Memorandum

Date: January 9, 2024

To: Emily Benoit & Laurel Priest, City of Vancouver

From: Kara Hall & Camilo Alvarez, Fehr & Peers

Subject: McGillivray Boulevard Safety & Mobility Project – Future Conditions

PT22-0078

Introduction

This technical memorandum documents the future conditions findings for the McGillivray Boulevard Safety & Mobility Project. The analysis documented in this memorandum was completed to answer two key questions:

- Can one travel lane in each direction be repurposed on McGillivray Boulevard without substantially impacting driver experience on McGillivray Boulevard?
- Can McGillivray Boulevard accommodate future growth with a two-vehicle lane cross-section?

To evaluate future conditions on the corridor, traffic volume forecasts[1] were developed for two future-year scenarios:

- **Mid-Term (2035)**: This scenario, which reflects approximately 10-years of growth and was used to understand how McGillivray Boulevard would function in 2035, which is generally expected to be the life of the planned paving project.
- **Horizon Year (2045)**: This scenario reflects 20-years of growth on the corridor and was used to inform what long-term improvements may be needed to maintain operations on McGillivray Boulevard after the life of the planned paving project.

To quantify changes to driver experience if one lane in each direction were to be repurposed, operations on the corridor were evaluated under a "No Build" and "With Project" scenario. The "No Build" maintains the existing four-lane cross-section, with two vehicle lanes in each direction,

[1] Traffic volumes are forecasted for cars and do not include forms of active transportation, such as bicycling.

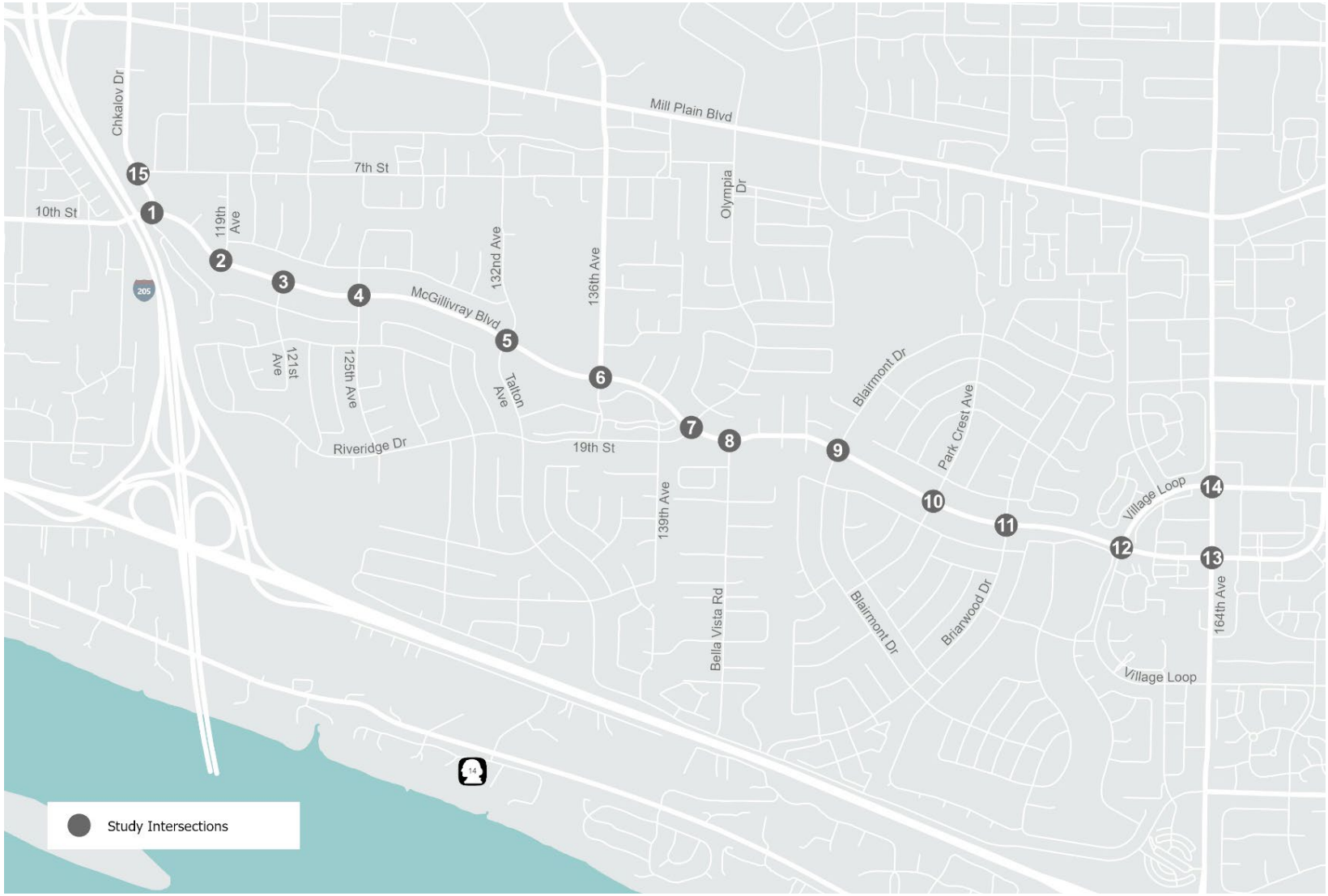
while the "With Project" scenario, assumes that one vehicle lane is repurposed in each direction. In addition to the two future-year scenarios described above, "With Project" analysis was also completed for existing conditions to understand how driver experience would change in the near-term. Baseline analysis for existing conditions is documented in the ***McGillivray Boulevard Safety & Mobility Existing Conditions Report***.

The remainder of this memorandum is organized in the following sections:

- **Analysis Approach & Methodology**: Presents the approach and methodology used to develop traffic forecasts for future years and complete traffic operations analysis.
- **Technical Evaluation**: Documents the findings for Existing with Project conditions and the No Build and With Project conditions for 2035 and 2045.
- **Conclusion & Next Steps**: Summarizes the key findings from the future conditions analysis and considerations for development of design options.

The study area for the Safety & Mobility Project, including study intersections that were evaluated under existing and future conditions, is shown on **Figure 1**.

Figure 1. Study Area



Analysis Approach & Methodology

This section documents the approach and data set used to develop traffic volume forecasts for 2035 and 2045 followed by the methodology used to evaluate traffic operations on the corridor.

Traffic Volume Forecasts

Traffic volume forecasts were developed to understand the ability for McGillivray Boulevard to accommodate the increase in vehicle traffic associated with expected growth in Vancouver and the surrounding areas.

As described above, forecasts were developed for 2035, the mid-term scenario, and 2045, the horizon year. Forecasts were developed using the Southwest Regional Transportation Council's (SW RTC) travel demand model. SW RTC's model is used to forecast traffic growth in Vancouver and the surrounding areas based on expected land use growth in Clark County over the next 20-years.

To develop a growth rate for the corridor, expected growth on the corridor was calculated using SW RTC's 2015 base year model and the 2040 future year model. Growth forecasts from SW RTC's model indicate that very little growth is expected to occur on McGillivray Boulevard over the next 20 years. As land use surrounding McGillivray Boulevard is generally built-out, meaning there are very few areas where new development could occur, traffic volumes would not be expected to increase substantially. To utilize a conservative approach, a growth rate of one percent (1%) per year was applied to existing traffic volumes to develop forecasts for 2035 and 2045 and traffic volumes were assumed to be the same under the No Build and With Build condition.

Intersection Operations

Intersection operations analysis was completed using the methodology documented in the Highway Capacity Manual, 6th Edition (HCM). Under this approach, the intersection level of service (LOS), is determined by assigning a letter grade, from A (the best) to F (the worst), based on the level of delay experienced by drivers at the intersection. For signalized and all-way stop-controlled (AWSC) intersections, LOS is assigned using the average delay for all approaches. For two-way stop-controlled (TWSC) intersections, LOS is assigned based on the movement with the highest delay. The LOS and delay thresholds based on HCM methodology are presented in **Table 1**.

Table 1. Level of Service Definitions

Level of Service	Description	Signalized Intersection Delay (seconds/vehicle)	Unsignalized Intersection Delay (seconds/vehicle)
A	Free-flowing Conditions	≤ 10	0-10
B	Stable Flow (slight delays)	>10-20	>10-15
C	Stable Flow (acceptable delays)	>20-35	>15-25
D	Approaching Unstable Flow (tolerable delay)	>35-55	>25-35
E	Unstable Flow (intolerable delay)	>55-80	>35-50
F	Forced Flow (congested and queues fail to clear)	>80	>50

Source: Highway Capacity Manual, 6th Edition

In addition to LOS and delay, two additional measures of effectiveness were also evaluated to understand changes to vehicle travel. Those metrics include:

- **Vehicle Queueing:** The length of vehicles waiting to make a specific movement at an intersection.
- **Travel Time:** The amount of time it takes drivers to travel between SE Chkalov Drive and SE 164th Avenue in the eastbound direction and between SE 164th Avenue and SE Chkalov Drive in the westbound direction.

All traffic operations analysis were completed using the microsimulation software Simtraffic, a microsimulation module included in Synchro 11. SimTraffic captures the observed characteristics of driver behavior and models the interaction between vehicles in a study network. For this study, microsimulation was used to accurately reflect operations along the corridor including driver behavior, the impact of the mid-block pedestrian crossing on traffic flow, and to capture the effects of any spillback between intersections that may occur as traffic volume increases in the future.

Results for LOS, queueing, and travel time along the corridor are based on the average results from ten statistically valid microsimulation runs for both the AM peak hour (7:45-8:45 AM) and the PM peak hour (4:00-5:00 PM), which were identified using traffic counts collected on the corridor in 2022.

Signal Warrants

As part of the future conditions analysis, all stop-controlled intersections were analyzed to determine if a traffic signal might be an appropriate form of intersection control. This analysis was

completed using the traffic signal warrants documented in the Manual on Uniform Traffic Control (MUTCD). The MUTCD includes nine different warrants that can be applied to determine if a traffic signal should be considered at an intersection.

For the purpose of this study, three warrants which are based on the number of vehicles using an intersection over a one-hour, four-hour, and eight-hour time period were evaluated. While these warrants can be used to determine if a traffic signal might be the appropriate form of intersection control, a more detailed engineering study is needed prior to determining if installation of a traffic signal should occur.

Existing with Project Conditions

This section documents the changes in vehicle operations that would result from repurposing one lane in each direction under existing conditions. This scenario is intended to inform the level of service that drivers can expect on McGillivray Boulevard in the near-term.

All analysis for Existing Conditions is documented in the ***McGillivray Boulevard Safety & Mobility Existing Conditions*** report.

Intersection LOS

Table 2 presents the LOS results for the AM and PM peak hours under Existing Conditions and Existing with Project Conditions.

Under Existing Conditions, only the McGillivray Boulevard & SE 164th Avenue intersection operates below LOS C, primarily due to congestion on SE 164th Avenue.

Under Existing With Project Conditions, which assumes that one-through lane is repurposed on McGillivray Boulevard between SE Chkalov Drive and Village Loop Drive, there is minimal change in intersection LOS. There are minimum changes to LOS during the AM peak hour while the lane repurposing results in LOS changes during the PM peak hour: SE Chkalov Drive, SE 121st Avenue, SE Bella Vista Road & SE McGillivray Boulevard from LOS B to LOS C under With Project Conditions and SE Village Loop Drive from LOS A to LOS C under With Project Conditions.

Queuing

Queueing was evaluated at key intersections along the corridor under Existing and Existing With Project Conditions, as shown in **Table 3**. Under Existing Conditions, queuing concerns are limited to the evening commute hours. Under the Existing With Project Scenario, repurposing a lane would increase queues at SE Chkalov Drive, including the eastbound left and through, westbound left and southbound left. At SE 136th Avenue, the eastbound left-turn queue would be extended by approximately two-vehicles causing the queue to exceed available storage by 10-feet.

Table 2. Existing Conditions LOS Summary

ID	Intersection	Control	Existing				Existing with Project				Delta	
			AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour	PM Peak Hour
			Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	Delay (Seconds)
1	SE Chkalov Drive & SE McGillivray Boulevard	Signal	11	B	18	B	14	B	31	C	+3	+13
2	SE 119th Avenue & SE McGillivray Boulevard	SSSC	10	B	13	B	13	B	13	B	+3	+0
3	SE 121st Avenue & SE McGillivray Boulevard	SSSC	9	A	13	B	11	B	16	C	+2	+3
4	SE 125th Avenue & SE McGillivray Boulevard	AWSC	7	A	7	A	9	A	11	B	+2	+4
5	SE 132nd Avenue & SE McGillivray Boulevard	AWSC	7	A	7	A	8	A	10	B	+1	+3
6	SE 136th Avenue & SE McGillivray Boulevard	AWSC	7	A	8	A	9	A	13	B	+2	+5
7	SE 19th Street & SE McGillivray Boulevard	SSSC	13	B	19	C	14	B	20	C	+1	+1
8	SE Bella Vista Road & SE McGillivray Boulevard	SSSC	10	B	13	B	13	B	15	C	+3	+2

Table 2. Existing Conditions LOS Summary

ID	Intersection	Control	Existing				Existing with Project				Delta	
			AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour	PM Peak Hour
			Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	Delay (Seconds)
9	SE Blairmont Drive & SE McGillivray Boulevard	SSSC	20	C	25	C	19	C	21	C	-1	-4
10	SE Park Crest Avenue & SE McGillivray Boulevard	SSSC	8	A	13	B	9	A	13	B	+1	+0
11	SE Briarwood Drive & SE McGillivray Boulevard	AWSC	6	A	7	A	7	A	10	B	+1	+3
12	SE Village Loop &SE McGillivray Boulevard	AWSC	6	A	8	A	8	A	19	C	+2	+11
13	SE 164th Avenue& SE McGillivray Boulevard	Signal	23	C	40	D	24	C	40	D	+1	+0
14	SE 164th Avenue & SE Village Loop - SE 20th Street	Signal	23	C	29	C	24	C	31	C	+1	+2
15	SE Chkalov Drive& SE 7th Street	Signal	6	A	8	A	5	A	8	A	-1	+0

Table Notes: AWSC = All-Way Stop Control, SSSC = Side-Street Stop Control

Table 3. Existing Conditions Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				Existing		Existing With Project		Change in Queue Length	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
SE Chkalov Drive & SE McGillivray Boulevard	EB	L	90	185	185	190	190	+5	+5
		T	465	200	365	250	480	+50	+115
		TR	465	60	250	-	-	-	-
	WB	L	55	30	35	40	70	+10	+35
		T	970	155	225	370	720	+215	+495
		R	105	125	130	130	130	+5	0
	NB	LTR	380	55	65	60	70	+5	+5
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
	SB	L	115	65	145	130	260	+65	+115
		LT	410	100	175	30	240	-70	+65
		R	410	100	320	120	350	+20	+30

Table 3. Existing Conditions Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				Existing		Existing With Project		Change in Queue Length	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
SE 136th Avenue & SE McGillivray Boulevard	EB	L	120	80	90	80	130	+0	+40
		T	1,135	60	70	100	190	+40	+120
		TR	1,135	65	75	-	-	-	-
	WB	L	155	35	35	40	90	+5	+55
		T	1,215	85	100	170	280	+85	+180
		R	255	5	5	10	10	+5	+5
	NB	LTR	300	70	80	70	80	+0	+0
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
	SB	L	175	100	145	110	160	+10	+15
		T	430	40	55	40	60	+0	+5
		R	345	90	85	90	90	+0	+5

Table 3. Existing Conditions Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				Existing		Existing With Project		Change in Queue Length	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Village Loop Drive & SE McGillivray Boulevard	EB	LT	1,340	95	130	140	260	+45	+130
		TR	1,340	75	95	-	-	-	-
		-	-	-	-	-	-	-	-
	WB	LT	410	5	5	10	10	+5	+5
		TR	410	85	150	-	-	-	-
		-	-	-	-	-	-	-	-
	NB	L	255	55	55	60	60	+5	+5
		TR	485	50	70	50	70	+0	+0
		-	-	-	-	-	-	-	-
	SB	L	180	25	30	30	30	+5	+0
		TR	685	80	115	80	130	+0	+15
		-	-	-	-	-	-	-	-

Table 3. Existing Conditions Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				Existing		Existing With Project		Change in Queue Length	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
SE 164th Avenue & SE McGillivray Boulevard	EB	L	205	115	**210**	100	**220**	-15	+10
		T	565	145	245	140	290	-5	+45
		R	565	75	110	80	110	+5	+0
	WB	L	205	165	**220**	150	**220**	-15	+0
		T	470	140	270	130	260	-10	-10
		TR	470	145	285	150	280	+5	-5
	NB	L	405	180	**410**	200	**420**	+20	+10
		T	770	300	525	290	580	-10	+55
		TR	770	225	335	260	380	+35	+45
	SB	L	220	140	**240**	110	**240**	-30	0
		T	390	215	340	220	330	+5	-10
		TR	390	190	350	200	340	+10	-10

Table Notes: NB=Northbound, SB=Southbound, EB=Eastbound, WB=Westbound; T=Through, L=Left, R=Right; **Bold** text indicates that queue exceeds available storage.

Travel Time

SimTraffic was also used to evaluate changes in travel time between SE 164th Avenue and SE Chkalov Drive for drivers traveling eastbound and westbound. As shown in **Table 4**, repurposing a lane in each direction would result in minimal, less than 30 seconds, travel time changes during the morning peak hour. During the evening peak hour, travel time would increase less than one minute in the eastbound direction and approximately one minute in the westbound direction.

Table 4. Existing Conditions Travel Time

Direction	Existing		Existing With Project		Delta	
	AM Peak Hour (Mins: Secs)	PM Peak Hour (Mins: Secs)	AM Peak Hour (Mins: Secs)	PM Peak Hour (Mins: Secs)	AM Peak Hour (Mins: Secs)	PM Peak Hour (Mins: Secs)
Eastbound	7:36	7:53	7:53	8:33	+0:17	+0:40
Westbound	8:08	8:24	8:35	9:34	+0:27	+1:10

Signal Warrants

Under Existing Conditions, the SE 136th Avenue intersection was found to meet the peak hour signal warrant. Signal warrants were also evaluated for the Existing With Project Condition to confirm that the reduction in the number of lanes on McGillivray Boulevard would not trigger any additional warrants. As shown in **Table 5**, no additional warrants were met under the Existing With Project Condition.

Table 5. Existing With Project Signal Warrants

ID	Intersection	Scenario Control Type	Existing With Project		
			Peak Hour	4-Hour	8-Hour
2	SE 119th Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met
3	SE 121st Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met
4	SE 125th Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met
5	SE 132nd Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met

Table 5. Existing With Project Signal Warrants

ID	Intersection	Scenario Control Type	Existing With Project		
			Peak Hour	4-Hour	8-Hour
6	SE 136th Avenue & SE McGillivray Boulevard	AWSC	**Met**	Not Met	Not Met
7	SE 19th Street & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met
8	SE Bella Vista Road & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met
9	SE Blairmont Drive & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met
10	SE Park Crest Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met
11	SE Briarwood Drive & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met
12	SE Village Loop &SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met

Table Notes: AWSC = All-Way Stop Control, SSSC = Side-Street Stop Control

Mid-Term (2035) Conditions

This section documents the findings for the traffic operations analysis completed for 2035 under a "No Build" scenario, which maintains the existing four-lane cross-section on McGillivray Boulevard and the "With Project" scenario which assumes that one vehicle travel lane is repurposed in each direction.

Future Traffic Volume

The first step to evaluating future conditions is developing traffic volume forecasts for future scenarios. For this study, future volume forecasts were developed for each study intersection during the morning and evening commute hours. Forecasts were also developed for the Average Daily Traffic (ADT), or the number of vehicles expected to use the corridor over a 24-hour period on an average weekday. ADT forecasts by segment, shown in **Table 6**, fall well below the most conservative industry thresholds for two lane streets indicating that McGillivray Boulevard can sufficiently serve the expected demand with one lane in each direction.

Table 6. 2035 ADT Forecasts

Segment	Existing ADT (vehicles)	2035 ADT (vehicles)
Between SE Chkalov Drive and SE 132nd Avenue	10,393	11,800
Between SE 132nd Avenue and SE 136th Avenue	9,818	11,100
Between SE 136th Avenue and SE Village Loop Drive	9,225	10,400
Between SE Village Loop Drive and SE 164th Avenue	10,836	12,300

Intersection LOS

Table 7 presents the LOS results for the AM and PM peak hours under 2035 Conditions for the No Build and With Project scenarios.

During the morning peak hour, most intersections operate at LOS C or better under both No Project and With Project conditions. Only the SE Blairmont Drive intersection operates at LOS D during the morning peak hour under both conditions. During the evening peak hour, several side-street stop-controlled intersections operate at LOS D without repurposing a lane. Those include intersections with: SE 19th Street, SE Blairmont Drive, and SE Park Crest Avenue. The two study intersections on SE 164th Avenue at McGillivray Boulevard and SE 20th Street/Village Loop also operate at LOS D under No Project conditions. Under With Project conditions, delay increases at two intersections (SE 119th Avenue and SE 19th Street) resulting in LOS E operations, while all other intersections continue to operate at LOS D or better. As indicated in **Table 10** traffic volume at the McGillivray Boulevard & SE Village Loop Drive intersection is forecast to meet the warrant for a traffic signal under the No Project and With Project conditions by 2035. If congestion increases in line with forecasts, a change in intersection control (a traffic signal or roundabout), may be needed to maintain acceptable levels of service at this intersection.

Queuing

Queueing results for 2035 Conditions are presented in **Table 8**. At SE Chkalov Drive and McGillivray Boulevard, there is adequate capacity to accommodate queueing for all movements during the morning peak hour. During the evening peak hour, queueing will exceed capacity for the eastbound, westbound, and southbound left-turns and the westbound right-turn under No Project conditions and additionally on the eastbound and southbound left-turn under With Project conditions.

At SE 136th Avenue, queueing would not exceed available storage under No Project or With Project conditions during the morning peak hour. During the PM peak hour, the southbound left-

turn is forecast to exceed available storage under No Build conditions and changes at the intersection under With Project would increase the queue by 25 feet or approximately one vehicle length. Queueing would also increase for the eastbound and westbound left-turn movements, resulting in queues for these movements exceeding available storage during the evening peak hour. No movements were found to exceed storage at SE Village Loop Drive during the peak hours while changes in queueing would be minimal at the SE 164th Avenue intersection as no changes to vehicle capacity are expected at that intersection.

Table 7. 2035 LOS Summary

ID	Intersection	Control	2035 No Build				2035 With Project				Delta	
			AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour	PM Peak Hour
			Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	Delay (Seconds)
1	SE Chkalov Drive & SE McGillivray Boulevard	Signal	14	B	21	C	15	B	24	C	+1	+3
2	SE 119th Avenue & SE McGillivray Boulevard	SSSC	14	B	16	A	17	C	**35**	**E**	+3	+19
3	SE 121st Avenue & SE McGillivray Boulevard	SSSC	11	B	17	A	17	C	25	C	+6	+8
4	SE 125th Avenue & SE McGillivray Boulevard	AWSC	7	A	7	A	11	B	14	B	+4	+7
5	SE 132nd Avenue & SE McGillivray Boulevard	AWSC	7	A	8	A	10	A	12	B	+3	+4
6	SE 136th Avenue & SE McGillivray Boulevard	AWSC	8	A	10	B	11	B	23	C	+3	+13
7	SE 19th Street & SE McGillivray Boulevard	SSSC	17	C	26	A	19	C	**36**	**E**	+2	+10
8	SE Bella Vista Road & SE McGillivray Boulevard	SSSC	14	B	16	A	18	C	22	C	+4	+6
9	SE Blairmont Drive & SE McGillivray Boulevard	SSSC	33	D	29	A	35	D	32	D	+2	+3
10	SE Park Crest Avenue & SE McGillivray Boulevard	SSSC	13	B	31	A	13	B	24	C	+0	-7

Table 7. 2035 LOS Summary

ID	Intersection	Control	2035 No Build				2035 With Project				Delta	
			AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour	PM Peak Hour
			Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	Delay (Seconds)
11	SE Briarwood Drive & SE McGillivray Boulevard	AWSC	6	A	8	A	8	A	18	C	+2	+10
12	SE Village Loop &SE McGillivray Boulevard[1]	AWSC	7	A	11	B	5	A	10	A	-2	-1
13	SE 164th Avenue& SE McGillivray Boulevard	Signal	29	C	44	D	27	C	41	D	-2	-3
14	SE 164th Avenue & SE Village Loop - SE 20th Street	Signal	25	C	37	D	26	C	39	D	+1	+2
15	SE Chkalov Drive& SE 7th Street	Signal	7	A	10	A	7	A	9	A	+0	-1

Table Notes:
AWSC = All-Way Stop Control, SSSC = Side-Street Stop Control

Bold text indicates LOS E or worse operations.

[1]By 2035, under the With Project Scenario changes to intersection control to maintain operations. Installation of a traffic signal or roundabout would maintain operations. This analysis assumes roundabout control.

Table 8. 2035 Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				2035 No Build		2035 With Project		Change in Queue Length (ft)	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
SE Chkalov Drive & SE McGillivray Boulevard	EB	L	90	**200**	**200**	**275**	**400**	+75	+200
		T	465	300	425	125	350	-175	-75
		TR	465	150	300	50	100	-	-
	WB	L	55	50	**100**	**75**	**75**	+25	-25
		T	970	225	275	225	425	+0	+150
		R	105	**125**	**150**	**125**	**125**	+0	-25
	NB	LTR	380	100	100	75	100	-25	+0
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
	SB	L	115	100	**175**	**150**	**275**	+50	+100
		LT	410	125	225	75	325	-50	+100
		R	410	125	350	100	350	-25	+0

Table 8. 2035 Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				2035 No Build		2035 With Project		Change in Queue Length (ft)	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
SE 136th Avenue & SE McGillivray Boulevard	EB	L	120	100	100	100	150	+0	+50
		T	1,135	75	100	125	275	+50	+175
		TR	1,135	75	100	-	-	-	-
	WB	L	155	50	50	50	**175**	+0	**+125**
		T	1,215	100	125	225	500	+125	+375
		R	255	150	125	175	225	+25	+100
	NB	LTR	300	75	100	100	100	+25	+0
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
	SB	L	175	125	225	125	250	+0	+25
		T	430	50	75	50	100	+0	+25
		R	345	100	100	100	100	+0	+0

Table 8. 2035 Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				2035 No Build		2035 With Project		Change in Queue Length (ft)	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Village Loop Drive & SE McGillivray Boulevard	EB	LT	1,340	125	200	100	125	-25	-75
		TR	1,340	100	150	-	-	-	-
		-	-	-	-	-	-	-	-
	WB	LT	410	100	175	175	325	+75	+150
		TR	410	100	200	-	-	-	-
		-	-	-	-	-	-	-	-
	NB	L	255	75	75	75	100	+0	+25
		TR	485	75	75	-	-	-	-
		-	-	-	-	-	-	-	-
	SB	L	180	50	50	100	150	+50	+100
		TR	685	100	175	-	-	-	-
		-	-	-	-	-	-	-	-

Table 8. 2035 Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				2035 No Build		2035 With Project		Change in Queue Length (ft)	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
SE 164th Avenue & SE McGillivray Boulevard	EB	L	205	150	**225**	125	**225**	-25	+0
		T	565	150	325	175	325	+25	+0
		R	565	100	125	75	150	-25	+25
	WB	L	205	150	**225**	175	**225**	+25	+0
		T	470	150	275	150	275	+0	+0
		TR	470	175	325	150	300	-25	-25
	NB	L	405	225	**425**	250	**425**	+25	+0
		T	770	350	**775**	350	575	+0	-200
		TR	770	300	550	300	500	+0	-50
	SB	L	220	175	**225**	150	**250**	-25	+25
		T	390	250	325	250	375	+0	+50
		TR	390	225	325	225	375	+0	+50

Table Notes: NB=Northbound, SB=Southbound, EB=Eastbound, WB=Westbound; T=Through, L=Left, R=Right; **Bold** text indicates that queue exceeds available storage.

Travel Time

Table 9 summarizes the travel time changes that would result from repurposing a travel lane under 2035 conditions. As shown, repurposing a travel lane would result in minimal changes to travel time between SE 164th Avenue and SE Chkalov Drive during the morning commute hours. During the evening commute hour, repurposing a lane would add approximately one minute to eastbound travel times and slightly less than two minutes for travelers in the westbound direction.

Table 9. 2035 Conditions Travel Time

Direction	2035		2035 With Project		Delta	
	AM Peak Hour (Mins: Secs)	PM Peak Hour (Mins: Secs)	AM Peak Hour (Mins: Secs)	PM Peak Hour (Mins: Secs)	AM Peak Hour (Mins: Secs)	PM Peak Hour (Mins: Secs)
Eastbound	7:39	8:03	7:58	8:59	+0:19	+0:56
Westbound	8:20	8:35	8:51	10:21	+0:31	+1:46

Signal Warrants

Intersection signal warrants were evaluated using traffic volume forecasts for 2035 for the No Build and With Project scenario. As shown in **Table 10**, under the two-lane cross-section assumed under the No Build Condition, the peak hour intersection warrant is met at the SE Village Loop Drive and McGillivray Boulevard intersection. Under the With Project Condition, the reduction in the number of lanes on McGillivray Boulevard results in the peak hour warrant being met at the SE 132nd Avenue intersection. As the SE 136th Avenue intersection was found to meet warrants under both existing conditions scenarios, it would also meet warrants in 2035.

Prior to installation of a traffic signal a more detailed engineering assessment is needed to confirm the appropriate traffic control and a traffic signal is only recommended for installation once the traffic volumes observed meet the threshold in the signal warrant. While forecast volumes provide an indication of when a signal may be warranted, forecast volumes alone should not be considered justification for installation of a traffic signal.

Table 10. 2035 Signal Warrants

ID	Intersection	Scenario Control Type	2035 No Build			2035 With Project		
			Peak Hour	4-Hour	8-Hour	Peak Hour	4-Hour	8-Hour
2	SE 119th Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
3	SE 121st Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
4	SE 125th Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
5	SE 132nd Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	**Met**	Not Met	Not Met
6	SE 136th Avenue & SE McGillivray Boulevard	AWSC	**Warrant Met Under Existing Conditions**					
7	SE 19th Street & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
8	SE Bella Vista Road & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
9	SE Blairmont Drive & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
10	SE Park Crest Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
11	SE Briarwood Drive & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
12	SE Village Loop &SE McGillivray Boulevard	SSSC	**Met**	Not Met	Not Met	**Met**	Not Met	Not Met

Table Notes: AWSC = All-Way Stop Control, SSSC= Side-Street Stop Control

Horizon Year (2045) Conditions

This section documents the findings for the traffic operations analysis completed for 2045 under a No Build scenario, which maintains the existing four-lane cross-section on McGillivray Boulevard and a With Project scenario which assumes that one vehicle travel lane is repurposed in each direction.

Future Traffic Volume

ADT forecasts for 2045 are shown in **Table 11.** As shown, the maximum number of vehicles forecast to use McGillivray Boulevard is 13,500 vehicles per day at the east end of the study area near Village Loop Drive. As shown, ADT is 2045 is forecast to be well below the typical capacity of a two-lane road.

Table 11. 2045 ADT Forecasts

Segment	Existing ADT (vehicles)	2045 ADT (vehicles)
Between SE Chkalov Drive and SE 132nd Avenue	10,393	13,000
Between SE 132nd Avenue and SE 136th Avenue	9,818	12,300
Between SE 136th Avenue and SE Village Loop Drive	9,225	11,500
Between SE Village Loop Drive and SE 164th Avenue	10,836	13,500

Intersection LOS

Table 12 presents the LOS results for the peak hours under 2045 Conditions for the No Build and With Project scenarios. During the morning peak hour, all intersections operate a LOS D or better, indicating the congestion on the corridor would be minimal under No Build conditions. Changes to delay under With Project conditions are minimal during the morning peak hour and all intersections continue to operate at LOS D or better.

During the evening peak hour, congestion will increase as a result of continued growth in areas surrounding the corridor, resulting in three intersections operating at LOS E under No Build conditions. Under With Project conditions, operations are degraded at several intersections, including SE 136th Avenue. As this intersection was found to meet warrants for a installation of a traffic signal under existing conditions, installation of a traffic signal could be considered as part of a future capital improvement project to maintain operations at this intersection in 2045.

Queuing

By 2045, queuing at SE Chaklov Drive and McGillivray Boulevard intersection will increase during both peak hours under No Build conditions. Repurposing a lane on McGillivray Boulevard will increase the queue for the eastbound left-turn during both peak hours, which is forecast to exceed available storage under No Build conditions. As design options are developed for the 112th Avenue Safety & Mobility Project, additional consideration may need to be given to this intersection to confirm alignment with options being evaluated as part of that effort and to fully understand operational changes.

At SE 136th Avenue, queueing is forecast to increase on the westbound approach during the evening peak hour under With Project conditions. As noted above, additional improvements may be needed to maintain acceptable operations at this intersection by 2045. It is expected that changes in intersection control would address queueing concerns at this intersection in 2045.

At SE Village Loop Drive and SE 164th Avenue, changes in queueing under With Project conditions are minimal during both peak hours. At SE 164th Avenue, during the PM peak hour, queueing for several movements is forecast to exceed available storage; however, proposed changes as part of the Safety & Mobility Project will not change capacity at this intersection, so queuing for these movements will not increase as a result of the Safety & Mobility Project.

Table 12. 2045 LOS Summary

ID	Intersection	Control	2045 No Build				2045 With Project				Delta	
			AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour	PM Peak Hour
			Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	Delay (Seconds)
1	SE Chkalov Drive & SE McGillivray Boulevard	Signal	15	B	24	C	16	B	27	C	+1	+3
2	SE 119th Avenue & SE McGillivray Boulevard	SSSC	15	B	22	C	21	C	30	D	+6	+8
3	SE 121st Avenue & SE McGillivray Boulevard	SSSC	14	B	18	C	17	C	23	C	+3	+5
4	SE 125th Avenue & SE McGillivray Boulevard	AWSC	7	A	8	A	13	B	16	C	+6	+8
5	SE 132nd Avenue & SE McGillivray Boulevard	AWSC	7	A	8	A	11	B	18	C	+4	+10
6	SE 136th Avenue & SE McGillivray Boulevard	AWSC	8	A	10	B	16	C	**59**	**F**	+8	+49
7	SE 19th Street & SE McGillivray Boulevard	SSSC	23	C	**36**	**E**	19	C	**49**	**E**	-4	+13
8	SE Bella Vista Road & SE McGillivray Boulevard	SSSC	14	B	16	C	16	C	25	C	+2	+9

Table 12. 2045 LOS Summary

ID	Intersection	Control	2045 No Build				2045 With Project				Delta	
			AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour	PM Peak Hour
			Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	Delay (Seconds)
9	SE Blairmont Drive & SE McGillivray Boulevard	SSSC	30	D	**43**	**E**	30	D	35	D	+0	-8
10	SE Park Crest Avenue & SE McGillivray Boulevard	SSSC	18	C	28	D	13	B	24	C	-5	-4
11	SE Briarwood Drive & SE McGillivray Boulevard	AWSC	6	A	8	A	9	A	29	D	+3	+21
12	SE Village Loop &SE McGillivray Boulevard[1]	AWSC	8	A	11	B	5	A	10	B	-3	-1
13	SE 164th Avenue& SE McGillivray Boulevard	Signal	29	C	**61**	**E**	28	C	**59**	**E**	-1	-2
14	SE 164th Avenue & SE Village Loop - SE 20th St	Signal	25	C	46	D	26	C	40	D	+1	-6
15	SE Chkalov Drive& SE 7th Street	Signal	7	A	11	B	7	A	11	B	+0	+0

Table Notes: AWSC = All-Way Stop Control, SSSC = Side-Street Stop Control

Bold text indicates LOS E or F operations.

[1]By 2045, under the With Project Scenario changes to intersection control to maintain operations. Installation of a traffic signal or roundabout would maintain operations. This analysis assumes roundabout control.

Table 13. 2045 Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				2045 No Build		2045 With Project		Change in Queue Length (ft)	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
SE Chkalov Drive & SE McGillivray Boulevard	EB	L	90	**200**	**200**	**325**	**400**	+125	+200
		T	465	350	475	150	350	-200	-125
		TR	465	175	325	25	100	-150	-225
	WB	L	55	**75**	**100**	**50**	**125**	-25	+25
		T	970	250	300	275	525	+25	+225
		R	105	**125**	**150**	**125**	**125**	+0	-25
	NB	LTR	380	75	100	100	100	+25	+0
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
	SB	L	115	100	**200**	**150**	**275**	+50	+75
		LT	410	125	225	50	350	-75	+125
		R	410	150	400	125	400	-25	+0

Table 13. 2045 Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				2045 No Build		2045 With Project		Change in Queue Length (ft)	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
SE 136th Avenue & SE McGillivray Boulevard	EB	L	120	100	100	**125**	**150**	+25	+50
		T	1,135	75	100	150	400	+75	+300
		TR	1,135	75	100	-	-	-	-
	WB	L	155	50	50	125	**225**	+75	+175
		T	1,215	100	125	375	**1,125**	+275	+1,000
		R	255	150	125	200	225	+50	+100
	NB	LTR	300	100	100	100	100	+0	+0
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
	SB	L	175	125	**200**	150	**250**	+25	+50
		T	430	50	75	50	75	0	0
		R	345	125	100	125	125	+0	+25

Table 13. 2045 Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				2045 No Build		2045 With Project		Change in Queue Length (ft)	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Village Loop Drive & SE McGillivray Boulevard	EB	LT	1,340	125	200	100	125	-25	-75
		TR	1,340	100	150	-	-	-	-
		-	-	-	-	-	-	-	-
	WB	LT	410	100	150	175	325	+75	+175
		TR	410	125	175	-	-	-	-
		-	-	-	-	-	-	-	-
	NB	L	255	75	75	75	100	+0	+25
		TR	485	75	75	-	-	-	-
		-	-	-	-	-	-	-	-
	SB	L	180	25	75	125	150	+100	+75
		TR	685	100	200	-	-	-	-
		-	-	-	-	-	-	-	-

Table 13. 2045 Queue Summary

Intersection	Approach	Movement	Storage (ft)	Maximum Queue (ft)					
				2045 No Build		2045 With Project		Change in Queue Length (ft)	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
SE 164th Avenue & SE McGillivray Boulevard	EB	L	205	125	**225**	150	**225**	+25	+0
		T	565	175	350	175	375	+0	+25
		R	565	100	150	100	175	+0	+25
	WB	L	205	175	**225**	175	**225**	+0	+0
		T	470	150	300	175	325	+25	+25
		TR	470	175	300	175	350	+0	+50
	NB	L	405	225	**450**	275	**425**	+50	-25
		T	770	350	**825**	375	**800**	+25	-25
		TR	770	300	750	300	700	+0	-50
	SB	L	220	200	**250**	175	**250**	-25	+0
		T	390	275	**400**	250	375	-25	-25
		TR	390	250	**400**	225	375	-25	-25

Table Notes: NB=Northbound, SB=Southbound, EB=Eastbound, WB=Westbound; T=Through, L=Left, R=Right; **Bold** text indicates that queue exceeds available storage.

Travel Time

Travel time for travel between SE Chkalov Drive and SE 164th Street under 2045 conditions is shown in **Table 14**. During the morning peak hour, when congestion on the corridor is minimal, travel time increases resulting from repurposing a lane, are less than 30 seconds. During the evening peak hour, travel time would increase approximately one minute in the eastbound direction and approximately three minutes in the westbound direction.

Table 14. 2045 Conditions Travel Time

Direction	2045 No Build		2045 With Project		Delta	
	AM Peak Hour (Mins: Secs)	PM Peak Hour (Mins: Secs)	AM Peak Hour (Mins: Secs)	PM Peak Hour (Mins: Secs)	AM Peak Hour (Mins: Secs)	PM Peak Hour (Mins: Secs)
Eastbound	7:44	8:06	8:02	9:21	+0:18	+1:15
Westbound	8:20	8:40	8:58	11:27	+0:38	+2:47

Signal Warrants

Intersection signal warrants were evaluated using traffic volume forecasts for 2045 for the No Build and With Project scenarios. As shown in **Table 15**, under the No Build Condition no additional signal warrants are met. Under the With Project Condition, the reduction in the number of lanes on McGillivray Boulevard results in the addition of the peak hour warrant being met at the SE Blairmont Drive intersection.

As noted above, a more detailed engineering assessment is needed to confirm the appropriate traffic control and a traffic signal is only recommended for installation once the traffic volumes observed meet the threshold in the signal warrant. While forecast volumes provide an indication of when a signal may be warranted, forecast volumes alone should not be considered justification for installation of a traffic signal.

Table 15. 2045 Signal Warrants

ID	Intersection	Control Type	2045 No Build			2045 With Project		
			Peak Hour	4-Hour	8-Hour	Peak Hour	4-Hour	8-Hour
2	SE 119th Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
3	SE 121st Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
4	SE 125th Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
5	SE 132nd Avenue & SE McGillivray Boulevard	SSSC	**Met**	Not Met	Not Met	**Met Under 2035 With Project Conditions**		
6	SE 136th Avenue & SE McGillivray Boulevard	AWSC	**Met Under Existing Conditions**					
7	SE 19th Street & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
8	SE Bella Vista Road & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
9	SE Blairmont Drive & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	**Met**	Not Met	Not Met
10	SE Park Crest Avenue & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
11	SE Briarwood Drive & SE McGillivray Boulevard	SSSC	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
12	SE Village Loop &SE McGillivray Boulevard	SSSC	**Met Under 2035 Conditions**					

Table Notes: AWSC = All-Way Stop Control, SSSC= Side-Street Stop Control

With Project Changes to Bicycle & Pedestrian Travel

A priority for this project is to improve comfort and safety for all who travel on McGillivray Boulevard, including people who walk, ride a bicycle, or use other small mobility devices and are accessing travel.

Bicycle Level of Traffic Stress (BLTS) is used to measure people's experience riding a bicycle or small mobility device along the corridor. While the proposed designs would provide additional space and separation for these modes and include design features known to improve safety for the most vulnerable users, BLTS was evaluated under the No Build configuration, consistent with methodology developed by the Washington State Department of Transportation, as part of existing conditions and under With Project conditions, which assumes one lane in each direction would be repurposed to provide a wider mobility lane with vertical separation.

As shown on **Figure 2**, existing BLTS was found to be LTS 3, meaning only enthused and confident riders are likely to feel comfortable using the corridor, between SE Chkalov Drive and SE Village Loop Drive. This segment is LTS due to high vehicle speeds, proximity of the mobility lane to the vehicle travel lanes, and the number of travel lanes present. The segment between SE Village Loop Drive and SE 164th Avenue is identified as LTS 4, meaning that only strong and fearless riders are likely to be comfortable, due to the challenging intersections, higher volume of vehicles, and lack of separation between the vehicle travel lane from the mobility lane.

BLTS for the future condition, which assumes that one lane is repurposed in each direction and that space is allocated to improving conditions for people walking and riding a bicycle, is shown on **Figure 3**. By reducing the number of vehicle travel lanes, slowing vehicle travel speeds, and providing separation between the vehicle travel lane and the mobility lane, BLTS would be reduced to LTS 2, meaning that interested and concerned riders are likely to feel comfortable riding on McGillivray Boulevard. While the proposed design options do not repurpose a lane between SE 164th Avenue and Village Loop Drive and those intersections are likely to remain challenging from riders, LTS is also reduced on this segment from 4 to 3 with the addition of buffers and widening of the mobility lane, which could be accommodated without repurposing a vehicle travel lane.

Figure 2. No Build BLTS

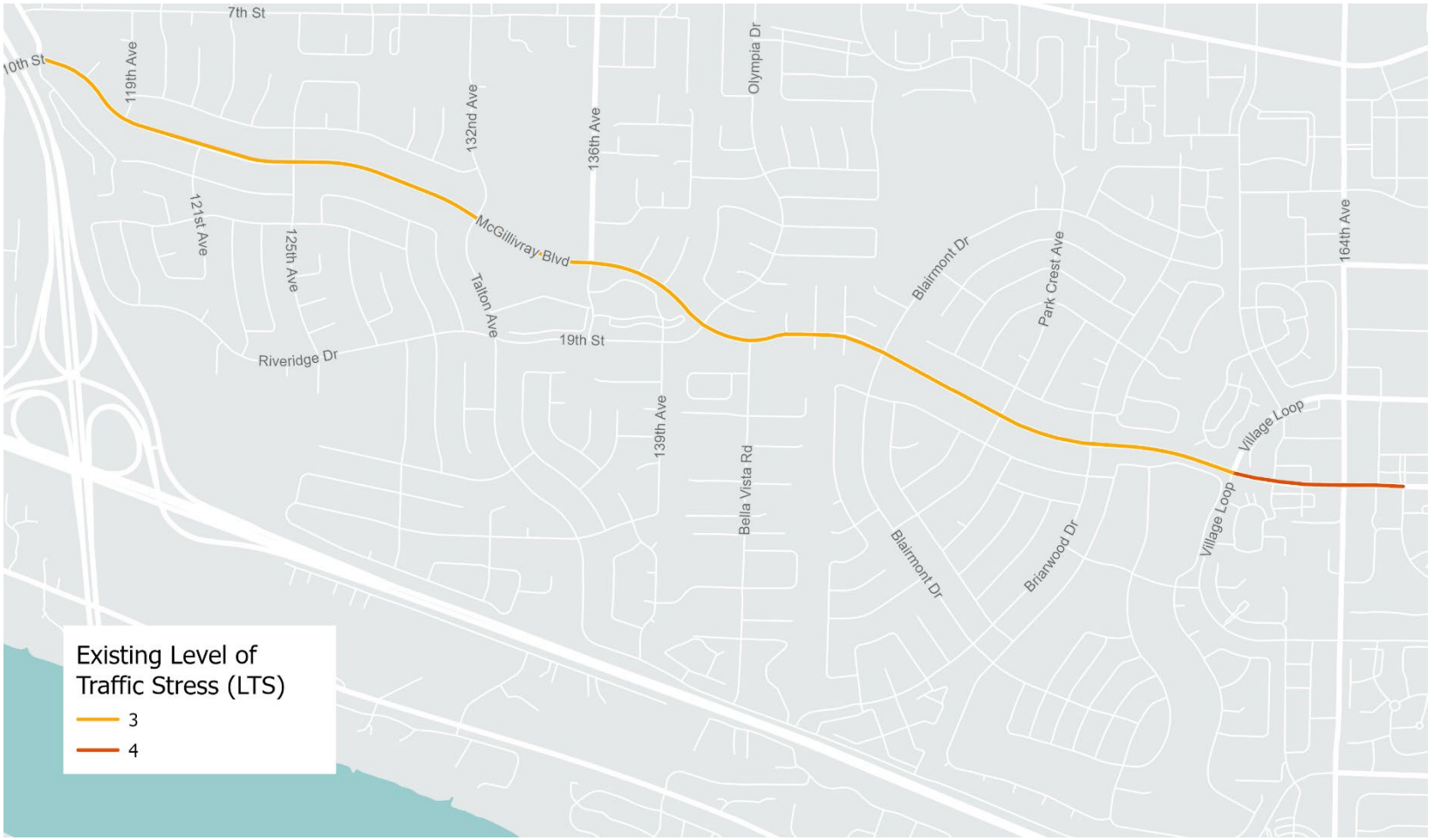
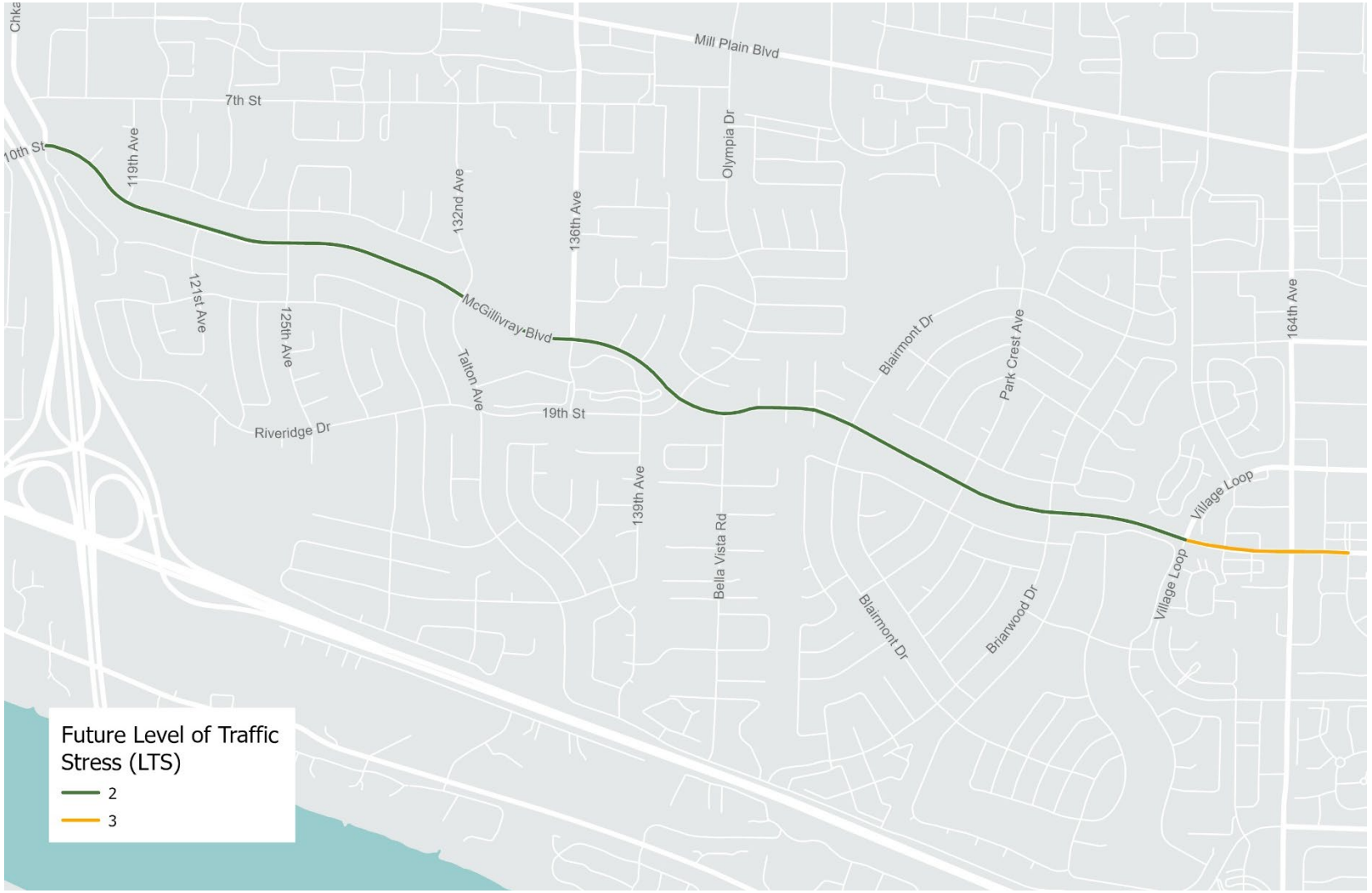


Figure 3. With Project BLTS



Conclusions & Next Steps

The analysis described above is intended to inform evaluation of the design options being considered as part of Phase 2 of the McGillivray Boulevard Safety & Mobility Project and identify locations where refinements may be needed to balance operations and safety for all modes. This analysis also identifies locations where improvements outside the scope of the Safety & Mobility Project could be recommended.

The following key takeaways should be considered as design options are advanced for the Safety & Mobility Study:

- The Average Daily Traffic (ADT) or number of vehicles that use the corridor over a 24-hour period is well below the capacity for a two-lane roadway at just over 10,000 vehicles per day based on traffic counts collected in 2022.
- Based on traffic forecasts developed for this study, ADT will not exceed 13,500 vehicles before 2045. This is well below the typical carrying capacity of a two-lane road.
- The design options, which include repurposing a vehicle travel lane in each direction, would achieve the project goal of improving safety and comfort for all who travel on McGillivray Boulevard, including lowering the BLTS between SE Chkalov Drive and SE 164th Avenue.
- In the near-term, a lane could be repurposed without substantially increasing delay or queueing at intersections or the time it takes to travel between SE Chkalov Drive and SE 164th Avenue.
- In the mid-term (2035), repurposing a vehicle lane would result in very little change for drivers during the morning commute hours. During evening commute hours, repurposing a vehicle travel lane in both directions will increase travel time by approximately one minute in the eastbound direction and two minutes in the westbound direction.
- In the long-term (2045), repurposing a vehicle travel lane would result in very little change for drivers during the morning commute hours. During evening commute hours, repurposing a travel lane would increase travel time by approximately one minute in the eastbound direction and three minutes in the westbound direction.
- In addition to the SE 136th Avenue intersection, which was found to meet signal warrants under Existing Conditions, the SE Village Loop Drive intersection is forecast to meet signal warrants under the No Project Condition by 2035.
- As design options are refined, opportunities to minimize increases in delay experienced by drivers while providing necessary safety and mobility improvements for other users should be considered.