3 Bus Rapid Transit Hybrid Design Alternative

3.1 Introduction

The previous chapter presented eight design alternatives for implementing BRT along MD 355 from Odendhal Avenue to Summit Avenue. These alternatives assumed a consistent application from end to end regardless of the impacts. Four of the alternatives presented show the most promise in achieving a BRT corridor that provides improved bus speeds, low- to moderate traffic impacts, and minimal property impacts compared to the other alternatives.

- Dual-lane Minimum Design
- Dual-lane Reduced Impact Design
- Single-lane Minimum Design
- Single-lane Reduced Impact Design

It has been acknowledged that the MD 355 corridor from Odendhal to Summit is not consistent in design and character. These differences result in some of the above alternatives being more advantageous than others for portions of the focal area. A more concentrated look at the focal study area was conducted to understand whether a blending of more than one alternative could be achieved to provide a greater balance of the benefits and impacts.

3.2 Focal Segment Hybrid Design Alternatives

To produce a hybrid design alternative planning-level layout for the BRT on MD 355 in the Gaithersburg focal segment, most of the design assumptions utilized in Chapter 2 to design the original alternatives are carried forward. These assumptions include the following:

- The single-lane guideway will operate with BRT vehicles using the guideway only in the peak direction, and BRT vehicles traveling in the opposite direction will travel in mixed traffic.
- A BRT station will be located at the MD 355/Odendhal Avenue intersection

- A median station at Odendhal Avenue will provide far-side platforms, allowing BRT vehicles to travel through the traffic signal prior to stopping at the station.
- Traffic signal control and full turning movement access will be maintained at the existing traffic signals on MD 355 at Odendhal Avenue, Chestnut Street, and Summit Avenue.
- The existing number of exclusive turn lanes will be maintained on MD 355 at signalized intersections.
- The median guideway design will not provide median breaks at unsignalized intersections to allow left turns to and from side streets.
- Given existing property constraints and the desire to minimize property impacts in the focal segment, on-street bicycle facilities are not included in any of the design alternatives.

In identifying the hybrid design the intent was to provide a balance between BRT operations, traffic operations, and property impacts. As with the previous roadway design layouts, buildings that are likely to be significantly impacted by the roadway design are identified. The layouts also identify buildings that are possibly impacted by the roadway design, where sidewalks still encroach on the buildings; however, these building impacts may be avoided through localized modifications to the sidewalk design intended to preserve the existing building. These roadway design layouts are conceptual, based on design assumptions developed specifically for the focal segment. Detailed roadway design will be required to determine a final roadway layout and define the actual degree of building or property impacts associated with the BRT in the City of Gaithersburg.

The following sections describe the development of the hybrid design alternative by breaking the focal study area into four segments:

- MD 355 from Odendhal Avenue to Chestnut Street
- MD 355 from Chestnut Street to the Father Cuddy Bridge
- MD 355 at the Father Cuddy Bridge
- MD 355 from the Father Cuddy Bridge to Summit Avenue

A copy of the hybrid design alternative layout concept is included in Appendix B.

Transitions between Single-lane and Dual-lane Guideway Segments

The hybrid design alternatives considers the potential to provide both single-lane and dual-lane guideway on different parts the focal segment. For design purposes, it is assumed that the single-lane design alternatives will result in a BRT operation that travels in the guideway in the peak direction only and in general traffic in the non-peak direction. This operational configuration provides the ability for BRT vehicles to travel in both directions at any frequency without conflicts within a single-lane guideway.

However, the interface between a single-lane guideway and dual-lane guideway segment requires a specialized traffic signal with a "queue jump" phase designed to allow for bus-only movements, particularly to exit the guideway. When a bus traveling in the non-peak direction reaches the single-lane guideway, the traffic signal will provide a bus-only phase designed to give the bus priority to enter the mixed traffic lanes. When a non-peak direction bus, traveling in mixed traffic, reaches a segment where dual-lane guideway is provided, the bus needs to

be positioned in the leftmost through lane to maneuver into the dual-lane guideway, or a merging area into the median guideway can be provided at a midblock location. Stations located along the single-lane guideway segment will need provide one or two curbside platforms for BRT vehicles operating in mixed traffic. To minimize the need for curbside platforms and BRT vehicles exiting the dual-lane guideway in advance of a station, it is generally preferable not to locate BRT stations at intersections where the guideway transitions between single-lane and dual-lane guideway.

An alternative operational option for the single-lane guideway could allow bi-directional travel in the guideway, which would place limits on the maximum service frequency that can be achieved in order to preclude simultaneous BRT bus operation in opposite directions within the single-lane guideway. Given the relatively short length of the segment between Odendhal Avenue and Chestnut Street (approximately 2,200 feet), an average BRT operating speed of 20 miles per hour would result in less than 2 minutes of travel time for this roughly half mile segment. A bi-directional operation within a single-lane guideway for this segment should be able to accommodate five minute frequencies. This frequency would still provide a very high quality BRT service, but buses may, at times, be required to idle in the dual-lane guideway at either of the transition points while waiting for a bus traveling in the opposite direction to clear the single-lane guideway.

MD 355 from Odendhal Avenue to Chestnut Street

The Dual-Lane Median Minimum design showed multiple building impacts, while the Dual-Lane Median Reduced Impact and Single-Lane Median Minimum design alternatives showed potential building impacts that may be avoidable. The only alternative out of the four that showed no apparent building impacts for this segment was the Single-Lane Median Reduced Impact design.

All four of the designs result in improved bus speeds due to the exclusive BRT guideway. Traffic operations are most negatively impacted by the Reduced Impact alternatives, which maintain existing lane capacity at intersections, but require eliminating the third southbound travel lane on MD 355 between Odendhal Avenue and Chestnut Street. A reduction in the number of travel lanes would result in increased congestion along MD 355. Retaining the existing signalized intersection lane configurations allows each intersection to continue operating at acceptable levels for all four design alternatives.

The Single-Lane Median Minimum design was selected for this segment in the hybrid design alternative because it provides for improved bus speeds and BRT operations, one potential property impact, and acceptable levels of service and roadway capacity. The transition from dual-lane median guideways to the single-lane guideway at both Odendhal Avenue and Chestnut Street will require specialized traffic signals to provide bus access to and from mixed traffic lanes. Placement of a BRT station at Odendhal Avenue will also require non-peak buses in the southbound direction to exit the median guideway at Lakeforest Boulevard to access a curbside platform at Odendhal Avenue. These design considerations suggest that locating the station at Lakeforest Boulevard may be preferable for operations. This will be explored further in the next chapter.

MD 355 from Chestnut Street to the Father Cuddy Bridge

This short segment of roadway consists of two through lanes in each direction, but widens slightly before approaching the Father Cuddy Bridge, where a third lane in each direction is provided. Despite the widening that occurs between Walker Avenue and Brookes Avenue, all of the design alternatives potentially impact one building on the northeast corner of the MD 355/Walker Avenue intersection. The Single-Lane and Double-Lane Minimum design alternatives are most likely to impact the building. No other buildings along this segment were impacted by any of four design alternatives.

The exclusive BRT guideway for all alternatives results in improved bus speeds and BRT operations along this segment. Traffic operations results are consistent in this segment because similar lane geometry is provided for all alternatives. The intersection at Chestnut Street would operate at the same level of service (LOS B) in each alternative, and the roadway capacity is only slightly decreased in the Dual-Lane Reduced Impact alternative in the peak direction.

The Dual-Lane Median Minimum design was selected for this segment in the hybrid design alternative because it provides for improved bus speeds and BRT operations, only one property impact, and acceptable levels of service and roadway capacity. The traffic signal at MD 355 and Chestnut Street is the planned transition point between the dual-lane median guideway and the single-lane median guideway to the north, and it will need to provide a bus-only phase to allow buses to enter or exit mixed traffic at this location.

MD 355 at Father Cuddy Bridge

This segment of the corridor is one of the most constrained because any alternative that is wider than the existing bridge deck would likely require full bridge replacement, at significant cost, to maintain traffic lane capacity but avoid impacts to the CSX railroad tracks and roadways below the bridge. Because of this, no alternative that would result in bridge widening is being considered as part of the hybrid design. This eliminates both the Single-Lane and Dual-Lane Median Minimum alternatives.

The Dual-Lane Reduced Impact was selected for this segment because it would allow for a consistent guideway design from Chestnut Street headed south. This design would result in three southbound and two northbound general traffic lanes on the bridge. This configuration will require traffic traveling north in the right lane on MD 355, between Summit Avenue and the bridge, to merge into the center lane. The traffic analysis indicates that levels of service will remain acceptable in the planning horizon year 2025, despite the reduction in lane capacity. This alternative provides two exclusive BRT median lanes with no requirement for bridge widening. The sidewalks along the bridge will remain five feet wide, meeting ADA minimum requirements for pedestrian mobility.

MD 355 from Father Cuddy Bridge to Summit Avenue

The segment from south of the Father Cuddy Bridge to Summit Avenue is the widest roadway cross-section of the focal study area. It currently includes three lanes in each direction and a wide median. None of the four alternatives being considered as part of the hybrid showed building impacts, but the two minimum design alternatives would require roadway widening.

Bus speeds and BRT operations are improved under any of these alternatives. Based on the hybrid design chosen for the segment from Chestnut Street to this point, selecting a single-lane design alternative would add another level of complexity. A transition from a dual-lane guideway to a single-lane guideway would be further complicated by requiring a new traffic signal south of the bridge to manage the transition between the different guideway types. These challenges suggest that one of the two dual-lane design alternatives is preferred.

Traffic operations along this segment are only slightly impacted in both of the Reduced Impact design alternatives, and only in the peak direction of travel. Roadway capacity from Chestnut Street to Summit Avenue would remain at acceptable levels of service in all four scenarios. The MD 355 at Summit Avenue intersection is anticipated to continue operating at acceptable levels (LOS B).

The Reduced Impact design for the Father Cuddy Bridge segment as part of the hybrid design provides only two northbound lanes on the bridge. The Dual-lane Reduced Impact alternative was designed to include a northbound merge on MD 355, and minimizes the need to widen the roadway south of the bridge. South of the Route 117 intersection with MD 355, there is a significant retaining wall along the west side and a significant descending slope along the east side of MD 355. This design sacrifices the wider sidewalks included in the Dual-lane Minimum design.

The Dual-Lane Median Reduced Impact design was selected for this segment in the hybrid design alternative and results in improved bus speeds and BRT operations. There are limited property impacts and no building impacts associated with this alternative. Traffic operations were shown to meet acceptable levels of service (D or better) for the segment between Chestnut Street and Summit Avenue. Under the hybrid alternative, northbound traffic in the right lane would merge into the center lane prior to the Father Cuddy Bridge.

Hybrid Alternative

The hybrid alternative that emerged from a review of those alternatives appears to achieve the greatest balance of BRT operations, traffic impacts, and property impacts throughout the corridor. The guideway treatments selected for each part of the corridor includes the following:

- Odendhal Avenue to Chestnut Street - Single-lane Median Minimum design
- Chestnut Street to Father Cuddy Bridge - Dual-lane Median Minimum design
- Father Cuddy Bridge - Dual-lane Median Reduced Impact design
- Father Cuddy Bridge to Summit Avenue - Dual-lane Reduced Impact design

A copy of the hybrid alternative design layout concept is included in Appendix B and identifies both building/entire property impacts and potential property impacts associated with the planned roadway geometry. Table 3-1 summarizes the property impacts for the hybrid design alternative.

Table 3-1: MD 355 Focal Segment – Hybrid Guideway Design Property Impacts

Location	Significant Building Impacts		Possible Building Impacts		Significant Parking Lot Impacts	
	East Side	West Side	East Side	West Side	East Side	West Side
Odendhal Avenue to Chestnut Street	0	0	1	0	2	2
Chestnut Street to Father Cuddy Bridge	1	0	0	0	0	1
Father Cuddy Bridge to Summit Avenue	0	0	0	0	0	0
Total Buildings/Properties	**1**	**0**	**1**	**0**	**2**	**3**

The design layout will require no widening of the Father Cuddy Bridge. In addition to the dual-lane median guideway, two northbound travel lanes and three southbound travel lanes can be accommodated on the bridge without widening. The existing sidewalks, representing the minimum standard sidewalk, are retained. No significant roadway widening is required along the steeply sloped roadside north or south of the bridge, so new retaining walls should not be required.

The hybrid guideway design would allow for improved BRT travel speeds throughout the length of the corridor. Buses traveling within either single-lane or dual-lane guideway are estimated to average speeds between 18 and 22 miles per hour, depending on time of day. The dual-lane guideway segments allows for buses in both directions to achieve these speeds. Buses traveling in the single-lane segments would achieve the same speeds when operating within the guideway, but would see lower speeds (11 to 15 miles per hour) when operating in the general traffic lanes. As detailed design of the BRT advances, operational decisions will be required to determine how buses should operate in the single-lane segments of the corridor. Two operating scenarios are possible:

- Only peak direction travel in the single-lane median guideway
- Bi-directional travel allowing two-way BRT travel within the median guideway at all times, but limiting the frequency of BRT service

In the hybrid design, a bi-directional operating scenario is achievable because of the short segment of single-lane guideway between two signalized intersections. The traffic signals can be design to provide coordination for buses approaching and within the single-lane median guideway.

Both the dual- and single-lane median guideway designs allow for BRT station platforms to be constructed within the median, including support for a single-lane bi-directional BRT operational design. The single-lane guideway design with a peak direction of travel operating scenario would require curbside stations for the non-peak buses, or eliminate stations within this segment.

3.3 Focal Segment Hybrid Design Alternative Cross-sections

As described in Chapter 2 the four smaller segments of the focal study area by character include the following areas:

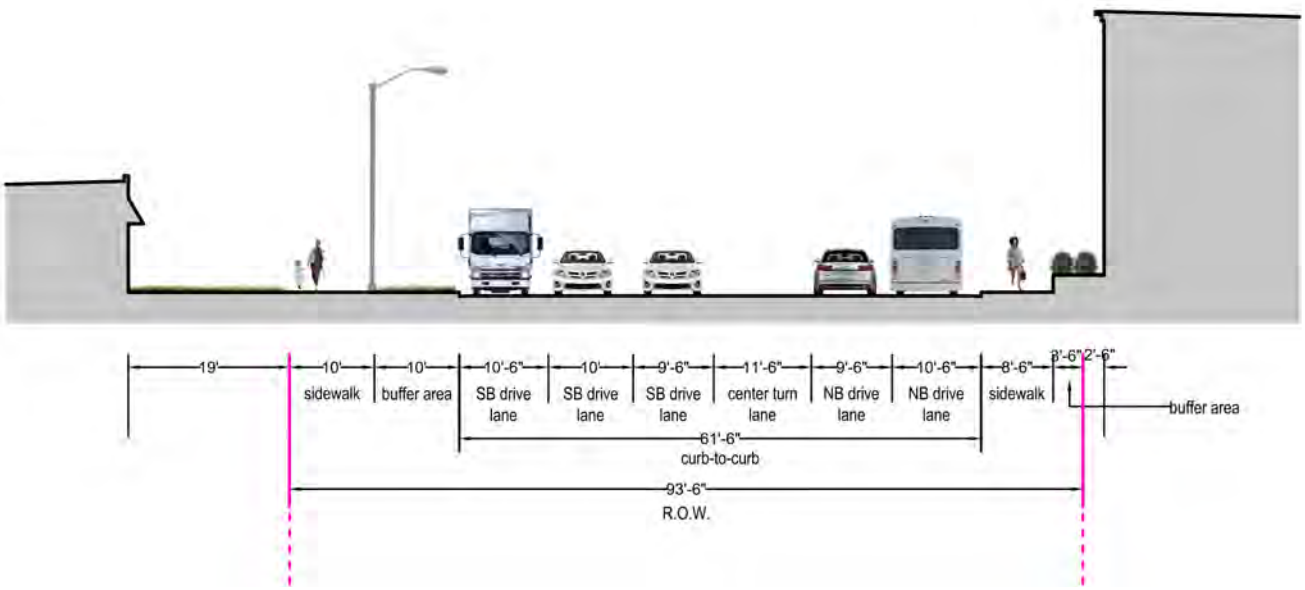
- Odendhal Avenue to Chestnut Street
- Chestnut Street to Father Cuddy Bridge
- Father Cuddy Bridge
- Father Cuddy Bridge to Summit Avenue

The same cross section locations used for the previous review of alternatives is used for the hybrid alternatives as well to provide a consistent comparison. The locations selected for cross sections include the following:

- MD 355 south of Whetstone Drive
- MD 355 at Montgomery Avenue
- MD 355 between Brookes Avenue and Walker Avenue
- MD 355 at Father Cuddy Bridge
- MD 355 north of Desellum Avenue

The following pages display each location, the existing lane widths and configuration, and the hybrid alternative. Each cross-section shows the proposed lane, median, and sidewalk widths, changes in roadway alignment, and necessary curb-to-curb width and right-of-way. Also indicated on the cross-sections are any potential property impacts.

1 EXISTING CONDITIONS



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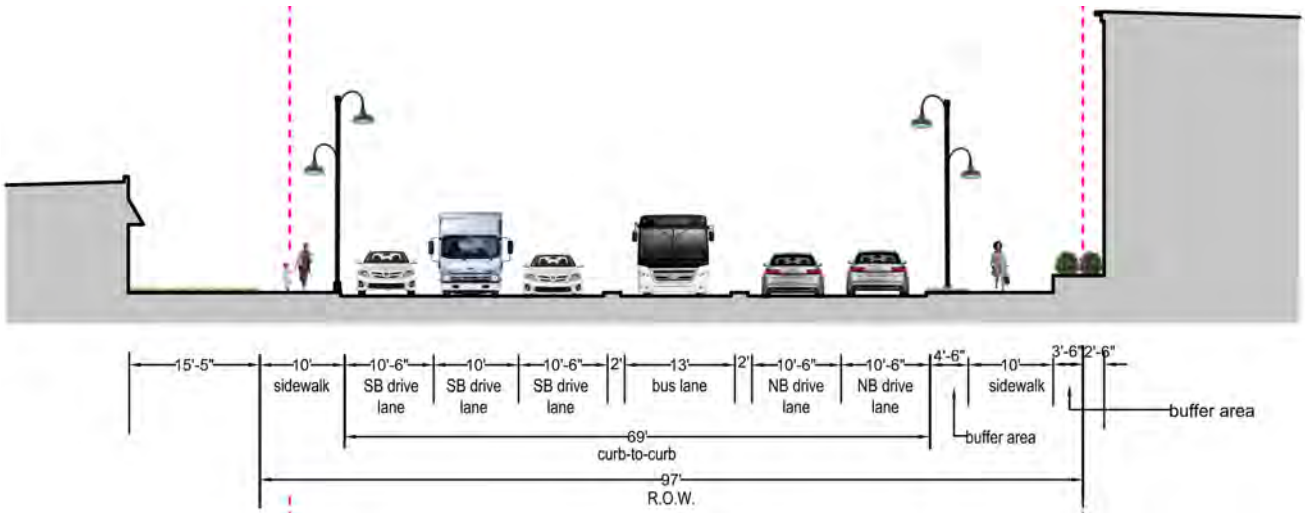

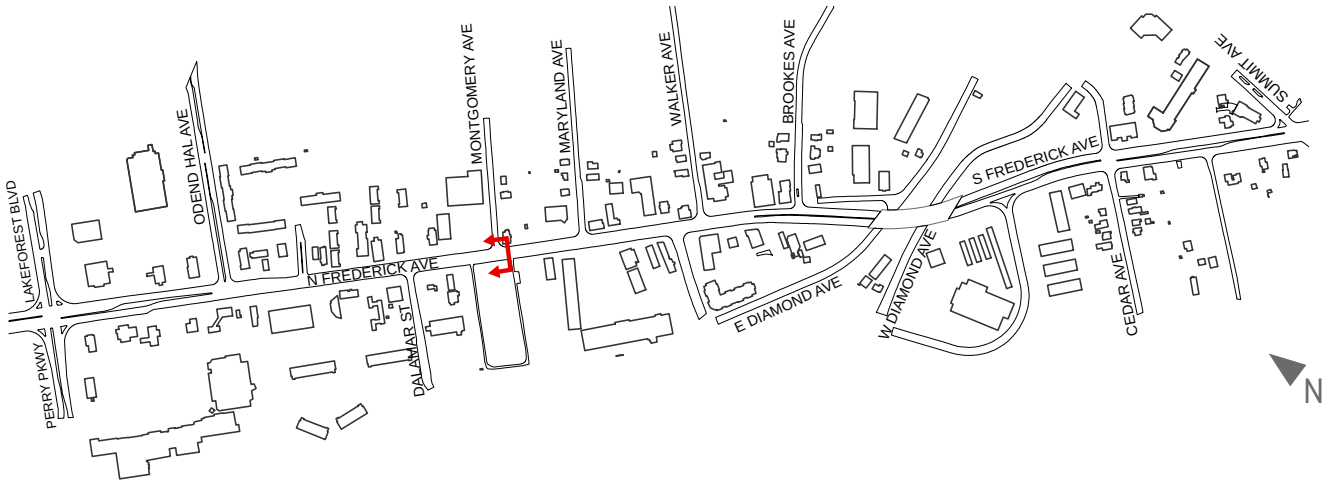

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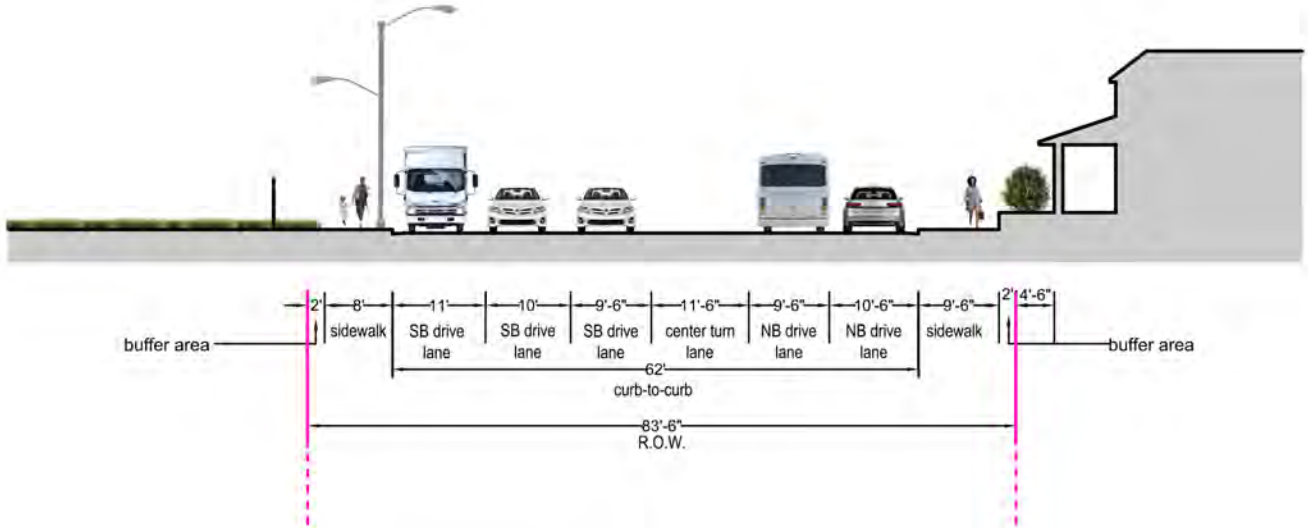

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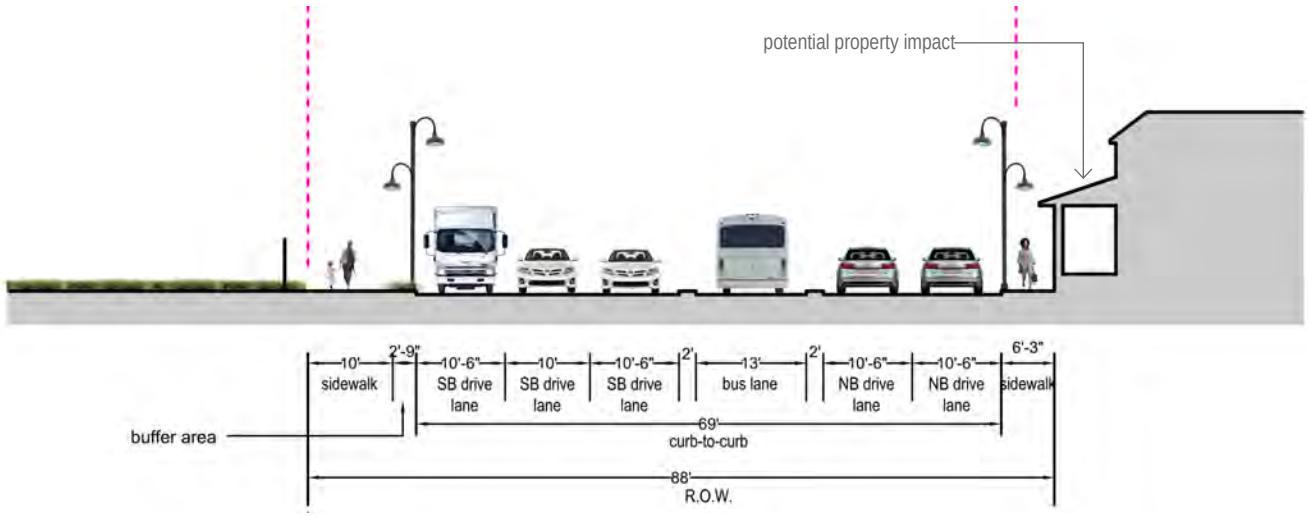
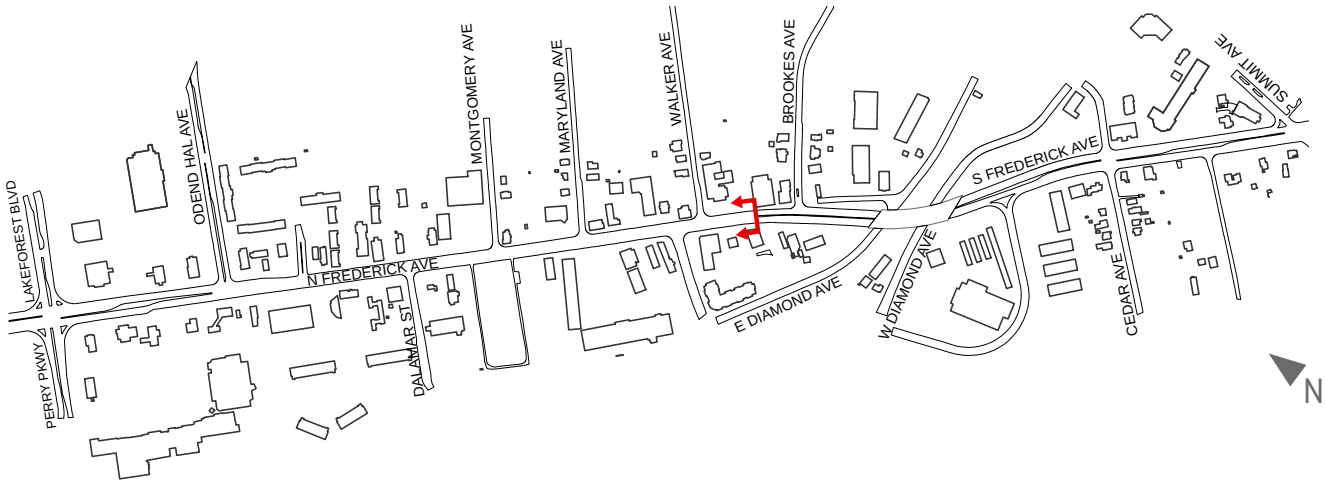
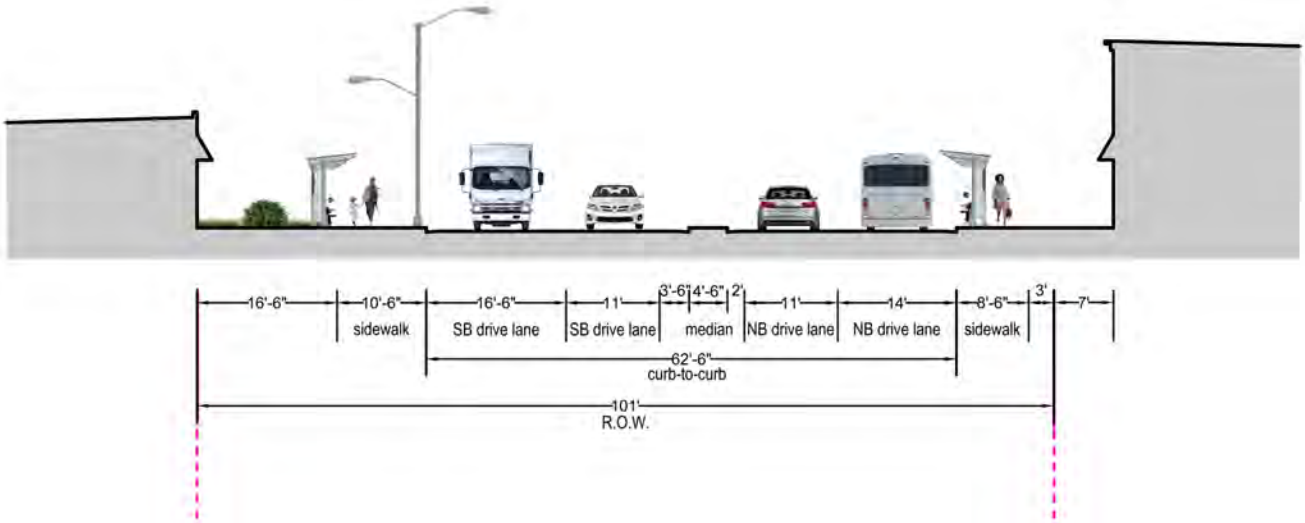
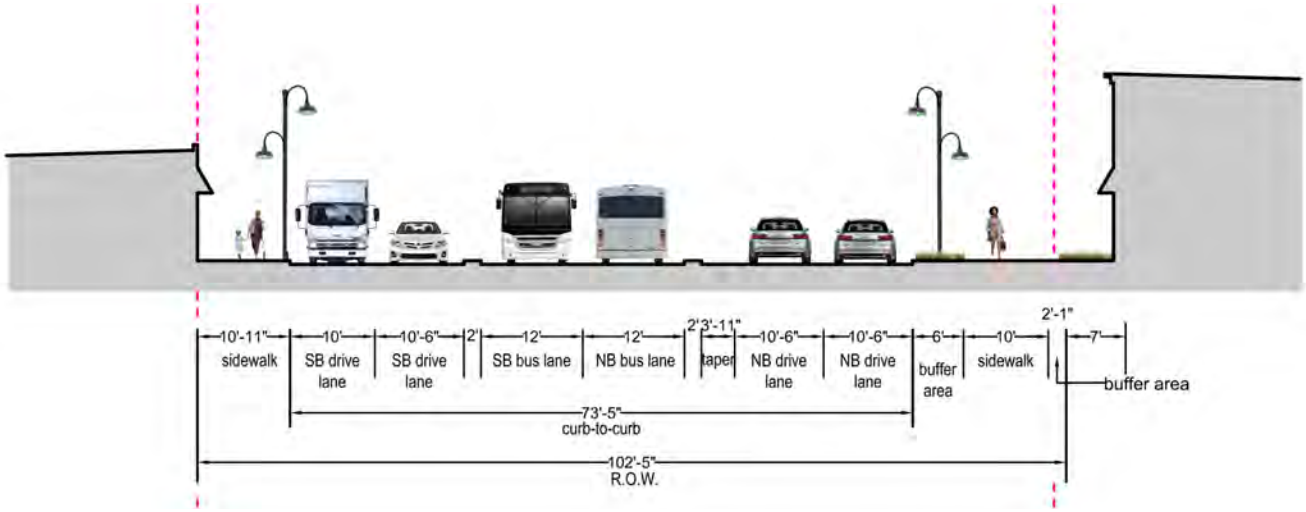


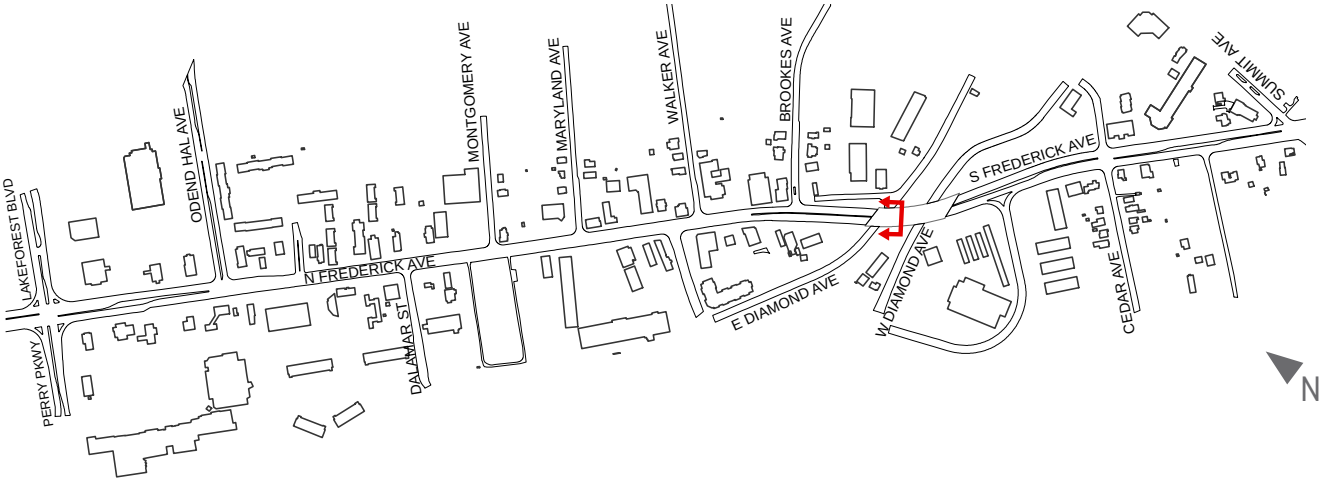


3 EXISTING CONDITIONS

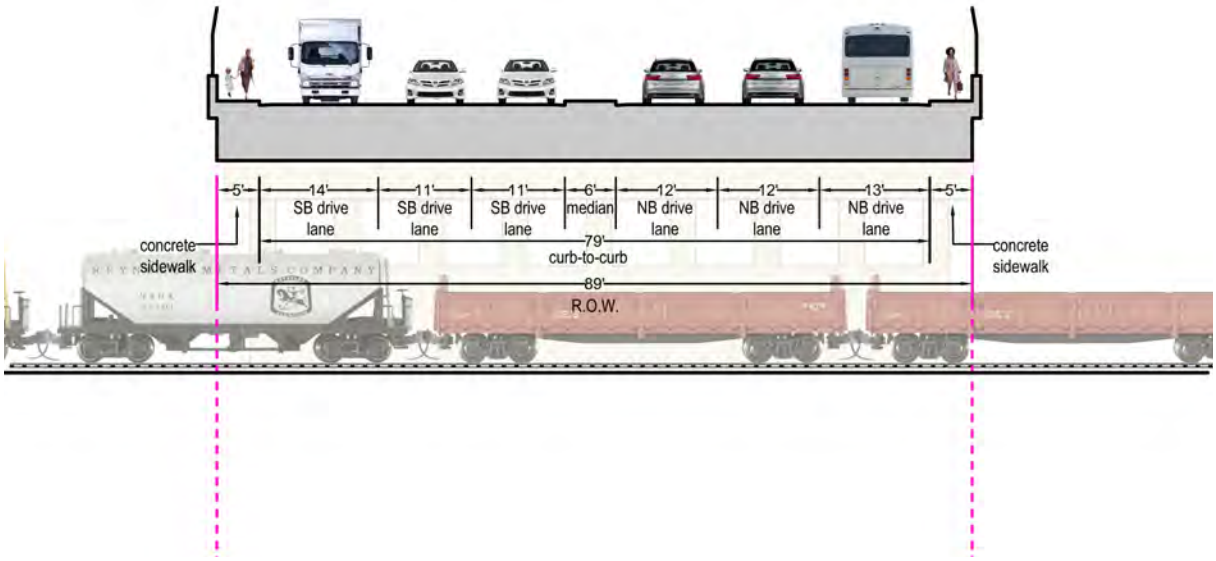


3.I DUAL-LANE MEDIAN BRT - HYBRID DESIGN ALTERNATIVE





4 EXISTING CONDITIONS



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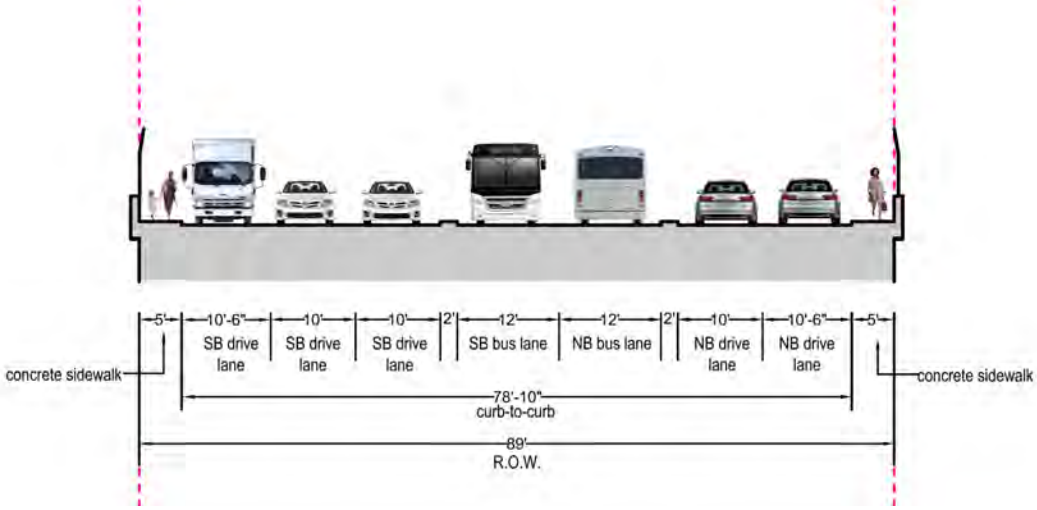

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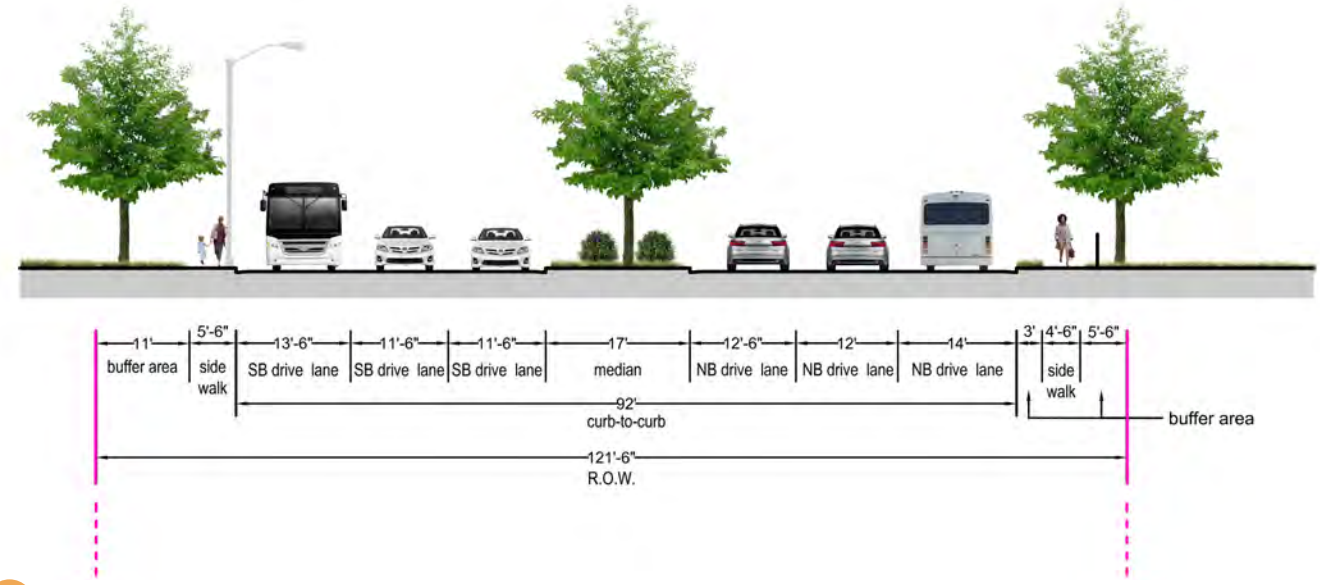

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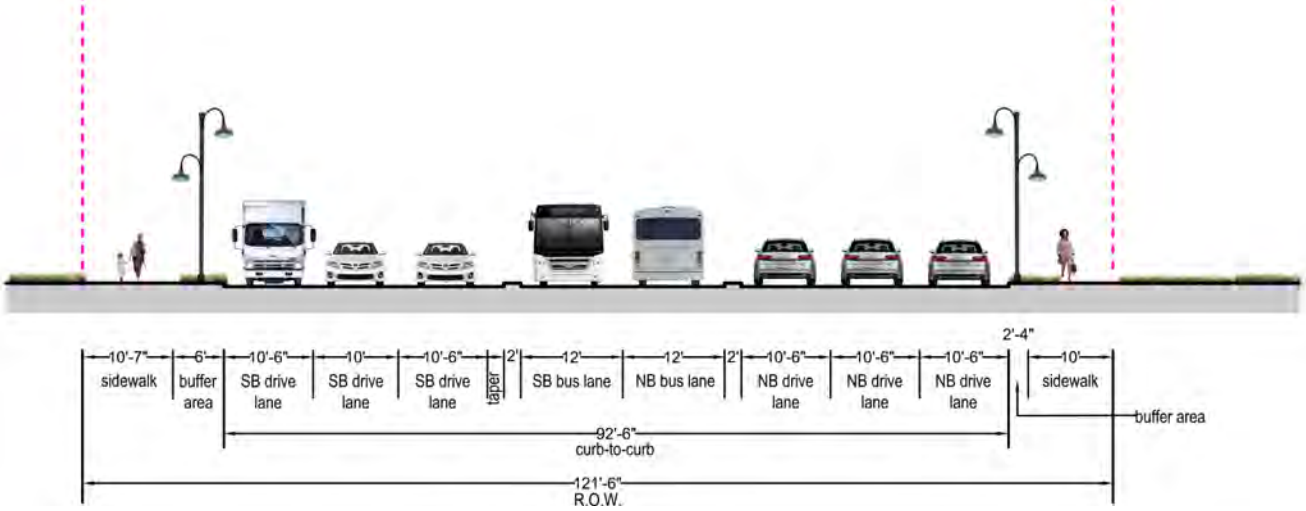

3.4 Traffic Operations Analysis

Traffic operations analysis was performed for the hybrid alternative, using the same methodologies employed for the other design options. The intersection and roadway traffic operations analysis was completed for the Existing, 2025 BRT Mixed Traffic, and 2025 BRT Alternatives conditions. The results of the intersection and roadway capacity analyses are summarized in Tables 3-2 and 3-3, including results from the other design alternatives for comparison. The detailed traffic operations analysis worksheets and results are included in Appendix C.

Table 3-2: Signalized Intersection Critical Lane Volume LOS Results Summary

Condition/Time Period	MD 355 at Odendhal Avenue		MD 355 at Chestnut Street		MD 355 at Summit Avenue	
	CLV	LOS	CLV	LOS	CLV	LOS
Existing Condition						
Weekday AM Peak Hour	1,088	B	931	A	889	A
Weekday PM Peak Hour	927	A	825	A	880	A
2025 BRT Mixed Traffic						
Weekday AM Peak Hour	1,299	C	1,136	B	1,063	B
Weekday PM Peak Hour	1,107	B	1,006	B	1,053	B
2025 BRT Dual-lane Standard						
Weekday AM Peak Hour	1,316	D	1,147	B	1,063	B
Weekday PM Peak Hour	1,241	C	1,025	B	1,049	B
2025 BRT Dual-lane Minimum						
Weekday AM Peak Hour	1,316	D	1,147	B	1,063	B
Weekday PM Peak Hour	1,241	C	1,025	B	1,049	B
2025 BRT Dual-lane Reduced Impact						
Weekday AM Peak Hour	1,283	C	1,147	B	1,057	B
Weekday PM Peak Hour	1,110	B	1,025	B	1,042	B
2025 BRT Single-lane Standard						
Weekday AM Peak Hour	1,316	D	1,147	B	1,063	B
Weekday PM Peak Hour	1,241	C	1,025	B	1,049	B
2025 BRT Single-lane Minimum						
Weekday AM Peak Hour	1,316	D	1,147	B	1,063	B
Weekday PM Peak Hour	1,241	C	1,025	B	1,049	B
2025 BRT Single-lane Reduced Impact						
Weekday AM Peak Hour	1,283	C	1,147	B	1,063	B
Weekday PM Peak Hour	1,110	B	1,025	B	1,049	B
2025 BRT Lane Repurposing						
Weekday AM Peak Hour	1,283	C	1,147	B	1,057	B
Weekday PM Peak Hour	1,110	B	1,025	B	1,042	B
2025 BRT Hybrid Alternative						
Weekday AM Peak Hour	1,308	D	1,147	B	1,057	B
Weekday PM Peak Hour	1,132	B	1,025	B	1,042	B

The traffic analysis results indicate that the signalized intersections will continue to operate at acceptable levels of service under the hybrid design alternative, similar to other options. The most constrained operations are anticipated at the MD 355/Odendhal Avenue intersection during the weekday morning peak hour, which is projected to operate at LOS D.

Table 3-3: Roadway Segment Capacity Analysis Results Summary

Condition/Time Period	MD 355 Southbound				**MD 355 Northbound**			
	Odendhal Ave to Chestnut Street		Chestnut Street to Summit Ave		Odendhal Ave to Chestnut Street		Chestnut Street to Summit Ave	
	Density	LOS	Density	LOS	Density	LOS	Density	LOS
Existing Condition								
Weekday AM Peak Hour	26.7	D	16.7	B	12.7	B	4.9	A
Weekday PM Peak Hour	15.8	B	10.3	A	32.1	D	12.8	B
2025 Mixed Traffic								
Weekday AM Peak Hour	32.0	D	20.0	C	15.2	B	5.9	A
Weekday PM Peak Hour	19.0	C	12.3	B	38.5	E	19.4	C
2025 BRT Dual-lane Standard								
Weekday AM Peak Hour	29.9	D	17.5	B	15.0	B	5.9	A
Weekday PM Peak Hour	17.1	B	10.3	A	36.6	E	13.0	B
2025 BRT Dual-lane Minimum								
Weekday AM Peak Hour	29.9	D	17.5	B	15.0	B	5.9	A
Weekday PM Peak Hour	17.1	B	10.3	A	36.6	E	13.0	B
2025 BRT Dual-lane Reduced Impact								
Weekday AM Peak Hour	43.7	E	20.0	C	14.6	B	8.9	A
Weekday PM Peak Hour	25.0	C	11.9	B	35.7	E	22.4	C
2025 BRT Single-lane Standard								
Weekday AM Peak Hour	29.9	D	17.5	B	15.0	B	5.9	A
Weekday PM Peak Hour	17.1	B	10.3	A	36.6	E	13.0	B
2025 BRT Single-lane Minimum								
Weekday AM Peak Hour	29.9	D	17.5	B	15.0	B	5.9	A
Weekday PM Peak Hour	17.1	B	10.3	A	36.6	E	13.0	B
2025 BRT Single-lane Reduced Impact								
Weekday AM Peak Hour	43.7	E	20.1	C	14.6	B	5.9	A
Weekday PM Peak Hour	25.0	C	12.0	B	35.7	E	15.0	B
2025 BRT Lane Repurposing								
Weekday AM Peak Hour	43.7	E	20.0	C	14.6	B	8.9	A
Weekday PM Peak Hour	25.0	C	11.9	B	35.7	E	22.4	C
2025 BRT Hybrid Alternative								
Weekday AM Peak Hour	29.7	D	20.0	C	14.9	B	8.9	A
Weekday PM Peak Hour	17.0	B	11.9	B	36.4	E	22.4	C

The results of the roadway segment traffic analysis indicate that the hybrid design alternative will operate at acceptable LOS for all locations and time periods, except one. These results are similar to several of the other highest performing design alternatives.

The Odendhal Avenue to Chestnut Street segment will operate at LOS E conditions in the northbound direction during the weekday evening peak hour for all future BRT alternatives, including the hybrid design alternative. None of the BRT alternatives plan to reduce the overall northbound lane capacity, so these results primarily reflect projected overall growth in regional traffic volume. The LOS E results for the northbound direction are generally on the lowest end of the LOS E range (35-37 pc/mi/ln), except for the mixed traffic alternative, which is projected to operate at slightly higher levels of traffic density and congestion.

3.5 Cost Estimates

Planning-level cost estimates for the hybrid design layout alternative were developed using the same methodology for the other alternatives in Chapter 2. The capital cost estimates for each of the BRT design alternatives are compared to the hybrid alternative in the table below. These cost estimates are provided in 2015 dollars. Copies of the detailed cost estimate worksheets and unit cost data assumptions used to calculate the overall BRT facility costs are included in Appendix D.

The capital cost estimates indicate that the overall capital costs for the hybrid alternative in the City of Gaithersburg is approximately $228 million. This cost falls between the dual-lane minimum and single-lane minimum alternatives, and close to the average cost for all of the alternatives.

Table 3-4: 2015 Gaithersburg BRT Capital Cost Estimate Summary

BRT Design Condition	Costs			Total Cost
	Game Preserve Road to Odendhal Avenue	Focal Segment (Odendhal Avenue to Summit Avenue)	Summit Avenue to O'Neill Drive	
Dual-lane Standard				
Design/Construction	$71,581,700	$88,771,300	$49,599,200	$209,952,200
Land Acquistion	$6,506,867	$23,698,031	$11,463,295	$41,668,194
Total	**$78,088,567**	**$112,469,331**	**$61,062,495**	**$251,620,394**
Dual-lane Minimum				
Design/Construction	$72,895,000	$80,704,300	$49,599,200	$203,198,500
Land Acquistion	$7,544,497	$6,395,706	$12,846,710	$26,786,913
Total	**$80,439,497**	**$87,100,006**	**$62,445,910**	**$229,985,413**
Dual-lane Reduced Impact				
Design/Construction	$72,895,000	$42,774,700	$49,599,200	$165,268,900
Land Acquistion	$7,544,497	$3,039,497	$12,846,708	$23,430,702
Total	**$80,439,497**	**$45,814,197**	**$62,445,908**	**$188,699,602**
Single-lane Standard				
Design/Construction	$72,895,000	$79,881,300	$49,599,200	$202,375,500
Land Acquistion	$7,544,497	$13,945,753	$12,846,708	$34,336,958
Total	**$80,439,497**	**$93,827,053**	**$62,445,908**	**$236,712,458**
Single-lane Minimum				
Design/Construction	$72,895,000	$77,415,200	$49,599,200	$199,909,400
Land Acquistion	$7,544,497	$2,550,287	$12,846,708	$22,941,493
Total	**$80,439,497**	**$79,965,487**	**$62,445,908**	**$222,850,893**
Single-lane Reduced Impact				
Design/Construction	$72,895,000	$37,350,600	$49,599,200	$159,844,800
Land Acquistion	$7,544,497	$1,449,934	$12,846,708	$21,841,139
Total	**$80,439,497**	**$38,800,534**	**$62,445,908**	**$181,685,939**
Lane Repurposing				
Design/Construction	$73,811,300	$21,592,700	$45,161,200	$140,565,200
Land Acquistion	$7,544,493	$1,406,273	$12,846,708	$21,797,474
Total	**$81,355,793**	**$22,998,973**	**$58,007,908**	**$162,362,674**
Mixed Traffic				
Design/Construction	$73,811,300	$2,958,000	$45,161,200	$121,930,500
Land Acquistion	$7,544,493	$0	$12,846,708	$20,391,201
Total	**$81,355,793**	**$2,958,000**	**$58,007,908**	**$142,321,701**
Hybrid				
Design/Construction	$72,895,000	$43,621,200	$49,599,200	$166,115,400
Land Acquistion	$7,544,497	$2,569,922	$12,846,708	$22,961,127
Total	**$80,439,497**	**$46,191,122**	**$62,445,908**	**$189,076,527**

3.6 Alternatives Comparison

Table 3-5 summarizes how the hybrid design alternative compares to the other MD 355 BRT design alternatives using several metrics for overall performance.

Table 3-5: Comparison of BRT Alternatives

	BRT Operations		Traffic Operations				Property Impacts	Cost ($ million)
	Operating Speed	Stop Locations	Traffic Density/ Congestion	Intersection Capacity	Unsignalized Turning Movements	Land Use Access/ Egress		
Dual-lane Standard	●	●	●	●	○	○	○	$251.6
Dual-lane Minimum	●	●	●	●	○	○	○	$230.0
Dual-lane Reduced	●	●	○	●	○	○	◑	$188.7
Single-lane Standard	◐	◐	●	●	○	○	○	$236.7
Single-lane Minimum	◐	◐	●	●	○	○	◑	$222.9
Single-lane Reduced	◐	◐	○	●	○	○	◐	$181.7
Lane Repurposing	◑	○	○	●	○	○	◐	$162.4
Mixed Traffic	○	◑	◐	●	●	●	●	$142.3
Hybrid Alternative	◐	◐	●	●	○	○	◐	$189.1

● ◐ ◑ ○

Better ⟷ Worse

3.7 Summary of Findings

The hybrid alternative minimizes many of the building impacts associated with the other alternatives while still maintaining higher bus speeds than a mixed traffic or entirely single-lane median guideway BRT operation. The bus operations associated with the hybrid alternative would require additional signal coordination to provide for the transition from the dual-lane and single-lane segments of the corridor and may require buses to idle at transition points while waiting for buses traveling in the opposite direction to pass through the single-lane median guideway. Overall, bus speeds will be improved compared to the existing local service. The traffic impacts associated with the hybrid alternative are similar to other design alternatives, and generally demonstrate acceptable levels of service throughout the focal segment. The hybrid alternative does not eliminate all potential impacts associated with the BRT system, but achieves a strong balance between the various construction, operational, and cost-related metrics considered for all of the design alternatives.