MDOT Chapter 30

Transit Project Report – US 29 Bus Rapid Transit (MD 99 to Silver Spring Metro)

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MDOT Chapter 30 Transit Project Report
US 29 Bus Rapid Transit

RENAISSANCE
PLANNING

CONTENTS

CHAPTER I. INTRODUCTION

1. OVERVIEW OF PROJECT

Project 20-19 would add Bus Rapid Transit (BRT) service between Burtonsville and Mount Hebron, with four intermediate stops along the route. At the southern terminus in Burtonsville, the project would connect with the companion Flash BRT corridor, which is scheduled to begin service from Mount Hebron into Downton Silver Spring in 2020.

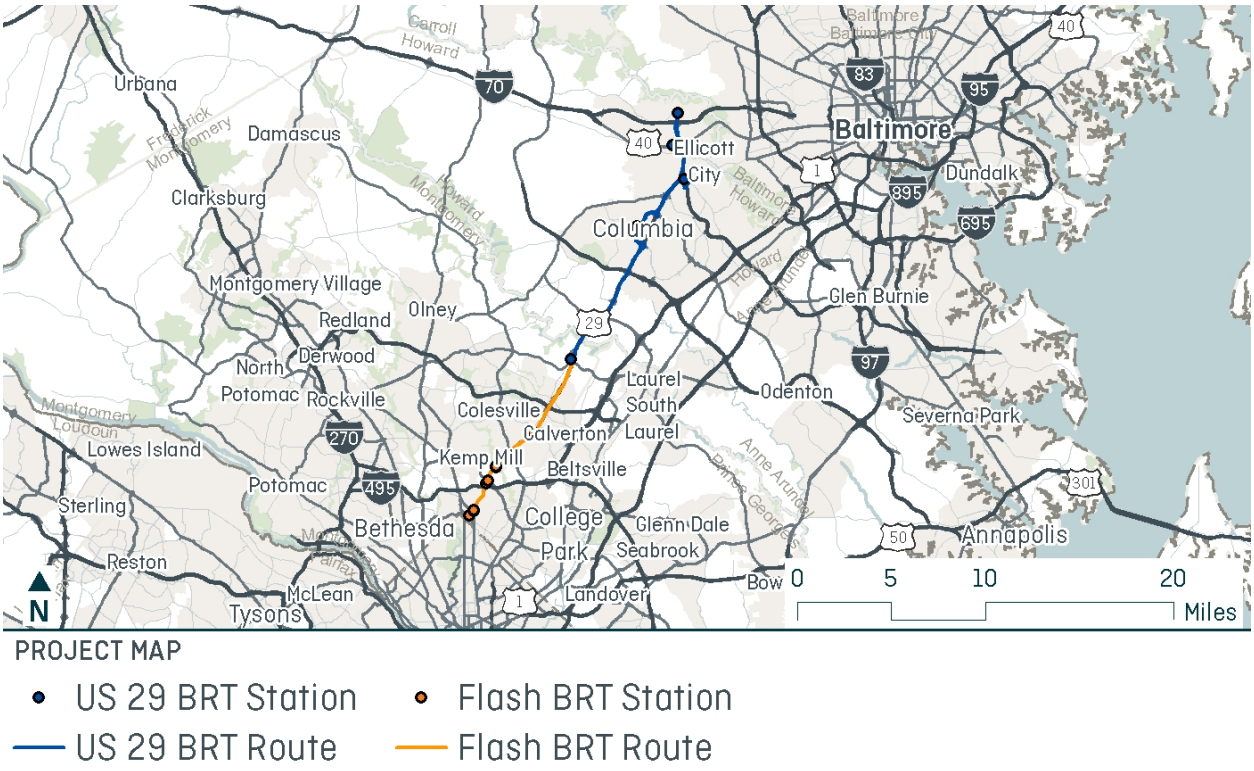

Figure 1: Project 20-19 Map

CHAPTER II. CODING ASSUMPTIONS

The analysis of Project 20-19 required developing General Transit Feed Specification (GTFS) files to model the proposed BRT service in addition to the companion Flash 29 BRT service, which is anticipated to begin service in 2020, offering a connection at Burtonsville to Silver Spring Transit Center.

The 23-mile 29 BRT project would carry passengers from Burtonsville to Mount Hebron, making 4 intermediate stops along the route that primarily follows US 29. The companion Flash BRT corridor would provide a connection in Burtonsville at the southern terminus of the BRT corridor, allowing transit riders to continue south on US 29 for an additional 10 miles to Silver Spring Transit Center. The Flash corridor includes 5 intermediate stops between the northern and southern terminal stations.

The 29 BRT line would serve a total of 6 stations, making stops at Burtonsville, Maple Lawn, Columbia Town Center, Long Gate, US 40 West, and Mount Hebron. The service would connect with the planned Flash BRT service in Burtonsville, which would provide connecting stops at Tech Road, Burnt Mills, University Boulevard, Fenton Street, with service terminating at Silver Spring Transit Center, which provides riders with connections to the WMATA Red Line and MARC trains.

The 29 BRT service is expected to have a 69-minute travel time. The companion Flash BRT is expected to have a 31-minute travel time. A 1-minute transfer was coded into the service schedule, allowing for coordinated transfers between BRT services at Burtonsville. Service on both BRT segments is expected to operate Monday through Sunday. On Monday-Thursday, service is expected to operate from 5:00 AM to midnight. On Friday and Saturday, service is expected to operate from 5:00 AM to 2:00 AM the following morning. Headways are expected to be 7.5 minutes for peak periods, 15 minutes of off-peak periods, and 30 minutes for late night and weekend service.

1. ALIGNMENT

Service on the 29 BRT and Flash BRT corridors would operate in a mixture of dedicated right of way (ROW) on the inside shoulder and in mixed traffic. The route operates primarily along the US 29 corridor, except for portions where vehicles would exit to access a transit stop off the corridor. The route is expected to use the following alignment:

- Northbound Flash BRT service would begin at Silver Spring Transit Center, with transit vehicles traveling north along US 29. Stops would occur at Fenton Street, University Boulevard, Burnt Mills, Tech Road along US 29, with Flash BRT service terminating in Burtonsville at the Burtonsville Crossing Mall.
- At Burtonsville, riders could transfer to the 29 BRT service, where vehicles would continue north along US 29, serving Maple Lawn area with a stop at the existing Scaggsville Park and Ride.
- From Maple Lawn, service would continue north on US 29, making an exit onto westbound Broken Land Parkway to serve a stop at The Mall in Columbia.
- Service would continue northbound on US 29, serving Long Gate Shopping Center via Maryland State Route 100 and Montgomery Road.
- At Baltimore National Pike, BRT vehicles would exit US 29 to serve a station at the Chatham Station Shopping Center, before returning to US 29 north.
- The northern terminus of the 29 BRT corridor would be a stop in Burtonsville located at the intersection of Rogers Ave. and Columbia Pike.

The details of how Project 20-19 was represented in GTFS are provided below by describing four key tables in the feed: Stops.txt, Trips.txt, Stop_times.txt, and Frequencies.txt. Other tables in the new Project 20-19 feed are based on standard tables defined in the Chapter 30 Transit Accessibility Scoring Guide ("Standard GTFS Tables" section) and are not described here.

2. ATTRIBUTES

The attributes of the base multimodal network were modified through the addition of the newly developed GTFS feed modeling Project 20-19. The details of how Project 20-19 was represented in GTFS are provided below by describing four key tables of the feeds: Stops.txt, Trips.txt, Stop_times.txt, and Frequencies.txt. Other tables in the new Project 8 feed are based on standard tables defined in the Chapter 30 Transit Accessibility Scoring Guide ("Standard GTFS Tables" section) and are not described here.

i. Stops.txt (stop locations)

Table 1: Project 20-19 Stops Table

stop_id	stop_code	stop_name	stop_lon	stop_lat
1	1	Silver Spring Transit Center	-77.03095	38.9942286
2N	2N	Fenton Street - Northbound	-77.02704	38.9974232
2S	2S	Fenton Street - Southbound	-77.027	38.9978924
3N	3N	University Boulevard - Northbound	-77.014147	39.0186438
3S	3S	University Boulevard - Southbound	-77.012641	39.0206505
4N	4N	Burnt Mills - Northbound	-77.004409	39.031359
4S	4S	Burnt Mills - Southbound	-77.004565	39.0316672
5N	5N	Tech Road - Northbound	-76.967997	39.0579907
5S	5S	Tech Road - Southbound	-76.96834	39.0583197
6	6	Burtonsville	-76.930596	39.1140225
7	7	Maple Lawn	-76.908676	39.1468464
8	8	Columbia Town Center	-76.864835	39.2163043
9	9	Long Gate	-76.81801	39.2527972
10	10	US 40 West	-76.830197	39.2789504
11	11	Mount Hebron	-76.824261	39.3034072

ii. Trips.txt (vehicle-trip enumeration)

The trips file represents a single route with a seven-day travel profile. The file further splits the route into trips, each identified by a specific ID, that reflect the various frequencies of the line. For instance, trip ID "flashbrt_early_1" corresponds to the BRT line's 15-minute headways

during early service hours. Trip IDs "flashbrt_peak_1" and "flashbrt_peak_2" correspond to the morning and evening peak headways of 7.5 minutes. The trips.txt file is shown below.

Table 2: Project 20-19 Trips Table

route_id	service_id	trip_id
FlashBRT	MTWTF	flashbrt_early_1
FlashBRT	MTWTF	flashbrt_early_2
FlashBRT	MTWTF	flashbrt_peak_1
FlashBRT	MTWTF	flashbrt_peak_2
FlashBRT	MTWTF	flashbrt_mid_1
FlashBRT	MTWTF	flashbrt_mid_2
FlashBRT	MTWTF	flashbrt_peak_3
FlashBRT	MTWTF	flashbrt_peak_4
FlashBRT	MTWTF	flashbrt_evening_1
FlashBRT	MTWTF	flashbrt_evening_2
29BRT	MTWTF	29brt_early_1
29BRT	MTWTF	29brt_early_2
29BRT	MTWTF	29brt_peak_1
29BRT	MTWTF	29brt_peak_2
29BRT	MTWTF	29brt_mid_1
29BRT	MTWTF	29brt_mid_2
29BRT	MTWTF	29brt_peak_3
29BRT	MTWTF	29brt_peak_4
29BRT	MTWTF	29brt_evening_1
29BRT	MTWTF	29brt_evening_2
route_id	**service_id**	**trip_id**

iii. Stop_times.txt (transit schedule)

The stop times table was developed based on an analysis of relevant planning documents. Service speeds on the Flash BRT corridor were interpolated based on distance with times derived from station-to-station estimates provided in the *US 29 Travel Time & OTP Memo*. [1] Stop-to-stop travel time estimates for the US 29 BRT portion of the corridor were interpolated based on distance using an average 20 mph running speed. The resulting schedule is represented in Table 3.

[1] MEMORANDUM: US 29 Travel Time & OTP. Sabra, Wang & Associates. March 15, 2017.

Table 3: Project 20-19 Stops Times Table

trip_id	arrival_time	departure_time	stop_id	stop_sequence
flashbrt_early_1	5:00:00	5:00:00	1	1
flashbrt_early_1	5:01:24	5:01:24	2N	2
flashbrt_early_1	5:09:00	5:09:00	3N	3
flashbrt_early_1	5:11:32	5:11:32	4N	4
flashbrt_early_1	5:18:00	5:18:00	5N	5
flashbrt_early_1	5:31:00	5:31:00	6	6
29brt_early_1	5:32:00	5:32:00	6	1
29brt_early_1	5:45:58	5:45:58	7	2
29brt_early_1	6:06:28	6:06:28	8	3
29brt_early_1	6:22:25	6:22:25	9	4
29brt_early_1	6:30:52	6:30:52	10	5
29brt_early_1	6:40:00	6:40:00	11	6
flashbrt_early_2	5:00:00	5:00:00	11	1
flashbrt_early_2	5:08:26	5:08:26	10	2
flashbrt_early_2	5:18:30	5:18:30	9	3
flashbrt_early_2	5:33:52	5:33:52	8	4
flashbrt_early_2	5:57:34	5:57:34	7	5
flashbrt_early_2	6:09:00	6:09:00	6	6
29brt_early_2	6:10:00	6:10:00	6	1
29brt_early_2	6:22:00	6:22:00	5S	2
29brt_early_2	6:28:44	6:28:44	4S	3
29brt_early_2	6:31:00	6:31:00	3S	4
29brt_early_2	6:38:35	6:38:35	2S	5
29brt_early_2	6:40:00	6:40:00	1	6
flashbrt_peak_1	5:00:00	5:00:00	1	1
flashbrt_peak_1	5:01:24	5:01:24	2N	2
flashbrt_peak_1	5:09:00	5:09:00	3N	3
flashbrt_peak_1	5:11:32	5:11:32	4N	4
flashbrt_peak_1	5:18:00	5:18:00	5N	5
flashbrt_peak_1	5:31:00	5:31:00	6	6
29brt_peak_1	5:32:00	5:32:00	6	1
29brt_peak_1	5:45:58	5:45:58	7	2
29brt_peak_1	6:06:28	6:06:28	8	3
29brt_peak_1	6:22:25	6:22:25	9	4
29brt_peak_1	6:30:52	6:30:52	10	5
29brt_peak_1	6:40:00	6:40:00	11	6
flashbrt_peak_2	5:00:00	5:00:00	11	1
flashbrt_peak_2	5:08:26	5:08:26	10	2
flashbrt_peak_2	5:18:30	5:18:30	9	3
flashbrt_peak_2	5:33:52	5:33:52	8	4

flashbrt_peak_2	5:57:34	5:57:34	7	5
flashbrt_peak_2	6:09:00	6:09:00	6	6
29brt_peak_2	6:10:00	6:10:00	6	1
29brt_peak_2	6:22:00	6:22:00	5S	2
29brt_peak_2	6:28:44	6:28:44	4S	3
29brt_peak_2	6:31:00	6:31:00	3S	4
29brt_peak_2	6:38:35	6:38:35	2S	5
29brt_peak_2	6:40:00	6:40:00	1	6
flashbrt_mid_1	5:00:00	5:00:00	1	1
flashbrt_mid_1	5:01:24	5:01:24	2N	2
flashbrt_mid_1	5:09:00	5:09:00	3N	3
flashbrt_mid_1	5:11:32	5:11:32	4N	4
flashbrt_mid_1	5:18:00	5:18:00	5N	5
flashbrt_mid_1	5:31:00	5:31:00	6	6
29brt_mid_1	5:32:00	5:32:00	6	1
29brt_mid_1	5:45:58	5:45:58	7	2
29brt_mid_1	6:06:28	6:06:28	8	3
29brt_mid_1	6:22:25	6:22:25	9	4
29brt_mid_1	6:30:52	6:30:52	10	5
29brt_mid_1	6:40:00	6:40:00	11	6
flashbrt_mid_2	5:00:00	5:00:00	11	1
flashbrt_mid_2	5:08:26	5:08:26	10	2
flashbrt_mid_2	5:18:30	5:18:30	9	3
flashbrt_mid_2	5:33:52	5:33:52	8	4
flashbrt_mid_2	5:57:34	5:57:34	7	5
flashbrt_mid_2	6:09:00	6:09:00	6	6
29brt_mid_2	6:10:00	6:10:00	6	1
29brt_mid_2	6:22:00	6:22:00	5S	2
29brt_mid_2	6:28:44	6:28:44	4S	3
29brt_mid_2	6:31:00	6:31:00	3S	4
29brt_mid_2	6:38:35	6:38:35	2S	5
29brt_mid_2	6:40:00	6:40:00	1	6
flashbrt_peak_3	5:00:00	5:00:00	1	1
flashbrt_peak_3	5:01:24	5:01:24	2N	2
flashbrt_peak_3	5:09:00	5:09:00	3N	3
flashbrt_peak_3	5:11:32	5:11:32	4N	4
flashbrt_peak_3	5:18:00	5:18:00	5N	5
flashbrt_peak_3	5:31:00	5:31:00	6	6
29brt_peak_3	5:32:00	5:32:00	6	1
29brt_peak_3	5:45:58	5:45:58	7	2
29brt_peak_3	6:06:28	6:06:28	8	3
29brt_peak_3	6:22:25	6:22:25	9	4
29brt_peak_3	6:30:52	6:30:52	10	5

29brt_peak_3	6:40:00	6:40:00	11	6
flashbrt_peak_4	5:00:00	5:00:00	11	1
flashbrt_peak_4	5:08:26	5:08:26	10	2
flashbrt_peak_4	5:18:30	5:18:30	9	3
flashbrt_peak_4	5:33:52	5:33:52	8	4
flashbrt_peak_4	5:57:34	5:57:34	7	5
flashbrt_peak_4	6:09:00	6:09:00	6	6
29brt_peak_4	6:10:00	6:10:00	6	1
29brt_peak_4	6:22:00	6:22:00	5S	2
29brt_peak_4	6:28:44	6:28:44	4S	3
29brt_peak_4	6:31:00	6:31:00	3S	4
29brt_peak_4	6:38:35	6:38:35	2S	5
29brt_peak_4	6:40:00	6:40:00	1	6
flashbrt_evening_1	5:00:00	5:00:00	1	1
flashbrt_evening_1	5:01:24	5:01:24	2N	2
flashbrt_evening_1	5:09:00	5:09:00	3N	3
flashbrt_evening_1	5:11:32	5:11:32	4N	4
flashbrt_evening_1	5:18:00	5:18:00	5N	5
flashbrt_evening_1	5:31:00	5:31:00	6	6
29brt_evening_1	5:32:00	5:32:00	6	1
29brt_evening_1	5:45:58	5:45:58	7	2
29brt_evening_1	6:06:28	6:06:28	8	3
29brt_evening_1	6:22:25	6:22:25	9	4
29brt_evening_1	6:30:52	6:30:52	10	5
29brt_evening_1	6:40:00	6:40:00	11	6
flashbrt_evening_2	5:00:00	5:00:00	11	1
flashbrt_evening_2	5:08:26	5:08:26	10	2
flashbrt_evening_2	5:18:30	5:18:30	9	3
flashbrt_evening_2	5:33:52	5:33:52	8	4
flashbrt_evening_2	5:57:34	5:57:34	7	5
flashbrt_evening_2	6:09:00	6:09:00	6	6
29brt_evening_2	6:10:00	6:10:00	6	1
29brt_evening_2	6:22:00	6:22:00	5S	2
29brt_evening_2	6:28:44	6:28:44	4S	3
29brt_evening_2	6:31:00	6:31:00	3S	4
29brt_evening_2	6:38:35	6:38:35	2S	5
29brt_evening_2	6:40:00	6:40:00	1	6

iv. Frequencies.txt (frequency of recurring trips)

A frequencies table was developed to model the differing headways of the line throughout a day of typical service. The table defines a start and end time for a headway, with each headway associated with a trip ID. The headways are provided in seconds. The trip IDs link the headway

times to the individual trips that comprise the route described in the trips.txt file. When frequencies table is used, the stop times file defines a template of stop sequences and travel times between stops, and the frequencies table defines the interval of recurrence for each trip following the stop times template. The frequencies table for project 20-19 is presented below.

Table 4: Project 20-19 Frequencies Table

trip_id	start_time	end_time	headway_secs
flashbrt_early_1	5:00:00	6:00:00	900
flashbrt_early_2	5:00:00	6:00:00	900
flashbrt_peak_1	6:00:01	9:00:00	450
flashbrt_peak_2	6:00:01	9:00:00	450
flashbrt_mid_1	9:00:01	16:00:00	900
flashbrt_mid_2	9:00:01	16:00:00	900
flashbrt_peak_3	16:00:01	19:00:00	450
flashbrt_peak_4	16:00:01	19:00:00	450
flashbrt_evening_1	19:01:00	21:59:00	900
flashbrt_evening_2	19:01:00	21:59:00	900
29brt_early_1	5:00:00	6:00:00	900
29brt_early_2	5:00:00	6:00:00	900
29brt_peak_1	6:00:01	9:00:00	450
29brt_peak_2	6:00:01	9:00:00	450
29brt_mid_1	9:00:01	16:00:00	900
29brt_mid_2	9:00:01	16:00:00	900
29brt_peak_3	16:00:01	19:00:00	450
29brt_peak_4	16:00:01	19:00:00	450
29brt_evening_1	19:00:01	21:59:59	900
29brt_evening_2	19:00:01	21:59:59	900

Figures 2 and 3 below show the complete multimodal network in the base and build conditions (respectively) for the study area. The project alignment is highlighted in the maps to clearly demarcate the changes in connectivity resulting from the new GTFS feed described above.

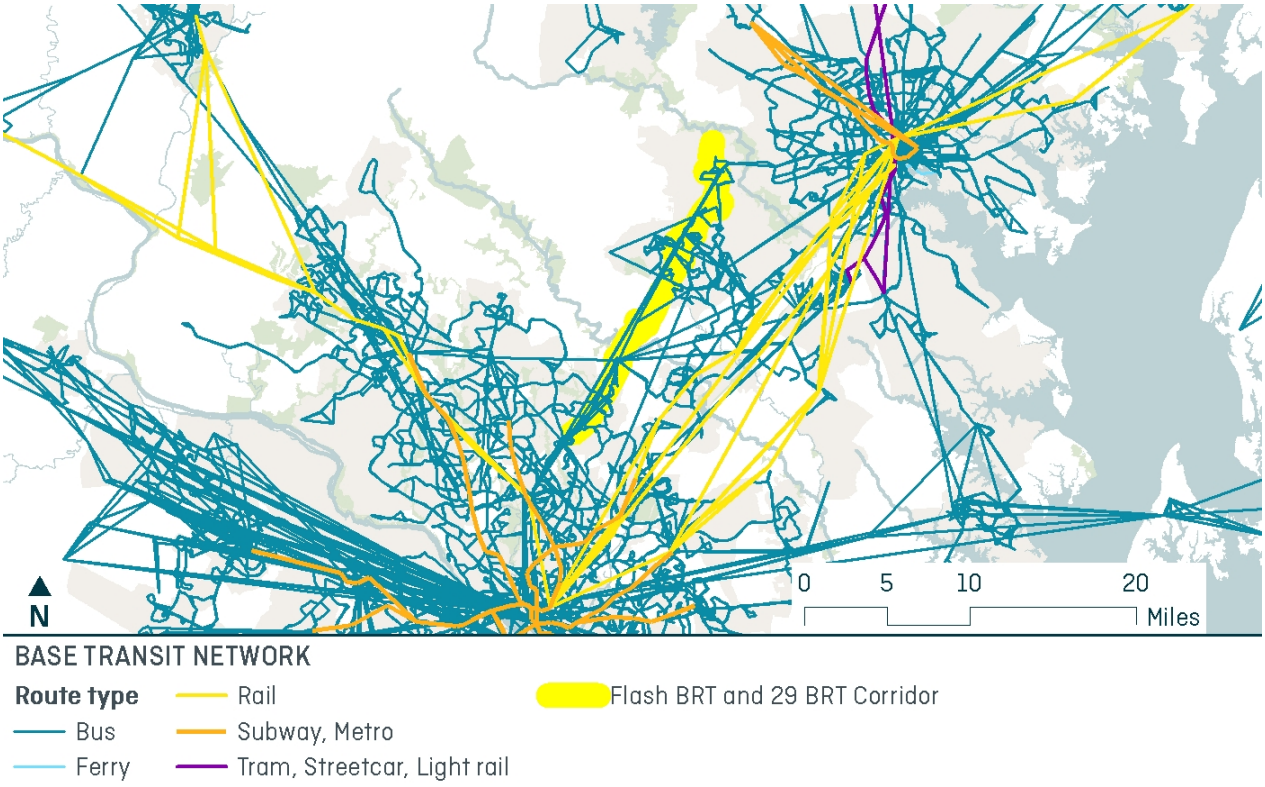

Figure 2: Base Network

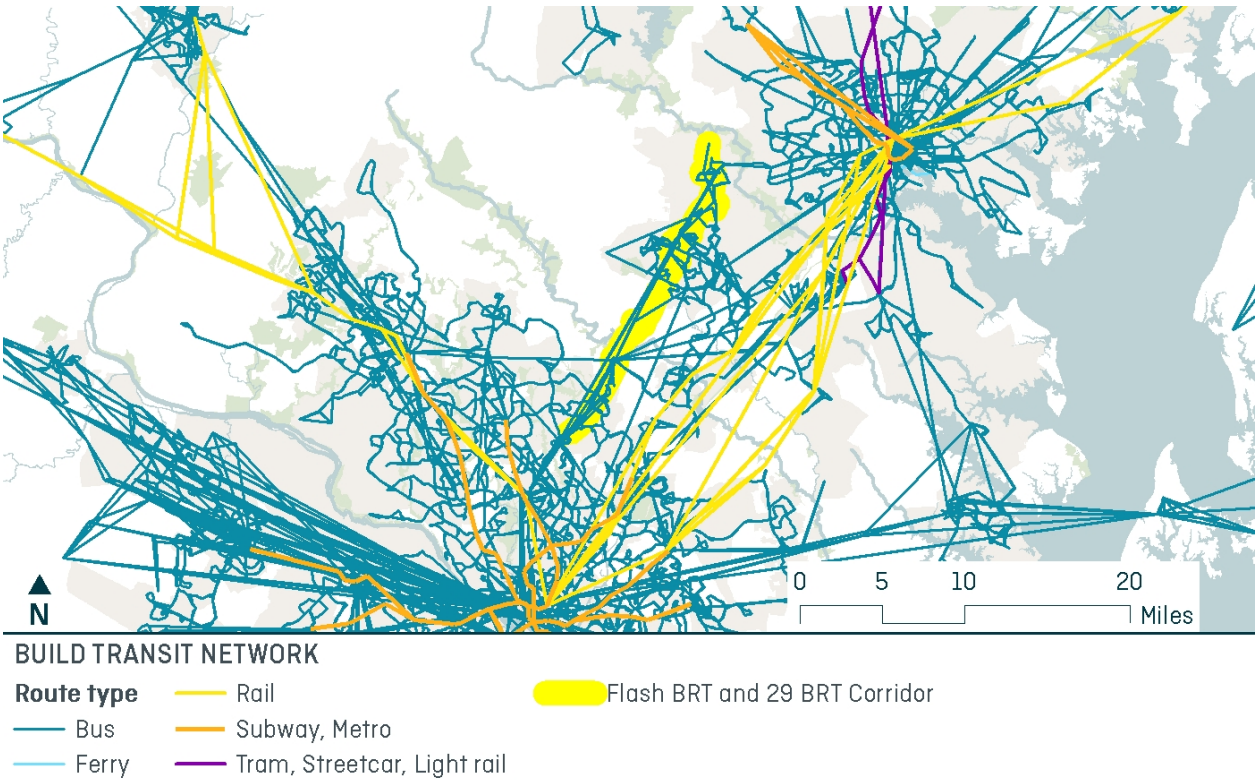

Figure 3: Project Network with Flash BRT and 29 BRT

3. MODIFICATIONS OF EXISTING GTFS FEEDS

Analyzing Project 20-19 did not require modifying existing GTFS feeds.

CHAPTER III. NETWORK REVIEW RESULTS

1. NETWORK DATASET CONFIGURATION REVIEW

The multi-modal network is composed of five features classes:

- "**TransitLines**" represents vehicle trips between transit stops;
- "**Stops**" represents transit stops served by transit vehicles;
- "**L3_HWY**" represents the local street network for access to/egress from transit stops;
- "**Stops_Snapped2Street**" represents each transit stop as a location "snapped" to the L3_HWY features;
- "**Connectors_Stops2Street**" represents the connections from the L3_HWY features to the transit Stop locations via the Stops_Snapped2Street junctions.

These features are grouped into three "connectivity groups" that enforce appropriate routing for transit network problems. Modeled paths must begin on the streets (L3_HWY) network (column 1) and can proceed to the transit lines (column 3) via the Connectors_Stops2Streets features (column 2). The network edge features are connected through the Stops (column 2-column 3) and the Stops_Snapped2Streets (column 1-column 2) node features. Figure 4 below shows the connectivity topological rules applied to the development of the Project 20-19 multimodal network.

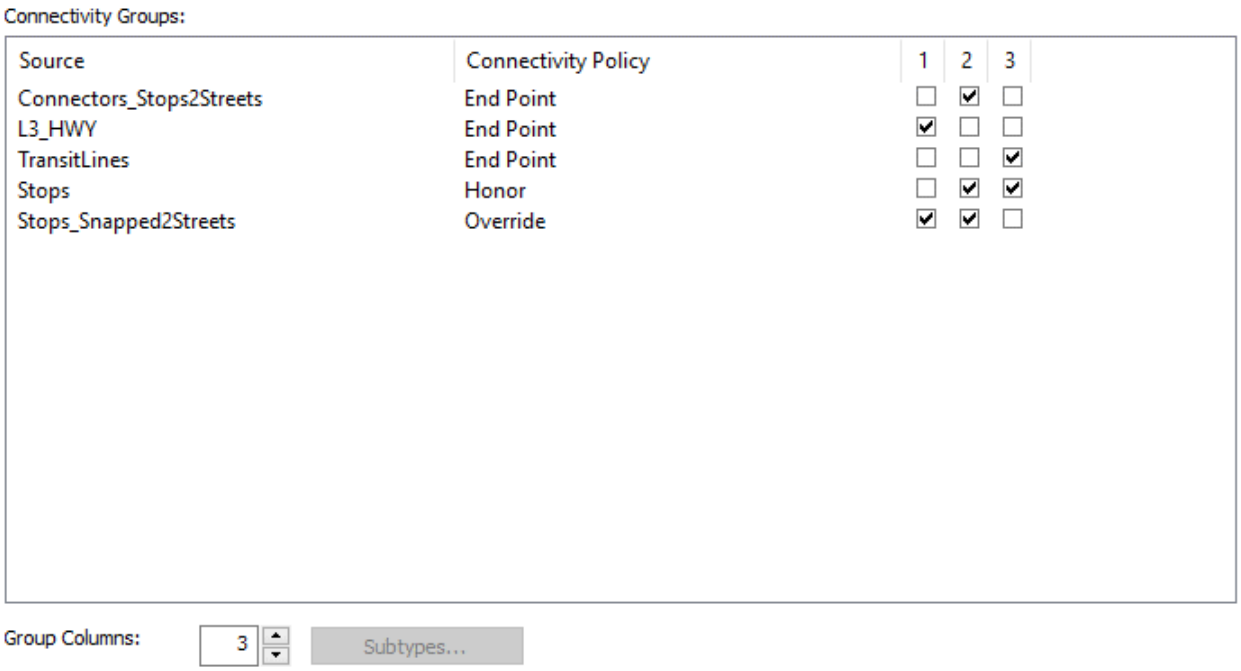

Figure 4: Connectivity Policy

Travel times between zones are computed using a travel time evaluator, setup for the Project 20-19 multimodal network in Network Analyst as shown in Figure 5. A 3 mph (264 feet per minute) walk speed is assumed and the transit evaluator computes time-of-departure-specific transit travel times using the GTFS schedule.

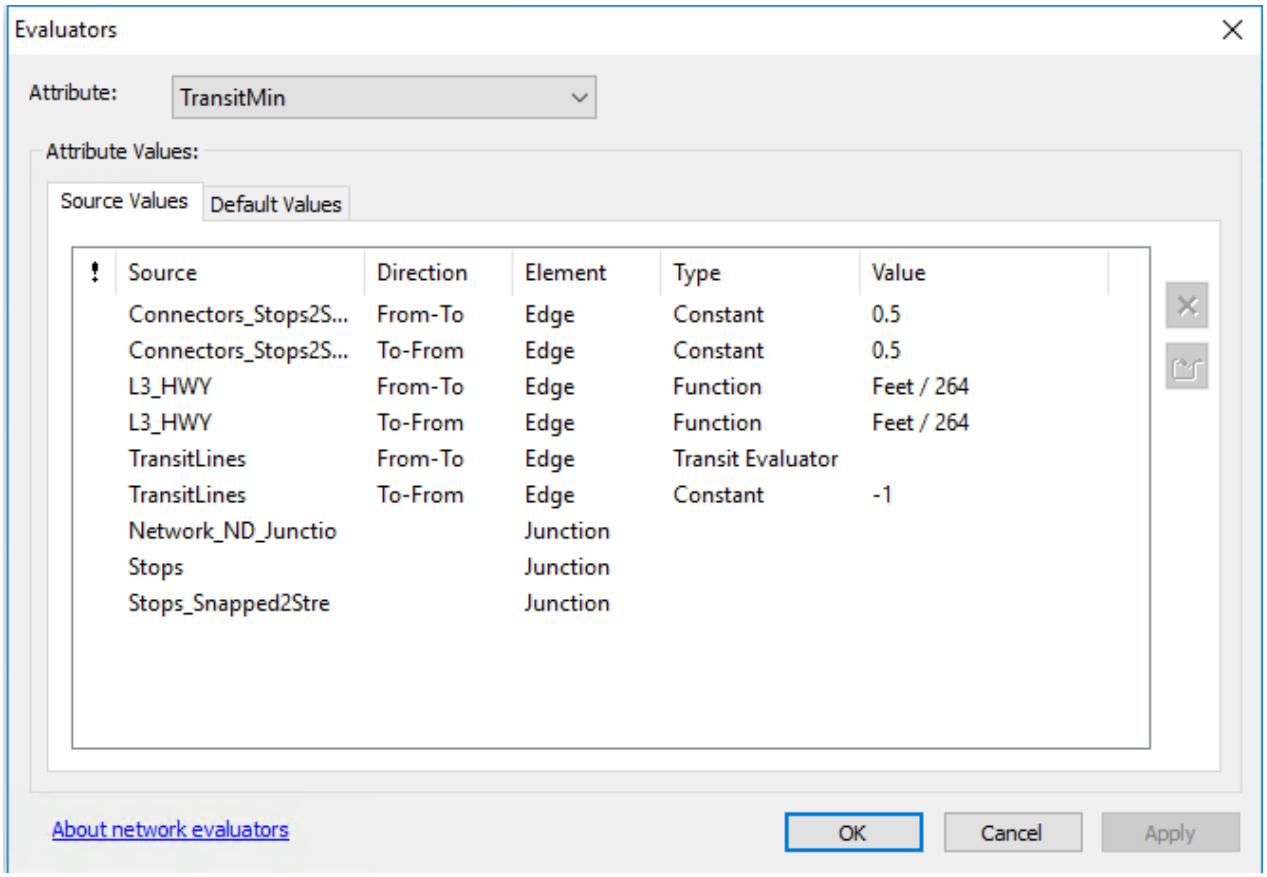

Figure 5: Minutes Evaluators

2. CONNECTIVITY TESTS

There are several steps required to create a multi-modal network, presenting opportunities for user error or technical anomalies to mis-represent network connectivity. To test the connectivity and usability of the Project 20-19 multimodal network, two quality control tests were performed: Service area analysis and routing analysis. These tests are described below. All test cases are based on an assumed departure time of 8:00 AM on a typical Wednesday.

Figures 6, 7a, and 7b show travel time isochrones for a single location within the project study area for the base network, the build network with only the northern 29 BRT service, and for the full Flash BRT and 29 BRT corridor, respectively. A simple check that the isochrones expand as the project provides additional service and that the expansion is intuitive given the nature of the project is sufficient to confirm that the project is appropriately integrated into the base multimodal network.

A comparison between the maps shows a clear expansion of service relative to the location used in the test, particularly in the northern extents of the corridor, where no transit service presently exists. The difference between Figures 7a and 7b is not as large, but the more frequent and higher speed service compared to the base transit network results in expanded isochrones in the southern portion of the corridor.

These changes confirm that Project 20-19 is appropriately integrated into the base multimodal network.

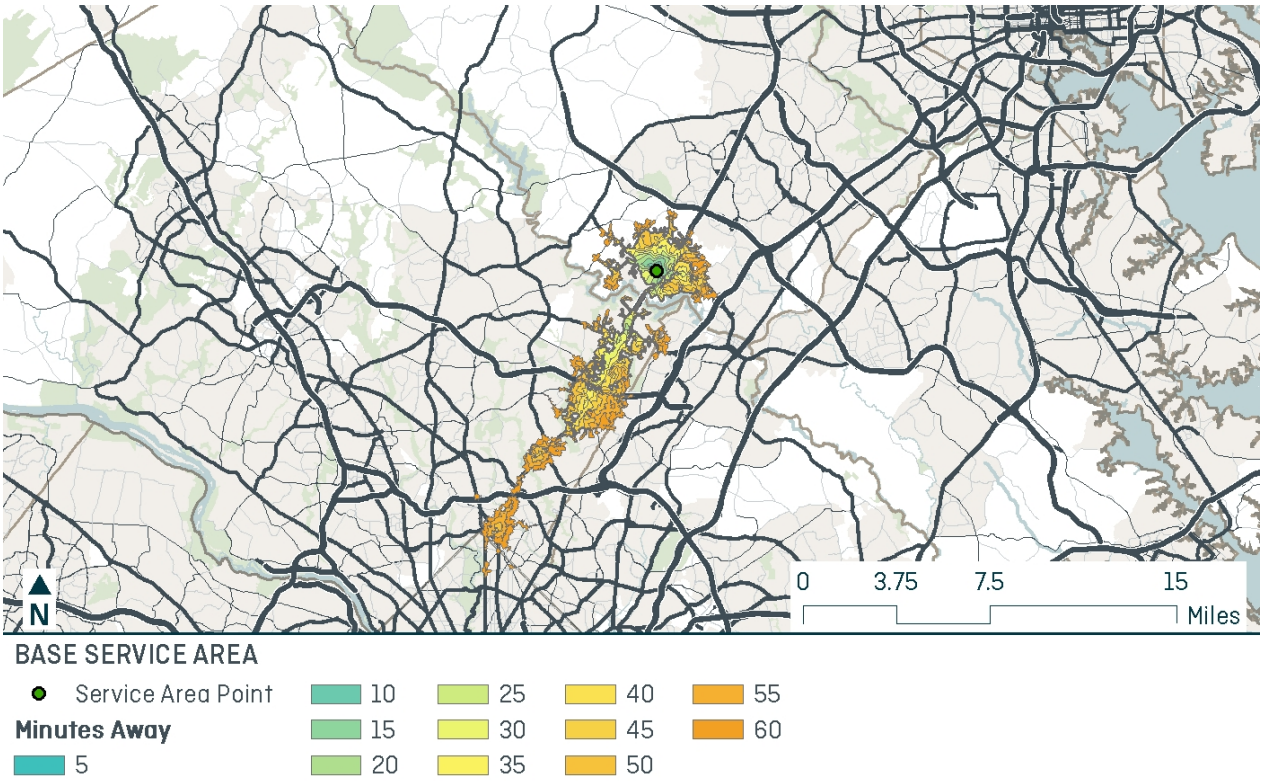

Figure 6: No-Build Service Area from Burtonsville at 8:00 am

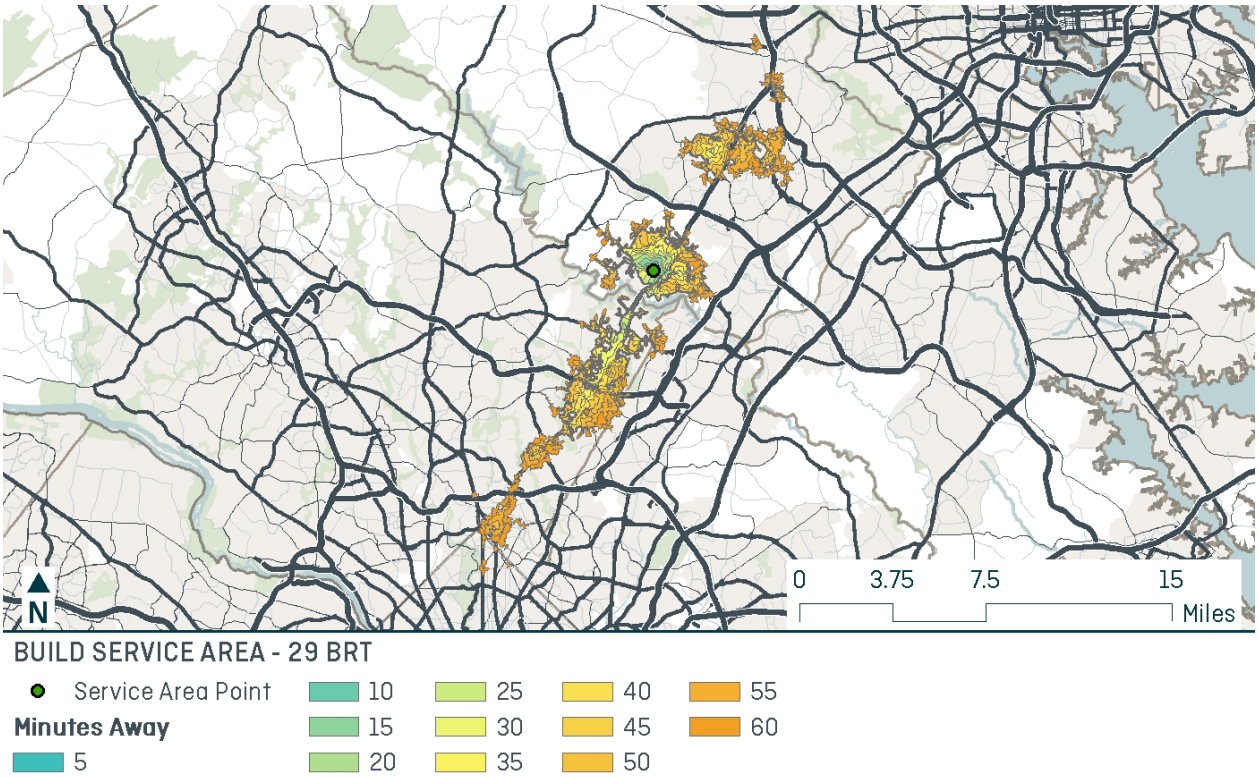

Figure 7a: Build Service Area from Burtonsville at 8:00 am for 29 BRT Service

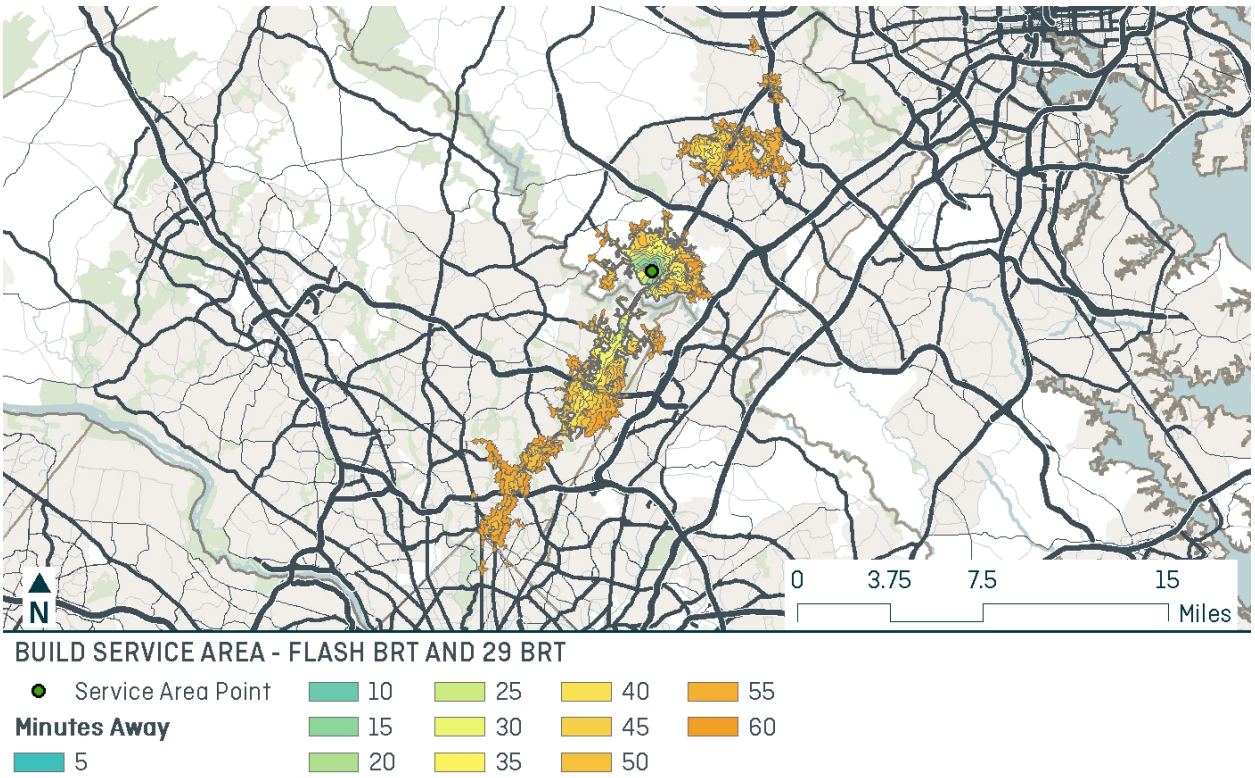

Figure 7b: Build Service Area from Burtonsville at 8:00 am for 29 BRT/Flash BRT service

3. SHORTEST PATH

Figures 8a, 8b, 9a, and 9b compare shortest path routing between two points. For these tests, beginning and ending points were identified near the termini of the project, with these points varying depending on whether the full corridor or only the 29 BRT portion were being tested. In Figure 8a and 8b, the shortest path should use the existing transit network. In Figure 9a and 9b, the shortest path should use the project and have a reduced travel time. Figures 8a and 9a represent no-build and build scenarios for travel between Burtonsville and Mount Hebron, with the intent of testing the 29 BRT service in the build scenario. Figures 8b and 9b represent travel between Mount Hebron and Silver Spring, with the intent of testing both Flash BRT and 29 BRT service in the build scenario.

The test confirms the network is utilizing the new path created by Project 20-19 in both scenarios. The no-build route takes an eastern path into Baltimore City before heading south to BWI Airport. From the airport the no-build route travels to Burtonsville in figure 8a and Silver Spring in figure 8b, as anticipated.

The test also shows a travel time reduction after the addition of Project 20-19. Under test 8a, which tests only the northern portion of the corridor, the route takes 352 minutes to complete in the no-build scenario. In 9a, the build scenario, the route takes 79 minutes to complete, resulting in a travel time savings of 273 minutes. In 8b, which tests the full corridor (including Flash BRT) from Silver Spring to Mount Hebron, the no-build route takes 240 minutes to complete. Under the Silver Spring to Mount Hebron build scenario, represented in figure 9b, service takes 121 minutes to complete, a travel time savings of 119 minutes.

This test further confirmed Project 20-19 was appropriately integrated into the base multimodal network in both the 29 BRT scenario and the Flash BRT and 29 BRT scenario.

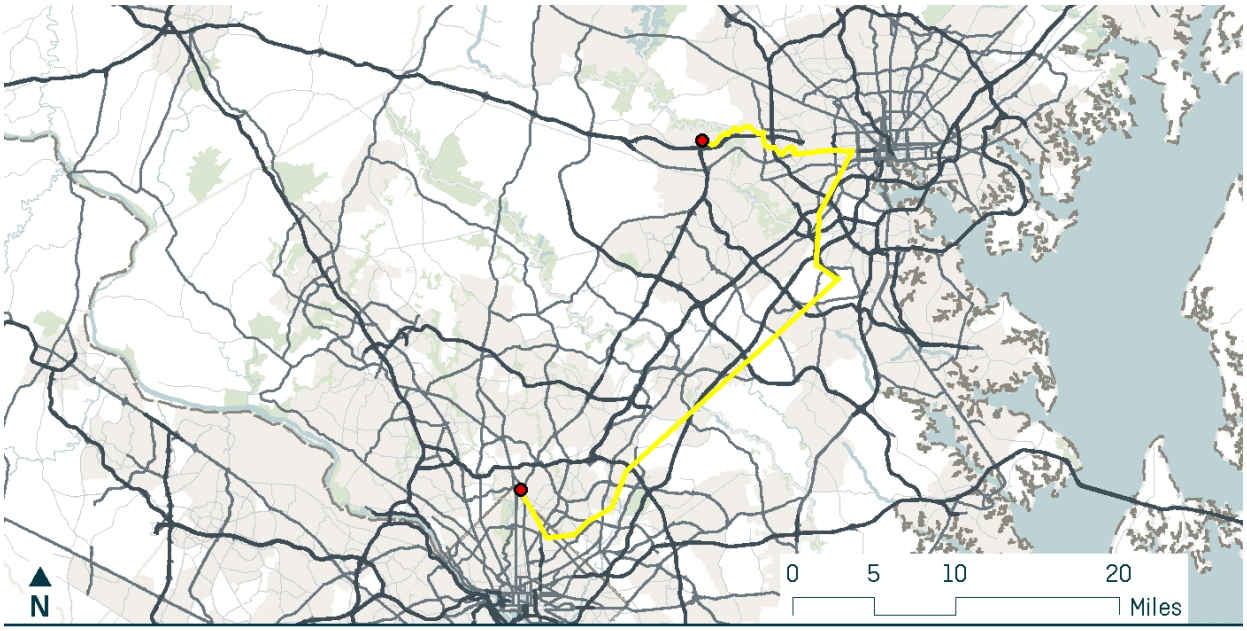

Figure 8a: No Build Route Burtonsville to Mount Hebron at 8:00am

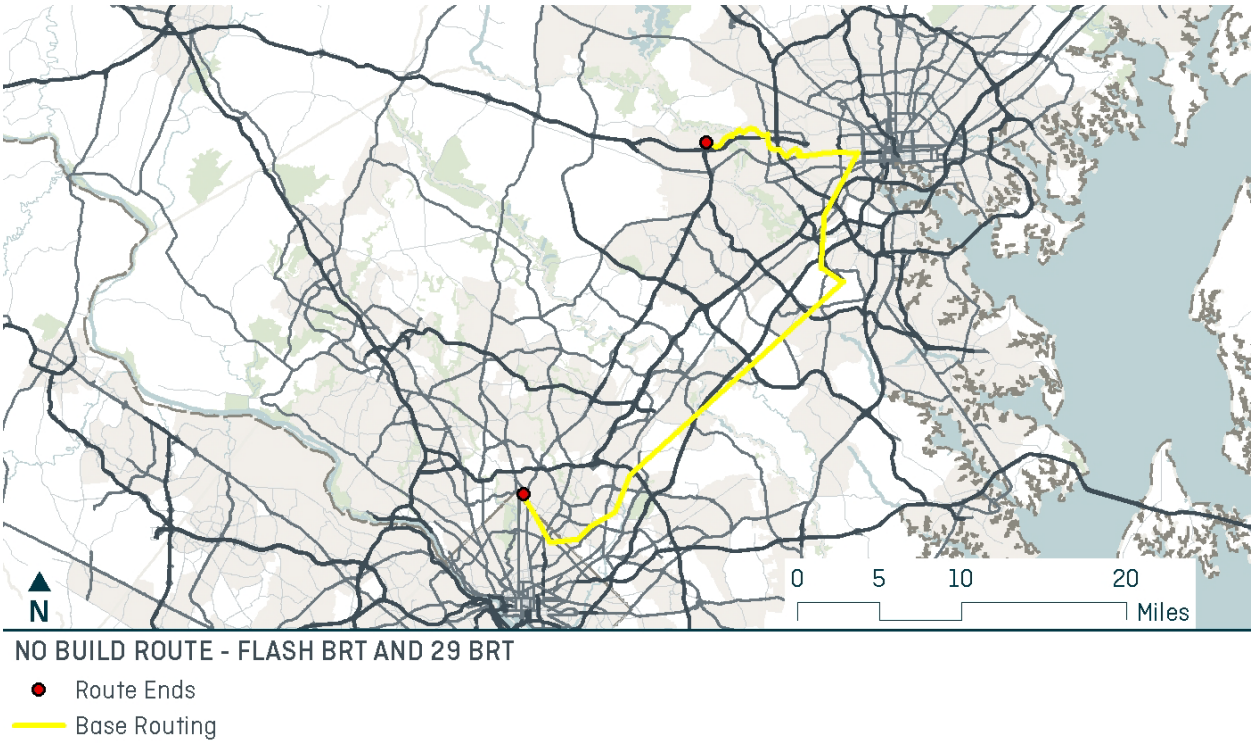

Figure 9b: No Build Route Silver Spring to Mount Hebron at 8:00am

Figure 10a: Build Route Burtonsville and Mount Hebron at 8:00am

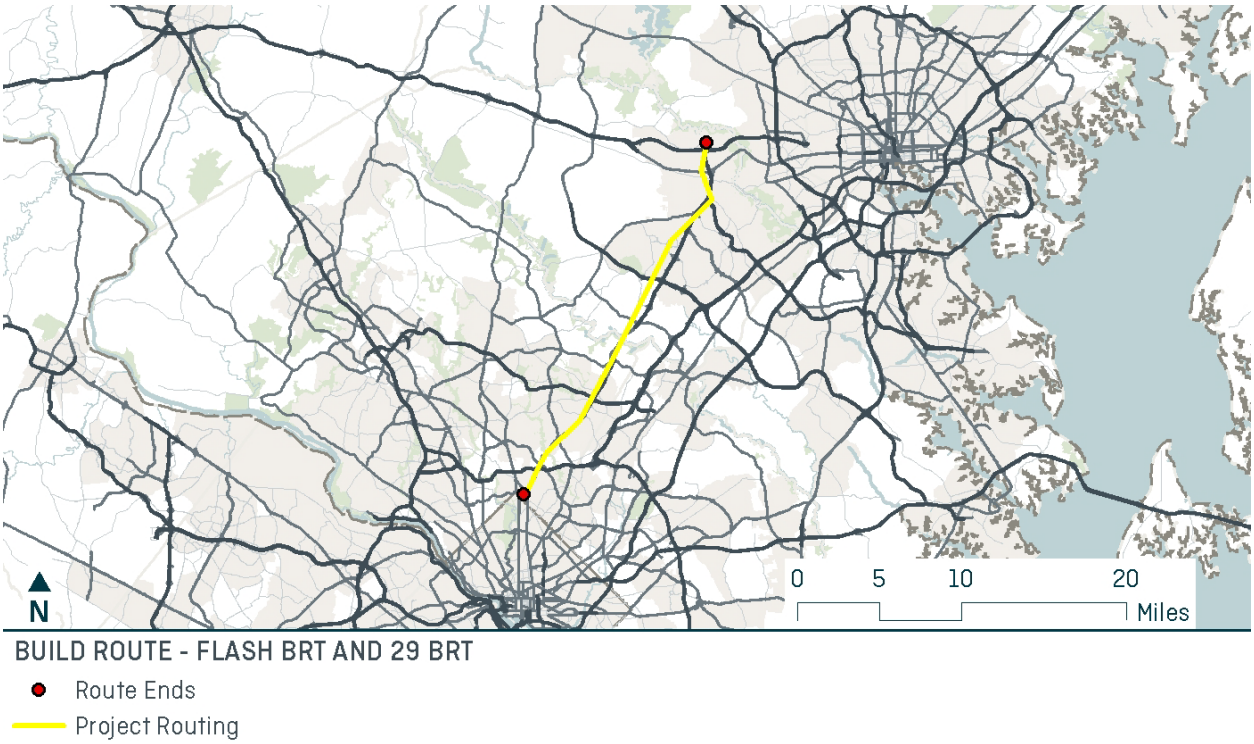

Figure 11b: Build Route Silver Spring to Mount Hebron at 8:00am

CHAPTER IV. REASONABLENESS OF RESULTS

1. EXTENT OF STUDY AREA

The project study area is based on travel time to the zones in which the project is implemented – any zones within 45 minutes by transit (in the project build scenario) are part of the study area as are any zones within 15 minutes by driving (based on MSTM highway skims).

The study area comprises 230 square miles that includes portions of Montgomery County, Howard County, and Ellicott City in Maryland. It extends approximately 1 mile north of the northern terminus of the 29 BRT corridor to Patapsco Valley State Park and extends approximately 5 miles south of the southern terminus of the 29 BRT corridor station in Burtonsville. The study area extends approximately 7 miles to the west and 6 miles to the east for the extent of the north-south running 29 BRT corridor

2. TRAVEL TIME CONTOURS TO PROJECT

The service area analysis shows that the project brings more of the study area within a one-hour travel time by transit. The largest gains are visible in the northern portion of the corridor, where little to no transit service presently exists. Travel time reductions are also evident in the southern portion of the corridor, where the Flash BRT service would increase the area accessible to riders within a 60-minute ride in the southern portion of the corridor due to the more frequent and higher speed service.

3. MMA RESULTS

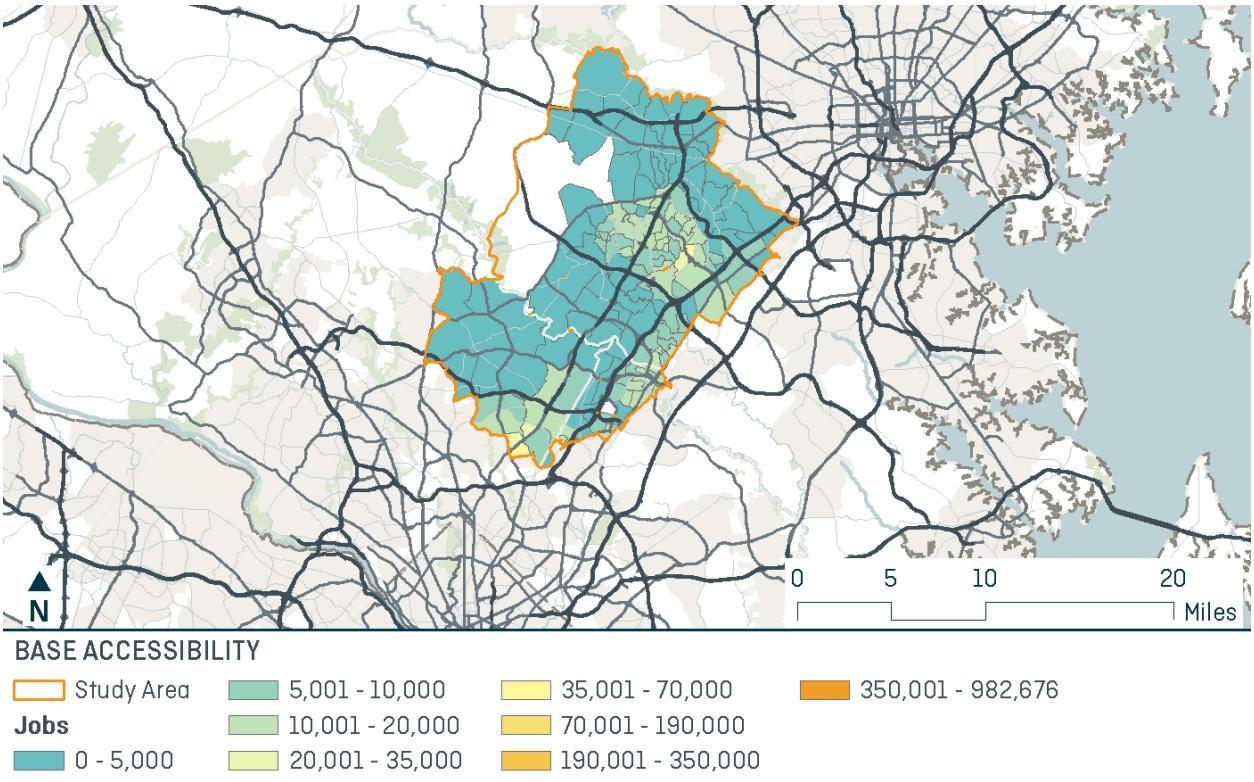

Figure 12: No-Build Jobs Accessibility in the Study Area

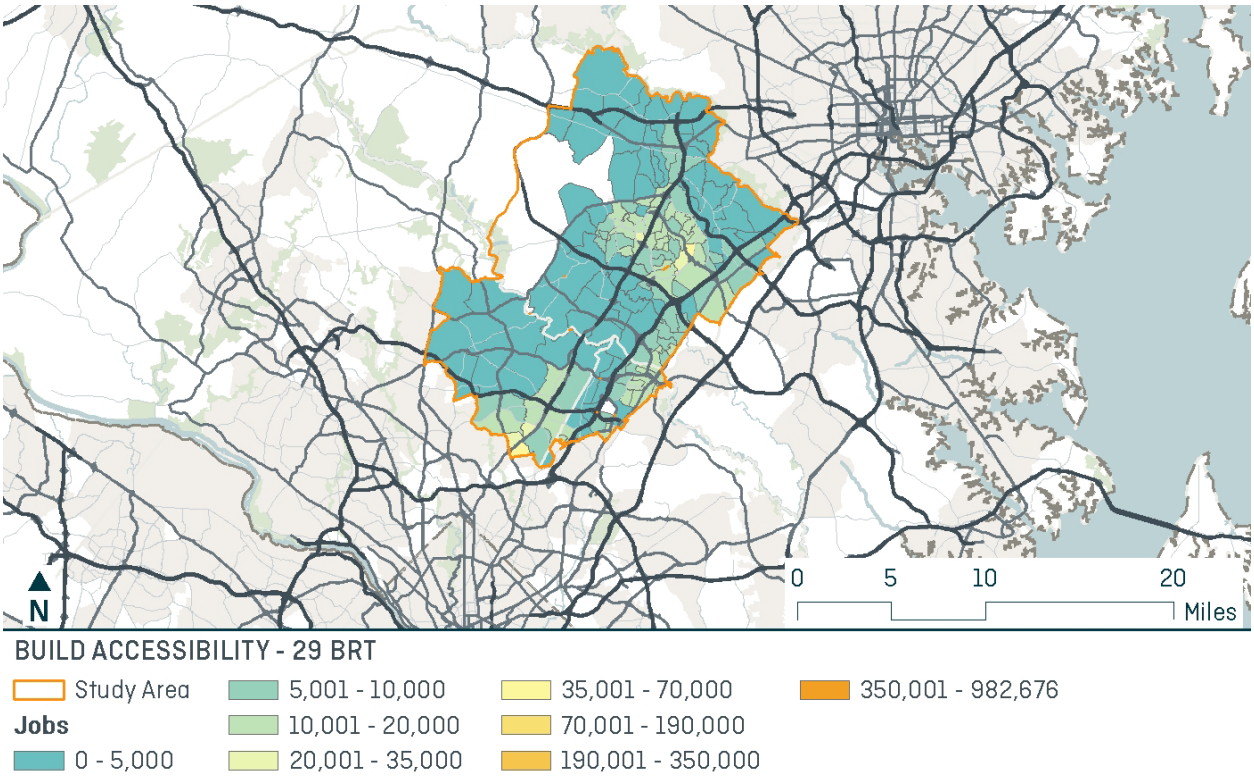

Figure 13a: Build Jobs Accessibility in the Study Area – 29 BRT

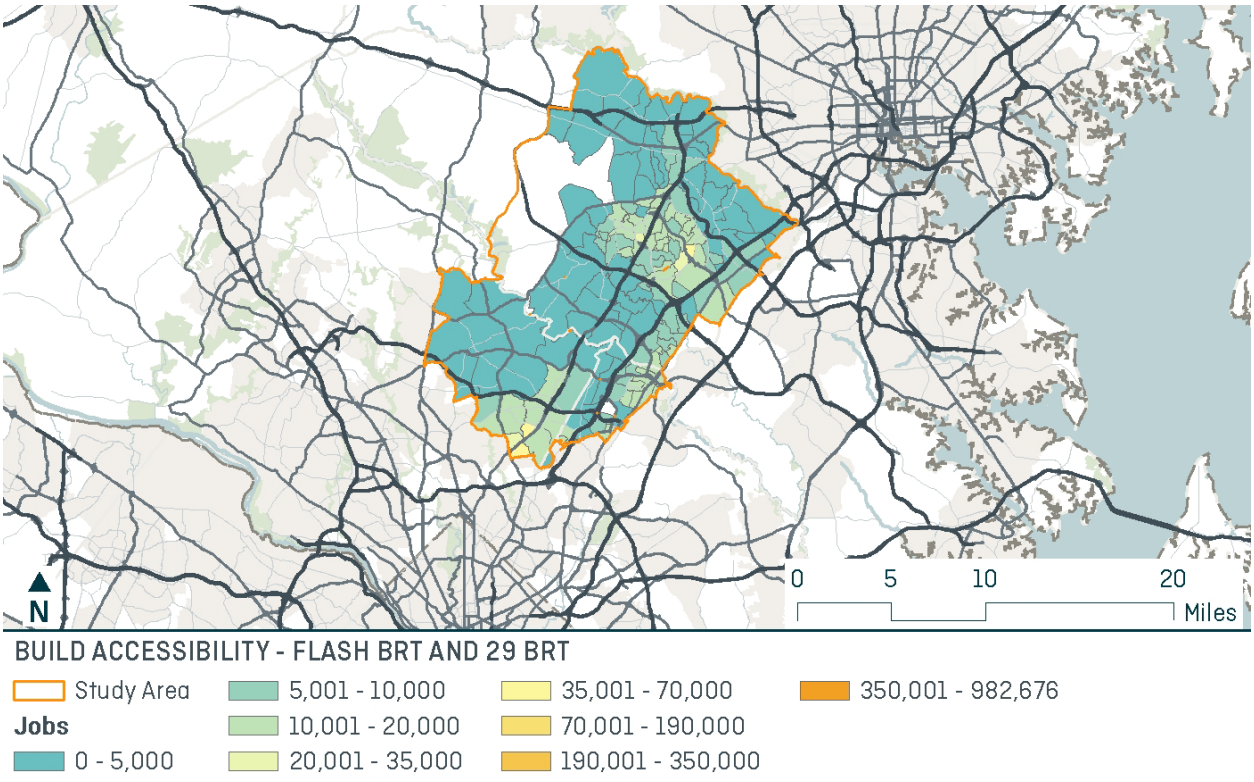

Figure 14b: Build Jobs Accessibility in the Study Area – 29 BRT and Flash BRT

CHAPTER V. MAPPING AND FINDINGS

1. NETWORK

i. Project Links and Stops

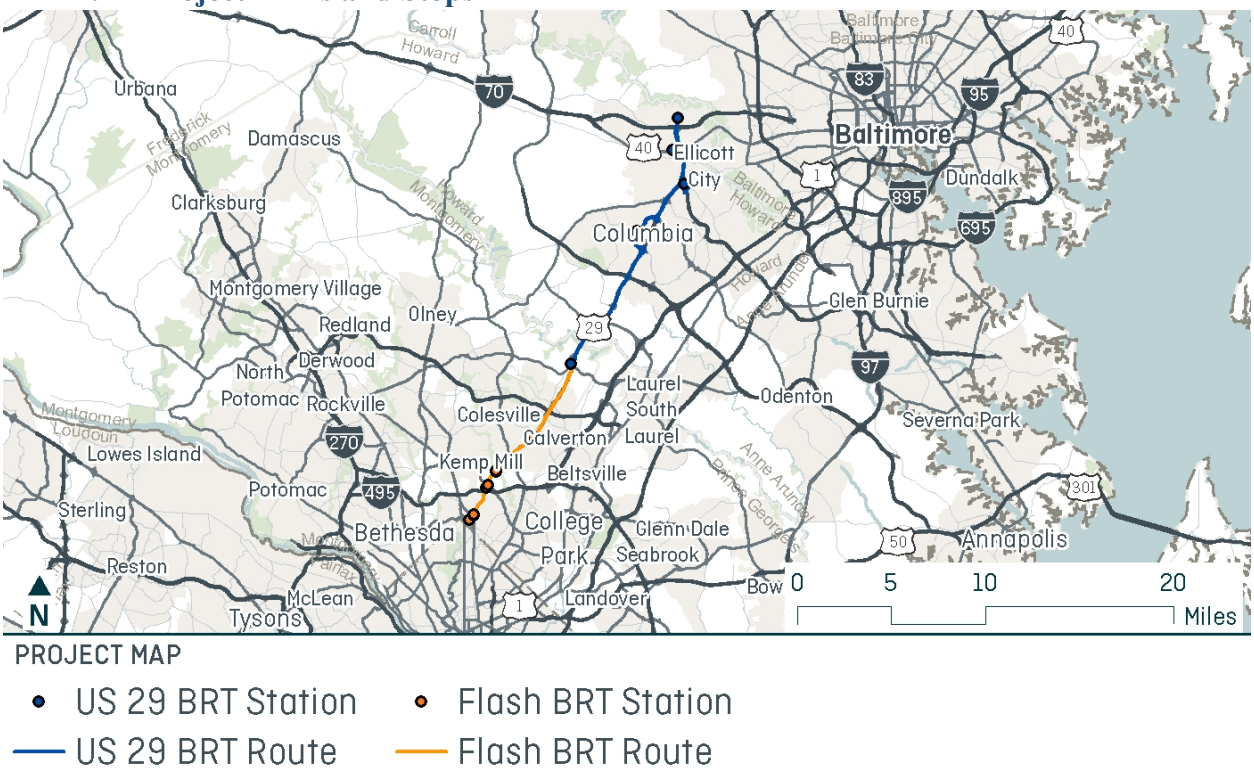

Figure 15: Project Links and Stops

2. BUILD VS NO BUILD

i. Average travel time changes

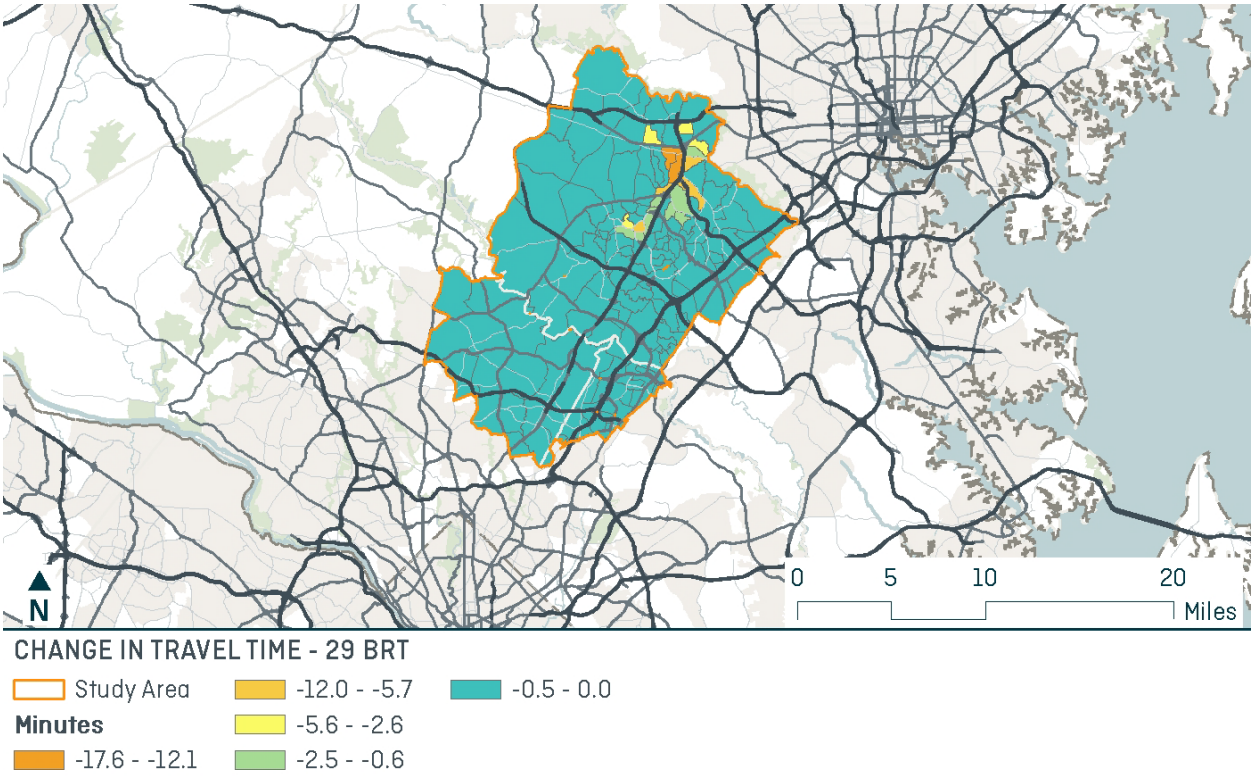

Figure 16a: Average change in travel time at 8:00 AM for 29 BRT

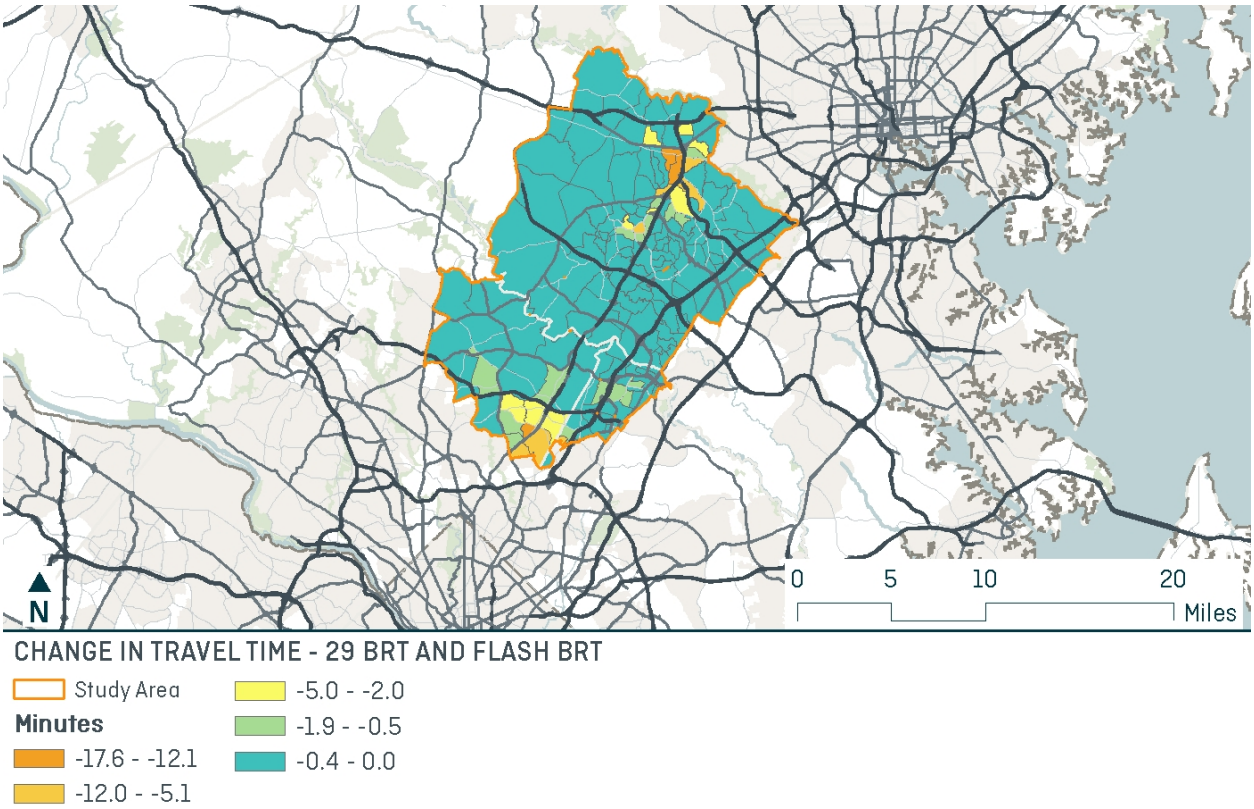

Figure 17b: Average change in travel time at 8:00 AM for 29 BRT and Flash BRT

3. TAZ

The MMA results show an increase in the number of jobs accessible by transit when compared to the no-build option, wither a larger impact evident in the full corridor scenario comprised of both 29 BRT and Flash BRT service. In the 29 BRT only scenario, portions of the study area see an increase in job accessibility ranging from 1 to more than 10,000. In the full corridor scenario, a larger geographic area experiences similar increases in job accessibility.

i. Project Study Area

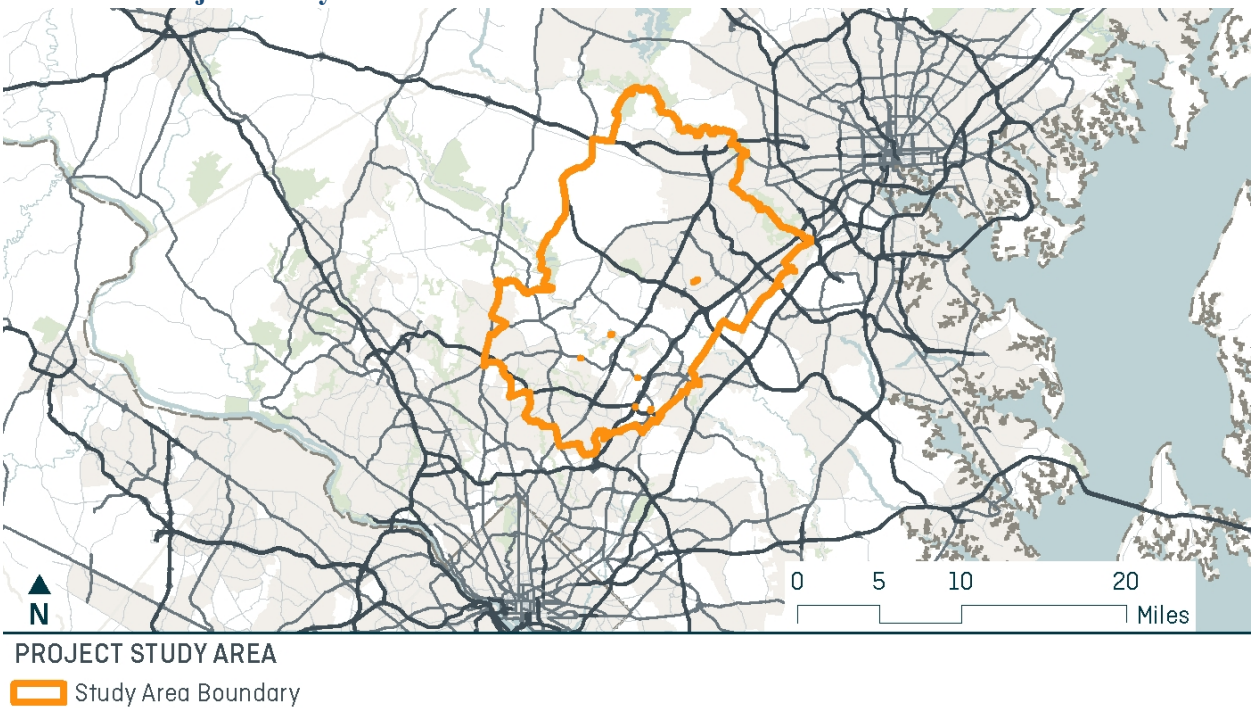

Figure 18: Project Study Area

ii. Positive and Negative Accessibility Changes

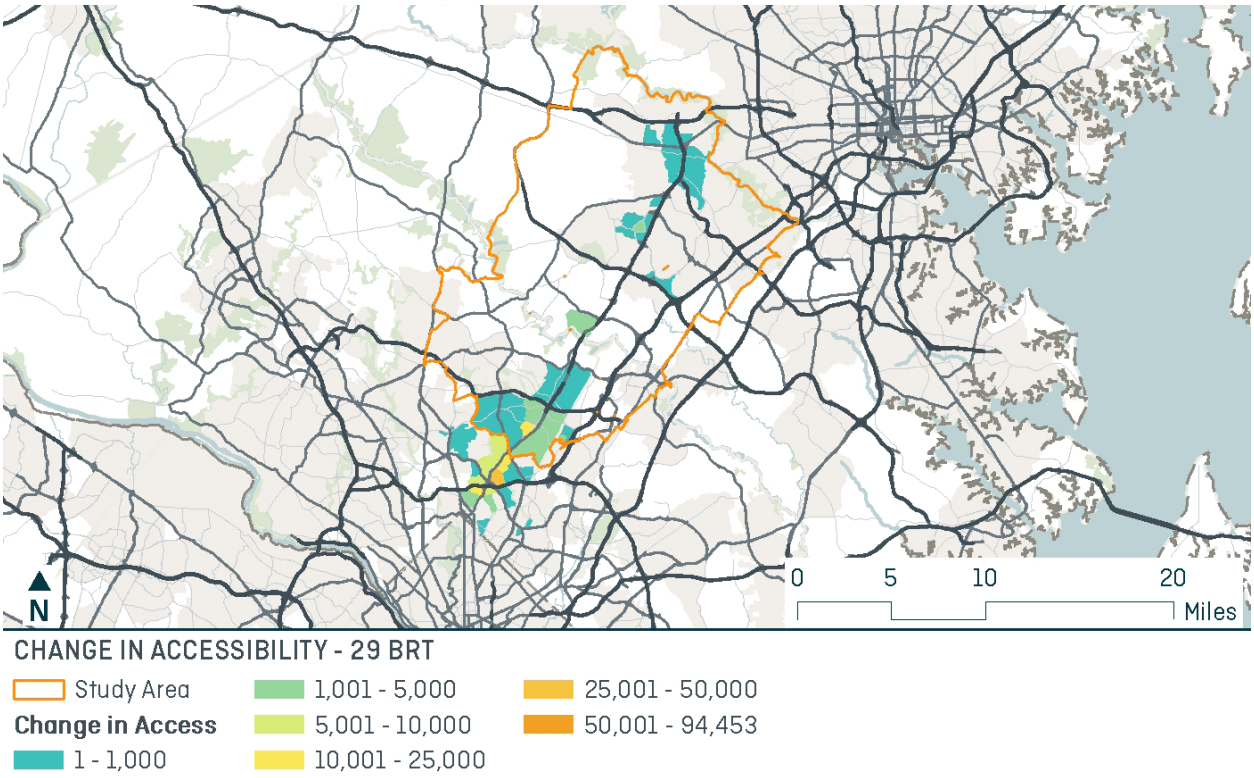

Figure 19a: Change in Accessibility between No-Build and 29 BRT Project in Study Area

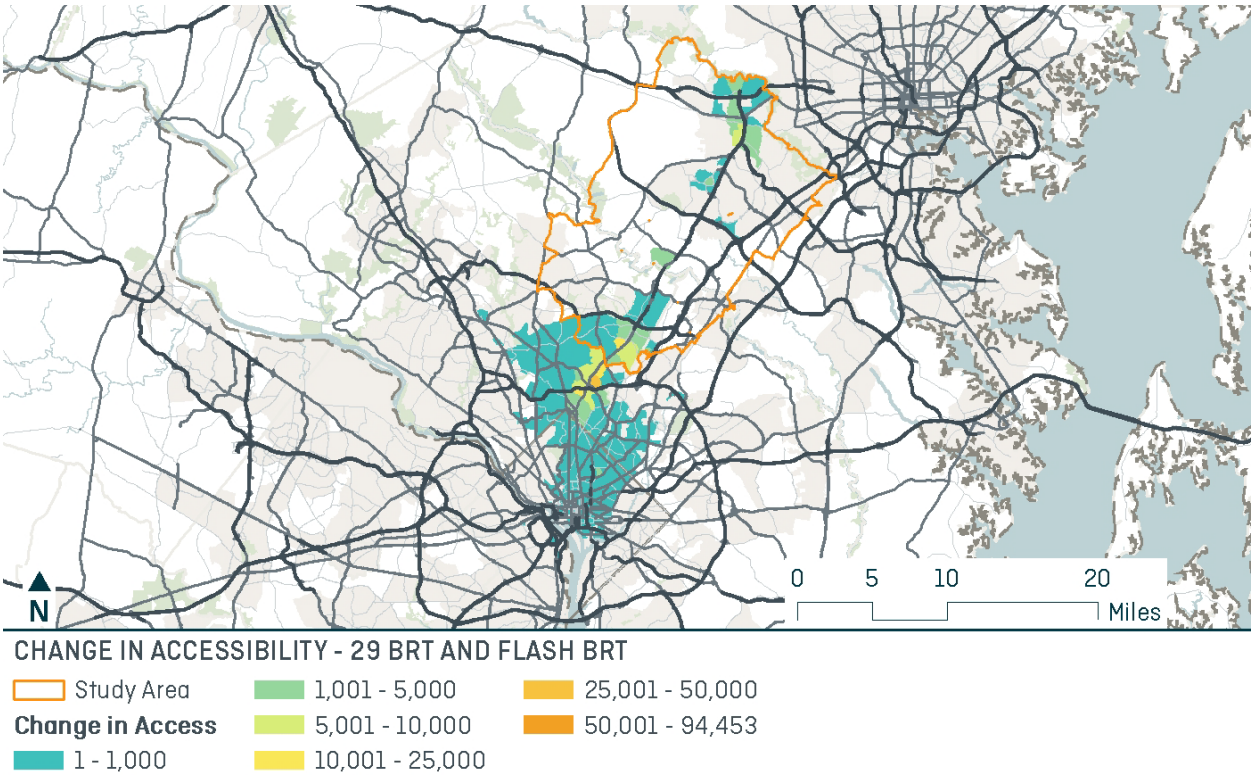

Figure 20b: Change in Accessibility between No-Build and 29 BRT and Flash BRT Projects in Study Area

4. PROJECT FINDINGS

Two sets of scores have been developed for this project. The first (and recommended) set of scores assumes the Flash BRT project in Montgomery County has already been implemented. The Howard County route is likely to connect directly to the Flash BRT, which is scheduled for construction in the next several years. The study area remains, however, limited to the zones within proximity to the Howard County portions of the route. The second set of scores assumes the US 29 BRT in Howard County is implemented without the Flash BRT.

The first set of scores is notably higher than the second set, meaning a large portion of the project benefits are only realized if the Flash BRT project is built and operational at the time the Howard County project is implemented. Since the Flash project is expected to be operational in 2020, this seems a reasonable assumption, and therefore the first set of scores is recommended as the official findings of the 2019 Chapter 30 scoring process. The second set of scores is provided for reference.

As shown in Figure 15a and 15b, the largest increases in job access occur in the TAZs in closest proximity to Project 20-19's alignment. The following tables summarizes the change in job accessibility for the general and disadvantaged populations in the study area for the 29 BRT only and 29 BRT with Flash BRT scenarios.

The addition of Project 20-19 increased the number of accessible jobs for the general population by 7.3 percent for the 29 BRT with Flash BRT scenario, and by 1.8 percent for the US 29 only scenario. Accessibility increases for the disadvantaged population are 11.6 percent and less than 0.1 percent, respectively. The following table summarizes the change in job accessibility for the general and disadvantaged populations in the study area.

Table 5: Project Finding

Combined US 29 BRT (Howard County) and Flash BRT (Montgomery County)

Measure:	**Value**
Access to Jobs in Base (*general population*)	7,478
Access to Jobs in Build (*general population*)	8,021
Change in Access to Jobs (*general population*)	543
Access to Jobs in Base (*disadvantaged population*)	10,916
Access to Jobs in Build (*disadvantaged population*)	12,185
Change in Access to Jobs (*disadvantaged population*)	1,269
Change in Average Travel Time Per Trip	-0.96 (mins)
Estimated Ridership	14,508
Estimated Existing Ridership (*Estimated Ridership * 80%*)	11,606
Total Estimated Travel Time Savings for Existing Transit Riders (*Change in Average Travel Time Per Trip * Estimated Existing Ridership*)	-11,142 (mins)

US 29 BRT (Howard County) only

Measure:	**Value**
Access to Jobs in Base (*general population*)	7,478
Access to Jobs in Build (*general population*)	7,611
Change in Access to Jobs (*general population*)	133
Access to Jobs in Base (*disadvantaged population*)	10,916
Access to Jobs in Build (*disadvantaged population*)	10,919
Change in Access to Jobs (*disadvantaged population*)	3
Change in Average Travel Time Per Trip	-0.46 (mins)
Estimated Ridership	14,508
Estimated Existing Ridership (*Estimated Ridership * 80%*)	11,606
Total Estimated Travel Time Savings for Existing Transit Riders (*Change in Average Travel Time Per Trip * Estimated Existing Ridership*)	-5,339 (mins)