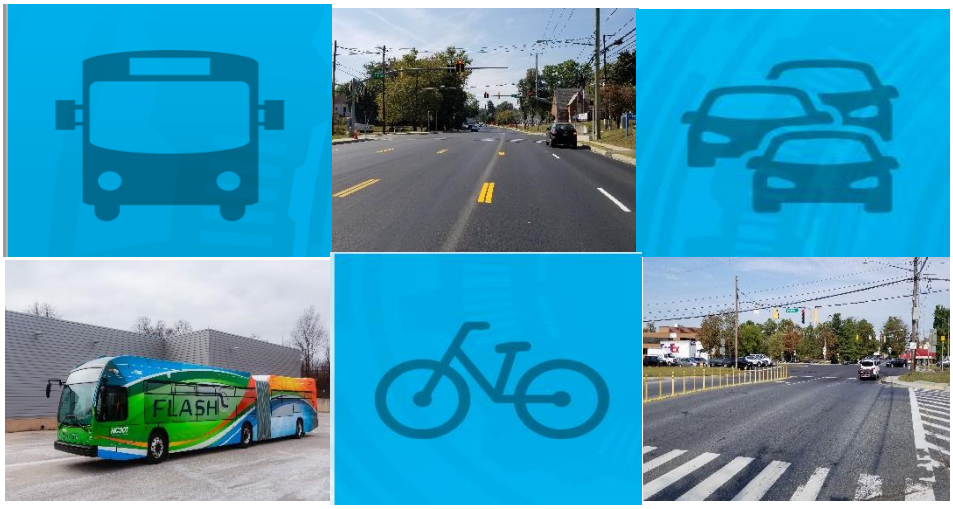
US 29 Mobility & Reliability Study

Report Addendum

November 2022



MCDOT
Montgomery County
Department of Transportation

Mead & Hunt

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Executive Summary

The Montgomery County Department of Transportation requested additional study to further refine the Median Bus Lane concept and improvements on US 29 originally identified in the US 29 Mobility & Reliability Study (2020) at the directive of the Montgomery County Council and Maryland-National Capital Park and Planning Commission (M-NCPPC). This report serves as an addendum to the US 29 Mobility & Reliability Study Technical Report published in 2020[1].

The report addendum carries forward the results and designs of the following concepts from the US 29 Mobility & Reliability Study (2020):

- **No Build:** The No Build alternative represents a "do nothing" option to evaluate the changes in traffic and transit operations if no improvements or network changes were completed. The results of the No Build provide a baseline to measure the impacts and benefits of the Build concepts.
- **Managed Lane:** The Managed Lane concept proposed a managed bus and High Occupancy Vehicle (HOV) lane to operate in the peak directions, southbound in the AM and northbound in the PM peak periods, along with optional FLASH station relocations and several intersection and interchange improvements along the US 29 study corridor.
- **Median Bus Lane Baseline:** The Median Bus Lane concept proposed a median separated dual or single lane reversible bus lane from Tech Road to Sligo Creek Parkway operating in the peak directions, southbound in the AM and northbound in the PM peak periods, along with an interchange improvement at the US 29 and I-495 interchange and new traffic signals.

Based on feedback received from the Montgomery County Council and M-NCPPC, the focus of this additional study is to:

- Improve the Median Bus Lane concept with respect to traffic and transit operations.
- Make the Median Bus Lane more cost effective.
- Identify the independent utility of the spot intersection improvements.
- Provide clarity regarding the High Occupancy Vehicles (HOV) and transit mode shifts.

To accomplish these goals, four (4) new refined concepts of the Median Bus Lane Baseline from the original study were developed and evaluated:

- Median Bus Lane with Intersection Improvements
- Median Bus Lane Optimized
- Median Bus Lane with Cost Reductions
- Median Bus Lane Hybrid

The refined Median Bus Lane concepts were developed iteratively to allow for a better comparison of the transit and traffic benefits to those found in the Managed Lane concept and isolate the independent benefits of different improvements. The refined concepts are by in large consistent with the transit facilities proposed in the Median Bus Lane Baseline concept, providing a median separated reversible bus lane from Tech Road to Sligo Creek Parkway. Additional details on the purpose and modifications considered in each concept are provided in the subsequent sections.

This report addendum is organized to document the development of the four (4) new refined Median Bus Lane concepts and present the results and findings of the traffic analysis and concept design. The study scope includes: 1) concept development and screening; 2) results from the traffic operations analysis; 3) public and stakeholder engagement and feedback; 4) a comparison between the No Build, Managed Lane,

[1] https://www.montgomerycountymd.gov/dot-dte/projects/US29Study/index.html

and Median Bus Lane Hybrid concepts; 5) updated travel forecasting and ridership assumptions and results; and 6) a discussion of the geometric concepts and cost estimates.

The results from the traffic analyses of the refined concepts found that the Median Bus Lane Hybrid strikes a balance between improving FLASH Bus Rapid Transit (BRT) travel times along the US 29 study corridor while not degrading the expected traffic operations for passenger vehicles from the No Build condition:

- **In the southbound AM peak direction**, the BRT travel time from MD 198 to Georgia Avenue would be expected to improve by approximately 20-minutes with no increases in travel time for passenger vehicles when compared to the No Build.
- **In the northbound PM peak direction**, the travel time from Georgia Avenue to MD 198 would be expected to improve by approximately 5-minutes for both the BRT service and passenger vehicles over the No Build.

The estimated costs for the Median Bus Lane Hybrid were also favorable with a total estimated cost of $128 million. This was $7 million less than the Median Bus Lane Baseline from the previous study and only $2 million more than the lowest cost Median Bus Lane with Cost Reductions. The anticipated right-of-way impacts for the Median Bus Lane Hybrid is 5.5 acres, primarily composed of strip easements along property frontages.

Based on the traffic analysis and design review, the Median Bus Lane Hybrid concept best addresses the project goals of maximizing the project benefits of improving traffic and transit operations while minimizing project costs and impacts. Based on these findings, **it is recommended that the Median Bus Lane Hybrid concept be carried forward for further consideration against the No Build and Managed Lane concepts.**

Comparing the traffic operations, person throughput, and ridership of the No Build, Managed Lane, and Median Bus Lane (Hybrid) concepts found the following:

- The model estimated travel time results indicate:
  - The Managed Lane and Median Bus Lane (Hybrid) provide similar benefits to transit operations in the peak directions of US 29 over the No Build.
  - General-purpose travel times under the Median Bus Lane (Hybrid) remain similar or better than the No Build in the AM and PM peak hour.
  - The Managed Lane shows significant travel time improvements for general-purpose vehicles over both the No Build and Median Bus Lane (Hybrid), due to increased capacity in some roadway sections and the reductions in overall traffic volumes associated with the mode shift to HOV.
- The intersection results indicate:
  - The Managed Lane concept would reduce the overall number of failing intersections along the corridor by 6 and 3 intersections in the AM and PM peak hours, respectively.
  - The Median Bus Lane (Hybrid) indicate that the number of failing intersections would increase over the No Build by 2 and 3 in the AM and PM peak hours, respectively.
- The person throughput comparison indicates the Managed Lane would provide a modest increase in person throughput in the AM and PM peak hours with similar person throughput between the No Build and Median Bus Lane (Hybrid).
- Both the Managed Lane and Median Bus Lane (Hybrid) concepts would significantly increase FLASH ridership over the No Build concept.

While the Managed Lane generally shows improved traffic operations over the Median Bus Lane (Hybrid), realization of these benefits would be contingent on mode shifts for increased carpooling which may require

marketing, program support, and incentives to reach the full potential. Additionally, the Managed Lane would require enforcement and monitoring to ensure optimal operation. Alternatively, the Median Bus Lane (Hybrid) is consistent with the master plan and would give the bus a prominent place within the streetscape. The separate guideway would also provide strong protection from unauthorized use of the transit lane(s) and from friction between lanes/turning movements, improving reliability for bus service which would be less impacted by congestion and incidents.

The design effort estimated that while the Managed Lane would require an additional 1.4 acres in right-of-way acquisition (assuming the Burnt Mills and Four Corner Station Improvements are constructed), the overall project costs of $105 million are $23 million less than the Median Bus Lane (Hybrid) costs of $128 million.

Introduction

The Montgomery County Department of Transportation requested additional study to further refine the Median Bus Lane concept and improvements on US 29 originally identified in the US 29 Mobility & Reliability Study (2020) at the directive of the Montgomery County Council and Maryland-National Capital Park and Planning Commission (M-NCPPC). This report serves as an addendum to the US 29 Mobility & Reliability Study Technical Report published in 2020.

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Based on feedback received from the Montgomery County Council and M-NCPPC, the focus of this additional study is to:

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- Make the Median Bus Lane more cost effective.
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This report addendum is organized to document the development of the four (4) new refined Median Bus Lane concepts and present the results and findings of the traffic analysis and concept design. The study scope includes: 1) concept development and screening; 2) results from the traffic operations analysis; 3) public and stakeholder engagement and feedback; 4) a comparison between the No Build, Managed Lane, and Median Bus Lane Hybrid concepts; 5) updated travel forecasting and ridership assumptions and results; and 6) a discussion of the geometric concepts and cost estimates.

Median Bus Lane Concept Development and Screening

Description of Concepts

Four (4) new refined concepts of the Median Bus Lane Baseline from the original study were developed and tested to further refine the Median Bus Lane concept along US 29 from MD 198 to Georgia Avenue. The concepts were developed through an iterative process each with specific goals to test the limits of improvements to transit operations, decrease impacts on passenger vehicles, and reduce overall project costs and impacts. The four (4) concepts considered in the study include:

- Median Bus Lane with Intersection Improvements
- Median Bus Lane Optimized
- Median Bus Lane with Cost Reductions
- Median Bus Lane Hybrid

Median Bus Lane with Intersection Improvements

The Median Bus Lane with Intersection Improvements carries forward the priority bus alignment and station locations and designs from the Median Bus Lane Baseline with the addition of all intersection improvements from the Managed Lane. The intention of Median Bus Lane with Intersection Improvements is to allow for a better comparison of the transit and traffic benefits to those found in the Managed Lane from US 29 Mobility & Reliability Report, and to better isolate the utility provided by each of the intersection improvements.

Median Bus Lane Optimized

The Median Bus Lane Optimized further advances the Median Bus Lane concept by improving the median station design at Hillwood Drive to allow buses to remain in the median bus lane, creating peak direction bus-only lanes in Silver Spring from Sligo Creek Parkway to Georgia Avenue, and the inclusion of an additional BRT station at Franklin Avenue based on public feedback. Median Bus Lane Optimized includes all intersection improvements considered in Managed Lane and Median Bus Lane with Intersection Improvements. The intention of the Median Bus Lane Optimized concept is to provide the best possible transit operations while maintaining acceptable vehicle operations.

Median Bus Lane with Cost Reductions

The Median Bus Lane with Cost Reductions refines the Median Bus Lane concept geometric design to reduce project costs while preserving the design features that provide the highest benefits for the priority transit service. The design modifications identified in the value engineering process included bus on shoulder operations between Industrial Parkway and Stewart Lane and a redesign of the Hillwood Drive/Lockwood Drive and Four Corners BRT stations. Additionally, select intersection signalization and improvements that were not found to provide a significant benefit to traffic or transit operations in the testing of prior concepts were removed from the concept.

Median Bus Lane Hybrid

The Median Bus Lane Hybrid considers the optimal features of the Median Bus Lane with Intersection Improvements and Median Bus Lane Optimized concepts with cost saving features from the Median Bus Lane with Cost Reductions concept. The Median Bus Lane Hybrid includes the intersection improvement at Greencastle Road, bus on shoulder operations between Industrial Parkway and Stewart Lane, a single median bus lane through Hillwood Drive, a dual median bus lane through Four Corners, the BRT station at Franklin Avenue, and southbound bus only lane in Silver Spring between Sligo Creek Parkway and Georgia Avenue.

Table 1 provides a summary of the priority bus alignments, intersection improvements, proposed signals, and BRT station locations along the US 29 study corridor for each concept. Additional details describing the design assumptions are provided in Addendum Appendix III along with roll plans.

Table 1: Concept Comparison Summary Table

Intersection	Managed Lane	Median Bus Lane Baseline	Median Bus Lane w/ Intersection Improvements	Median Bus Lane Optimized	Median Bus Lane with Cost Reductions	Median Bus Lane Hybrid
Sandy Spring Rd (MD198)	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder
Blackburn Rd	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder
Greencastle Rd	Shoulder ⊕	Shoulder	Shoulder ⊕	Shoulder ⊕	Shoulder ⊕	Shoulder ⊕
Briggs Chaney Rd	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder
ICC (MD 200)	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder
Fairland Rd	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder
Musgrove Rd	Managed	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder
Cherry Hill Rd	Managed	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder
Tech Rd	Managed ⊕ 🚌	Shoulder 🚌	Shoulder ⊕ 🚌	Shoulder ⊕ 🚌	Shoulder 🚌	Shoulder 🚌
Industrial Pkwy	Managed	Dual	Dual	Dual	Shoulder	Shoulder
Stewart Lane	Managed ⊕	Dual	Dual ⊕	Dual ⊕	Shoulder	Shoulder
NH Ave (MD 650)	Managed ⊕	Single	Single ⊕	Single ⊕	Single	Single
Oak Leaf Dr	Managed	Single 🚦	Single 🚦	Single 🚦	Single	Single
Prelude Dr	Managed	Single	Single	Single	Single	Single
Northwest Dr	Managed	Single 🚦	Single 🚦	Single	Single	Single
Southwest Dr	Managed	Single	Single	Single	Single	Single
Burnt Mills Ave	Managed	Single	Single	Single	Single	Single
Lockwood Dr	Managed	Single 🚌	Single 🚌	Single	Single	Single
Hillwood Dr	Managed 🚌	Single 🚦	Single 🚦	Dual 🚦 🚌	Single 🚦 🚌	Single 🚦 🚌
Crestmoor Dr	Managed	Single 🚦	Single 🚦	Single 🚦	Single 🚦	Single 🚦
Southwood Ave	Managed	Single	Single	Single	Single	Single
Lorain Ave	Mixed	Single	Single	Single	Single	Single
Timberwood Ave	Mixed	Dual 🚦	Dual 🚦	Dual 🚦	Single	Dual 🚦
University Blvd (MD 193)	Mixed	Dual 🚌	Dual 🚌	Dual 🚌	Single	Dual 🚌
Lanark Way	Mixed 🚌	Dual	Dual	Dual	Dual 🚌	Dual
Capital Beltway (I-495)	Mixed ⊕	Dual ⊕	Dual ⊕	Dual ⊕	Dual ⊕	Dual ⊕
Granville Dr/Hastings Dr*	Mixed	Single 🚦	Single 🚦	Single 🚦	Single 🚦	Single 🚦
Indian Springs Dr	Mixed	Single	Single	Single	Single	Single
Brewster Ave	Mixed	Single	Single	Single	Single	Single
Leighton Ave	Mixed	Single	Single	Single 🚌	Single	Single 🚌
Franklin Ave	Mixed	Single	Single	Single	Single	Single
Sligo Creek Pkwy	Mixed ⊕	Single	Single ⊕	Single ⊕	Single	Single
Greyrock Dr	Mixed	Mixed	Mixed	Bus Lane (NB/SB)	Bus Lane (NB/SB)	Bus Lane (SB)
Dale Dr	Managed	Mixed	Mixed	Bus Lane (NB/SB)	Bus Lane (NB/SB)	Bus Lane (SB)
Highland Dr	Managed	Mixed	Mixed	Bus Lane (NB/SB)	Bus Lane (NB/SB)	Bus Lane (SB)
Rowen Rd	Managed	Mixed	Mixed	Bus Lane (NB/SB)	Bus Lane (NB/SB)	Bus Lane (SB)
Woodside Pkwy	Managed	Mixed	Mixed	Bus Lane (NB/SB)	Bus Lane (NB/SB)	Bus Lane (SB)
Mansion Dr	Managed	Mixed	Mixed	Bus Lane (NB/SB)	Bus Lane (NB/SB)	Bus Lane (SB)
Noyes Dr	Managed	Mixed	Mixed	Bus Lane (NB/SB)	Bus Lane (NB/SB)	Bus Lane (SB)
Spring St	Managed	Mixed	Mixed	Bus Lane (NB/SB)	Bus Lane (NB/SB)	Bus Lane (SB)
Fenton St	Mixed 🚌	Mixed 🚌	Mixed 🚌	Bus Lane (NB/SB) 🚌	Bus Lane (NB/SB) 🚌	Bus Lane (SB) 🚌
Georgia Ave (MD97)	Mixed	Mixed	Mixed	Bus Lane (NB/SB)	Bus Lane (NB/SB)	Bus Lane (SB)

Shoulder	Bus on inside or outside shoulder	🚦	New traffic signal
Bus Lane	Dedicated bus only lane in peak direction*		
Single	Single lane reversible median busway in peak direction*	🚌	Station Location
Dual	Dual lane median busway		
Managed	Managed lane in peak direction*	⊕	Intersection improvement
Mixed	Mixed traffic		

*Peak directions are based on traffic patterns, which for US 29 refer to the southbound direction in the AM peak and the northbound direction in the PM peak.

Project Cost Comparison

The costs of each concept were estimated, and previous cost estimates adjusted to year 2022 dollars. A summary table comparing the project costs for each concept is provided in Table 2. Detailed information on the cost estimates is provided in Addendum Appendix III.

The estimated cost for the Median Bus Lane Baseline is $133 million. The refined Median Bus Lane with Intersection Improvements and Median Bus Lane Optimized concepts have increased project costs over the baseline with total costs of $151 million and $152 million, respectively. The cost increases can primarily be attributed to the addition of common intersection improvements from the Managed Lane, station layouts, and increased lane widths. Overall project costs are reduced in the Median Bus Lane with Cost Reductions and Median Bus Lane Hybrid concepts when compared to the baseline with total costs of $126 million and $128 million, respectively. The reduced project costs in the Median Bus Lane with Common Intersection Improvements and Median Bus Lane Hybrid concepts can be primarily attributed to bus-on-shoulder operations between Stewart Lane and Industrial Parkway, scaling back intersection improvements, and less impactful BRT station designs at Lockwood Drive/Hillwood Drive. It should also be noted that the Managed Lane concept includes the costs of optional Burnt Mills ($16.6) and Four Corners ($8.7) station improvements.

Table 2: Comparison of Estimated Costs

Concepts	Estimated Cost
Managed Lane	$105M
Median Bus Lane Baseline	$133M
Median Bus Lane w/ Intersection Improvements	$151M
Median Bus Lane Optimized	$152M
Median Bus Lane with Cost Reductions	$126M
Median Bus Lane Hybrid	$128M

Traffic and Transit Operations Summary

The refined Median Bus Lane concepts were evaluated using the previously developed and calibrated Synchro and Vissim models from the US 29 Mobility and Reliability Study. Year 2025 traffic volumes were used in this analysis and are consistent with the volumes used in the previous US 29 Mobility & Reliability Study (2020) to allow for comparison of results.

The results of the Synchro capacity analysis reveal similar intersection results across the refined Median Bus Lane concepts with 12 to 14 of the 33 study intersections operating at Level of Service (LOS) E or F during the AM and PM peak hours. Intersection and movement delay, LOS, and volume-to-capacity ratios for each of the refined Median Bus Lane concepts are provided in Appendix I.

The Vissim models were used to estimate person throughput, network performance, and corridor travel times consistent with the methodology from the US 29 Mobility and Reliability Study (2020). Detailed person throughput, network performance metrics, and travel times for each of the refined Median Bus Lane concepts are provided in Addendum Appendix I. As the person throughput and network performance

metrics are fairly similar across the refined Median Bus Lane concepts, the report focuses on the travel time results and comparisons.

The estimated travel time results from the Vissim microsimulation analysis in the 2025 design year are presented in Figure 1 and Figure 2 for the peak direction AM and PM peak hours, respectively. The limits of the travel time analysis are between MD 198 and Georgia Avenue.

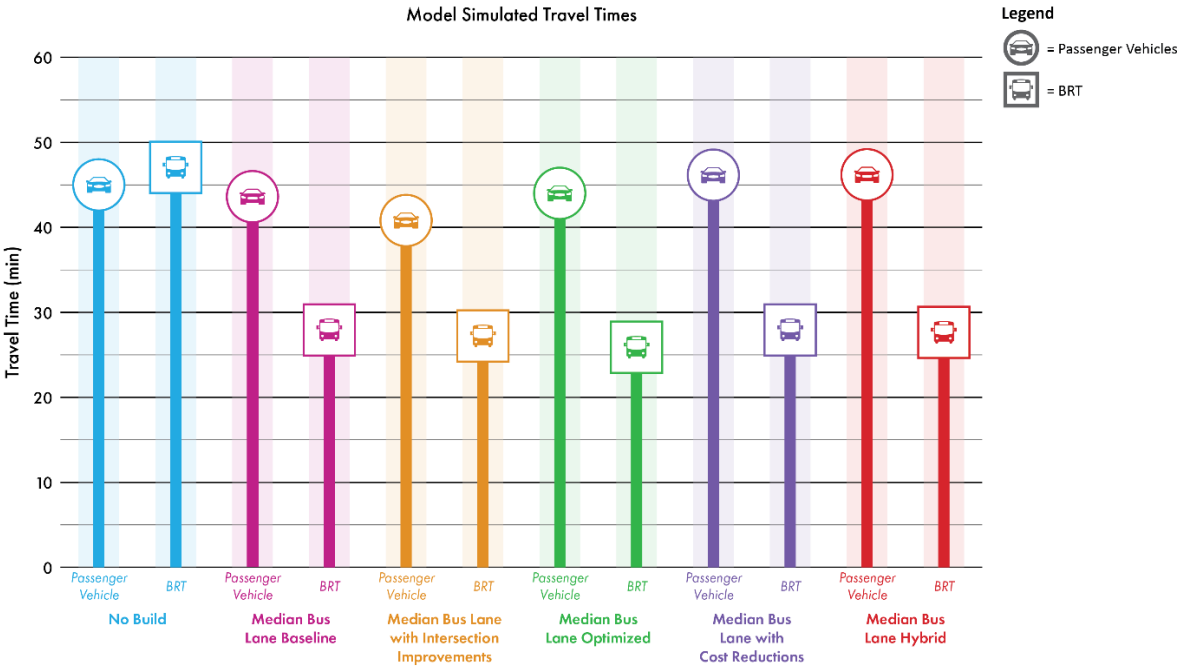

Figure 1: 2025 Southbound Travel Times - AM Peak

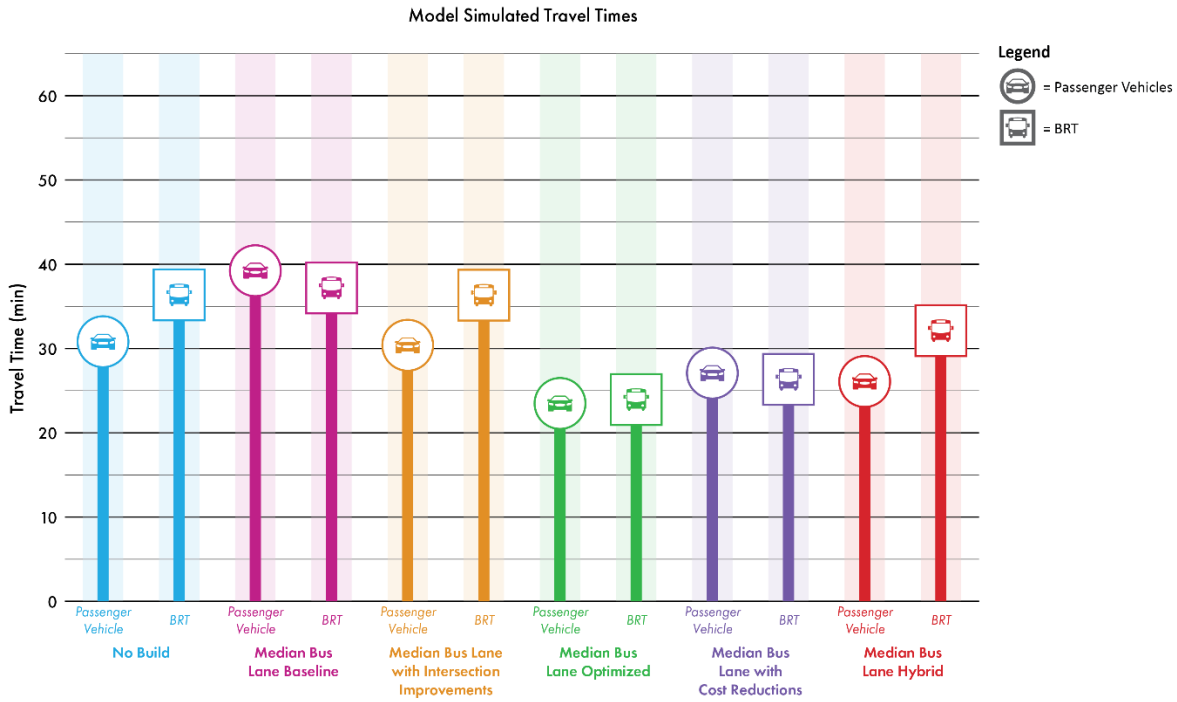

Figure 2: 2025 Northbound Travel Times - PM Peak

AM Peak – Southbound Direction

The model estimated travel time results of the four (4) refined bus lane concepts in the peak southbound direction are similar to that of the Median Bus Lane Baseline concept with BRT travel times between 26-minutes and 28-minutes and general-purpose travel times between 41-minutes and 47-minutes across all concepts. The Median Bus Lane Optimized concept offers the best BRT travel times at 26-minutes and the best general-purpose travel time were in the Median Bus Lane with Intersection Improvements at 41-minutes.

The Median Bus Lane Baseline concept showed favorable operations when compared to the No Build, with a 50% reduction in BRT travel times and similar travel times for general-purpose vehicles in the AM peak hour. The results of the refined Median Bus Lane concepts in the AM peak hour indicate that the cost saving concept modifications in the Median Bus Lane with Cost Reductions and Median Bus Lane Hybrid concepts do not degrade transit or general-purpose travel times along US 29. Further, the inclusion of the dedicated bus lanes southbound in Silver Spring were not found to significantly impact general-purpose travel times in the morning peak hour. Southbound travel times generally show a 2-minute increase for general-purpose vehicles in the segment between MD 193 and Franklin Avenue approaching the bus only lanes as compared to the Median Bus Lane Baseline. BRT transit travel times in the bus only segment show minor increases of less than a minute due to dwell times at the new Franklin Avenue station and the need for a queue jump at Georgia Avenue to access the Silver Spring Transit Center.

PM Peak – Northbound Direction

The model estimated travel times in the PM peak hour northbound vary across the Median Bus Lane concepts; however, all refined concepts see travel time improvements over the Median Bus Lane Baseline concept for both BRT and general-purpose vehicles. BRT travel time in the northbound direction varied from 24-minutes to 36-minutes and general-purpose travel times varied from 24-minutes to 30-minutes. The Median Bus Lane Optimized concept offers the best BRT and general-purpose travel times at 24-minutes[2].

While the PM results of the Median Bus Lane Baseline concept showed favorable BRT operations when compared to the No Build, there were significant impacts to general-purpose vehicles with a nearly 40% increase in travel times. The results of the refined Median Bus Lane concepts in the PM peak hour indicate that improving transit operations and signal timing surrounding the Lockwood Drive BRT station significantly reduced impacts to general-purpose vehicles.

The analysis of the refined concepts revealed that the dedicated northbound bus lanes in Silver Spring considered in Median Bus Lane Optimized and Median Bus Lane with Cost Reductions result in improvements in BRT travel times of approximately 10-minutes over concepts without the bus lane; however, it was found to cause significant degradation of general-purpose travel lanes in both the southbound and northbound directions of US 29. The increased congestion associated with the northbound dedicated bus lane raised concerns that the adjacent neighborhoods could be potentially impacted due to spillover impacts from the congested traffic conditions.

[2] The Median Bus Lane Optimized and Median Bus Lane with Cost Reductions show favorable general-purpose travel times along the study corridor in the PM peak hour due to the significant metering caused by the proposed bus lanes in Silver Spring. The model indicated significant increases in congestion in Silver Spring for vehicles attempting to enter the study corridor from the south which are not captured in the travel time results.

Median Bus Lane (Hybrid)

Based on the traffic analysis and design review, the Median Bus Lane Hybrid concept best addresses the project goals of maximizing the project benefits of improving traffic and transit operations while minimizing project costs and impacts. Based on these findings, **it is recommended that the Median Bus Lane Hybrid concept be carried forward for further consideration against the No Build and Managed Lane concepts.**

Advanced Engineering Design Considerations

To address the project goals of optimizing the traffic and transit operations and reducing overall project costs, the initial recommendations in the Median Bus Lane Baseline concept for new signalized intersections were reviewed. The review considered balancing the negative impacts to BRT and general-purpose traffic progression along US 29, due to the new signals, with pedestrian needs for signalized crossings and vehicular access for neighborhoods. Based on current signal spacing and neighborhood roadway connectivity, the number of new signalized intersections was reduced by two (2). The Median Bus Lane concept recommends upgrading intersection control to full-color traffic signals at the following intersections:

- US 29 at Hillwood Drive
- US 29 at Crestmoor Drive
- US 29 at Timberwood Drive
- US 29 at Hastings Drive (MDOT-SHA planned improvement)

The Median Bus Lane will require new turn prohibitions at select locations due to safety considerations and median closures associated with the reversible median bus lane alignment. The new turn prohibitions are recommended at the following intersections, with anticipated diversion routes[3] described below and presented in Figure 3 and Figure 4.

- US 29 at Oak Leaf Drive – Northbound
  - Northbound left turns to use signal at Prelude Drive.
- US 29 at Northwest Drive – Northbound and Southbound
  - Northbound and southbound left turns to use signal at Burnt Mills Avenue.
- US 29 at Lockwood Drive – Southbound
  - Southbound left turns to use signal at Burnt Mills Avenue then Lockwood Drive.
- US 29 at Hillwood Drive – Southbound
  - Southbound left turns to use signal at Burnt Mills Avenue then Lockwood Drive.
- US 29 at Lorain Avenue – Northbound and Southbound
  - Northbound left turns to use signal at Southwood Avenue.
  - Southbound left turns to use signal at Timberwood Avenue.
- US 29 at Brewster Avenue – Southbound
  - Southbound left turns to use signal at Hastings Drive.
- US 29 at Leighton Avenue – Northbound and Southbound
  - Northbound and southbound left turns to use signal at Hastings Avenue.

It should be noted that MDOT-SHA has plans to install a signal at Oak Leaf Drive as part of a separate project.

[3] All turn prohibitions and subsequent diversions were accounted for in the traffic analysis.

Figure 3: New Turn Prohibitions (1 of 2)

Figure 4: New Turn Prohibitions (2 of 2)

In addition to the improvements to traffic and transit operations, the Median Bus Lane would enhance pedestrian and bicycle safety and connectivity with additional signalized crossings at all new traffic signals and protected only left turn phasing along US 29. Appendix III of the US 29 Mobility Study Technical Report (2020) identified over 200 individual pedestrian and bicycle improvements between Silver Spring and Tech Road. The County Council approved funding to begin advancing pedestrian and bicycle improvements around all stations as part of the FY23-28 budget[4]. These ped/bike improvements would be pursued separately from this BRT study, with their own timeline and budget. The improvements include:

- new and widened sidewalks
- ADA compliance updates
- bike routes/lanes
- US 29 crossing upgrades
- bike parking/shares

A critical component of both the Managed Lane and the Median Bus Lane will be the widening of the on-ramp from US 29 southbound to the I-495 Outerloop. Independent testing of the ramp widening found that the improvement reduces southbound corridor travel times by 10-minutes, offsetting travel time increases that would otherwise be realized in the proposed build concepts. The improvement will be contingent on treatments that mitigate the pedestrian multiple-threat scenario that is introduced with the second ramp lane in further stages of design. Potential treatment options that may be considered are shown in Table 3.

Table 3: Pedestrian Treatment Options for I-495 Interchange

Treatment Options	Illustration	Treatment Options	Illustration
Raised Crosswalk		Tighter turn radius	
Full Color Signal		Shared-use path on east side of bridge	
Peak Hour Use Only (dynamic lane sign)		Pedestrian Bridge	

[4]https://apps.montgomerycountymd.gov/BASISCAPITAL/Common/Project.aspx?ID=P502304&CID=3&SCID=8

Public & Stakeholder Engagement

Throughout the refinement of the Median Bus Lane, public and stakeholder engagement was performed to solicit input on transportation issues and concerns and to shape the concepts/recommendations. Meetings held included the following:

- Agency Meeting #1 – Held Virtually (MNCPPC, MDOT SHA)
  - October 6, 2021 (10:30 AM – 12:00 PM)
- CAC Meeting #18 – Held Virtually
  - November 16, 2021 (6:30 PM – 8:30 PM)
- Public Meeting #1 – Held Virtually (Follow Up Study Overview)
  - December 16, 2021 (6:30 PM – 8:30 PM)
- Agency Meeting #2 – Held Virtually (MNCPPC, MDOT SHA)
  - May 27, 2022 (11:00 AM – 12:00 PM)
- CAC Meeting #19 – Held Virtually
  - June 9, 2022 (7:00 PM – 9:00 PM)
- Agency Update #3 – Held Virtually (MNCPPC, MDOT SHA)
  - September 6, 2022 (8:00 AM – 10:00 AM)
- CAC Meeting #20 – Held Virtually
  - October 6, 2022 (7:00 PM – 9:00 PM)
- Public Meeting #3 – Held In-Person at Pine Crest Elementary School (Project Findings)
  - October 13, 2022 (7:00 PM – 9:00 PM)

Meeting summaries, presentations, and recordings can be found on the project website (https://www.montgomerycountymd.gov/dot-dte/projects/US29Study/index.html).

Comparison of No Build, Managed Lane, and Median Bus Lane (Hybrid) Concepts

With the selection of the Median Bus Lane (Hybrid) for further consideration, the next step in the planning process will be to choose which concept to carry forward between the No Build, Managed Lane, and Median Bus Lane (Hybrid). The type of facilities provided along US 29 in both build concepts is shown in Figure 5 below. The selection process should consider safety, project costs, right-of-way impacts, expected benefits, and input from the public and other stakeholder agencies. This section provides a summary of the traffic operations, transit benefits, costs, and additional considerations of the recommended concepts.

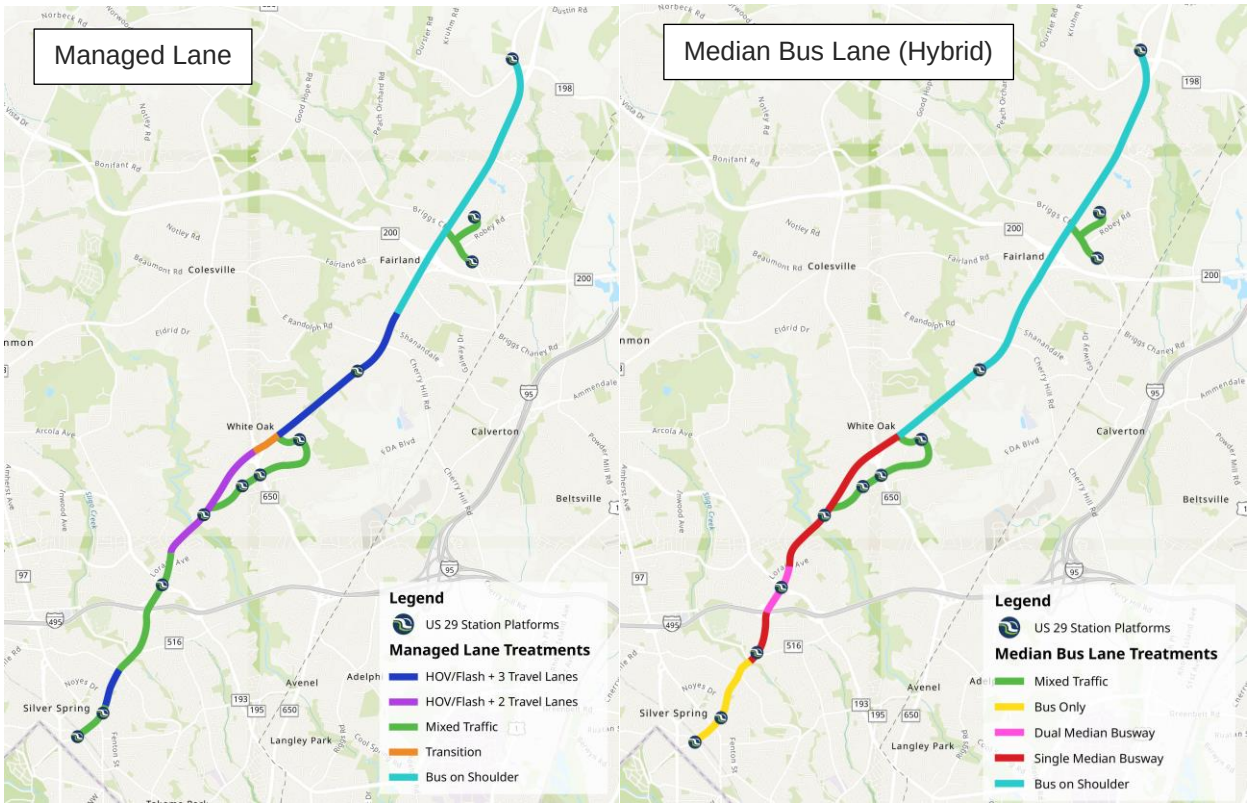

Figure 5: Managed Lane and Median Bus Lane (Hybrid) Transitway Type and Station Locations

Ridership and HOV Mode Shifts

Travel forecasting model runs were performed to estimate ridership and HOV mode shifts for the 2025 build year and to identify long-term trends in the future year 2040 under the No Build, Managed Lane, and Median Bus Lane (Hybrid) concepts. The Managed Lane concept increases ridership from No Build by 32% per day in 2025, and by 38% over No Build in 2040. The Median Bus Lane (Hybrid) has the highest weekday BRT boardings increase of 34% over No Build in 2025 and a 41% increase over No Build in 2040.

The mode share of the AM southbound person trips just outside the Beltway north of Lanark Way in the future year 2040 are shown in Figure 6. The share of HOV 2+ (two or more people per vehicle) in the No Build is 15% in the northern section of the US 29 corridor (White Oak), increases to 19% just north of the Beltway and drops to 15% inside the Beltway. The Managed Lane increases the share of AM southbound HOV 2+ person trips to between 2% to 35% outside the Beltway and 26% inside the Beltway. The Median Bus Lane (Hybrid) has the lowest share of AM southbound HOV 2+ person trips at 15% to 16% outside the Beltway, and 13% inside the Beltway. The No Build and Median Bus Lane (Hybrid) concepts have similar percentages of daily HOV person trips of 20% to 22% outside the Beltway increasing by approximately 1% from 2017. The Managed Lane concept increases the share of daily HOV 2+ vehicles assigned along the corridor to between 27% to 32%. Additional detail on the mode shift and ridership analysis and results are provided in Addendum Appendix II.

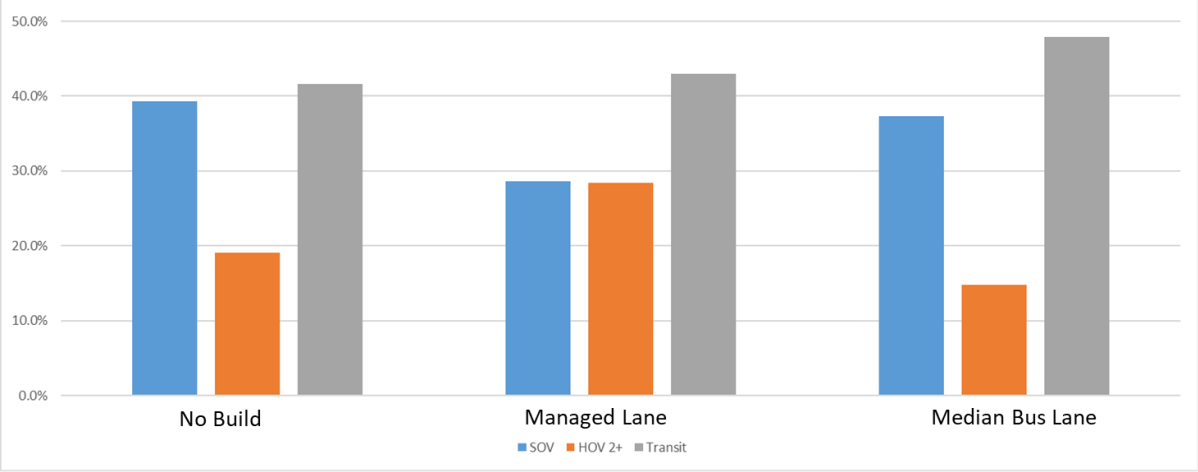

Figure 6: 2040 AM Southbound Person Trip Mode Share (north of Lanark Way)

Traffic and Transit Operations

Corridor travel time results for the No Build, Managed Lane, and Median Bus Lane concepts in the peak AM and PM directions are shown in Figure 7 and Figure 8, respectively. The model estimated travel times indicate that the Managed Lane and Median Bus Lane (Hybrid) provide similar benefits to transit operations in the peak directions of US 29 over the No Build. The travel times for general-purpose vehicles under the Median Bus Lane (Hybrid) remain similar or better than the No Build in the AM and PM peak hour, while the Managed Lane shows significant travel time improvements over both the No Build and Median Bus Lane (Hybrid), due to the reductions in overall traffic volumes associated with the mode shift to HOV. Heat maps with the BRT speeds and intersection results are provided in Addendum Appendix I.

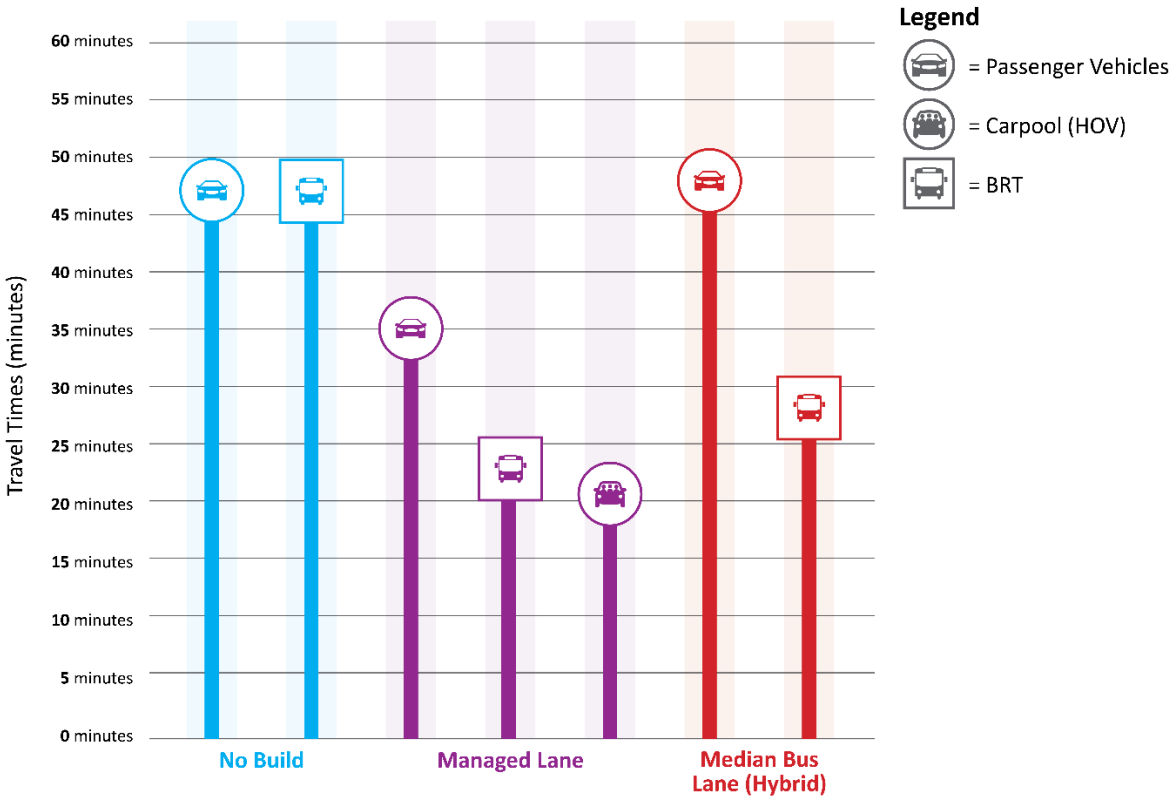

Figure 7: 2025 Southbound AM - Travel Time Comparison

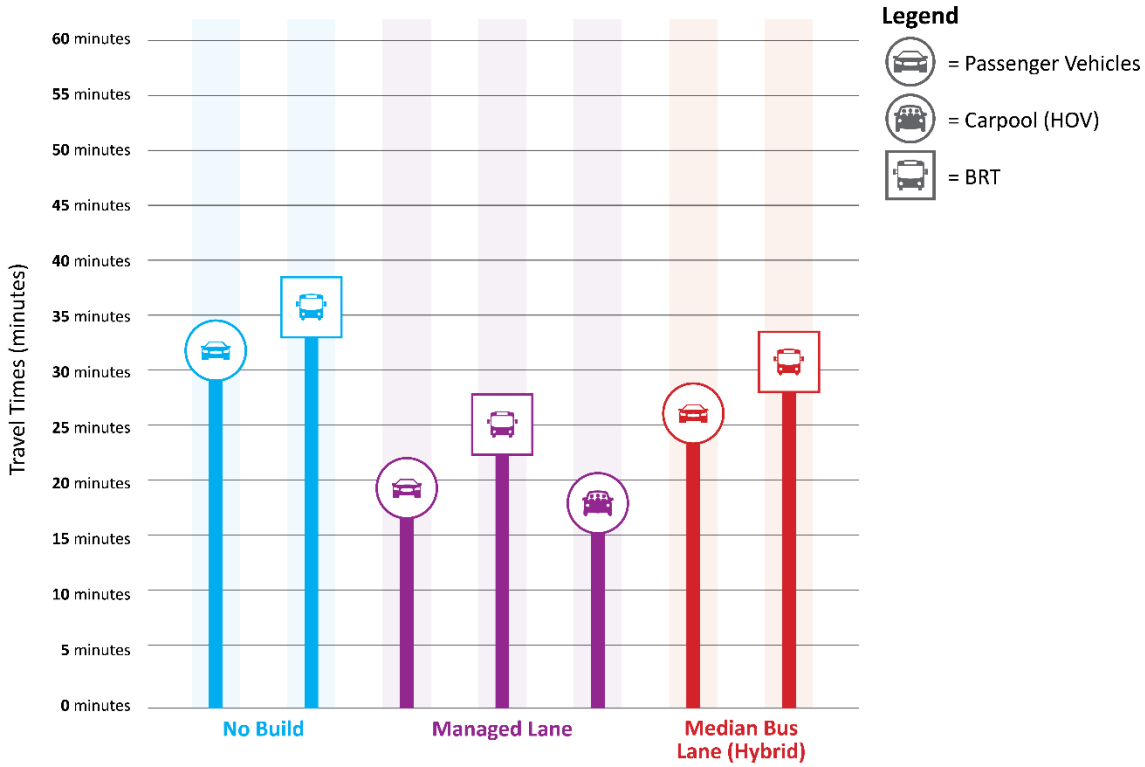

Figure 8: 2025 Northbound PM - Travel Time Comparison

Table 4 provides a summary of operational differences between each concept and a comparison of the right-of-way requirements and costs for each of the Managed Lane and Median Bus Lane (Hybrid).

Table 4: Preferred Concept Comparisons

		No Build	Managed (Bus/HOV) Lane	Median Bus Lane (Hybrid)
Travel Time in minutes AM SB (PM NB)	Single-Occupant Vehicle:	46 (32)	35 (19)	47 (26)
	HOV 2+ Vehicle:	n/a	20 (18)	n/a
	BRT:	47 (36)	23 (25)	28 (31)
Number of Level of Service E/F Signalized Intersections AM (PM)		11 (8)	5 (5)	13 (11)
Person Throughput AM (PM)[1]		3800 (4250)	4550 (4650)	3850 (4250)
2040 Flash Weekday Boardings[2,3]		8200	11200	11500
Right-of-Way (acres)		-	6.9[4]	5.5
Cost		-	$105 million[5]	$128 million

[1] Person throughput estimated using Vissim model.
[2] Weekday boardings estimated using travel forecasting model.
[3] Flash April 2022 ridership – 2500 daily riders.
[4] Includes right-of-way for **optional** Burnt Mills (1.5 acres) and Four Corners (1.2 acres) stations.
[5] Includes costs of **optional** Burnt Mills ($16.6M) and Four Corners ($8.7M) stations.

The intersection results indicate that the Managed Lane concept would reduce the overall number of failing intersections along the corridor by 6 and 3 intersections in the AM and PM peak hours, respectively. The results from the Median Bus Lane (Hybrid) indicate that the number of failing intersections would increase over the No Build by 2 and 3 in the AM and PM peak hours, respectively. The person throughput comparison indicates the Managed Lane would provide the highest person throughput in the AM and PM peak hours with similar person throughput between the No Build and Median Bus Lane (Hybrid). Both the Managed Lane and Median Bus Lane (Hybrid) concepts would significantly increase FLASH ridership over the No Build concept. Figure 9 and Figure 10 compare the intersection and segment level of service between the No Build, Managed Lane, and Median Bus Lane (Hybrid) concepts.

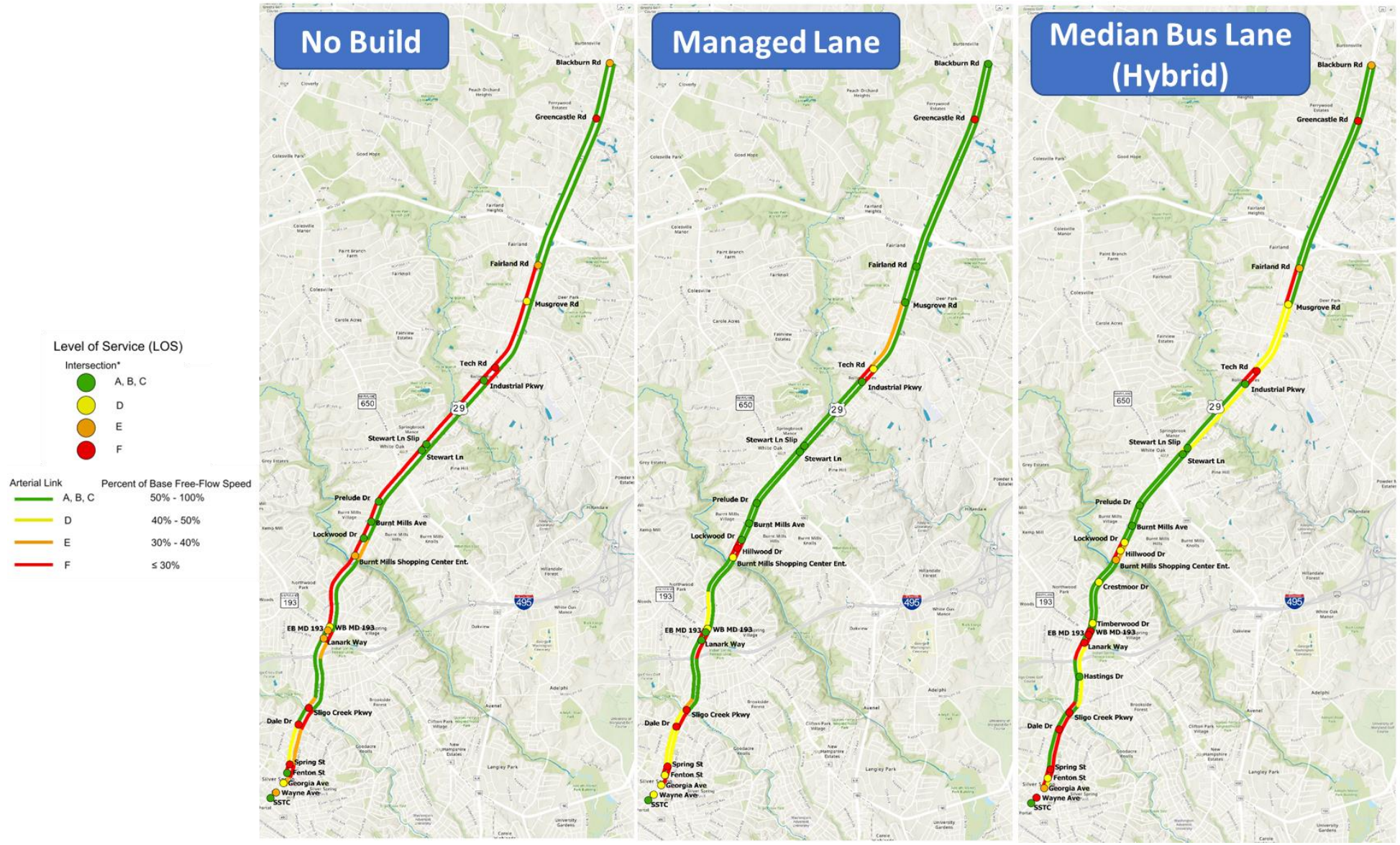

Figure 9: 2025 AM Intersection and BRT Segment Level of Service

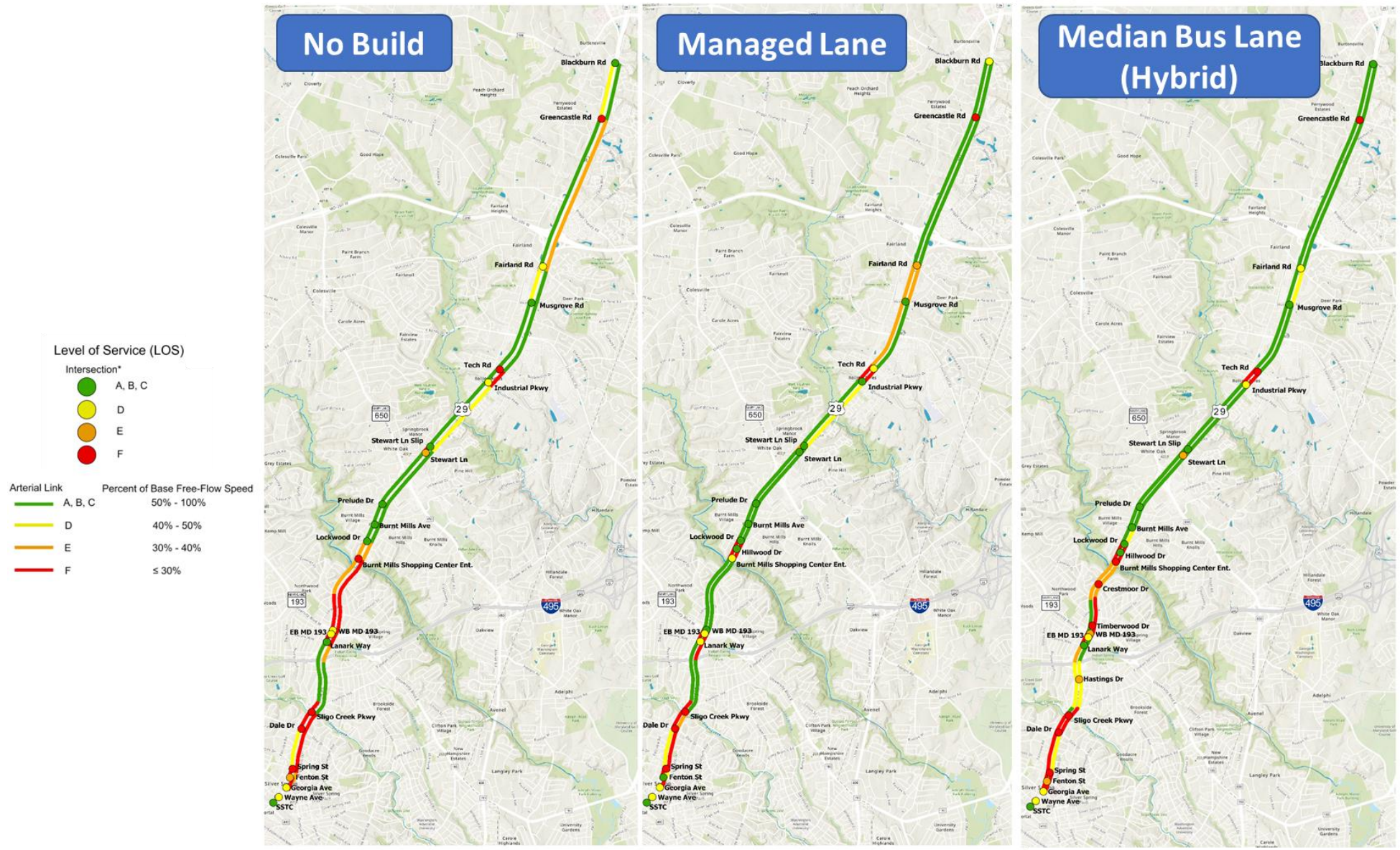

Figure 10: 2025 PM Intersection and Segment Level of Service

Summary

Comparing the traffic operations, person throughput, and ridership of the No Build, Managed Lane, and Median Bus Lane (Hybrid) concepts found the following:

- The model estimated travel time results indicate:
  - The Managed Lane and Median Bus Lane (Hybrid) provide similar benefits to transit operations in the peak directions of US 29 over the No Build.
  - General-purpose travel times under the Median Bus Lane (Hybrid) remain similar or better than the No Build in the AM and PM peak hour.
  - The Managed Lane shows significant travel time improvements for general-purpose vehicles over both the No Build and Median Bus Lane (Hybrid), due to increased capacity in some roadway sections and the reductions in overall traffic volumes associated with the mode shift to HOV.
- The intersection results indicate:
  - The Managed Lane concept would reduce the overall number of failing intersections along the corridor by 6 and 3 intersections in the AM and PM peak hours, respectively.
  - The Median Bus Lane (Hybrid) indicate that the number of failing intersections would increase over the No Build by 2 and 3 in the AM and PM peak hours, respectively.
- The person throughput comparison indicates the Managed Lane would provide a modest increase in person throughput in the AM and PM peak hours with similar person throughput between the No Build and Median Bus Lane (Hybrid).
- Both the Managed Lane and Median Bus Lane (Hybrid) concepts would significantly increase FLASH ridership over the No Build concept to similar levels.

While the Managed Lane generally shows improved traffic operations over the Median Bus Lane (Hybrid), realization of these benefits would be contingent on mode shifts for increased carpooling which may require marketing, program support, and incentives to reach the full potential. Additionally, the Managed Lane would require enforcement and monitoring to ensure optimal operation. Alternatively, the Median Bus Lane (Hybrid) is consistent with the master plan and would give the bus a prominent place within the streetscape. The separate guideway would also provide strong protection from unauthorized use of transit lane(s) and from friction between lanes/turning movements, improving reliability for bus service which would be less impacted by congestion and incidents.

The design effort estimated that while the Managed Lane would require an additional 1.4 acres in right-of-way acquisition (assuming the Burnt Mills and Four Corner Station Improvements are constructed), the overall project costs of $105 million are $23 million less than the Median Bus Lane (Hybrid) costs of $128 million.