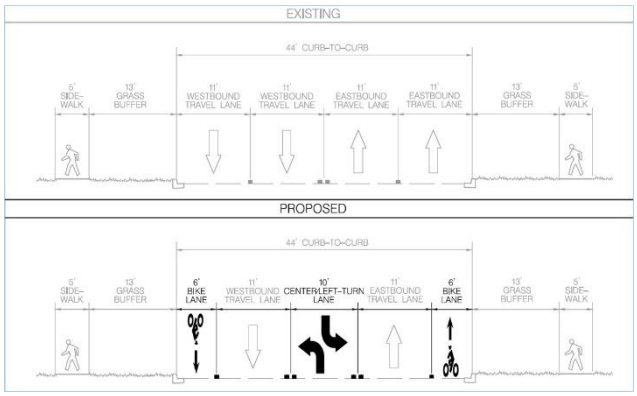
Complete Streets Feasibility Study and 10% Design Plan

for

Tamar Drive



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HOWARD COUNTY
MARYLAND

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1 Introduction

The purpose of this feasibility study is to determine how to implement a *Complete Streets* design for Tamar Drive in Columbia, in order to provide greater pedestrian and bike safety and accessibility while addressing speed, parking, and congestion concern for vehicles, where needed.

Designing for Complete Streets means creating streets that are safe and accessible for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities. In 2019, the Howard County Council passed a Complete Streets Resolution, CR120-2019:

> *To ensure that Howard County is a place for individuals of all backgrounds to live and travel freely, safely, and comfortably, public and private roadways in Howard County shall be safe and convenient for residents of all ages and abilities who travel by foot, bicycle, public transportation or automobile, ensuring sustainable communities Countywide.*

To efficiently reduce the numerous possible options for redesigning Tamar Drive, the assumption was made by the County that the curb-to-curb dimensions would generally remain the same, and that proposed modifications will occur within the roadbed or behind the fixed curbs. This assumption was due to the substantial capital costs associated with altering the width of the roadbed.

1.1 Project Purpose and Goals

The purpose of the feasibility study is to develop conceptual improvements for Tamar Drive, coordinate with and obtain "buy-in" from the local community, and develop 10% design plans, with all design assumptions documented for the Final Design phase.

The project evaluated safety, parking needs, vehicle speed, and pedestrian and bike accessibility/connectivity along Tamar Drive. Primary objectives for this feasibility study include:

1. Identifying community needs and vision for Tamar Drive, in accordance with community goals and the guidance of *PlanHoward, BikeHoward,* and *WalkHoward.*
2. Conducting traffic counts, speed data, traffic operations, and reviewing crash data.
3. Quantifying safety and operational impacts of possible improvements.
4. Develop cost-effective planning-level concepts for improvements to address community concerns and implementing Complete Streets guidelines.
5. Obtain community concurrence with conceptual plans and develop 10% design drawings, with design assumptions documented.

1.2 Methodology

To achieve the project's objectives, the following steps were conducted and are documented herein:

1. Collect traffic data at select intersections and roadway segments.
2. Evaluate existing traffic operations, pedestrian/bike counts, parking needs, vehicle speeds, and crash data.
3. Obtain community input prior to and after developing planning level improvements.
4. Analyze planning level improvements for their impacts on safety, congestion, and accessibility.
5. Develop 10% Conceptual Designs and cost estimates, and document design assumptions.

This Technical Memorandum is the summary of the data collection efforts, community input, conceptual design, and design assumptions.

1.3 Study Area

Tamar Drive is classified as a major collector for the Long Reach neighborhood of Columbia. It generally parallels MD 175 and provides access to both MD 175 and Snowden River Parkway. As shown in Figure 1, the study area limits represent a 1 ½ mile segment of Tamar Drive from Snowden River Parkway to ¼ mile north of MD 175.

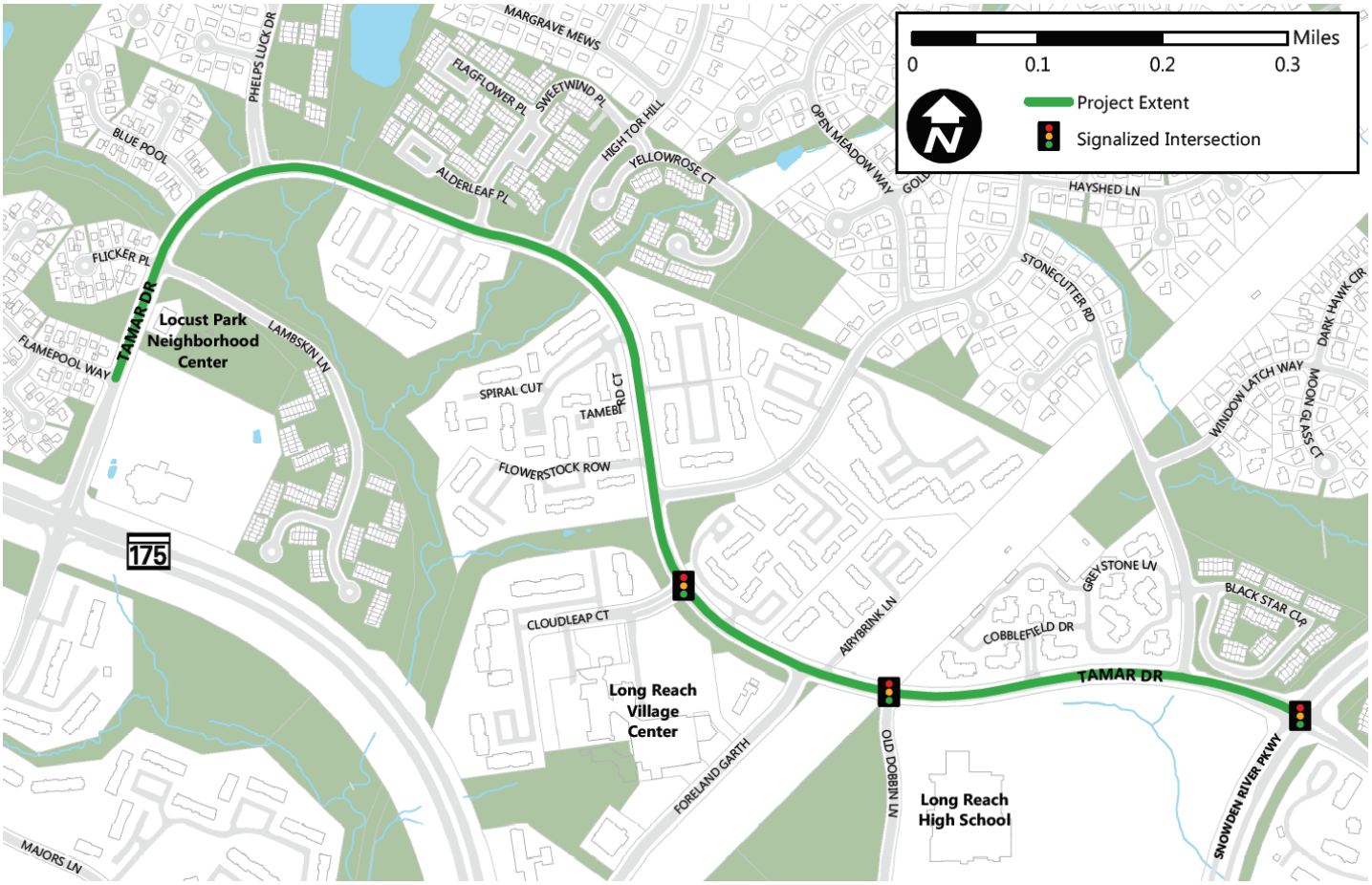

Figure 1: Study area

2 Existing Conditions

2.1 Roadway Characteristics and Typical Section

Tamar Drive is a closed-section (i.e., curbed for collecting and distributing stormwater) major collector that is 44 feet wide curb-to-curb, with sidewalks on both sides, separated by a grass buffer for lighting, trees, and signs. Each direction of the roadway has a single general-purpose travel lane and shoulder for on-street parking. The roadway's typical section is shown in Figure 2.

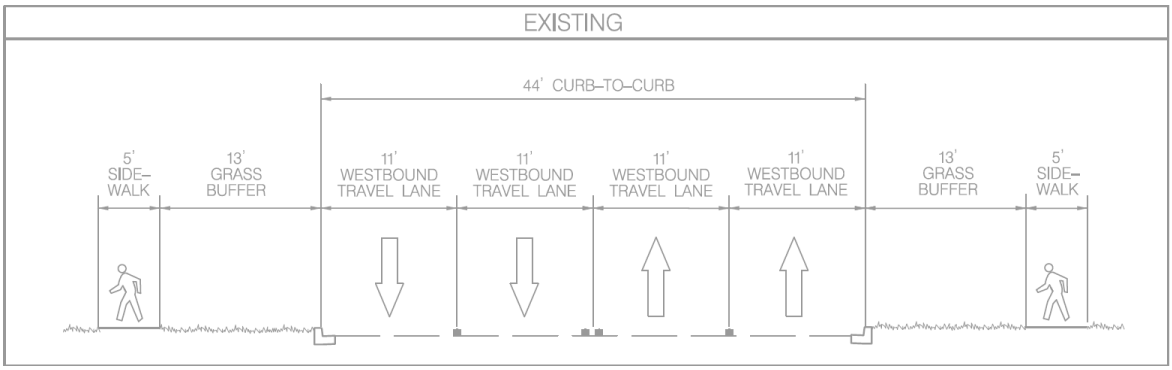

Figure 2: Existing typical section for Tamar Drive

The speed limit for the roadway is 30 mph, with a 25 mph advisory speed segment near Long Reach High School. Speed data was collected during a typical day when County schools were in session. The speed data, as well as overall average daily traffic (ADT) data, is summarized in the following table. Raw Speed data and graphs for 48 successive hours can be found in Appendix A.

Table 1: Speed and ADT Data along Tamar Drive

Location	ADT	Posted Speed Limit	Average Speed	% of Traffic Exceeding Posted Speed Limit by 10+ mph
Tamar Drive near Hayshed Lane	12,000	30 MPH	32 MPH	8% Eastbound Drivers and 6% Westbound Exceed Posted Speed Limit by 10 mph

Vehicle Classification data was also collected; this data showed that about 95% of all traffic to be FHWA Class 1, 2, or 3 vehicles, i.e., passenger vehicles.

2.2 Crash Data

Five years of crash data (2013 through 2017) were obtained for the study area in order to determine if there were any recurring crash types or locations with a large number of overall crashes. Over the five-year timeframe, no fatal crashes occurred, and two crashes involved cyclists. The highest number of crashes occurred at the Phelps Luck intersection, with the many of these being fixed-object crashes. Figure 3 shows where along Tamar Drive these crashes occurred.

Figure 3: Location and number of crashes within the study area, 2013 - 2017.

A summary of all crashes is shown in the following table.

Table 2: Crash Data Summary

Tamar Drive Crash Data Summary (2013-2017)												
Cross Street	**Pedestrian**	**Bicycle**	**Fatalities**	**Head On**	**Angle**	**Rear End**	**Fixed Object**	**Sideswipe**	**Other**	**Unknown**	**Total**	**Proportion**
FLAMEPOOL WAY	0	0	0	1	1	2	1	2	0	0	**7**	**4%**
LAMBSKIN LN	0	0	0	2	2	5	1	1	1	0	**12**	**7%**
BLUE POOL	0	0	0	0	0	3	0	0	1	0	**4**	**2%**
PHELPS LUCK DR	0	0	0	3	4	4	8	2	4	0	**25**	**14%**
SWEETWIND PL	0	0	0	1	1	5	3	0	7	0	**17**	**9%**
HIGH TOR HILL	0	1	0	1	7	1	2	3	1	0	**16**	**9%**
SPIRAL CUT	0	0	0	0	0	0	1	1	0	0	**2**	**1%**
8810-8860	0	0	0	1	2	1	1	3	11	0	**19**	**10%**
FLOWERSTOCK ROW	0	0	0	2	2	4	0	2	0	0	**10**	**5%**
HAYSHED LN	0	1	0	0	1	3	0	1	0	0	**6**	**3%**
CLOUDLEAP CT	0	0	0	1	4	4	1	2	3	0	**15**	**8%**
FORELAND GARTH	0	0	0	0	2	3	0	0	0	0	**5**	**3%**
AIRYBRINK LN	0	0	0	0	1	2	0	1	1	0	**5**	**3%**
OLD DOBBIN LN	1	0	0	0	2	8	2	2	7	0	**22**	**12%**
AUTUMN RIDGE DR	0	0	0	0	0	0	0	0	1	0	**1**	**1%**
STONECUTTER RD	0	0	0	0	1	6	0	0	1	0	**8**	**4%**
SNOWDEN RIVER PKWY	0	0	0	2	0	3	1	0	2	0	**8**	**4%**
Total	**1**	**2**	**0**	**14**	**30**	**54**	**21**	**20**	**40**	**0**	**182**	**100%**
Proportion	**1%**	**1%**	**0%**	**8%**	**16%**	**30%**	**12%**	**11%**	**22%**	**0%**	**100%**	

A summary of crash types for the higher-incident locations is shown in Figure 4 and in Figure 5.

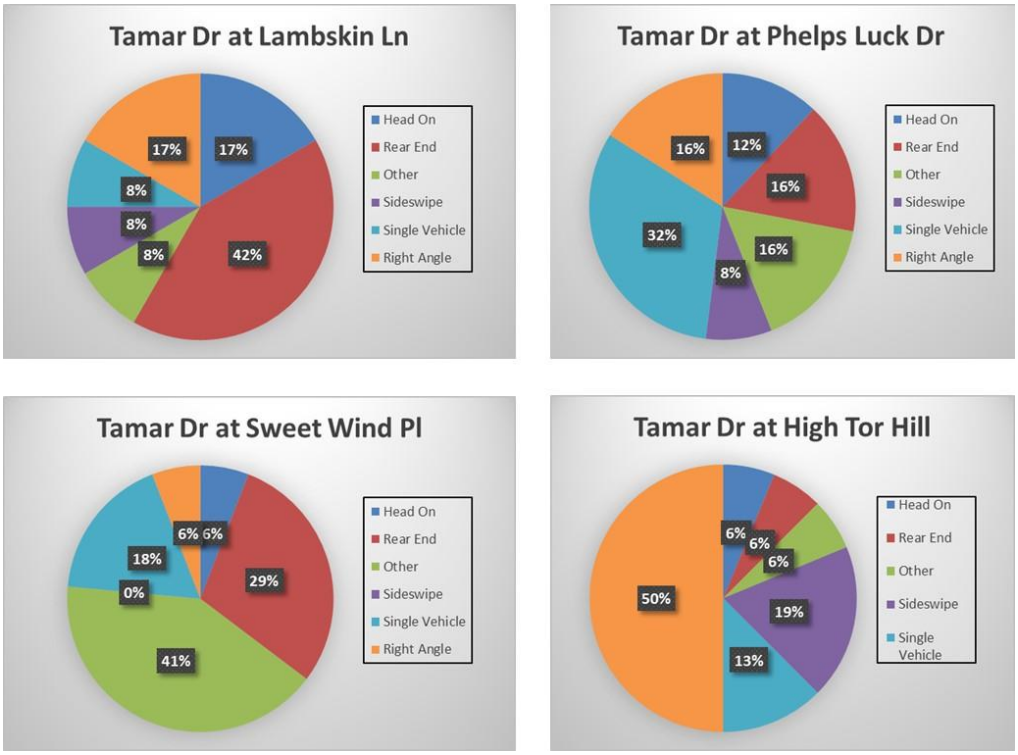

Figure 4: Breakdown of crashes at select locations

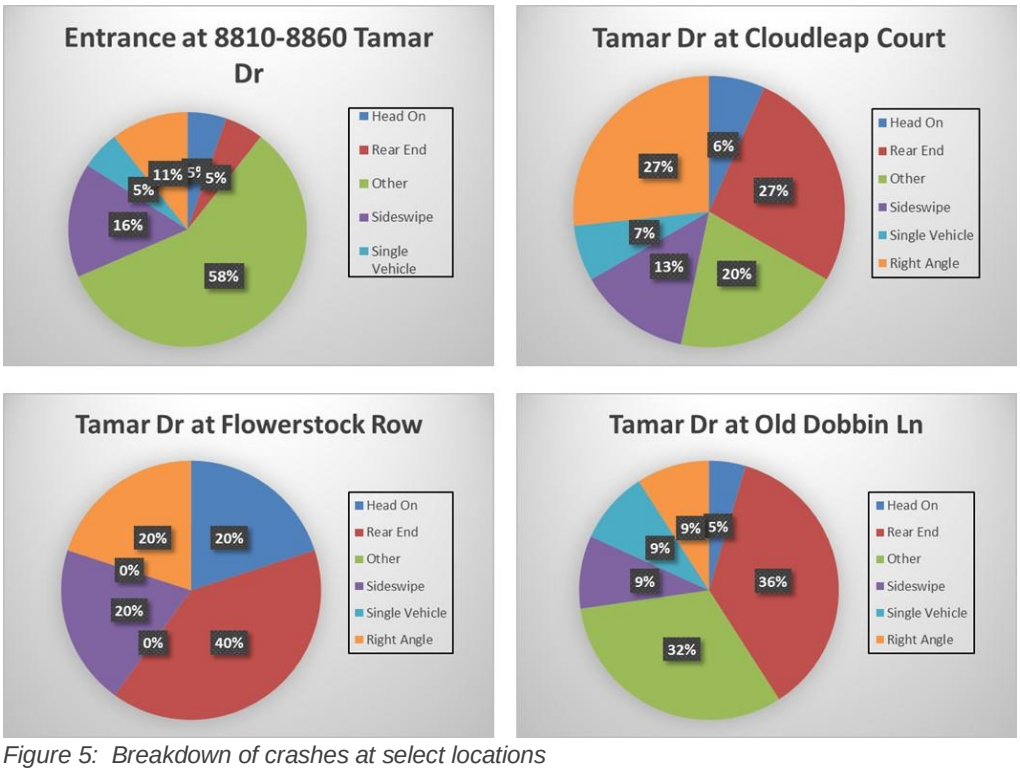

Figure 5: Breakdown of crashes at select locations

2.3 Existing Pedestrian and Bicycle Infrastructure

Tamar Drive has buffered sidewalks along both sides within the study area, as well as an integrated paved trail network, as shown in Figure 6. Cyclists may use the general-purpose travel lane; however, the prevailing vehicle

speeds are typically twice that of casual riders. Additionally, cyclists are legally allowed to utilize sidewalks in Howard County. However, the sidewalks are not wide enough to share with pedestrians simultaneously.

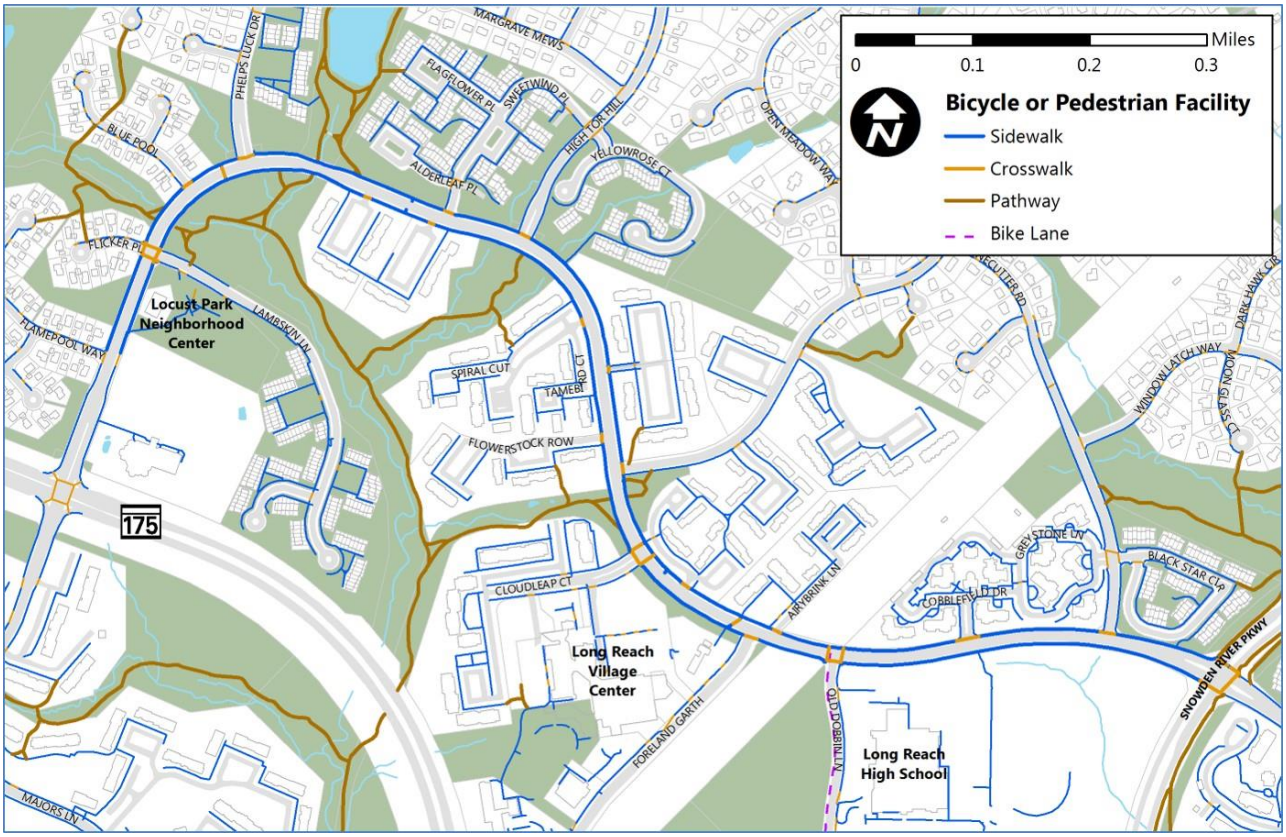

Figure 6: Existing sidewalk and trails along the Tamar Drive corridor

Marked crosswalks to cross Tamar Drive Road are located at:

- Cloudleap Court (signalized).
- Old Dobbin Lane (signalized).

Additionally, there are trail connections, joining Columbia Association trails, under Tamar Drive located:

- north of Lambskin Lane.
- east of Phelps Luck Drive.
- east of Hayshed Lane.

2.4 Capacity Analysis

The following sixteen study area intersections were identified to study potential capacity constraints:

1. Tamar Drive at Flamepool Way
2. Tamar Drive at Lambskin Lane
3. Tamar Drive at Blue Pool
4. Tamar Drive at Phelps Luck Drive
5. Tamar Drive at Sweet Wind Place
6. Tamar Drive at High Tor Hill
7. Tamar Drive at Spiral Cut
8. Tamar Drive at the driveway entrance to 8810 – 8860 Tamar Drive
9. Tamar Drive at Hayshed Lane
10. Tamar Drive at Cloudleap Court
11. Tamar Drive at Foreland Garth
12. Tamar Drive at Airybrink Lane
13. Tamar Drive at Old Dobbin Road
14. Tamar Drive at Autumn Ridge Drive
15. Tamar Drive at Stonecutter Road
16. Tamar Drive at Snowden River Pkwy

Turning movement counts were conducted in January 2019 for these sixteen intersections; cyclists, pedestrians, and vehicle were all counted during the AM and PM peak commuting periods. The raw count data can be found in Appendix B.

All study intersections were coded into a Synchro network to perform capacity analysis. Synchro is a deterministic and macroscopic intersection analysis computer software program that models street networks and traffic signal systems. Geometric data such as number of lanes, lane configuration, storage lengths, tapers, and distances between intersections were inputted into Synchro. Existing signal timings and phasing were obtained from the Maryland Department of Transportation State Highway Administration and Howard County Department of Public Works and coded into the Synchro traffic model along with existing traffic volumes.

The Synchro model representing *Existing Conditions* was validated via field observations and modifications to parameters such as link speeds and headway factors were made, where necessary, to ensure the model represented field-observed delays and queue lengths.

Signal operations during the AM and PM peak period are summarized below:

- Tamar Drive at Cloudleap Court
  - AM and PM – Free with a max cycle length of 100 seconds
- Tamar Drive at Old Dobbin Lane
  - AM and PM – Free with a max cycle length of 90 seconds
- Tamar Drive at Snowden River Parkway
  - AM – Coordinated with a cycle length of 120 seconds
  - PM – Coordinated with a cycle length of 160 seconds

Intersection capacity analyses were performed using the industry standard National Academy of Sciences Transportation Research Board's Highway Capacity Manual (HCM) methodology for all study intersections. Performance measures of effectiveness include level of service (LOS), volume-to-capacity (v/c) ratio, and average vehicle delay. Key performance measures are defined as follows:

Level of Service (LOS) is a qualitative measure describing vehicle traffic conditions of an intersection or any other transportation facility. At intersections, LOS is a letter designation that corresponds to a certain range of average vehicle delay caused by the traffic control device or conflicting traffic movements. The LOS range from 'A' to 'F', with 'A' indicating limited average delay for vehicles at an intersection and 'F' indicating significant delay. Table 3 shows each Level of Service and their corresponding delay values, as measured in seconds of wait time, for signalized and unsignalized intersections. LOS is typically calculated for peak commuting hours in the AM and PM. Different approaches to an intersection can have different wait times to clear it. The overall intersection LOS is a weighted average, by traffic volume, of each approach's delay.

Table 3: Intersection level of service delay ranges

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

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

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

Synchro implements Highway Capacity Manual 2000 (HCM) methods of analysis to determine LOS. Table 4 summarizes the HCM analysis performed under existing traffic conditions.

The results of the static *existing conditions* capacity analysis indicate that while all movements within the study area are operating below capacity, some movements do experience failing LOS due to long delays during the PM peak hour only:

- Tamar Drive at Phelps Luck Drive
  - Southbound Left
- Tamar Drive at Foreland Garth
  - Northbound Left
- Tamar Drive at Snowden River Parkway
  - Eastbound Left
  - Northbound Left
  - Southbound Left

Detailed HCM reports are in Appendix C.

In addition to capacity analysis, queuing was assessed using SimTraffic, Synchro's companion software. Estimated queue 95th % queue lengths were based on the average of five 60-minute model runs in SimTraffic. Estimated queue lengths are shown in Table 5. As shown in the table, 95th percentile queue lengths do not exceed 150 feet (or approximately five vehicle lengths at any unsignalized intersection). Detailed queuing reports are in Appendix C.

Table 4: Existing conditions capacity analysis summary

Node	Intersection	Approach	Movement	Existing Conditions AM (PM) Delay (sec)	LOS	V/C
1	Flamepool Way & Tamar Drive	Control Type		Stop (2-Way)		
		Eastbound	Overall	0.3 (0.4)	A (A)	0.10 (0.23)
			left-through-right	0.5 (0.8)	A (A)	0.01 (0.02)
		Westbound	Overall	0.0 (0.1)	A (A)	0.25 (0.21)
			left-through-right	0.1 (0.2)	A (A)	0.00 (0.00)
		Northbound	Overall	15.7 (9.9)	C (A)	0.02 (0.01)
			left-through	20.8 (-)	C (-)	0.02 (-)
			right	9.3 (9.9)	A (A)	0.00 (0.01)
		Southbound	Overall	13.5 (17.4)	B (C)	0.07 (0.06)
			left-right	13.5 (17.4)	B (C)	0.07 (0.06)
2	Lambskin Lane/Flicker Place & Tamar Drive	Control Type		Stop (2-Way)		
		Eastbound	Overall	0.0 (0.1)	A (A)	0.10 (0.25)
			left-through	- (0.2)	- (A)	- (0.01)
			right			
		Westbound	Overall	0.3 (0.6)	A (A)	0.24 (0.21)
			left	0.5 (1.1)	A (A)	0.02 (0.04)
			through-right			
		Northbound	Overall	16.1 (30.0)	C (D)	0.14 (0.30)
			left-right	16.1 (30.0)	C (D)	0.14 (0.30)
		Southbound	Overall	11.0 (21.6)	B (C)	0.00 (0.02)
			left-right	- (21.6)	- (C)	- (0.02)
3	Tamar Drive & Blue Pool	Control Type		Stop (T Int)		
		Eastbound	Overall	0.0 (0.1)	A (A)	0.14 (0.31)
			left	0.1 (0.4)	A (A)	0.00 (0.01)
			through			
		Westbound	Overall	0.0 (0.0)	A (A)	0.32 (0.30)
			through-right	0.0 (0.0)	A (A)	0.32 (0.30)
		Southbound	Overall	13.4 (17.8)	B (C)	0.04 (0.04)
			left-right	13.4 (17.8)	B (C)	0.04 (0.04)
4	Tamar Drive & Phelps Luck Drive	Control Type		Stop (T Int)		
		Eastbound	Overall	3.4 (4.6)	A (A)	0.12 (0.30)
			left	6.1 (7.8)	A (A)	0.12 (0.30)
			through			
		Westbound	Overall	0.0 (0.0)	A (A)	0.21 (0.20)
			through-right	0.0 (0.0)	A (A)	0.21 (0.20)
		Southbound	Overall	14.5 (31.6)	B (D)	0.42 (0.67)
			left	22.4 (96.9)	C (F)	0.13 (0.67)
			right	13.6 (12.6)	B (B)	0.42 (0.32)
5	Tamar Drive & Sweet Wind Place	Control Type		Stop (T Int)		
		Eastbound	Overall	0.4 (0.5)	A (A)	0.10 (0.21)
			left	1.2 (1.4)	A (A)	0.01 (0.03)
			through			
		Westbound	Overall	0.0 (0.0)	A (A)	0.21 (0.24)
			through-right	0.0 (0.0)	A (A)	0.21 (0.24)
		Southbound	Overall	11.9 (15.2)	B (C)	0.08 (0.10)
			left-right	11.9 (15.2)	B (C)	0.08 (0.10)
6	Tamar Drive & High Tor Hill	Control Type		Stop (T Int)		
		Eastbound	Overall	0.8 (1.4)	A (A)	0.10 (0.19)
			left	2.2 (3.3)	A (A)	0.02 (0.08)
			through			
		Westbound	Overall	0.0 (0.0)	A (A)	0.18 (0.23)
			through-right	0.0 (0.0)	A (A)	0.18 (0.23)
		Southbound	Overall	15.5 (30.2)	C (D)	0.29 (0.48)
			left	18.7 (37.0)	C (E)	0.29 (0.48)
			right	10.7 (11.1)	B (B)	0.10 (0.06)
7	Spiral Cut & Tamar Drive	Control Type		Stop (T Int)		
		Eastbound	Overall	0.0 (0.0)	A (A)	0.13 (0.20)
			through-right	0.0 (0.0)	A (A)	0.13 (0.20)
		Westbound	Overall	0.1 (0.5)	A (A)	0.21 (0.27)
			left	0.4 (1.5)	A (A)	0.01 (0.03)
			through			
		Northbound	Overall	12.3 (14.3)	B (B)	0.11 (0.09)
			left-right	12.3 (14.3)	B (B)	0.11 (0.09)
8	Tamar Drive & 8810-8860 Driveway	Control Type		Stop (T Int)		
		Eastbound	Overall	0.5 (0.5)	A (A)	0.14 (0.22)
			left	1.3 (1.4)	A (A)	0.02 (0.03)
			through			
		Westbound	Overall	0.0 (0.0)	A (A)	0.21 (0.29)
			through-right	0.0 (0.0)	A (A)	0.21 (0.29)
		Southbound	Overall	13.4 (19.5)	B (C)	0.10 (0.13)
			left-right	13.4 (19.5)	B (C)	0.10 (0.13)

Node	Intersection	Approach	Movement	Existing Conditions AM (PM) Delay (sec)	LOS	V/C
9	Tamar Drive & Hayshed Lane	Control Type		Stop (T Int)		
		Eastbound	Overall	0.8 (1.7)	A (A)	0.13 (0.18)
			left	2.1 (3.9)	A (A)	0.03 (0.09)
			through			
		Westbound	Overall	0.0 (0.0)	A (A)	0.17 (0.27)
			through-right	0.0 (0.0)	A (A)	0.17 (0.27)
		Southbound	Overall	12.6 (16.6)	B (C)	0.14 (0.19)
			left	16.5 (25.9)	C (D)	0.14 (0.19)
			right	10.4 (10.1)	B (B)	0.12 (0.08)
10	Cloudleap Court & Tamar Drive	Control Type		Signal		
		Eastbound	Overall	6.0 (8.5)	A (A)	0.21 (0.32)
			through	6.0 (8.5)	A (A)	0.21 (0.32)
			right			
		Westbound	Overall	3.3 (4.1)	A (A)	0.18 (0.32)
			left	3.1 (3.6)	A (A)	0.03 (0.11)
			through	3.3 (4.2)	A (A)	0.18 (0.32)
		Northbound	Overall	17.9 (18.4)	B (B)	0.22 (0.24)
			left	18.2 (18.8)	B (B)	0.22 (0.24)
			right	17.4 (17.8)	B (B)	0.03 (0.03)
11	Foreland Garth & Tamar Drive	Control Type		Stop (T Int)		
		Eastbound	Overall	0.0 (0.0)	A (A)	0.14 (0.19)
			through-right	0.0 (0.0)	A (A)	0.14 (0.19)
		Westbound	Overall	1.2 (0.9)	A (A)	0.24 (0.45)
			left	8.3 (8.7)	A (A)	0.06 (0.08)
			through	0.0 (0.0)	A (A)	0.24 (0.45)
		Northbound	Overall	13.8 (27.7)	B (D)	0.13 (0.39)
			left	21.1 (56.4)	C (F)	0.13 (0.39)
			right	9.8 (10.1)	A (B)	0.07 (0.09)
12	Tamar Drive & Airbrink Lane	Control Type		Stop (T Int)		
		Eastbound	Overall	0.3 (0.3)	A (A)	0.16 (0.20)
			left	0.9 (0.9)	A (A)	0.01 (0.02)
			through			
		Westbound	Overall	0.0 (0.0)	A (A)	0.27 (0.47)
			through-right	0.0 (0.0)	A (A)	0.27 (0.47)
		Southbound	Overall	13.3 (18.8)	B (C)	0.07 (0.09)
			left-right	13.3 (18.8)	B (C)	0.07 (0.09)
13	Old Dobbin Lane & Tamar Drive	Control Type		Signal		
		Eastbound	Overall	12.3 (16.6)	B (B)	0.27 (0.43)
			through-right	12.3 (16.6)	B (B)	0.27 (0.43)
		Westbound	Overall	4.0 (7.9)	A (A)	0.34 (0.44)
			left	4.0 (7.3)	A (A)	0.34 (0.35)
			through	4.0 (8.2)	A (A)	0.31 (0.44)
		Northbound	Overall	19.4 (18.6)	B (B)	0.27 (0.64)
			left	19.9 (21.1)	B (C)	0.27 (0.64)
			right	18.8 (16.2)	B (B)	0.04 (0.21)
14	Tamar Drive & Autumn Ridge Drive	Control Type		Stop (T Int)		
		Eastbound	Overall	0.3 (0.6)	A (A)	0.11 (0.25)
			left	0.9 (1.6)	A (A)	0.01 (0.04)
			through			
		Westbound	Overall	0.0 (0.0)	A (A)	0.36 (0.38)
			through-right	0.0 (0.0)	A (A)	0.36 (0.38)
		Southbound	Overall	15.3 (16.1)	C (C)	0.10 (0.06)
			left-right	15.3 (16.1)	C (C)	0.10 (0.06)
15	Tamar Drive & Stonecutter Road	Control Type		Stop (T Int)		
		Eastbound	Overall	0.3 (0.8)	A (A)	0.12 (0.24)
			left	0.8 (2.2)	A (A)	0.01 (0.05)
			through			
		Westbound	Overall	0.0 (0.0)	A (A)	0.37 (0.44)
			through-right	0.0 (0.0)	A (A)	0.37 (0.44)
		Southbound	Overall	19.7 (24.1)	C (C)	0.30 (0.18)
			left	21.0 (27.5)	C (D)	0.30 (0.18)
			right	13.7 (14.5)	B (B)	0.05 (0.03)
16	Snowden River Parkway & Tamar Drive	Control Type		Signal		
		Overall		29.8 (40.8)	C (D)	0.70 (0.76)
		Eastbound	Overall	49.5 (74.1)	D (E)	0.59 (0.81)
			left	52.9 (81.1)	D (F)	0.59 (0.81)
			left-through-right	47.7 (70.5)	D (E)	0.38 (0.76)
		Westbound	Overall	52.2 (75.1)	D (E)	0.44 (0.60)
			left	53.6 (78.0)	D (E)	0.44 (0.60)
			through-right	51.5 (73.6)	D (E)	0.29 (0.56)
		Northbound	Overall	19.1 (34.0)	B (C)	0.43 (0.76)
			left	56.7 (80.5)	E (F)	0.43 (0.69)
			through-right	15.6 (30.2)	B (C)	0.27 (0.76)
		Southbound	Overall	26.5 (28.0)	C (C)	0.81 (0.59)
			left	59.0 (83.0)	E (F)	0.37 (0.59)
			through	28.3 (26.9)	C (C)	0.81 (0.50)
			right	18.5 (23.6)	B (C)	0.35 (0.30)

Table 5: Existing conditions queueing analysis summary

Tamar Road - Road Diet Study
95th Percentile Queue Length (ft) - AM (PM)

Node	Cross-Street	Approach	Movement	Existing Conditions
1	Flamepool Way	Eastbound	LTR	25 (75)
			LT	- -
			TR	- -
		Westbound	LTR	25 (25)
		Northbound	LT	25 (0)
			R	25 (25)
		Southbound	LTR	50 (50)
2	Lambskin Lane/ Flicker Place	Eastbound	LTR	0 (25)
			LT	- -
			R	- -
		Westbound	LTR	25 (75)
			L	- -
			TR	- -
		Northbound	LTR	75 (0)
		Southbound	LTR	25 (25)
3	Blue Pool	Eastbound	LT	0 (50)
			L	- -
			T	- -
		Westbound	TR	0 (0)
		Southbound	LR	50 (50)
4	Phelps Luck Drive	Eastbound	LT	75 (150)
			L	- -
			T	- -
		Westbound	TR	25 (25)
		Southbound	L	50 (75)
			R	100 (100)
5	Sweet Wind Place	Eastbound	LT	25 (50)
			L	- -
			T	- -
		Westbound	TR	25 (0)
		Southbound	LR	50 (50)
6	High Tor Hill	Eastbound	LT	50 (75)
			L	- -
			T	- -
		Westbound	TR	25 (25)
		Southbound	L	75 (100)
			R	75 (50)
7	Spiral Cut	Eastbound	TR	25 (25)
		Westbound	LT	25 (50)
			L	- -
			T	- -
		Northbound	LR	50 (50)
8	8810-8860 Driveway	Eastbound	LT	50 (50)
			L	- -
			T	- -
		Westbound	TR	25 (25)
		Southbound	LR	50 (50)

Tamar Road - Road Diet Study
95th Percentile Queue Length (ft) - AM (PM)

9	Hayshed Lane	Eastbound	LT	50 (75)
			L	- -
			T	- -
		Westbound	TR	25 (25)
		Southbound	L	50 (50)
			R	50 (50)
10*	Cloudleap Court	Eastbound	TR	50 (100)
			T	- -
			R	- -
		Westbound	L	75 (50)
			T	75 (100)
		Northbound	L	75 (75)
			R	50 (50)
11	Foreland Garth	Eastbound	TR	25 (25)
		Westbound	L	50 (50)
			T	0 (25)
		Northbound	L	50 (50)
			R	50 (50)
12	Airbrink Lane	Eastbound	LT	50 (50)
			L	- -
			T	- -
		Westbound	TR	25 (50)
		Northbound	LR	50 (50)
13*	Old Dobbin Lane	Eastbound	TR	100 (150)
		Westbound	L	100 (150)
			T	100 (200)
		Northbound	L	75 (175)
			R	50 (125)
14	Autumn Ridge Drive	Eastbound	LT	25 (50)
			L	- -
			T	- -
		Westbound	TR	0 (25)
		Southbound	LR	50 (25)
15	Stonecutter Road	Eastbound	LT	25 (75)
			L	- -
			T	- -
		Westbound	TR	0 (25)
		Southbound	L	75 (50)
			R	50 (50)
16*	Snowden River Parkway	Eastbound	L	200 (300)
			LTR	225 (300)
		Westbound	L	125 (175)
			TR	125 (225)
		Northbound	L	100 (325)
			TR	175 (500)
		Southbound	L	200 (125)
			T	750 (325)
			R	425 (125)

*Signalized intersection

L-Left
T-Through
R-Right

2.5 On-street Parking

Generally, on-street parking is not allowed along Tamar Drive.

2.6 Community Feedback prior to Concept Development

A public meeting was conducted on January 3, 2019 to discuss the project goals and solicit feedback from the community on specific transportation-related needs. A summary of the comments received include:

- There is a need for additional pedestrian crossings across Tamar Drive.
  - An additional crossing of Tamar Drive at Phelps Luck was highlighted as specific need.
- Cars travel too fast along Tamar Drive.
- Tamar Drive utilized as a cut-through road to avoid MD 175.
- There was a desire to have crosswalks installed at all four legs of the intersection of Tamar Drive at Snowden River Parkway.
- The timing of the traffic signal at the intersection of Tamar Drive at Snowden River Parkway is long, resulting in lengthy delays at the eastbound approach.
- Bus service was too infrequent and additional bus shelters are needed.
- A bike lane is needed; on-road cycling is uncomfortable.
- Tamar Drive is generally not a congested roadway.

3 Road Diet Alternative

A road diet involves reducing the number of general travel lanes along a roadway segment through the use of re-striping – often when it gets re-surfaced. Common road diets involve reducing a four-lane roadway to a three-lane roadway, with the remaining space repurposed for parking or bike lanes. Road diets provide traffic calming on streets that have extra vehicle capacity. This extra capacity often results in aggressive driving and speeding. Road diets can also reduce the crossing distance for pedestrians and provide opportunity for midblock pedestrian refuge island that break up a crossing for added safety.

For more information, see https://safety.fhwa.dot.gov/road_diets/.

3.1 Alternatives Development and Preferred Option Design Elements

Based on the infrastructure needs and community responses, the following specific objectives were incorporated into the conceptual design:

- Increase pedestrian crossings across Tamar Drive.
- Provide dedicated bike facilities – either marked on-road bike lanes or a wide side path.
- Provide pedestrian median refuges where feasible.
- Calm traffic along Tamar Drive.
- Provide trail connections where pedestrian generators are expected.

A preliminary cross section for Tamar Drive was developed among Planning and Engineering Staff, shown in Figure 7 to address these objectives. This cross-section restripes the existing four lane section into a three-lane section, with a travel lane in each direction, a two-way center left-turn lane, and curbside bike lanes in each direction. Providing on-street parking was not considered for the typical cross section, due to lack of demand.

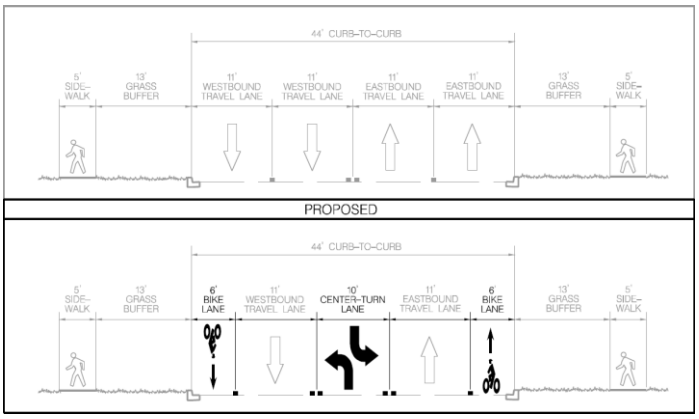

Figure 7: Existing and proposed typical cross-section for Tamar Drive

A rendering of the proposed layout is shown in Figure 8.

Figure 8: Rendering showing the proposed street lane layout

A conceptual plan (10% Design) was developed utilizing this cross section. These conceptual plans can be found in Appendix E. Additional design elements included in these conceptual plans include:

A. New pedestrian crossings, with median refuge, at:
    a. High Tor Hill.
    b. Autumn Ridge Drive.
B. Use of green paint to delineate and highlight bike crossings through select intersections
C. Bike lane terminations.
    a. Option for terminating on-road bike lanes with a side path at the eastern project limits.

The following subsections of this report provide additional details and design assumptions.

3.1.1 Terminating the Bike Lanes

Terminating bikes prior to an intersection can often present design challenges, particularly when a road diet does not extend completely to a major intersection. Along the limits of the project area, the road diet typical section was terminated as follows:

- Western Limits, between Flamepool Way and Flicker Place
  - The proposed typical section with 3 general travel lanes and 2 curbside bike lanes would terminate at Flicker Place.
  - Between Flamepool Way and Flicker Place, the westbound travel direction would have a single travel lane and a buffered bike; the eastbound direction would have a single travel lane and right turn lane drop at Flicker Place. See Figure 9.
- Eastern Limits, west of Snowden River Parkway
  - Under Option 1, the proposed typical section terminates at Stonecutter Road, just west of Snowden River Parkway. The westbound bike lane begins at Stonecutter Road, while the eastbound bike lane terminates with a curb cut and bike ramp to the adjacent sidewalk (cyclists can still take the travel lane, but Howard County permits riding bikes on the sidewalk). See Figure 10.
  - Under Option 2, both the eastbound and westbound bike lanes begin and end at Autumn Ridge Drive, where a pedestrian/bike pedestrian crossing and median refuge is proposed. From Autumn Ridge to Snowden River Parkway, cyclists would use a new side path that connects the trails at the intersection of Tamar/Snowden River Parkway. See Figure 11.

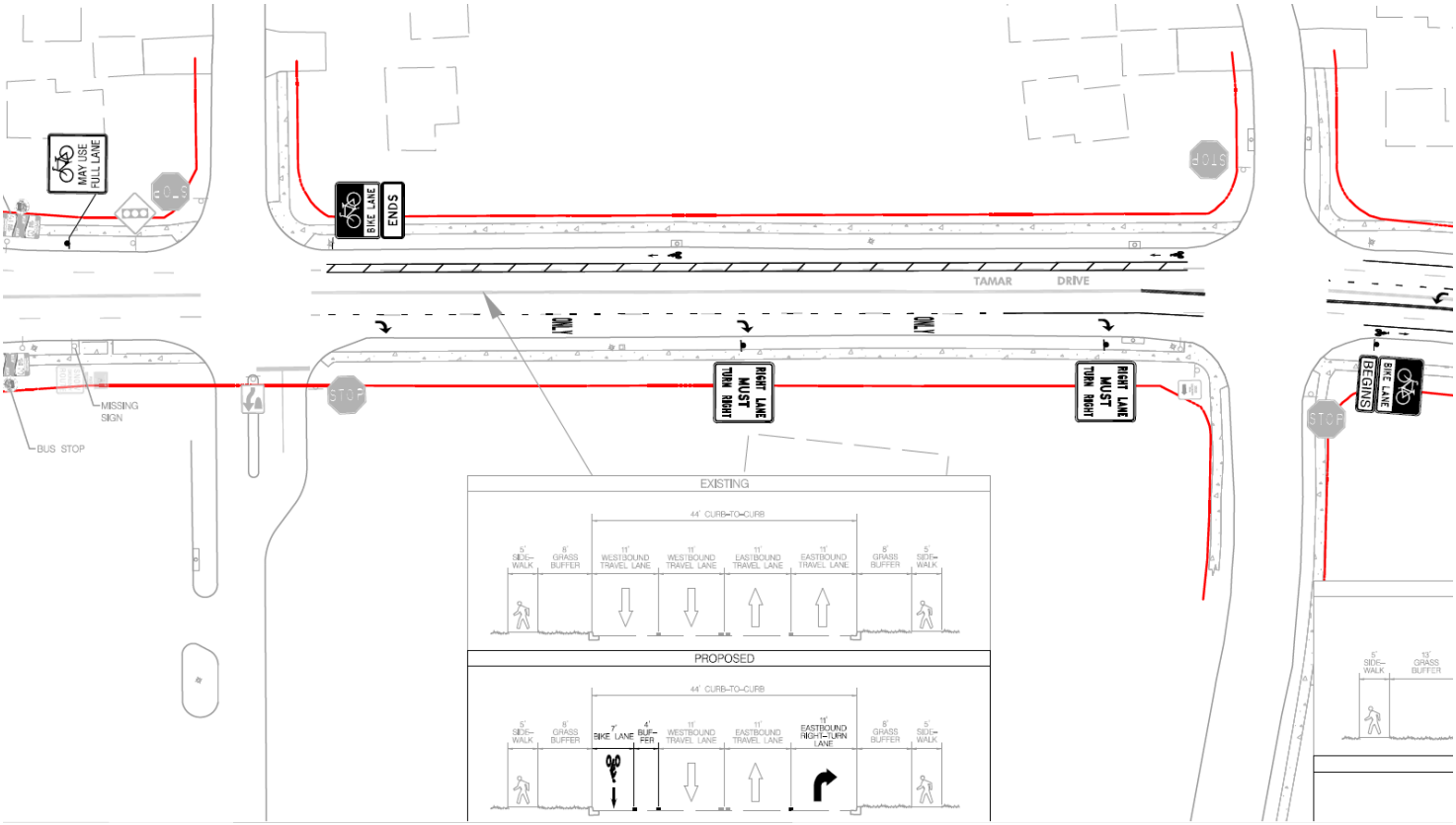

Figure 9: Bike lane termination and beginning at the western project limits

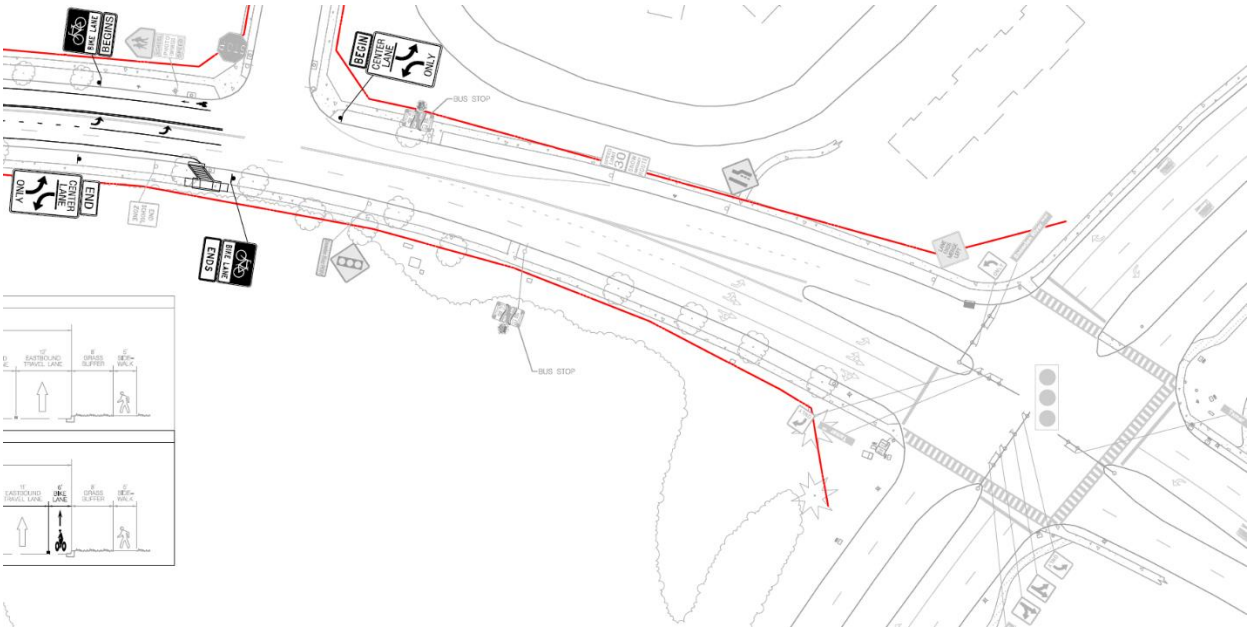

Figure 10: Option 1, eastbound bike lane ends with curb cut and bike ramp to sidewalk

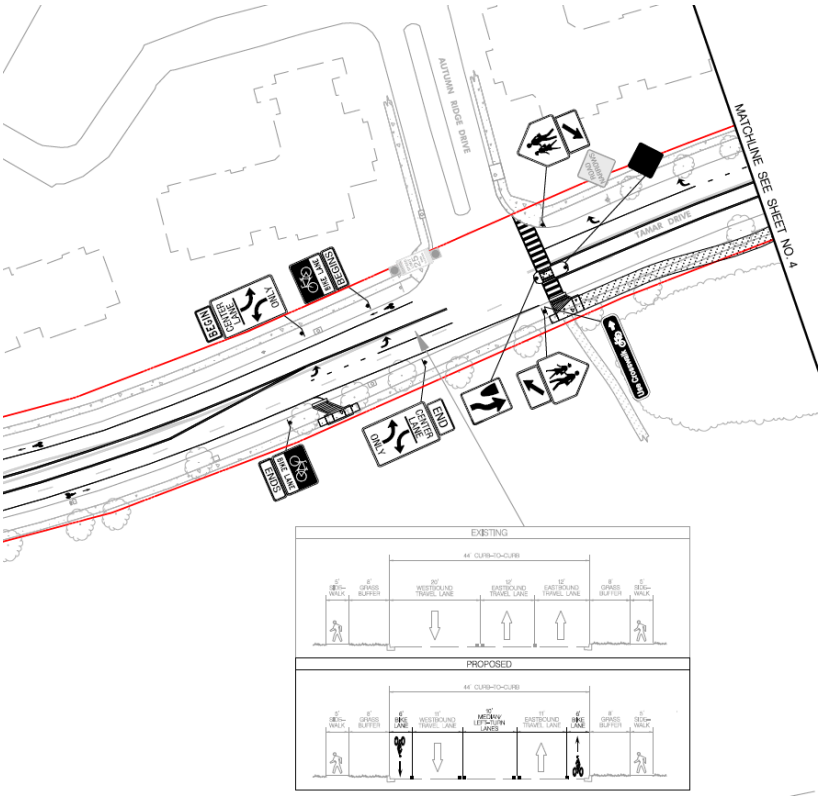

Figure 11: Option 2, both bike lanes begin and end with a curb cut and side trail at Autumn Ridge

A field survey was conducted, showing that a side path can be implemented within County ROW; periodically jogging the trail slightly allows it to avoid utilities and mature trees. The layout of the side path is shown in the plan view set of drawings (appendix E).

3.1.2 Proposed Pedestrian Crossings and Refuge Medians

Two new pedestrian crossings are proposed for this corridor:

- at High Tor Hill.
- at Autumn Ridge Drive.

Both of these locations are T-intersections, which allow for a curbed pedestrian refuge in the center-median turn lane. Figure 12 shows the location of the proposed pedestrian crossing and median refuge. This crossing aligns with the existing Columbia Association trail to the south.

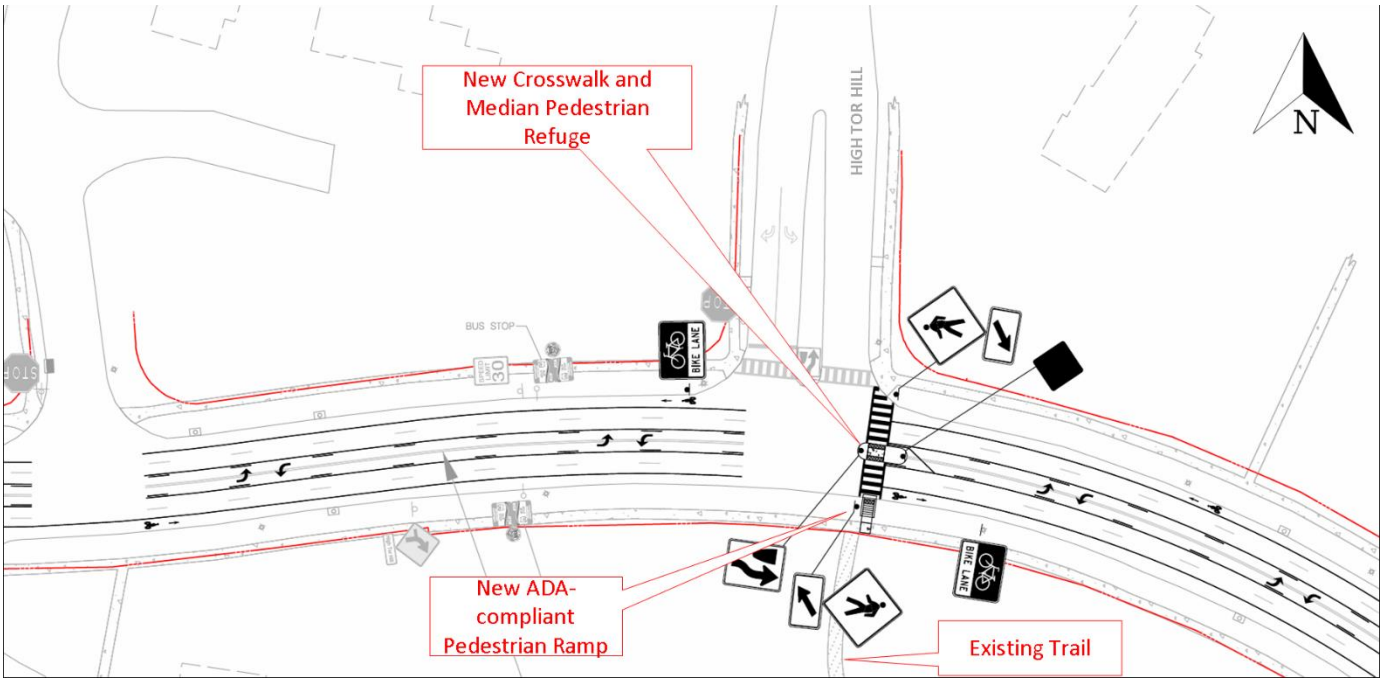

Figure 12: New crossing at High Tor Hill

Similarly, Figure 13 shows a new proposed pedestrian crossing and median refuge. This crossing aligns with the existing trail to the south that leads to Long Reach High School.

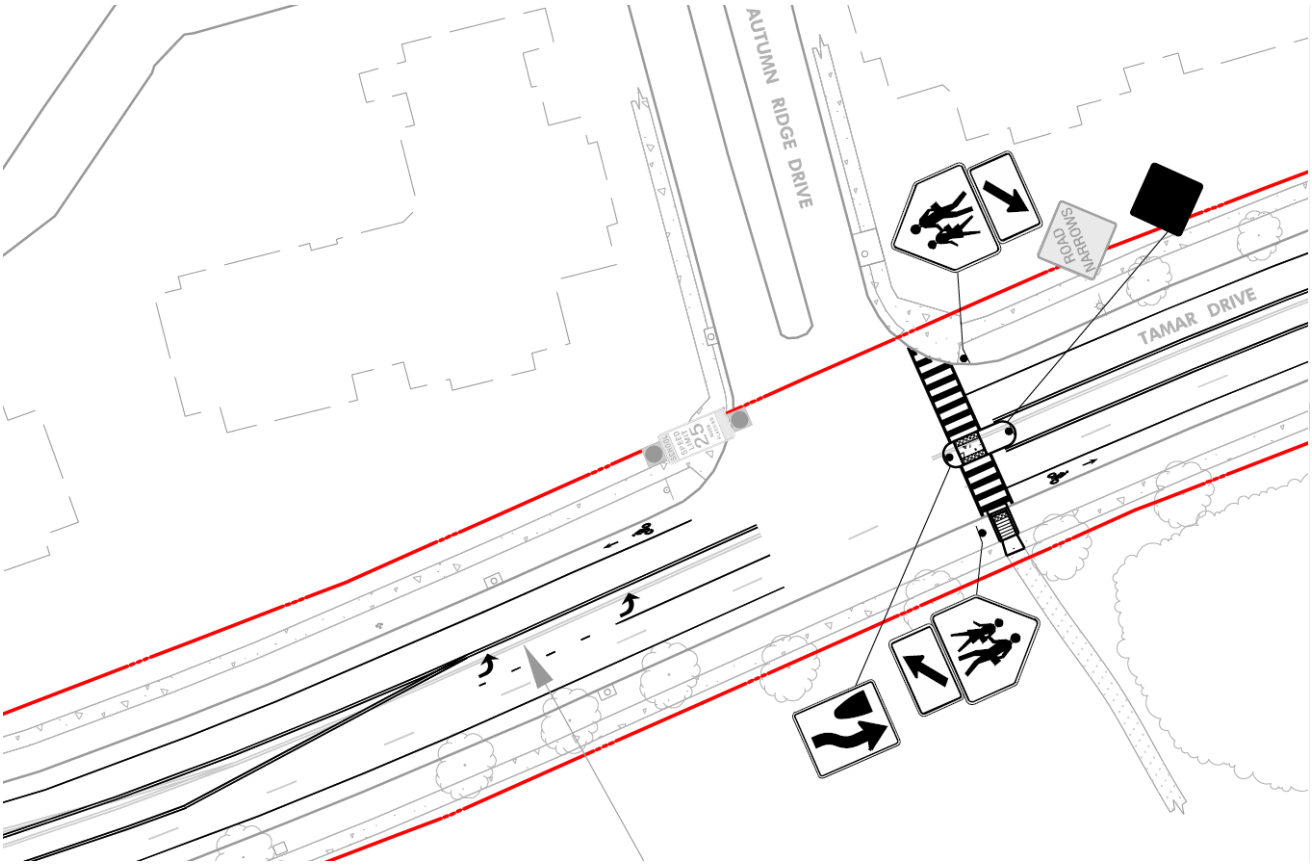

Figure 13: Proposed pedestrian refuge and marked crossing at Autumn Ridge Drive (Option 1 bike lane termination)

Consideration was initially given to an additional at-grade pedestrian crossing at Phelps Luck, however, there are two below-grade trail crossings, each about 300 feet to the east and to the west of the road, respectively, that are part of the Columbia Association trail network.

3.1.3 Green Paint through Select Intersections

Additionally, green paint was proposed to highlight the eastbound bike lane through the intersection of Cloudleap Court at Tamar Drive. This intersection is proposed to have a short westbound right turn pocket, where motorists will be required to yield to cyclists. Providing a green bike crosswalk through the intersection helps drivers and cyclists stay aligned within the road so that they do not cross into each other's designated lanes. See Figure 14.

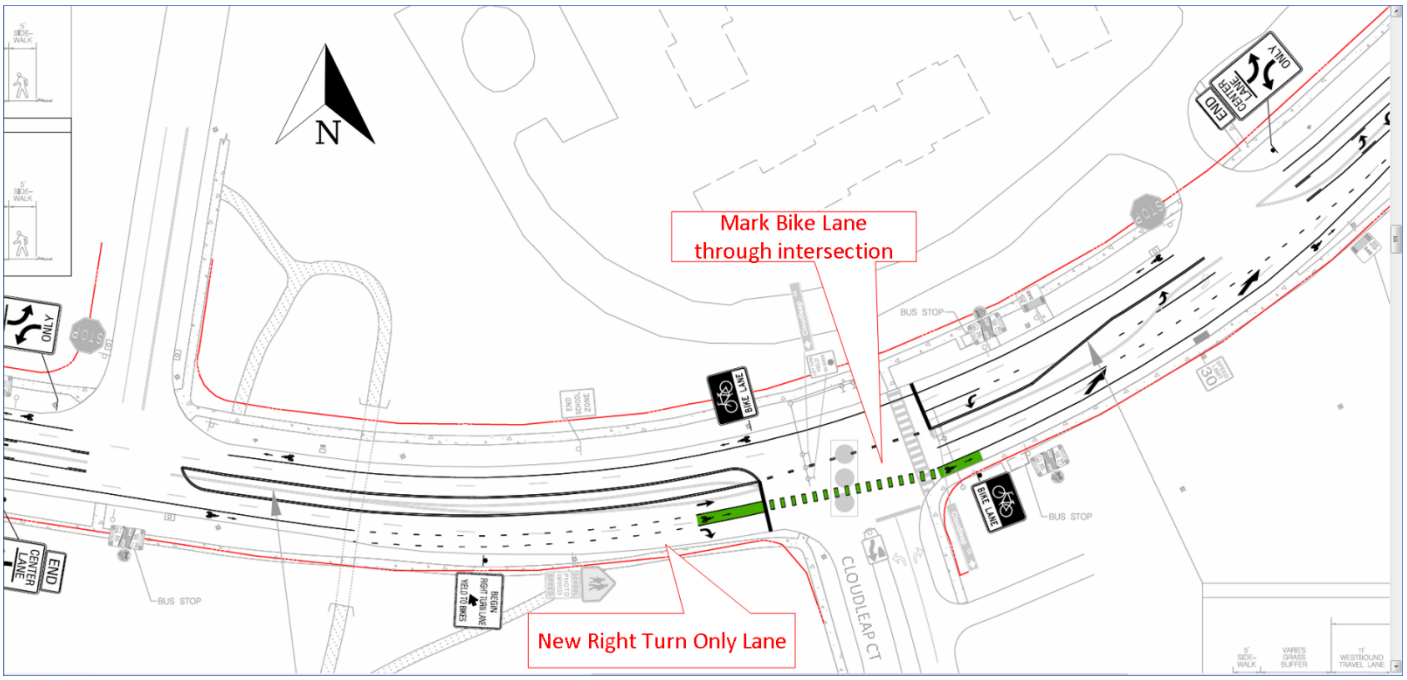

Figure 14: How bike lanes are proposed through the Cloudleap Court

3.2 Traffic Analysis of Preferred Option

Road Diet Analysis

To perform a capacity analysis of the proposed road diet conditions, the existing AM and PM peak Synchro models were updated with the proposed geometry and lane configurations to reflect the road diet alternative. No changes to signal timing, signal phasing, or turning movement volumes were assumed under this baseline "build" condition.

Table 6 compares the HCM analysis performed under existing traffic conditions to the build conditions.

The results of the static capacity analysis reveal that the corridor will continue to operate below capacity under the proposed build conditions. The only degradation to failing LOS due to the build conditions is the side street left turn movement from Lambskin Lane. Further west along the corridor the introduction of a two-way left turn lane mitigated failing stop-controlled movements at Phelps Luck Drive and Foreland Garth with the ability of drivers to perform two stage left turn movements. Operations at Tamar Drive and Snowden River Parkway are not expected to change. Detailed HCM reports of the Build Condition are provided in Appendix D.

Travel time runs were conducted, by vehicle, in the AM and PM commuting hours. The vehicle runs indicated that the time to travel between Flamepool Way and Snowden River Parkway is about 2 minutes and 36 seconds for each direction. This travel time equates to about 30.4 mph throughout the corridor, including stopping for any red traffic signals at Cloudleap Court and Old Dobbin Road.

Several factors influence travel time, including the volume vehicles on the road, the traffic control devices (e.g. the percentage of green time, within a traffic signal cycle, provided to the main road in a sign), and the availability of turn lanes to prevent left-turning vehicles from blocking through traffic along a main road. A general rule of thumb is that a two-lane suburban roadway with turn lanes can accommodate about 20,000 cars per day. This compares to the 11,900 cars per day along the four lanes of Tamar Drive. Accordingly, if Tamar Drive were a two-lane roadway with turn lanes, it would still be well under capacity.

By adding left-turn lanes at intersections where there are none, less through traffic will be delayed. While the proposed road diet will have left turn lanes at all intersections, currently left turn lanes are located only at Old Dobbin Road and at Cloudleap Court. The approach to Old Dobbin with the left turn lane only has one westbound through lane, currently. This is similar to the proposed road diet condition.

Finally, an estimate of the travel time was conducted based on the proposed typical section, without any changes to existing traffic signal timing. The travel time for the entire corridor with the proposed road diet is expected to increase by only about 12 seconds. This is due to the fact that: 1) the roadway is currently well under capacity; 2) the left turning movements that currently block through travel lanes will be allocated a dedicated left turning lane; and 3) there is localized area of congestion within the affected study limits that will be impacted by the proposed road diet. Table 7 compares the existing and build condition queuing analysis results. The results of the queuing analysis indicate no major changes in queue length under the proposed road diet conditions. Detailed queuing reports for the Build Condition are in Appendix D.

Table 6: Build condition capacity analysis summary

Node	Intersection	Approach	Movement	Existing Conditions AM (PM)			Option 1 AM (PM)		
				Delay (sec)	LOS	V/C	Delay (sec)	LOS	V/C
1	Flamepool Way & Tamar Drive	Control Type		Stop (2-Way)			Stop (2-Way)		
		Eastbound	Overall	0.3 (0.4)	A (A)	0.10 (0.23)	0.3 (0.4)	A (A)	0.10 (0.23)
			left-through-right	0.5 (0.8)	A (A)	0.01 (0.02)	0.5 (0.8)	A (A)	0.01 (0.02)
		Westbound	Overall	0.0 (0.1)	A (A)	0.25 (0.21)	0.0 (0.1)	A (A)	0.00 (0.00)
			left-through-right	0.1 (0.2)	A (A)	0.00 (0.00)	0.0 (0.1)	A (A)	0.00 (0.00)
		Northbound	Overall	15.7 (9.9)	C (A)	0.02 (0.01)	23.1 (25.0)	C (C)	0.04 (0.02)
			left-through	20.8 (-)	C (-)	0.02 (-)	23.1 (-)	C (-)	0.04 (-)
			right	9.3 (9.9)	A (A)	0.00 (0.01)	- (-)	- (-)	- (-)
		Southbound	Overall	13.5 (17.4)	B (C)	0.07 (0.06)	19.6 (19.9)	C (C)	0.12 (0.07)
			left-right	13.5 (17.4)	B (C)	0.07 (0.06)	- (-)	- (-)	- (-)
2	Lambskin Lane/Flicker Place & Tamar Drive	Control Type		Stop (2-Way)			Stop (2-Way)		
		Eastbound	Overall	0.0 (0.1)	A (A)	0.10 (0.25)	0.0 (0.1)	A (A)	0.19 (0.03)
			left-through	- (0.2)	- (A)	- (0.01)	0.0 (0.2)	A (A)	0.01 (0.01)
			right				0.0 (0)	A (A)	0.01 (0.03)
		Westbound	Overall	0.3 (0.6)	A (A)	0.24 (0.21)	0.2 (0.4)	A (A)	0.47 (0.43)
			left	0.5 (1.1)	A (A)	0.02 (0.04)	8.0 (9.8)	A (A)	0.02 (0.04)
			through-right				0.0 (0.0)	A (A)	0.47 (0.43)
		Northbound	Overall	16.1 (30.0)	C (D)	0.14 (0.30)	25.0 (62.7)	D (F)	0.22 (0.51)
			left-right	16.1 (30.0)	C (D)	0.14 (0.30)	25.0 (62.7)	D (F)	0.22 (0.51)
		Southbound	Overall	11.0 (21.6)	B (C)	0.00 (0.02)	14.3 (35.9)	B (E)	0.01 (0.03)
			left-right	- (21.6)	- (C)	- (0.02)	- (35.9)	- (E)	- (0.03)
3	Tamar Drive & Blue Pool	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.0 (0.1)	A (A)	0.14 (0.31)	0.0 (0.1)	A (A)	0.21 (0.47)
			left	0.1 (0.4)	A (A)	0.00 (0.01)	9.5 (9.3)	A (A)	0.00 (0.01)
			through				0.0 (0.0)	A (A)	0.21 (0.47)
		Westbound	Overall	0.0 (0.0)	A (A)	0.32 (0.30)	0.0 (0.0)	A (A)	0.49 (0.45)
			through-right	0.0 (0.0)	A (A)	0.32 (0.30)	0.0 (0.0)	A (A)	0.49 (0.45)
		Southbound	Overall	13.4 (17.8)	B (C)	0.04 (0.04)	17.0 (25.0)	C (C)	0.06 (0.07)
			left-right	13.4 (17.8)	B (C)	0.04 (0.04)	17.0 (25.0)	C (C)	0.06 (0.07)
4	Tamar Drive & Phelps Luck Drive	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	3.4 (4.6)	A (A)	0.12 (0.30)	3.2 (3.9)	A (A)	0.14 (0.30)
			left	6.1 (7.8)	A (A)	0.12 (0.30)	9.1 (10.3)	A (B)	0.12 (0.30)
			through				0.0 (0.0)	A (A)	0.14 (0.28)
		Westbound	Overall	0.0 (0.0)	A (A)	0.21 (0.20)	0.0 (0.0)	A (A)	0.33 (0.36)
			through-right	0.0 (0.0)	A (A)	0.21 (0.20)	- (0.0)	- (A)	- (0.36)
		Southbound	Overall	14.5 (31.6)	B (D)	0.42 (0.67)	19.3 (19.2)	C (C)	0.56 (0.42)
			left	22.4 (96.9)	C (F)	0.13 (0.67)	13.9 (27.8)	B (D)	0.07 (0.29)
			right	13.6 (12.6)	B (B)	0.42 (0.32)	19.9 (16.7)	C (C)	0.56 (0.42)
5	Tamar Drive & Sweet Wind Place	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.4 (0.5)	A (A)	0.10 (0.21)	0.4 (0.4)	A (A)	0.15 (0.32)
			left	1.2 (1.4)	A (A)	0.01 (0.03)	8.6 (8.9)	A (A)	0.01 (0.03)
			through				0.0 (0.0)	A (A)	0.15 (0.32)
		Westbound	Overall	0.0 (0.0)	A (A)	0.21 (0.24)	0.0 (0.0)	A (A)	0.32 (0.38)
			through-right	0.0 (0.0)	A (A)	0.21 (0.24)	0.0 (0.0)	A (A)	0.32 (0.38)
		Southbound	Overall	11.9 (15.2)	B (C)	0.08 (0.10)	12.3 (13.8)	B (B)	0.09 (0.08)
			left-right	11.9 (15.2)	B (C)	0.08 (0.10)	12.3 (13.8)	B (B)	0.09 (0.08)
6	Tamar Drive & High Tor Hill	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.8 (1.4)	A (A)	0.10 (0.19)	0.8 (1.1)	A (A)	0.14 (0.28)
			left	2.2 (3.3)	A (A)	0.02 (0.08)	8.7 (9.5)	A (A)	0.02 (0.08)
			through				0.0 (0.0)	A (A)	0.14 (0.28)
		Westbound	Overall	0.0 (0.0)	A (A)	0.18 (0.23)	0.0 (0.0)	A (A)	0.34 (0.44)
			through-right	0.0 (0.0)	A (A)	0.18 (0.23)	0.0 (0.0)	A (A)	0.34 (0.44)
		Southbound	Overall	15.5 (30.2)	C (D)	0.29 (0.48)	13.1 (16.6)	B (C)	0.20 (0.26)
			left	18.7 (37.0)	C (E)	0.29 (0.48)	13.5 (17.7)	B (C)	0.20 (0.26)
			right	10.7 (11.1)	B (B)	0.10 (0.06)	12.5 (13.5)	B (B)	0.13 (0.08)
7	Spiral Cut & Tamar Drive	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.0 (0.0)	A (A)	0.13 (0.20)	0.0 (0.0)	A (A)	0.21 (0.32)
			through-right	0.0 (0.0)	A (A)	0.13 (0.20)	0.0 (0.0)	A (A)	0.21 (0.32)
		Westbound	Overall	0.1 (0.5)	A (A)	0.21 (0.27)	0.1 (0.4)	A (A)	0.32 (0.40)
			left	0.4 (1.5)	A (A)	0.01 (0.03)	8.0 (8.6)	A (A)	0.01 (0.03)
			through				0.0 (0.0)	A (A)	0.32 (0.40)
		Northbound	Overall	12.3 (14.3)	B (B)	0.11 (0.09)	11.8 (13.3)	B (B)	0.10 (0.08)
			left-right	12.3 (14.3)	B (B)	0.11 (0.09)	11.8 (13.3)	B (B)	0.10 (0.08)
8	Tamar Drive & 8810-8860 Driveway	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.5 (0.5)	A (A)	0.14 (0.22)	0.4 (0.4)	A (A)	0.21 (0.32)
			left	1.3 (1.4)	A (A)	0.02 (0.03)	8.6 (9.8)	A (A)	0.02 (0.03)
			through				0.0 (0.0)	A (A)	0.21 (0.32)
		Westbound	Overall	0.0 (0.0)	A (A)	0.21 (0.29)	0.0 (0.0)	A (A)	0.32 (0.46)
			through-right	0.0 (0.0)	A (A)	0.21 (0.29)	- (0.0)	- (A)	- (0.46)
		Southbound	Overall	13.4 (19.5)	B (C)	0.10 (0.13)	12.7 (15.7)	B (C)	0.09 (0.10)
			left-right	13.4 (19.5)	B (C)	0.10 (0.13)	12.7 (15.7)	B (C)	0.09 (0.10)

Node	Intersection	Approach	Movement	Existing Conditions AM (PM)			Option 1 AM (PM)		
				Delay (sec)	LOS	V/C	Delay (sec)	LOS	V/C
9	Tamar Drive & Hayshed Lane	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.8 (1.7)	A (A)	0.13 (0.18)	0.7 (1.5)	A (A)	0.20 (0.27)
			left	2.1 (3.9)	A (A)	0.03 (0.09)	8.4 (10.0)	A (B)	0.03 (0.10)
			through				0.0 (0.0)	A (A)	0.20 (0.27)
		Westbound	Overall	0.0 (0.0)	A (A)	0.17 (0.27)	0.0 (0.0)	A (A)	0.28 (0.44)
			through-right	0.0 (0.0)	A (A)	0.17 (0.27)	0.0 (0.0)	A (A)	0.28 (0.44)
		Southbound	Overall	12.6 (16.6)	B (C)	0.14 (0.19)	12.1 (15.2)	B (C)	0.15 (0.13)
			left	16.5 (25.9)	C (D)	0.14 (0.19)	12.1 (15.2)	B (C)	0.15 (0.13)
			right	10.4 (10.1)	B (B)	0.12 (0.08)	- (-)	- (-)	- (-)
10	Cloudleap Court & Tamar Drive	Control Type		Signal			Signal		
		Eastbound	Overall	6.0 (8.5)	A (A)	0.21 (0.32)	6.4 (8.8)	A (A)	0.36 (0.48)
			through	6.0 (8.5)	A (A)	0.21 (0.32)	6.5 (9.1)	A (A)	0.36 (0.48)
			right				5.0 (6.3)	A (A)	0.02 (0.03)
		Westbound	Overall	3.3 (4.1)	A (A)	0.18 (0.32)	3.8 (5.5)	A (A)	0.34 (0.58)
			left	3.1 (3.6)	A (A)	0.03 (0.11)	3.0 (3.9)	A (A)	0.02 (0.11)
			through	3.3 (4.2)	A (A)	0.18 (0.32)	3.8 (5.7)	A (A)	0.34 (0.58)
		Northbound	Overall	17.9 (18.4)	B (B)	0.22 (0.24)	19.1 (22.0)	B (C)	0.23 (0.27)
			left	18.2 (18.8)	B (B)	0.22 (0.24)	19.5 (22.5)	B (C)	0.23 (0.27)
			right	17.4 (17.8)	B (B)	0.03 (0.03)	18.5 (21.2)	B (C)	0.03 (0.03)
11	Foreland Garth & Tamar Drive	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.0 (0.0)	A (A)	0.14 (0.19)	0.0 (0.0)	A (A)	0.24 (0.31)
			through-right	0.0 (0.0)	A (A)	0.14 (0.19)	0.0 (0.0)	A (A)	0.24 (0.31)
		Westbound	Overall	1.2 (0.9)	A (A)	0.24 (0.45)	1.2 (0.9)	A (A)	0.24 (0.45)
			left	8.3 (8.7)	A (A)	0.06 (0.08)	8.3 (8.9)	A (A)	0.06 (0.09)
			through	0.0 (0.0)	A (A)	0.24 (0.45)	0.0 (0.0)	A (A)	0.24 (0.45)
		Northbound	Overall	13.8 (27.7)	B (D)	0.13 (0.39)	11.4 (14.3)	B (B)	0.09 (0.14)
			left	21.1 (56.4)	C (F)	0.13 (0.39)	11.4 (14.3)	B (B)	0.09 (0.14)
			right	9.8 (10.1)	A (B)	0.07 (0.09)	- (-)	- (-)	- (-)
12	Tamar Drive & Airbrink Lane	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.3 (0.3)	A (A)	0.16 (0.20)	0.3 (0.3)	A (A)	0.23 (0.30)
			left	0.9 (0.9)	A (A)	0.01 (0.02)	8.4 (9.7)	A (A)	0.01 (0.02)
			through				0.0 (0.0)	A (A)	0.23 (0.30)
		Westbound	Overall	0.0 (0.0)	A (A)	0.27 (0.47)	0.0 (0.0)	A (A)	0.27 (0.47)
			through-right	0.0 (0.0)	A (A)	0.27 (0.47)	0.0 (0.0)	A (A)	0.27 (0.47)
		Southbound	Overall	13.3 (18.8)	B (C)	0.07 (0.09)	11.7 (15.1)	B (C)	0.06 (0.07)
			left-right	13.3 (18.8)	B (C)	0.07 (0.09)	11.7 (15.1)	B (C)	0.06 (0.07)
13	Old Dobbin Lane & Tamar Drive	Control Type		Signal			Signal		
		Eastbound	Overall	12.3 (16.6)	B (B)	0.27 (0.43)	15.4 (24.6)	B (C)	0.61 (0.77)
			through-right	12.3 (16.6)	B (B)	0.27 (0.43)	- (24.6)	- (C)	- (0.77)
		Westbound	Overall	4.0 (7.9)	A (A)	0.34 (0.44)	4.2 (8.0)	A (A)	0.37 (0.41)
			left	4.0 (7.3)	A (A)	0.34 (0.35)	4.8 (9.0)	A (A)	0.37 (0.40)
			through	4.0 (8.2)	A (A)	0.31 (0.44)	3.8 (7.6)	A (A)	0.30 (0.41)
		Northbound	Overall	19.4 (18.6)	B (B)	0.27 (0.64)	20.9 (23.1)	C (C)	0.28 (0.70)
			left	19.9 (21.1)	B (C)	0.27 (0.64)	21.4 (26.8)	C (C)	0.28 (0.70)
			right	18.8 (16.2)	B (B)	0.04 (0.21)	20.2 (19.5)	C (B)	0.04 (0.22)
14	Tamar Drive & Autumn Ridge Drive	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.3 (0.6)	A (A)	0.11 (0.25)	0.3 (0.5)	A (A)	0.17 (0.38)
			left	0.9 (1.6)	A (A)	0.01 (0.04)	8.8 (9.1)	A (A)	0.01 (0.04)
			through				0.0 (0.0)	A (A)	0.17 (0.38)
		Westbound	Overall	0.0 (0.0)	A (A)	0.36 (0.38)	0.0 (0.0)	A (A)	0.36 (0.38)
			through-right	0.0 (0.0)	A (A)	0.36 (0.38)	0.0 (0.0)	A (A)	0.36 (0.38)
		Southbound	Overall	15.3 (16.1)	C (C)	0.10 (0.06)	12.9 (13.6)	B (B)	0.08 (0.05)
			left-right	15.3 (16.1)	C (C)	0.10 (0.06)	12.9 (13.6)	B (B)	0.08 (0.05)
15	Tamar Drive & Stonecutter Road	Control Type		Stop (T Int)			Stop (T Int)		
		Eastbound	Overall	0.3 (0.8)	A (A)	0.12 (0.24)	0.3 (0.6)	A (A)	0.18 (0.36)
			left	0.8 (2.2)	A (A)	0.01 (0.05)	8.9 (9.5)	A (A)	0.01 (0.05)
			through				0.0 (0.0)	A (A)	0.18 (0.36)
		Westbound	Overall	0.0 (0.0)	A (A)	0.37 (0.44)	0.0 (0.0)	A (A)	0.37 (0.44)
			through-right	0.0 (0.0)	A (A)	0.37 (0.44)	0.0 (0.0)	A (A)	0.37 (0.44)
		Southbound	Overall	19.7 (24.1)	C (C)	0.30 (0.18)	14.1 (15.4)	B (C)	0.20 (0.10)
			left	21.0 (27.5)	C (D)	0.30 (0.18)	14.1 (15.4)	B (C)	0.20 (0.10)
			right	13.7 (14.5)	B (B)	0.05 (0.03)	- (-)	- (-)	- (-)
16	Snowden River Parkway & Tamar Drive	Control Type		Signal			Signal		
		Overall		29.8 (40.8)	C (D)	0.70 (0.76)	29.8 (40.8)	C (D)	0.70 (0.76)
		Eastbound	Overall	49.5 (74.1)	D (E)	0.59 (0.81)	49.5 (74.1)	D (E)	0.59 (0.81)
			left	52.9 (81.1)	D (F)	0.59 (0.81)	52.9 (81.1)	D (F)	0.59 (0.81)
			left-through-right	47.7 (70.5)	D (E)	0.38 (0.76)	47.7 (70.5)	D (E)	0.38 (0.76)
		Westbound	Overall	52.2 (75.1)	D (E)	0.44 (0.60)	52.2 (75.1)	D (E)	0.44 (0.60)
			left	53.6 (78.0)	D (E)	0.44 (0.60)	53.6 (78.0)	D (E)	0.44 (0.60)
			through-right	51.5 (73.6)	D (E)	0.29 (0.56)	51.5 (73.6)	D (E)	0.29 (0.56)
		Northbound	Overall	19.1 (34.0)	B (C)	0.43 (0.76)	19.1 (34.0)	B (C)	0.43 (0.76)
			left	56.7 (80.5)	E (F)	0.43 (0.69)	56.7 (80.5)	E (F)	0.43 (0.69)
			through-right	15.6 (30.2)	B (C)	0.27 (0.76)	15.6 (30.2)	B (C)	0.27 (0.76)
		Southbound	Overall	26.5 (28.0)	C (C)	0.81 (0.59)	26.5 (28.0)	C (C)	0.81 (0.59)
			left	59.0 (83.0)	E (F)	0.37 (0.59)	59.0 (83.0)	E (F)	0.37 (0.59)
			through	28.3 (26.9)	C (C)	0.81 (0.50)	28.3 (26.9)	C (C)	0.81 (0.50)
			right	18.5 (23.6)	B (C)	0.35 (0.30)	18.5 (23.6)	B (C)	0.35 (0.30)

Table 7: Build condition queuing summary

Tamar Road - Road Diet Study 95th Percentile Queue Length (ft) - AM (PM)					
#	Cross-Street	Approach	Movement	Existing Conditions	Option 1
1	Flamepool Way	Eastbound	LTR	25 (75)	- -
			LT	- -	50 (50)
			TR	- -	25 (25)
		Westbound	LTR	25 (25)	25 (50)
		Northbound	LT	25 (0)	25 (0)
			R	25 (25)	25 (25)
		Southbound	LTR	50 (50)	50 (50)
2	Lambskin Lane/ Flicker Place	Eastbound	LTR	0 (25)	- -
			LT	- -	0 (50)
			R	- -	0 (0)
		Westbound	LTR	25 (75)	- -
			L	- -	25 (50)
			TR	- -	0 (0)
		Northbound	LTR	75 (0)	50 (50)
		Southbound	LTR	25 (25)	25 (25)
3	Blue Pool	Eastbound	LT	0 (50)	- -
			L	- -	25 (25)
			T	- -	0 (50)
		Westbound	TR	0 (0)	0 (0)
		Southbound	LR	50 (50)	50 (50)
4	Phelps Luck Drive	Eastbound	LT	75 (150)	- -
			L	- -	75 (125)
			T	- -	0 (75)
		Westbound	TR	25 (25)	25 (25)
		Southbound	L	50 (75)	50 (75)
			R	100 (100)	125 (100)
5	Sweet Wind Place	Eastbound	LT	25 (50)	- -
			L	- -	25 (50)
			T	- -	0 (0)
		Westbound	TR	25 (0)	25 (0)
		Southbound	LR	50 (50)	50 (50)
6	High Tor Hill	Eastbound	LT	50 (75)	- -
			L	- -	50 (50)
			T	- -	25 (0)
		Westbound	TR	25 (25)	0 (25)
		Southbound	L	75 (100)	75 (100)
			R	75 (50)	75 (50)
7	Spiral Cut	Eastbound	TR	25 (25)	0 (25)
		Westbound	LT	25 (50)	- -
			L	- -	25 (50)
			T	- -	0 (0)
		Northbound	LR	50 (50)	50 (50)
8	8810-8860 Driveway	Eastbound	LT	50 (50)	- -
			L	- -	25 (50)
			T	- -	0 (25)
		Westbound	TR	25 (25)	25 (25)
		Southbound	LR	50 (50)	50 (50)

Tamar Road - Road Diet Study 95th Percentile Queue Length (ft) - AM (PM)					
9	Hayshed Lane	Eastbound	LT	50 (75)	- -
			L	- -	50 (75)
			T	- -	0 (25)
		Westbound	TR	25 (25)	0 (25)
		Southbound	L	50 (50)	50 (50)
			R	50 (50)	50 (50)
10*	Cloudleap Court	Eastbound	TR	50 (100)	- -
			T	- -	100 (150)
			R	- -	25 (50)
		Westbound	L	75 (50)	25 (75)
			T	75 (100)	100 (200)
		Northbound	L	75 (75)	100 (75)
			R	50 (50)	50 (0)
11	Foreland Garth	Eastbound	TR	25 (25)	0 (25)
		Westbound	L	50 (50)	50 (50)
			T	0 (25)	0 (25)
		Northbound	L	50 (50)	50 (50)
			R	50 (50)	50 (50)
12	Airbrink Lane	Eastbound	LT	50 (50)	- -
			L	- -	25 (50)
			T	- -	0 (100)
		Westbound	TR	25 (50)	25 (50)
		Northbound	LR	50 (50)	25 (25)
13*	Old Dobbin Lane	Eastbound	TR	100 (150)	150 (225)
		Westbound	L	100 (150)	100 (125)
			T	100 (200)	100 (175)
		Northbound	L	75 (175)	75 (200)
			R	50 (125)	50 (150)
14	Autumn Ridge Drive	Eastbound	LT	25 (50)	- -
			L	- -	25 (50)
			T	- -	0 (0)
		Westbound	TR	0 (25)	0 (25)
		Southbound	LR	50 (25)	50 (50)
15	Stonecutter Road	Eastbound	LT	25 (75)	- -
			L	- -	25 (50)
			T	- -	0 (50)
		Westbound	TR	0 (25)	0 (25)
		Southbound	L	75 (50)	75 (75)
			R	50 (50)	50 (50)
16*	Snowden River Parkway	Eastbound	L	200 (300)	200 (300)
			LTR	225 (300)	150 (300)
		Westbound	L	125 (175)	200 (175)
			TR	125 (225)	125 (275)
		Northbound	L	100 (325)	100 (300)
			TR	175 (500)	150 (475)
		Southbound	L	200 (125)	175 (125)
			T	750 (325)	550 (325)
			R	425 (125)	400 (100)

*Signalized intersection

L-Left
T-Through
R-Right

3.3 Community Feedback

Proposed plans and details were presented to the community at an October 17, 2019 Public Meeting. Comments received during Proposed Conditions Meeting were generally positive toward the plans. Specific concerns enumerated are as follows:

- Lambskin Lane has LOS D in Existing and Proposed scenarios. Community Feedback requested mitigation.
  - The approach consists of large shared left-right-through lane, however, due because it is sufficiently-wide, it can be striped for a small right-turn pocket.
- At Old Dobbin Road, consider extending a green "bike" walk across the intersection, to emphasize the bike lane to students and parents.
- There were questions about the impact of a future redevelopment (since cancelled) at the Long Reach Village Center.
  - For modeling of addition development at Long Reach Village Center, the study assumed 132 multifamily units, 110 senior housing units, and 73 townhouses, equivalent to about 130 peak hour trips with an 50/50 westbound/eastbound directional split from Cloudleap Court (no trips utilizing Foreland Garth)[1].
- Towards the approach to Snowden River, consider a re-striping of eastbound Tamar Drive to have a through and a through-left lane at Autumn Ridge Drive and at StoneCutter Road.
- Consider striping the westbound shoulder at Stonecutter into a westbound right turn lane.

4 Summary of Findings and Recommendations for Final Design

Based on the County's Complete Streets policy, along with input from residents, a conceptual plan of improvements was developed for the Tamar Drive corridor in the Long Reach neighborhood of Columbia. Highlights of the Conceptual Plan – to be incorporated into Final design are summarized below:

- Conceptual Plans would not alter the curb-to-curb width.
- The preferred design has a typical section where:
  - The four-lane typical section would be replaced with three lanes for general purpose vehicles and curb side bike lanes in each direction:
    - One eastbound and one westbound general-purpose travel lane at 11' width
    - One center two-way left turn lane at 10' width
    - One 6' wide curbside bike lane in each direction.
- Reduction from a four-lane cross-section to a three-lane cross section has minimal impacts on congestion, but is expected to reduce instances of, an ability for, speeding.
- Two new pedestrian crossings and median refuges are proposed at: High Tor Hill and at Autumn Ridge Drive.
- Green paint is recommended for bike crosswalks across select intersections: at Cloudleap Court and at Old Dobbin Lane.

[1] At the time of this study completion, the proposed development has been withdrawn.