low	High	No
32	Wayne Ave @ Dixon Ave	-	-	-	-	-	-	-	-	-
33	Wayne Ave @ Georgia Ave	-	-	-	-	-	-	-	-	-

NB - Northbound, SB - Southbound
EB - Eastbound, WB - Westbound

T - Through
L - Left
R - Right

Low: 1 - 9	Low: 1 - 9	Low: 1 - 999
Med: 10 - 19	Med: 10 - 19	Med: 1000 - 1999
High: 20+	High: 20+	High: 2000+

PM Peak - Southbound Service

#	Intersection	Movement SB Bus	TSP Acceptable?	Cross-Street Functional Class	Bus Stop Location	Other Priority Treatments	Parallel Buses per Hour	Conflicting Buses per Hour	Parallel Daily Bus Ridership	Bus Approach Speed < 10mph?
1	US 29 @ Blackburn Rd	SBT	No	Residential Primary	No Stop	Bus on Shoulder	Medium	None	Low	No
2	US 29 @ Green Castle Rd	SBT	No	Arterial	No Stop	Bus on Shoulder	Medium	None	Low	No
3	US 29 @ Fairland Rd	SBT	Yes	Arterial	No Stop	Bus on Shoulder	Medium	None	Medium	No
4	US 29 @ Musgrove Rd	SBT	Yes	Arterial	No Stop	Bus on Shoulder	Medium	None	Medium	No
5	US 29 @ Tech Rd	SBT	Yes	Arterial	Near Side	None	Medium	None	Medium	No
6	US 29 @ Industrial Pkwy	SBT	No	Arterial	No Stop	None	Medium	Low	Medium	No
7-a	US 29 @ Stewart Ln Slip	SBT	Yes	Other	No Stop	None	High	Low	High	Yes
7-b	US 29 @ Stewart Ln Slip	SBT	Yes	Other	No Stop	None	High	Low	High	Yes
8-a	US 29 @ Stewart Ln	SBT	Yes	Arterial	No Stop	None	Medium	None	Medium	Yes
8-b	US 29 @ Stewart Ln	SBL	Yes	Arterial	No Stop	None	Low	High	Medium	Yes
9	US 29 @ Prelude Dr	SBT	Yes	Other	No Stop	None	Medium	Low	Medium	No
10	US 29 @ Burnt Mills Ave	SBT	No	Other	No Stop	None	Medium	None	Medium	No
11-a	US 29 @ Lockwood Dr	SBT	No	Arterial	No Stop	None	Medium	Low	Medium	No
11-b	Lockwood Dr @ US 29	WBL	Yes	Arterial	No Stop	None	Low	High	High	No
12	US 29 @ Burnt Mills Shopping Center	SBT	No	Other	Near Side	None	High	None	High	No
13	US 29 @ Southwood Ave	SBT	Yes	Other	No Stop	None	High	None	High	No
14	US 29 @ University Blvd WB	SBT	Yes	Major Highway	Near Side	None	High	Medium	High	No
15	US 29 @ University Blvd EB	SBT	Yes	Major Highway	No Stop	None	High	Medium	High	Yes
16	US 29 @ Franklin Ave	SBT	No	Residential Primary	No Stop	None	High	Low	High	No
17	US 29 @ Sligo Creek Pkwy	SBT	No	Other	No Stop	None	High	Low	High	No
18	US 29 @ Dale Dr	SBT	Yes	Arterial	No Stop	None	High	Low	High	Yes
19	US 29 @ Spring St	SBT	Yes	Arterial	No Stop	None	High	None	High	No
20	US 29 @ Fenton St	SBT	Yes	Arterial	Near Side	None	High	None	High	Yes
21	US 29 @ Georgia Ave	SBT	Yes	Major Highway	No Stop	None	High	High	High	Yes
22	Colesville Rd @ 2nd Ave	SBL	No	Arterial	No Stop	None	High	High	High	Yes
23	2nd Ave @ Ramsey Ave	EBR	No	Business	No Stop	None	High	High	High	Yes
24	MD 198 @ US 29 NB Ramps	-	-	-	-	-	-	-	-	-
25	Briggs Chaney Rd @ US 29 SB Ramps	WBR	Yes	Other	No Stop	None	Low	None	Low	No
26	Briggs Chaney Rd @ US 29 NB Ramps	WBT	Yes	Other	No Stop	None	Low	Low	Low	No
27	Briggs Chaney Rd @ Outlet Dr	WBT	Yes	Other	No Stop	None	Low	None	Low	No
28-a	Briggs Chaney Rd @ Auto Dr/Castle Blvd	SBR	Yes	Industrial	No Stop	None	Low	Low	Low	No
28-b	Briggs Chaney Rd @ Auto Dr/Castle Blvd	WBR	Yes	Industrial	No Stop	None	Low	Medium	Low	No
29	Briggs Chaney Rd @ Gateshead Manor Way	SBR	Yes	Other	No Stop	None	Low	Medium	Low	No
30	Lockwood Dr @ White Oak S.C.	SBT	No	Other	Near Side	None	Low	None	High	Yes
31	Lockwood Dr @ MD 650	SBT	Yes	Major Highway	No Stop	None	Low	High	High	Yes
32	Wayne Ave @ Dixon Ave	-	-	-	-	-	-	-	-	-
33	Wayne Ave @ Georgia Ave	-	-	-	-	-	-	-	-	-

NB - Northbound, SB - Southbound	T - Through	Low: 1 - 9	Low: 1 - 9	Low: 1 - 999
EB - Eastbound, WB - Westbound	L - Left	Med: 10 - 19	Med: 10 - 19	Med: 1000 - 1999
	R - Right	High: 20+	High: 20+	High: 2000+

AM Peak - Northbound Service

#	Intersection	Movement SB Bus	TSP Acceptable?	Mandatory Points	Cross-Street Functional Class	Bus Stop Location	Other Priority Treatments	Parallel Buses per Hour	Conflicting Buses per Hour	Parallel Daily Bus Ridership	Bus Approach Speed < 10mph?
1	US 29 @ Blackburn Rd	NBT	No	0	Residential Primary	No Stop	Bus on Shoulder	Medium	None	Low	No
2	US 29 @ Green Castle Rd	NBT	No	0	Arterial	No Stop	Bus on Shoulder	Medium	None	Low	No
3	US 29 @ Fairland Rd	NBT	Yes	1	Arterial	No Stop	Bus on Shoulder	Medium	None	Medium	No
4	US 29 @ Musgrove Rd	NBT	No	0	Arterial	No Stop	Bus on Shoulder	Medium	None	Medium	No
5	US 29 @ Tech Rd	NBT	Yes	1	Arterial	Far Side	None	Medium	None	Medium	No
6	US 29 @ Industrial Pkwy	NBT	Yes	1	Arterial	No Stop	None	Medium	Low	High	No
7-a	US 29 @ Stewart Ln Slip	NBT	Yes	1	Other	No Stop	None	High	Low	Medium	No
7-b	US 29 @ Stewart Ln Slip	WBR	Yes	1	Other	No Stop	None	High	High	High	No
8-a	US 29 @ Stewart Ln	NBT	Yes	1	Arterial	No Stop	None	Medium	Low	Medium	Yes
8-b	US 29 @ Stewart Ln	-	-	-	-	-	-	-	-	-	-
9	US 29 @ Prelude Dr	NBT	No	0	Other	No Stop	None	Medium	Low	Medium	No
10	US 29 @ Burnt Mills Ave	NBT	No	0	Other	No Stop	None	Medium	None	Medium	No
11-a	US 29 @ Lockwood Dr	NBT	No	0	Arterial	No Stop	None	Medium	Low	Medium	No
11-b	Lockwood Dr @ US 29	-	-	-	-	-	-	-	-	-	-
12	US 29 @ Burnt Mills Shopping Center	NBT	No	0	Other	Far Side	None	High	None	High	No
13	US 29 @ Southwood Ave	NBT	No	0	Other	No Stop	None	High	None	High	No
14	US 29 @ University Blvd WB	NBT	No	0	Major Highway	No Stop	None	High	Medium	High	No
15	US 29 @ University Blvd EB	NBT	No	0	Major Highway	Near Side	None	High	Medium	High	No
16	US 29 @ Franklin Ave	NBT	Yes	1	Residential Primary	No Stop	None	High	Low	High	No
17	US 29 @ Sligo Creek Pkwy	NBT	No	0	Other	No Stop	None	High	Low	High	Yes
18	US 29 @ Dale Dr	NBT	Yes	1	Arterial	No Stop	None	High	Low	High	Yes
19	US 29 @ Spring St	NBT	Yes	1	Arterial	No Stop	None	High	None	High	Yes
20	US 29 @ Fenton St	NBT	Yes	1	Arterial	Far Side	None	High	None	High	Yes
21	US 29 @ Georgia Ave	WBR	Yes	1	Major Highway	No Stop	None	High	High	High	Yes
22	Colesville Rd @ 2nd Ave	WBR	Yes	1	Arterial	No Stop	None	High	High	High	Yes
23	2nd Ave @ Ramsey Ave	NBR	Yes	1	Business	No Stop	None	High	High	High	Yes
24	MD 198 @ US 29 NB Ramps	NBL	Yes	1	Major Highway	No Stop	None	Low	Low	Low	No
25	Briggs Chaney Rd @ US 29 SB Ramps	-	-	-	-	-	-	-	-	-	-
26	Briggs Chaney Rd @ US 29 NB Ramps	NBR	Yes	1	Other	No Stop	None	Low	Low	Low	No
27	Briggs Chaney Rd @ Outlet Dr	-	-	-	-	-	-	-	-	-	-
28-a	Briggs Chaney Rd @ Auto Dr/Castle Blvd	EBL	Yes	1	Industrial	No Stop	None	Low	Low	Medium	Yes
28-b	Briggs Chaney Rd @ Auto Dr/Castle Blvd	SBL	Yes	1	Industrial	No Stop	None	Low	Medium	Low	No
29	Briggs Chaney Rd @ Gateshead Manor Way	EBL	Yes	1	Other	No Stop	None	Low	Medium	Low	Yes
30	Lockwood Dr @ White Oak S.C.	NBT	No	0	Other	Far Side	None	Low	None	High	No
31	Lockwood Dr @ MD 650	NBT	No	0	Major Highway	No Stop	None	Low	High	High	No
32	Wayne Ave @ Dixon Ave	EBT	No	0	Other	No Stop	None	High	None	High	No
33	Wayne Ave @ Georgia Ave	EBL	Yes	1	Major Highway	No Stop	None	High	High	High	No

NB - Northbound, SB - Southbound
EB - Eastbound, WB - Westbound

T - Through
L - Left
R - Right

Low: 1 - 9	Low: 1 - 9	Low: 1 - 999
Med: 10 - 19	Med: 10 - 19	Med: 1000 - 1999
High: 20+	High: 20+	High: 2000+

MD Peak - Northbound Service

#	Intersection	Movement SB Bus	TSP Acceptable?	Cross-Street Functional Class	Bus Stop Location	Other Priority Treatments	Parallel Buses per Hour	Conflicting Buses per Hour	Parallel Daily Bus Ridership	Bus Approach Speed < 10mph?
1	US 29 @ Blackburn Rd	NBT	No	Residential Primary	No Stop	Bus on Shoulder	Low	None	Low	No
2	US 29 @ Green Castle Rd	NBT	Yes	Arterial	No Stop	Bus on Shoulder	Low	None	Low	No
3	US 29 @ Fairland Rd	NBT	Yes	Arterial	No Stop	Bus on Shoulder	Low	None	Medium	No
4	US 29 @ Musgrove Rd	NBT	No	Arterial	No Stop	Bus on Shoulder	Low	None	Medium	No
5	US 29 @ Tech Rd	NBT	Yes	Arterial	Near Side	None	Low	None	Medium	No
6	US 29 @ Industrial Pkwy	NBT	Yes	Arterial	No Stop	None	Low	Low	High	No
7-a	US 29 @ Stewart Ln Slip	NBT	Yes	Other	No Stop	None	Low	Low	Medium	No
7-b	US 29 @ Stewart Ln Slip	WBR	No	Other	No Stop	None	Low	High	High	No
8-a	US 29 @ Stewart Ln	NBT	Yes	Arterial	No Stop	None	Low	Low	Medium	No
8-b	US 29 @ Stewart Ln	-	-	-	-	-	-	-	-	-
9	US 29 @ Prelude Dr	NBT	No	Other	No Stop	None	Low	None	Medium	No
10	US 29 @ Burnt Mills Ave	NBT	No	Other	No Stop	None	Low	None	Medium	No
11-a	US 29 @ Lockwood Dr	NBT	No	Arterial	No Stop	None	Low	Low	Medium	No
11-b	Lockwood Dr @ US 29	-	-	-	-	-	-	-	-	-
12	US 29 @ Burnt Mills Shopping Center	NBT	Yes	Other	TBD	None	Low	None	High	No
13	US 29 @ Southwood Ave	NBT	No	Other	No Stop	None	Low	None	High	No
14	US 29 @ University Blvd WB	NBT	Yes	Major Highway	TBD	None	Low	Low	High	No
15	US 29 @ University Blvd EB	NBT	Yes	Major Highway	TBD	None	Low	Low	High	No
16	US 29 @ Franklin Ave	NBT	Yes	Residential Primary	No Stop	None	Medium	Low	High	No
17	US 29 @ Sligo Creek Pkwy	NBT	Yes	Other	No Stop	None	Medium	Low	High	No
18	US 29 @ Dale Dr	NBT	Yes	Arterial	No Stop	None	Medium	None	High	No
19	US 29 @ Spring St	NBT	Yes	Arterial	TBD	None	Medium	None	High	No
20	US 29 @ Fenton St	NBT	Yes	Arterial	TBD	None	Medium	None	High	No
21	US 29 @ Georgia Ave	WBR	Yes	Major Highway	No Stop	None	Medium	High	High	No
22	Colesville Rd @ 2nd Ave	WBR	Yes	Arterial	No Stop	None	High	High	High	No
23	2nd Ave @ Ramsey Ave	NBR	Yes	Business	No Stop	None	High	High	High	No
24	MD 198 @ US 29 NB Ramps	NBL	Yes	Major Highway	No Stop	None	Low	None	Low	No
25	Briggs Chaney Rd @ US 29 SB Ramps	-	Yes	-	-	-	-	-	-	-
26	Briggs Chaney Rd @ US 29 NB Ramps	NBR	Yes	Other	No Stop	None	Low	Low	Low	No
27	Briggs Chaney Rd @ Outlet Dr	-	Yes	-	-	-	-	-	-	-
28-a	Briggs Chaney Rd @ Auto Dr/Castle Blvd	EBL	No	Industrial	No Stop	None	Low	Low	Medium	No
28-b	Briggs Chaney Rd @ Auto Dr/Castle Blvd	SBL	Yes	Industrial	No Stop	None	Low	Low	Low	No
29	Briggs Chaney Rd @ Gateshead Manor Way	EBL	Yes	Other	No Stop	None	Low	Low	Low	No
30	Lockwood Dr @ White Oak S.C.	NBT	No	Other	TBD	None	Low	None	High	No
31	Lockwood Dr @ MD 650	NBT	Yes	Major Highway	No Stop	None	Low	Medium	High	No
32	Wayne Ave @ Dixon Ave	EBT	No	Other	No Stop	None	High	None	High	No
33	Wayne Ave @ Georgia Ave	EBL	Yes	Major Highway	No Stop	None	High	Medium	High	No

NB - Northbound, SB - Southbound
EB - Eastbound, WB - Westbound

T - Through
L - Left
R - Right

Low: 0 - 9	Low: 1 - 9	Low: 0 - 999
Med: 10 - 19	Med: 10 - 19	Med: 1000 - 1999
High: 20+	High: 20+	High: 2000+

PM Peak - Northbound Service

#	Intersection	Movement SB Bus	TSP Acceptable?	Cross-Street Functional Class	Bus Stop Location	Other Priority Treatments	Parallel Buses per Hour	Conflicting Buses per Hour	Parallel Daily Bus Ridership	Bus Approach Speed < 10mph?
1	US 29 @ Blackburn Rd	NBT	No	Residential Primary	No Stop	Bus on Shoulder	Medium	None	Low	No
2	US 29 @ Green Castle Rd	NBT	No	Arterial	No Stop	Bus on Shoulder	Medium	None	Low	No
3	US 29 @ Fairland Rd	NBT	Yes	Arterial	No Stop	Bus on Shoulder	Medium	None	Medium	No
4	US 29 @ Musgrove Rd	NBT	No	Arterial	No Stop	Bus on Shoulder	Medium	None	Medium	No
5	US 29 @ Tech Rd	NBT	Yes	Arterial	Near Side	None	Medium	None	Medium	No
6	US 29 @ Industrial Pkwy	NBT	Yes	Arterial	No Stop	None	High	Low	High	No
7-a	US 29 @ Stewart Ln Slip	NBT	Yes	Other	No Stop	None	Medium	Low	Medium	No
7-b	US 29 @ Stewart Ln Slip	WBR	Yes	Other	No Stop	None	Medium	High	High	No
8-a	US 29 @ Stewart Ln	NBT	Yes	Arterial	No Stop	None	Medium	Low	Medium	No
8-b	US 29 @ Stewart Ln	-	-	-	-	-	-	-	-	-
9	US 29 @ Prelude Dr	NBT	No	Other	No Stop	None	Medium	Low	Medium	No
10	US 29 @ Burnt Mills Ave	NBT	No	Other	No Stop	None	Medium	None	Medium	No
11-a	US 29 @ Lockwood Dr	NBT	No	Arterial	No Stop	None	Medium	Low	Medium	No
11-b	Lockwood Dr @ US 29	-	-	-	-	-	-	-	-	-
12	US 29 @ Burnt Mills Shopping Center	NBT	No	Other	TBD	None	High	None	High	No
13	US 29 @ Southwood Ave	NBT	No	Other	No Stop	None	High	None	High	No
14	US 29 @ University Blvd WB	NBT	Yes	Major Highway	TBD	None	High	Medium	High	No
15	US 29 @ University Blvd EB	NBT	Yes	Major Highway	TBD	None	High	Medium	High	No
16	US 29 @ Franklin Ave	NBT	Yes	Residential Primary	No Stop	None	High	Low	High	Yes
17	US 29 @ Sligo Creek Pkwy	NBT	No	Other	No Stop	None	High	Low	High	Yes
18	US 29 @ Dale Dr	NBT	Yes	Arterial	No Stop	None	High	Low	High	Yes
19	US 29 @ Spring St	NBT	Yes	Arterial	TBD	None	High	None	High	Yes
20	US 29 @ Fenton St	NBT	Yes	Arterial	TBD	None	High	None	High	Yes
21	US 29 @ Georgia Ave	WBR	Yes	Major Highway	No Stop	None	High	High	High	Yes
22	Colesville Rd @ 2nd Ave	WBR	Yes	Arterial	No Stop	None	High	High	High	Yes
23	2nd Ave @ Ramsey Ave	NBR	Yes	Business	No Stop	None	High	High	High	Yes
24	MD 198 @ US 29 NB Ramps	NBL	Yes	Major Highway	No Stop	None	Low	Low	Low	No
25	Briggs Chaney Rd @ US 29 SB Ramps	-	-	-	-	-	-	-	-	-
26	Briggs Chaney Rd @ US 29 NB Ramps	NBR	Yes	Other	No Stop	None	Low	Low	Low	No
27	Briggs Chaney Rd @ Outlet Dr	-	-	-	-	-	-	-	-	-
28-a	Briggs Chaney Rd @ Auto Dr/Castle Blvd	EBL	Yes	Industrial	No Stop	None	Low	Low	Medium	Yes
28-b	Briggs Chaney Rd @ Auto Dr/Castle Blvd	SBL	Yes	Industrial	No Stop	None	Low	Medium	Low	No
29	Briggs Chaney Rd @ Gateshead Manor Way	EBL	Yes	Other	No Stop	None	Low	Medium	Low	Yes
30	Lockwood Dr @ White Oak S.C.	NBT	No	Other	TBD	None	Low	None	High	Yes
31	Lockwood Dr @ MD 650	NBT	Yes	Major Highway	No Stop	None	Low	High	High	Yes
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33	Wayne Ave @ Georgia Ave	EBL	Yes	Major Highway	No Stop	None	High	High	High	No

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Med: 10 - 19	Med: 10 - 19	Med: 1000 - 1999
High: 20+	High: 20+	High: 2000+