CHARBONNEAU
ENGINEERING LLC

MEMORANDUM

Date: June 9, 2014

To: Jim Sandlin
MacKay & Sposito, Inc.
1325 SE Tech Center Drive
Suite 140
Vancouver WA 98683

copy: Matt Kilmartin
CHPRD

From: Frank Charbonneau, PE, PTOE

Subject: **AM Peak Hour Analysis** FL1460
SW Walker Road at Lynnfield Lane, Beaverton

As requested by Washington County staff an AM peak hour traffic analysis has been completed for the intersection of SW Walker Road at Lynnfield Lane in association with the planned expansion of Cedar Hills Park in Beaverton. This report will serve as an addendum to the traffic study completed in March 2014 that did not address the AM conditions.

The AM analysis addresses the intersection's operations in terms of LOS, queuing conditions, safety, and need for an eastbound left turn lane. The traffic scenarios addressed in the latest full study (year 2014 existing traffic, 2018 background traffic, 2018 option 1, 2018 option 2, and 2018 option 3) were included in the AM analysis. For clarification the three options as previously defined in the study are described as follows.

Option 1
Park access at Cedar Hills Blvd provides full access with no restricted traffic movements

Option 2
Park access at Cedar Hills Blvd restricted to right turn ingress & and right turn egress

Option 3
Park access at Cedar Hills Blvd restricted to right turn ingress, right turn egress, & left turn ingress (no left turn egress movement)

Currently Walker Road at Lynnfield Lane is configured as a tee-shaped intersection controlled by signalization. The signal operates with two phases and provides a pedestrian crossing on Walker Road activated by pushbuttons. There are no separate turn lanes at the intersection and each approach lane is a single lane. Lynnfield Lane provides access to William Walker Elementary School and residences in the area. The school operates between 8:00AM to 2:35PM.

In order to incorporate the AM peak hour into the study it was necessary to collect new traffic counts at Walker & Lynnfield Lane during the hours of 7:00AM to 9:00AM on a school day. The count data is included in the appendix along with the traffic flow mapping, LOS and queuing conditions, crash data, and left turn lane warrant. The AM peak traffic hour was determined to occur from 7:15AM to 8:15AM with a total of 1,868 vehicles traveling through the intersection during that period. A total of 107 vehicles entered Lynnfield Lane from Walker Road and a total of 44 vehicles entered Walker Road from Lynnfield Lane during the peak hour. The peak 15 minute period occurred between 7:45AM and 8:00AM with a total of 488 vehicles entering the intersection.

The AM peak hour analysis results are summarized as listed below.

- The LOS results indicate that the signalized intersection operates at acceptable LOS 'B' or better for all traffic scenarios. This operational level remains consistent for each of the traffic control options considered at the Park access on Cedar Hills Blvd. Reference Table 1- Capacity Analysis & LOS.
- The eastbound left turn lane on Walker Road at Lynnfield Lane is warranted. The warrant is met for the existing traffic conditions, year 2018 background traffic, and year 2018 total traffic for all of the options. It is noted that redevelopment of the park does not cause the warrant to be met as the left turn lane is currently warranted.
- When the left turn lane is constructed a length of 175 feet is recommended to accommodate up to two school busses and three cars.
- The latest available crash history report for the study intersection was obtained from ODOT. The report documented that there were five crashes within the five year period (2008-2012) with a rate of 0.13 accidents per MEV/year (rate is below the safety threshold rate of 1.0 MEV/year). Two of the crashes were rear-end types involving eastbound vehicles and may have been preventable if a left turn lane was in place. Reference Table 2 below.

Table 1 Capacity Analysis Summary

Intersection	Type of Control	Traffic Scenario														
		2014 Existing			2018 Background			2018 Total - Option 1 -			2018 Total - Option 2 -			2018 Total - Option 3 -		
		LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c
Lynnfield Lane & Walker Road	Signal	A	4.4	0.69	A	4.8	0.71	A	4.8	0.72	A	4.9	0.72	A	4.9	0.72
	w/EB Left Turn Lane	-	-	-	-	-	-	*B*	*12.8*	*0.81*	*B*	*12.8*	*0.81*	*B*	*12.4*	*0.81*

Notes: 2000 *Highway Capacity Manual* methodology used in analysis.

Table 2 Crash Rate Results

Intersection	Accident History (Years)	Number of Accidents	Accidents per year	PM Peak Vol. Entering (veh/hr)	Accident rate per M.E.V.*
Lynnfield Lane and Walker Road	5	5	1.0	2094	**0.13**

* M.E.V. - million entering vehicles.

The study has revealed that due to the existing high volume conditions at Walker Road and Lynnfield Lane (48 eastbound vehicles turn left against over 1,000 westbound vehicles) in the AM peak hour the left turn lane warrant is easily met. For traffic circulation and safety reasons it is recommended that Washington County strongly consider constructing a new eastbound left turn lane at this location.

Appendix

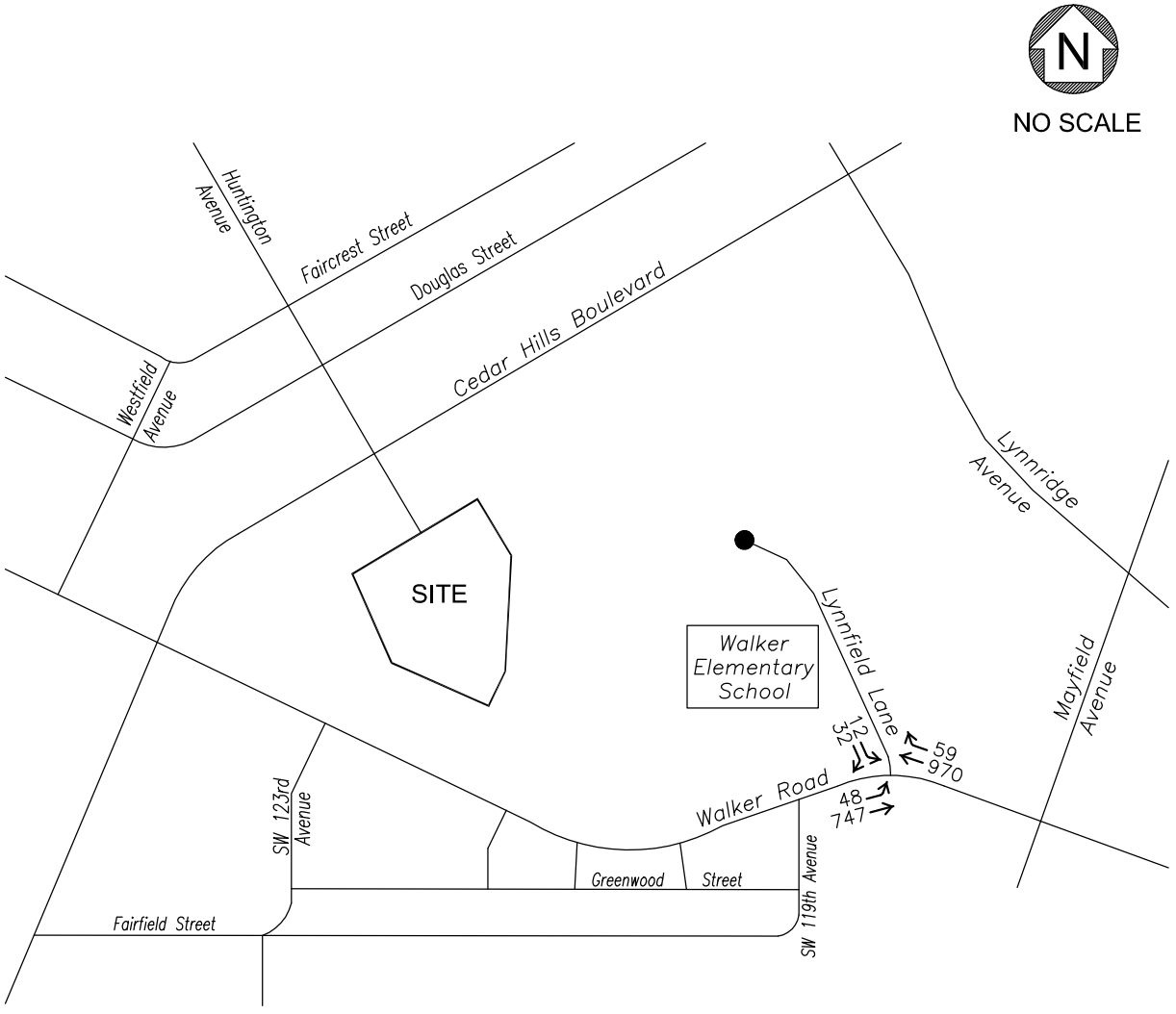
- Traffic Flow Maps
  - Figure 1, Existing Traffic
  - Figure 2, Year 2018 Background Traffic
  - Figure 3a, Trip Distribution Option 1
  - Figure 3b, Trip Assignment Option 1
  - Figure 4, Year 2018 Total Traffic Option 1
  - Figure 5a, Trip Distribution Option 2
  - Figure 5b, Trip Assignment Option 2
  - Figure 6, (blank, not used)
  - Figure 7, Year 2018 Total Traffic Option 2
  - Figure 8a, Trip Distribution Option 3
  - Figure 8b, Trip Assignment Option 3
  - Figure 9, (blank, not used)
  - Figure 10, Year 2018 Total Traffic Option 3
- AM Peak Hour Count Data
- Left Turn Lane Warrant
- HCS & Traffix Capacity Analysis Printouts

If you should have any questions, please contact Frank Charbonneau, PE, PTOE at 503.293.1118 or email Frank@CharbonneauEngineer.com.

6-9-14

REGISTERED PROFESSIONAL ENGINEER
9301
OREGON
July 22, 1977
FRANK R. CHARBONNEAU

RENEWS: 12-31-15



FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC

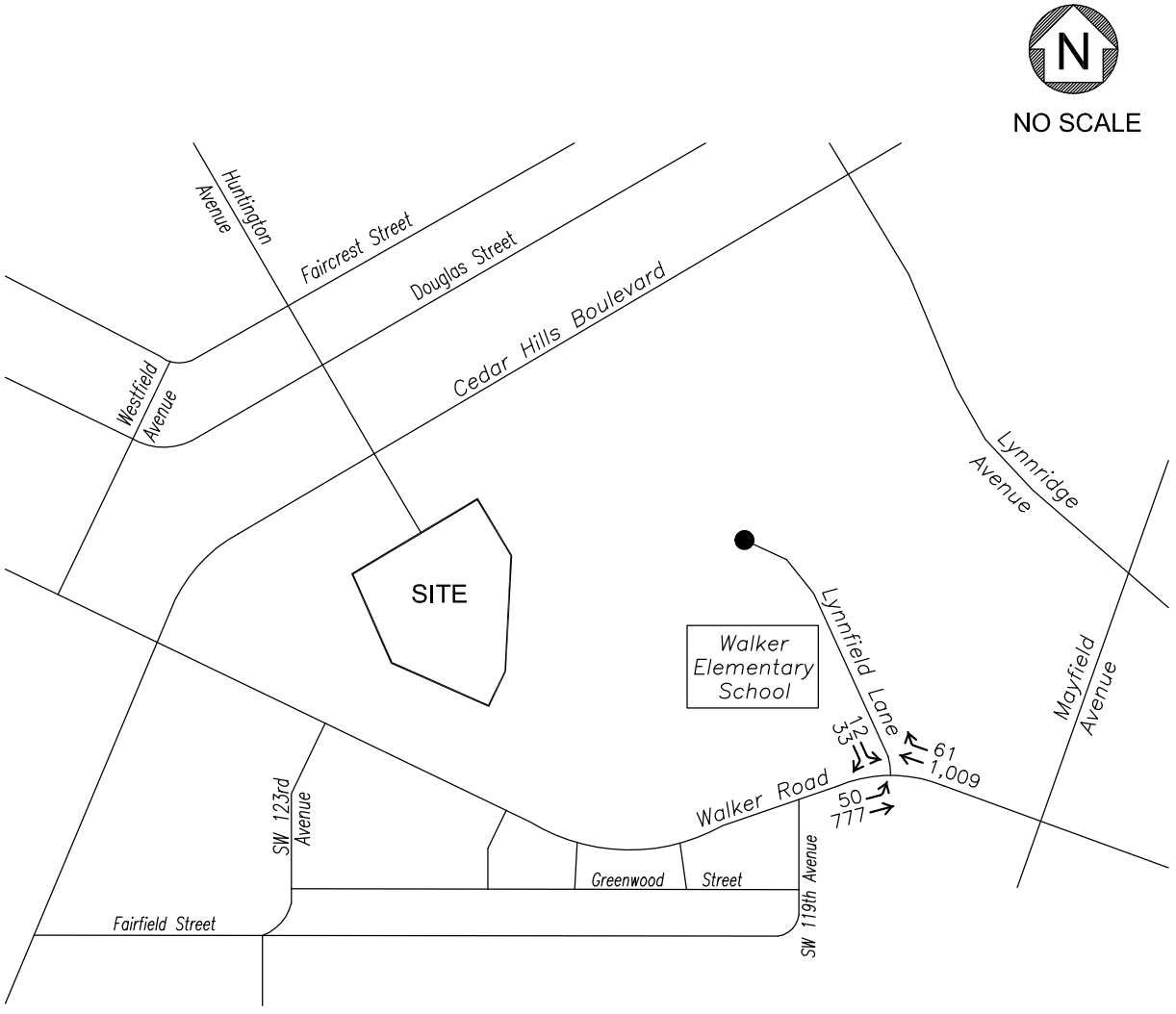
PROJECT: 13-28

NOTES:

2014 EXISTING TRAFFIC
AM PEAK HOUR
CEDAR HILLS COMMUNITY PARK

FIGURE

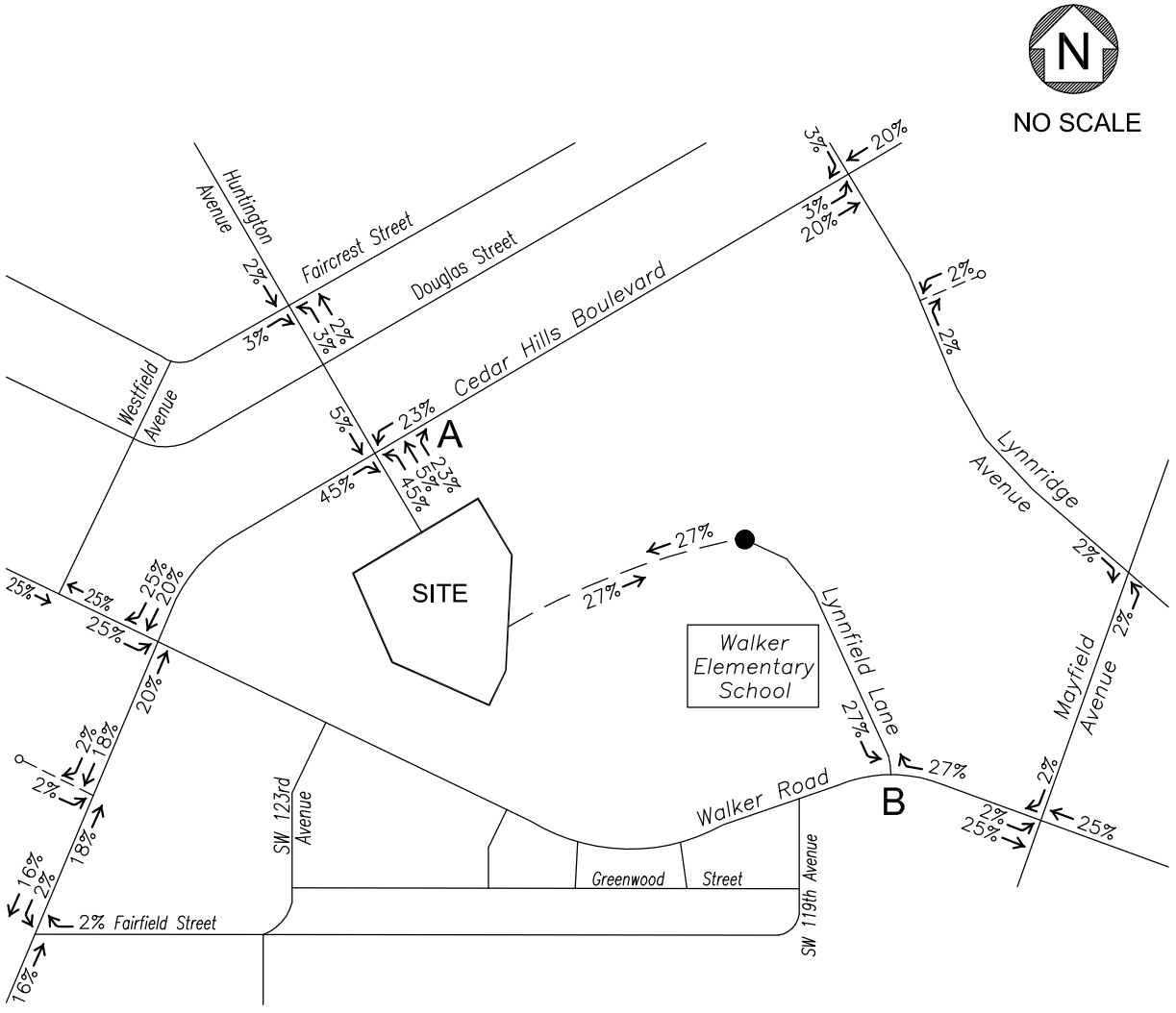
1



FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: 2018 Background Traffic = 2014 Existing Traffic + growth (1% per year for four (4) years).	2018 BACKGROUND TRAFFIC AM PEAK HOUR CEDAR HILLS COMMUNITY PARK	FIGURE 2



WEEKDAY AM PEAK HOUR

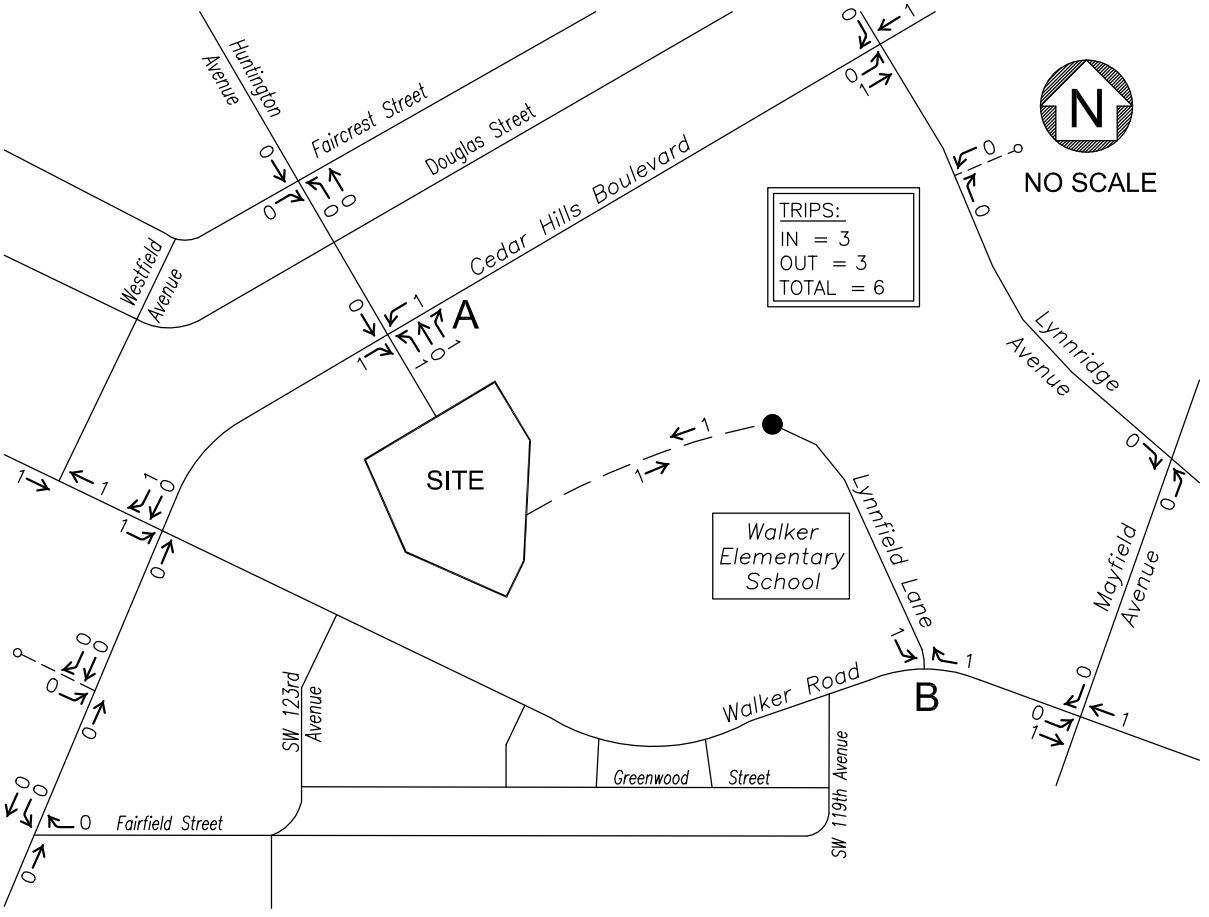
OPTION 1

ACCESS 'A' = Full-movement
ACCESS 'B' = Full-movement

FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: Trip distribution based on access configurations and engineering judgement.	TRIP DISTRIBUTION OPTION 1 CEDAR HILLS COMMUNITY PARK	FIGURE 3a

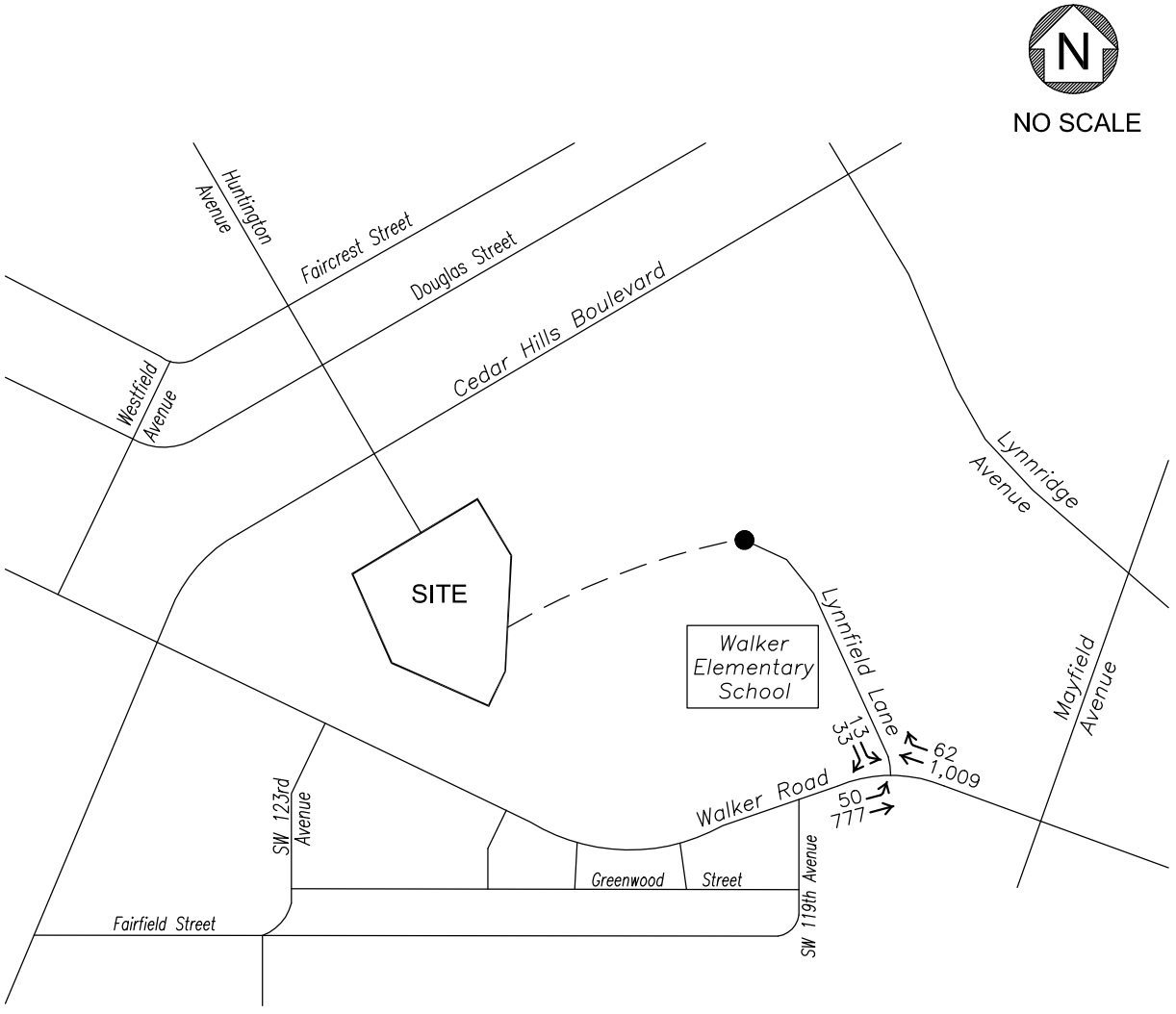


WEEKDAY AM PEAK HOUR

FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: Trip generation based on site-specific information.	TRIP ASSIGNMENT OPTION 1 CEDAR HILLS COMMUNITY PARK	FIGURE 3b



WEEKDAY AM PEAK HOUR

FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

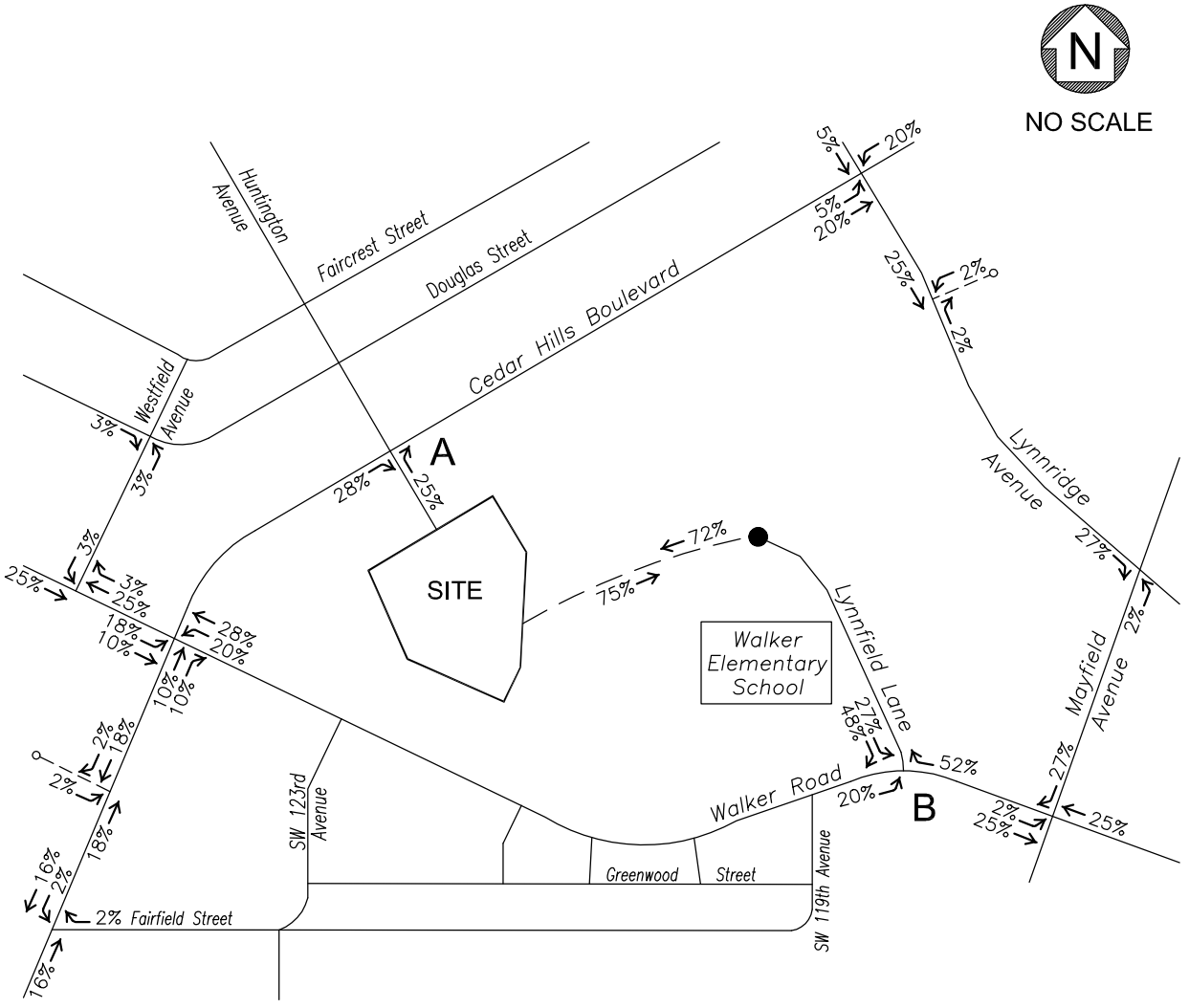
CHARBONNEAU ENGINEERING LLC

PROJECT: 13-28

NOTES:
2018 Total Traffic (Option 1)
= 2018 Background Traffic
+ Option 1 Trip Assignment.

2018 TOTAL TRAFFIC
OPTION 1
CEDAR HILLS COMMUNITY PARK

FIGURE
4



WEEKDAY AM PEAK HOUR

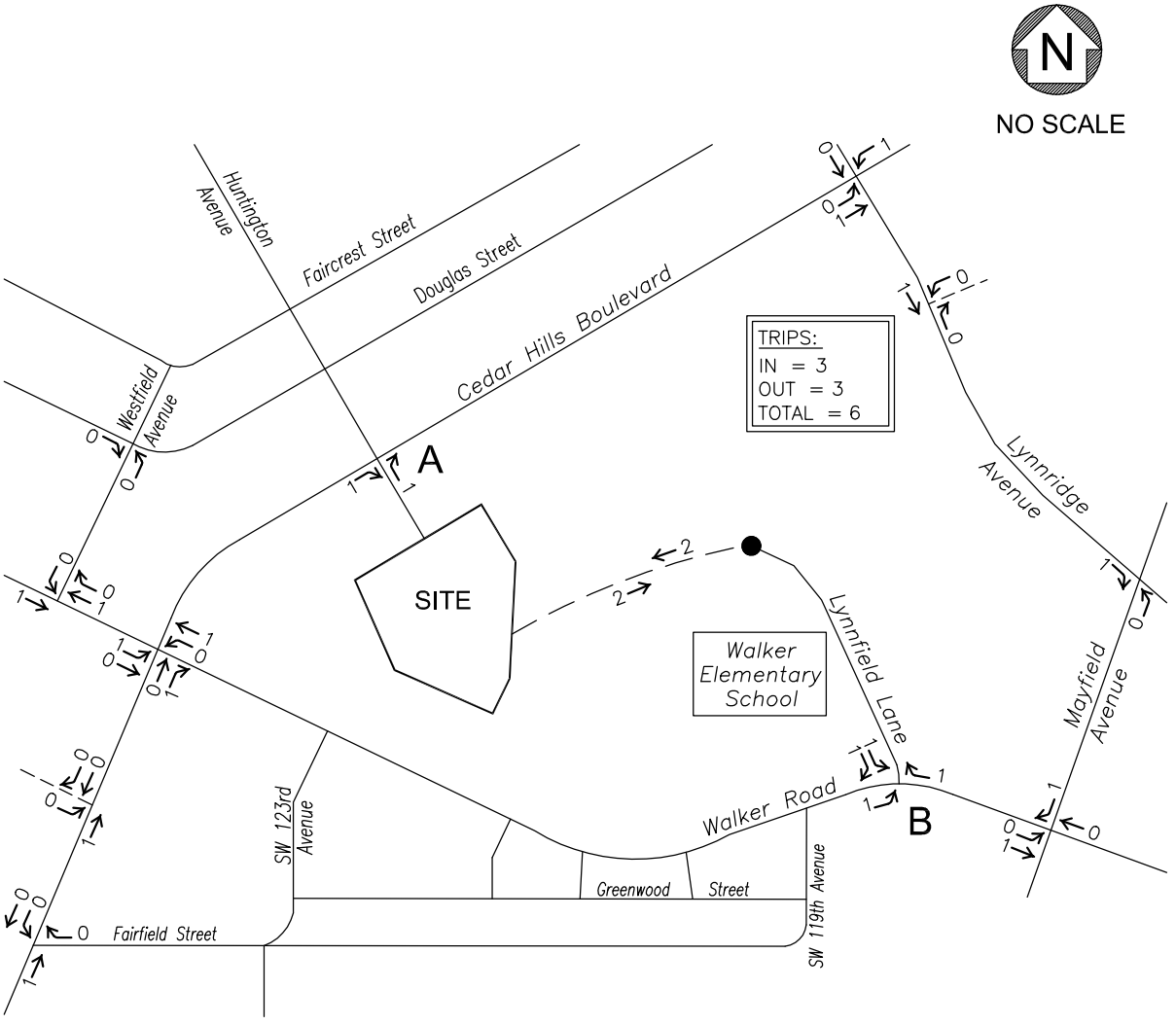
OPTION 2

ACCESS 'A' = Right In-Right Out
ACCESS 'B' = Full-movement

FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: Trip distribution based on access configurations and engineering judgement.	TRIP DISTRIBUTION OPTION 2 CEDAR HILLS COMMUNITY PARK	FIGURE 5a



WEEKDAY AM PEAK HOUR

FILE NAME: 1328flow2.dwg

PLOT DATE: 01.29.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: Trip generation based on site-specific information.	TRIP ASSIGNMENT OPTION 2 CEDAR HILLS COMMUNITY PARK	FIGURE 5b

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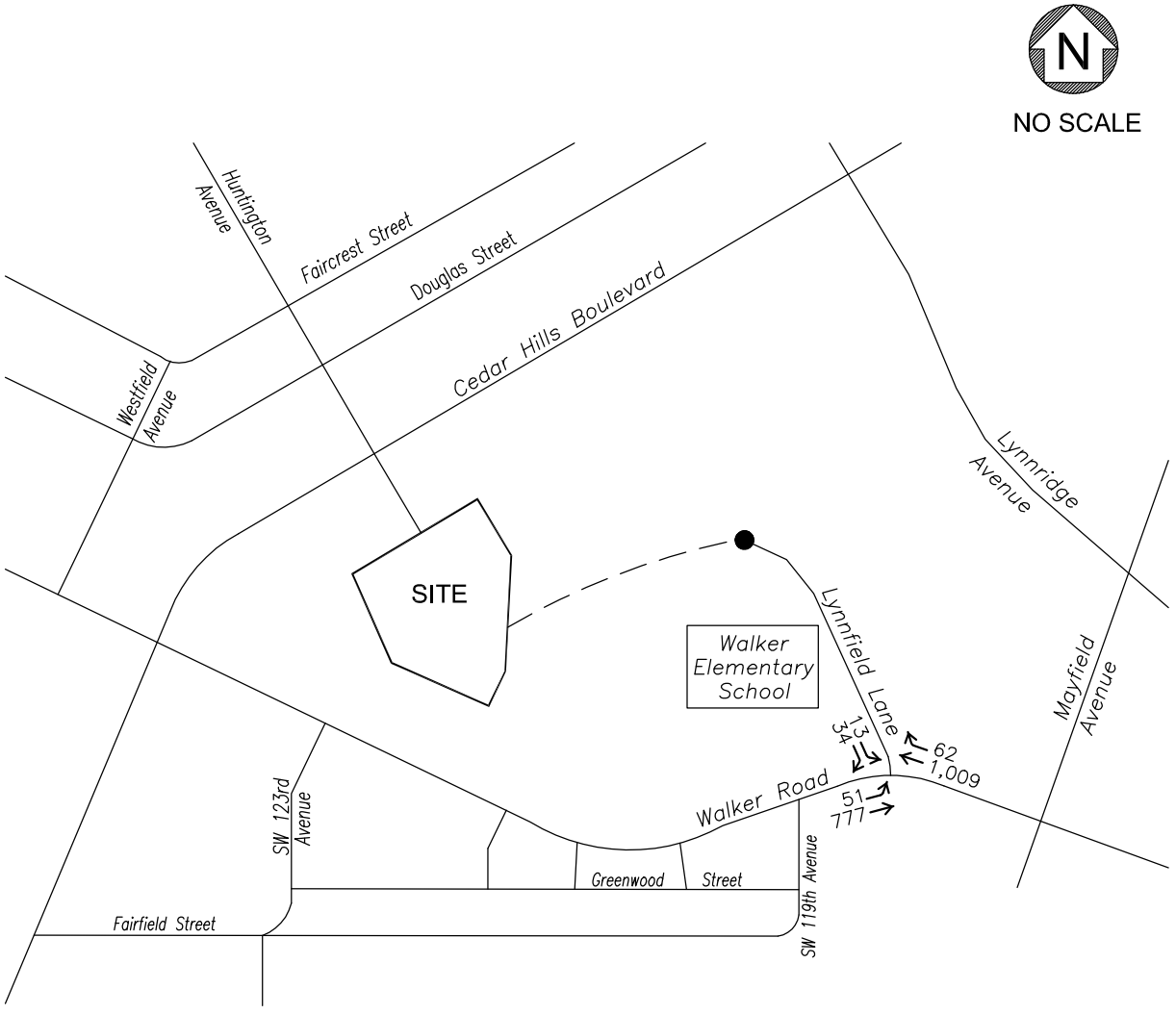
FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: Option 2 reroute based on the Right In-Right Out configuration at Access 'A' (the park's access to Cedar Hills Blvd).	TRAFFIC REROUTE OPTION 2 CEDAR HILLS COMMUNITY PARK	FIGURE 6

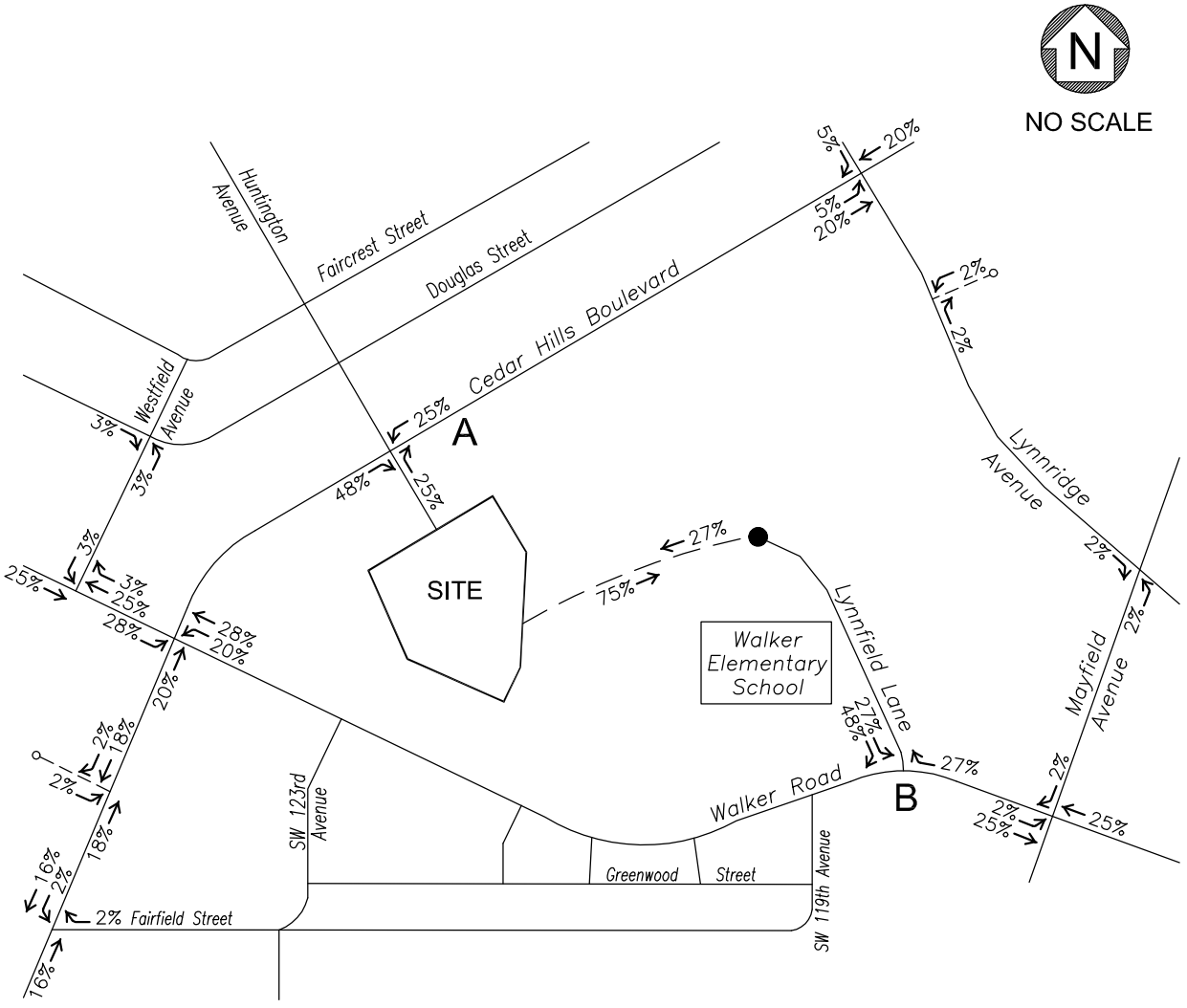


WEEKDAY AM PEAK HOUR

FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: 2018 Total Traffic (Option 2) = 2018 Background Traffic + Option 2 Reroute + Option 2 Trip Assignment.	2018 TOTAL TRAFFIC OPTION 2 CEDAR HILLS COMMUNITY PARK	FIGURE 7



WEEKDAY AM PEAK HOUR

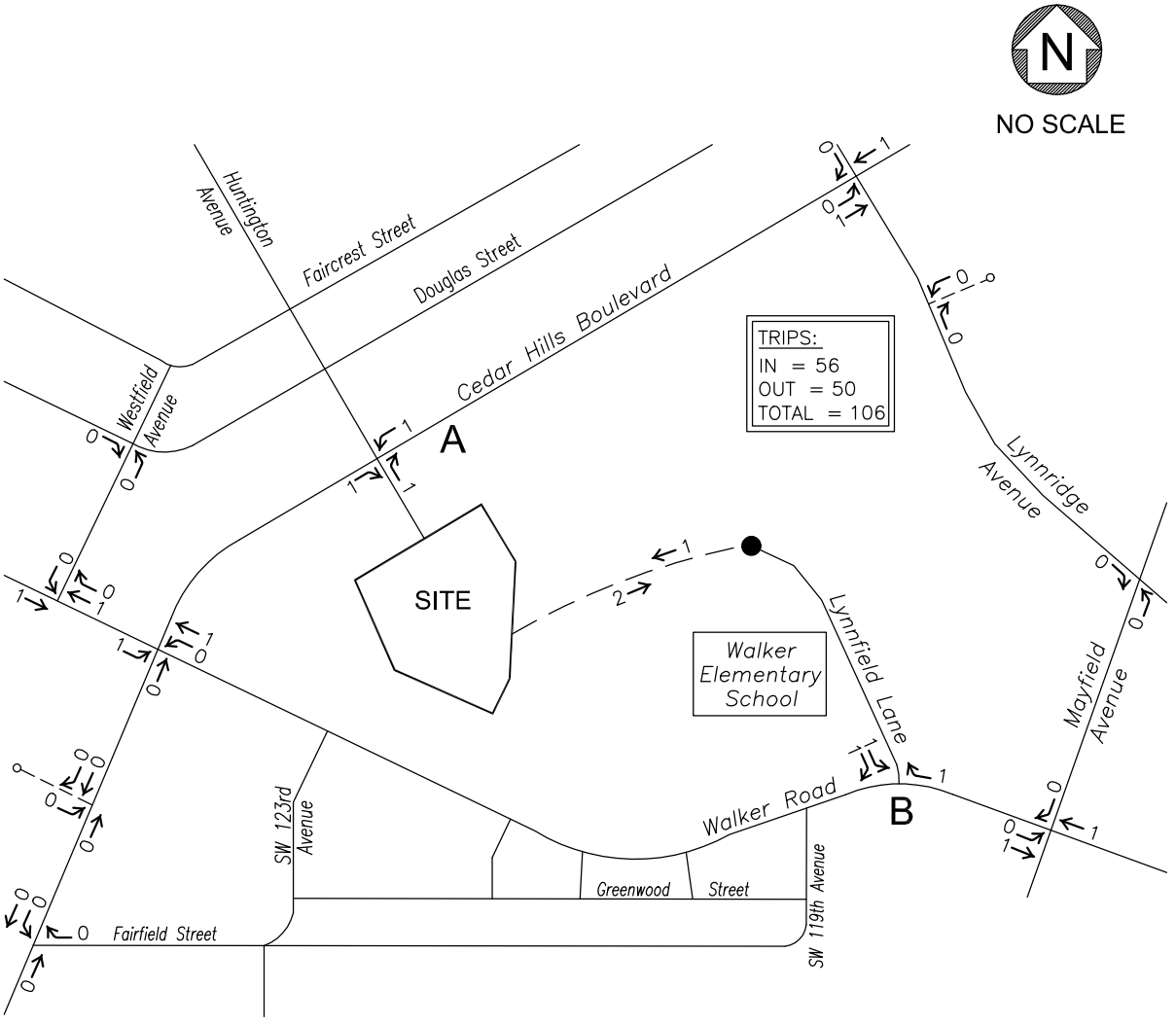
OPTION 3

ACCESS 'A' = Right In-Right Out-Left In
ACCESS 'B' = Full-movement

FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: Trip distribution based on access configurations and engineering judgement.	TRIP DISTRIBUTION OPTION 3 CEDAR HILLS COMMUNITY PARK	FIGURE 8a



FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC

PROJECT: 13-28

NOTES: Trip generation based on site-specific information.

TRIP ASSIGNMENT
OPTION 3
CEDAR HILLS COMMUNITY PARK

FIGURE

8b

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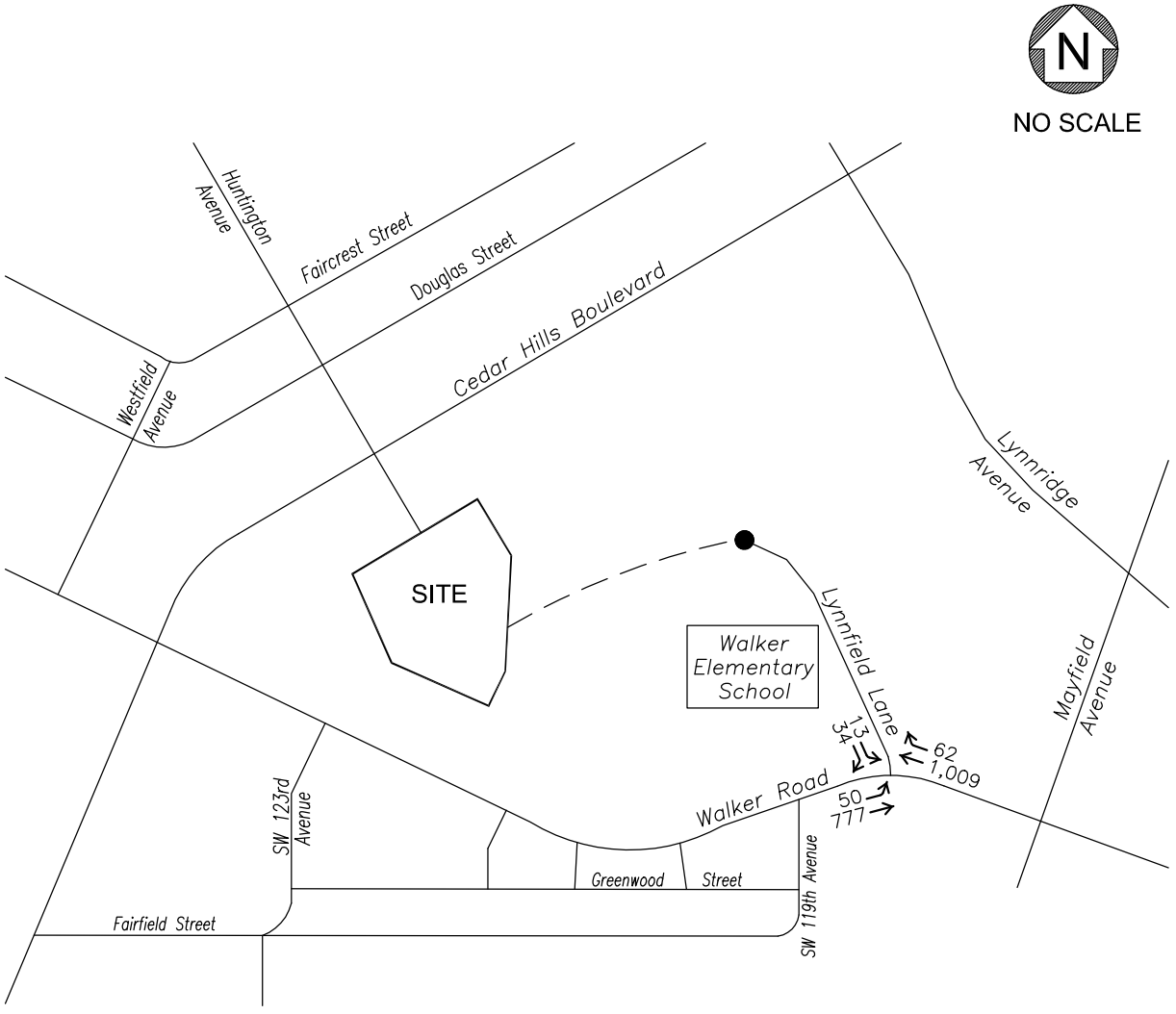
FILE NAME: 1328flow.dwg

PLOT DATE: 01.15.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: Option 3 reroute based on the Right In-Right Out-Left In configuration at Access 'A' (the park's access to Cedar Hills Blvd).	TRAFFIC REROUTE OPTION 3 CEDAR HILLS COMMUNITY PARK	FIGURE 9



WEEKDAY AM PEAK HOUR

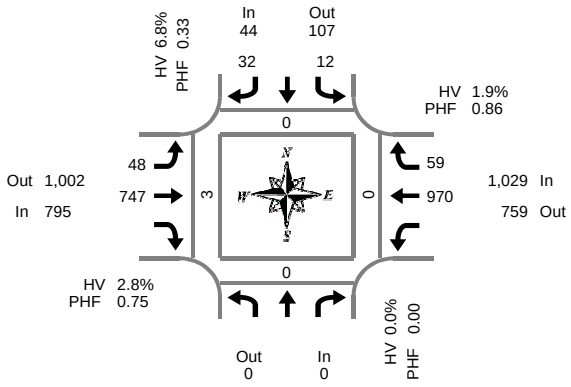
FILE NAME: 1328flow3.dwg

PLOT DATE: 05.13.14

CHARBONNEAU ENGINEERING LLC PROJECT: 13-28	NOTES: 2018 Total Traffic (Option 3) = 2018 Background Traffic + Option 3 Reroute + Option 3 Trip Assignment.	2018 TOTAL TRAFFIC OPTION 3 CEDAR HILLS COMMUNITY PARK	FIGURE 10

Total Vehicle Summary

Clay Carney
(503) 833-2740



Peak Hour Summary
7:15 AM to 8:15 AM

SW Lynnfield Ln & SW Walker Rd

Thursday, May 01, 2014
7:00 AM to 9:00 AM

15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SW Lynnfield Ln				Southbound SW Lynnfield Ln				Eastbound SW Walker Rd				Westbound SW Walker Rd				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
7:00 AM				0	0		2	0	2	211		0		184	2	1	401	0	0	0	3
7:15 AM				0	0		1	0	1	264		1		204	5	2	475	0	0	0	0
7:30 AM				0	1		1	0	7	217		0		250	10	4	486	0	0	0	0
7:45 AM				0	1		7	0	14	167		0		282	17	0	488	0	0	0	0
8:00 AM				0	10		23	0	26	99		0		234	27	3	419	0	0	0	3
8:15 AM				0	11		24	0	16	122		0		232	18	1	423	0	0	0	4
8:30 AM				0	4		13	0	5	169		0		251	3	1	445	0	0	0	0
8:45 AM				0	1		3	0	4	146		0		250	3	0	407	0	0	0	0
Total Survey				0	28		74	0	75	1,395		1		1,887	85	12	3,544	0	0	0	10

Peak Hour Summary
7:15 AM to 8:15 AM

By Approach	Northbound SW Lynnfield Ln				Southbound SW Lynnfield Ln				Eastbound SW Walker Rd				Westbound SW Walker Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	0	0	0	0	44	107	151	0	795	1,002	1,797	1	1,029	759	1,788	9	1,868	0	0	0	3
%HV	0.0%				6.8%				2.8%				1.9%				2.4%				
PHF	0.00				0.33				0.75				0.86				0.96				

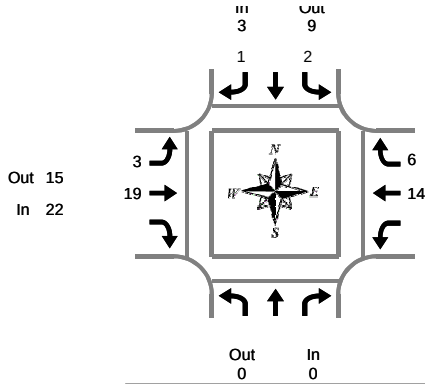
By Movement	Northbound SW Lynnfield Ln				Southbound SW Lynnfield Ln				Eastbound SW Walker Rd				Westbound SW Walker Rd				Total
				Total	L		R	Total	L	T		Total		T	R	Total	
Volume				0	12		32	44	48	747		795		970	59	1,029	1,868
%HV	NA	NA	NA	0.0%	16.7%	NA	3.1%	6.8%	6.3%	2.5%	NA	2.8%	NA	1.4%	10.2%	1.9%	2.4%
PHF				0.00	0.30		0.35	0.33	0.46	0.71		0.75		0.86	0.55	0.86	0.96

Rolling Hour Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SW Lynnfield Ln				Southbound SW Lynnfield Ln				Eastbound SW Walker Rd				Westbound SW Walker Rd				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
7:00 AM				0	2		11	0	24	859		1		920	34	7	1,850	0	0	0	3
7:15 AM				0	12		32	0	48	747		1		970	59	9	1,868	0	0	0	3
7:30 AM				0	23		55	0	63	605		0		998	72	8	1,816	0	0	0	7
7:45 AM				0	26		67	0	61	557		0		999	65	5	1,775	0	0	0	7
8:00 AM				0	26		63	0	51	536		0		967	51	5	1,694	0	0	0	7

Heavy Vehicle Summary

Clay Carney
(503) 833-2740



Peak Hour Summary
7:15 AM to 8:15 AM

SW Lynnfield Ln & SW Walker Rd

Thursday, May 01, 2014
7:00 AM to 9:00 AM

Heavy Vehicle 15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SW Lynnfield Ln				Southbound SW Lynnfield Ln				Eastbound SW Walker Rd				Westbound SW Walker Rd				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
7:00 AM				0	0		0	0	0	4		4		3	0	3	7
7:15 AM				0	0		0	0	0	7		7		5	0	5	12
7:30 AM				0	0		0	0	0	6		6		3	0	3	9
7:45 AM				0	0		0	0	0	3		3		5	0	5	8
8:00 AM				0	2		1	3	3	3		6		1	6	7	16
8:15 AM				0	2		6	8	2	2		4		2	2	4	16
8:30 AM				0	1		2	3	1	4		5		9	1	10	18
8:45 AM				0	0		0	0	0	4		4		8	0	8	12
Total Survey				0	5		9	14	6	33		39		36	9	45	98

Heavy Vehicle Peak Hour Summary
7:15 AM to 8:15 AM

By Approach	Northbound SW Lynnfield Ln			Southbound SW Lynnfield Ln			Eastbound SW Walker Rd			Westbound SW Walker Rd			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	0	0	0	3	9	12	22	15	37	20	21	41	45
PHF	0.00			0.05			0.32			0.23			0.23

By Movement	Northbound SW Lynnfield Ln				Southbound SW Lynnfield Ln				Eastbound SW Walker Rd				Westbound SW Walker Rd				Total
				Total	L		R	Total	L	T		Total		T	R	Total	
Volume				0	2		1	3	3	19		22		14	6	20	45
PHF				0.00	0.10		0.03	0.05	0.13	0.28		0.32		0.18	0.17	0.23	0.23

Heavy Vehicle Rolling Hour Summary
7:00 AM to 9:00 AM

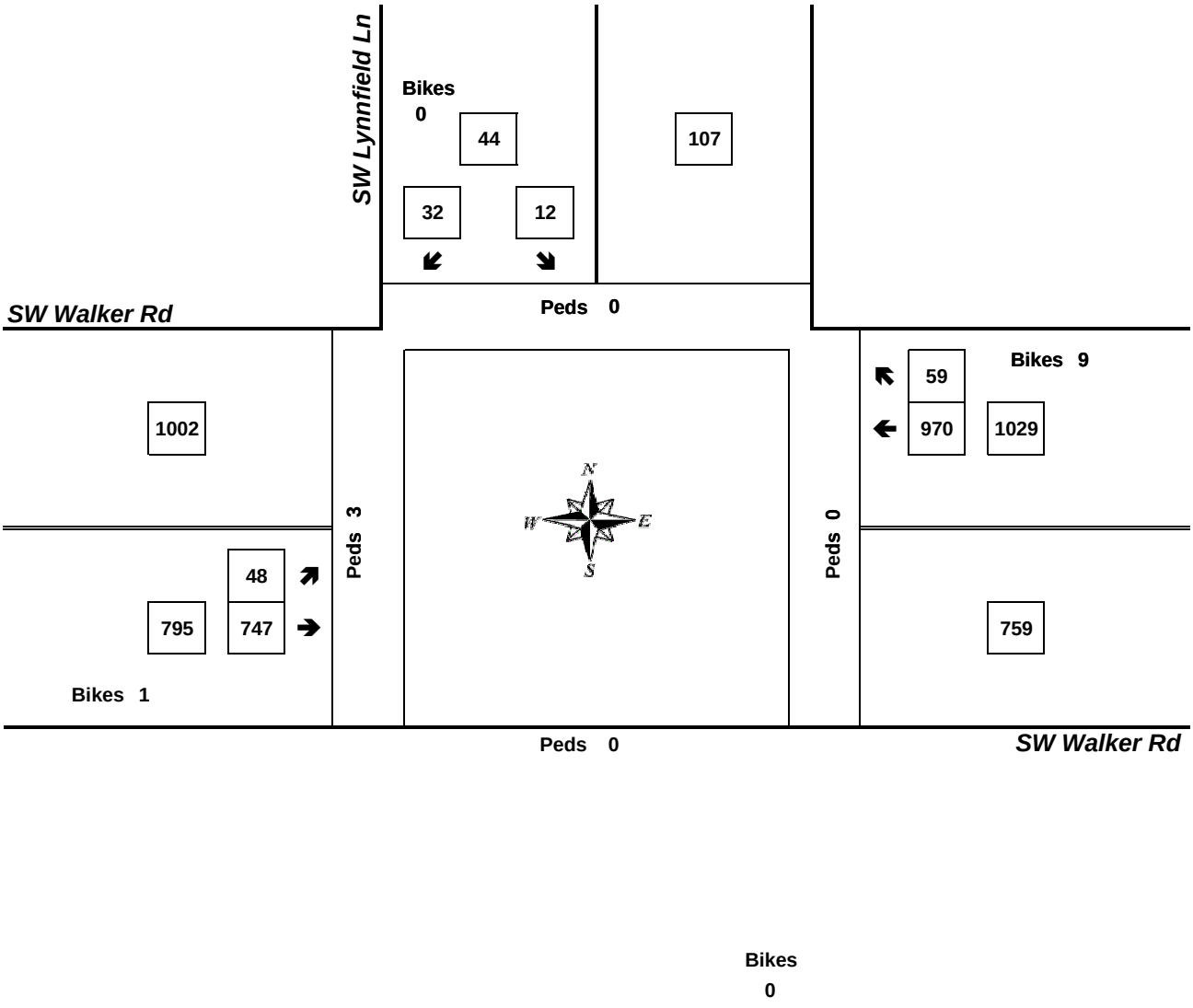
Interval Start Time	Northbound SW Lynnfield Ln				Southbound SW Lynnfield Ln				Eastbound SW Walker Rd				Westbound SW Walker Rd				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
7:00 AM				0	0		0	0	0	20		20		16	0	16	36
7:15 AM				0	2		1	3	3	19		22		14	6	20	45
7:30 AM				0	4		7	11	5	14		19		11	8	19	49
7:45 AM				0	5		9	14	6	12		18		17	9	26	58
8:00 AM				0	5		9	14	6	13		19		20	9	29	62

Peak Hour Summary

Clay Carney
(503) 833-2740

SW Lynnfield Ln & SW Walker Rd

7:15 AM to 8:15 AM
Thursday, May 01, 2014



Approach	PHF	HV%	Volume
EB	0.75	2.8%	795
WB	0.86	1.9%	1,029
NB	0.00	0.0%	0
SB	0.33	6.8%	44
Intersection	0.96	2.4%	1,868

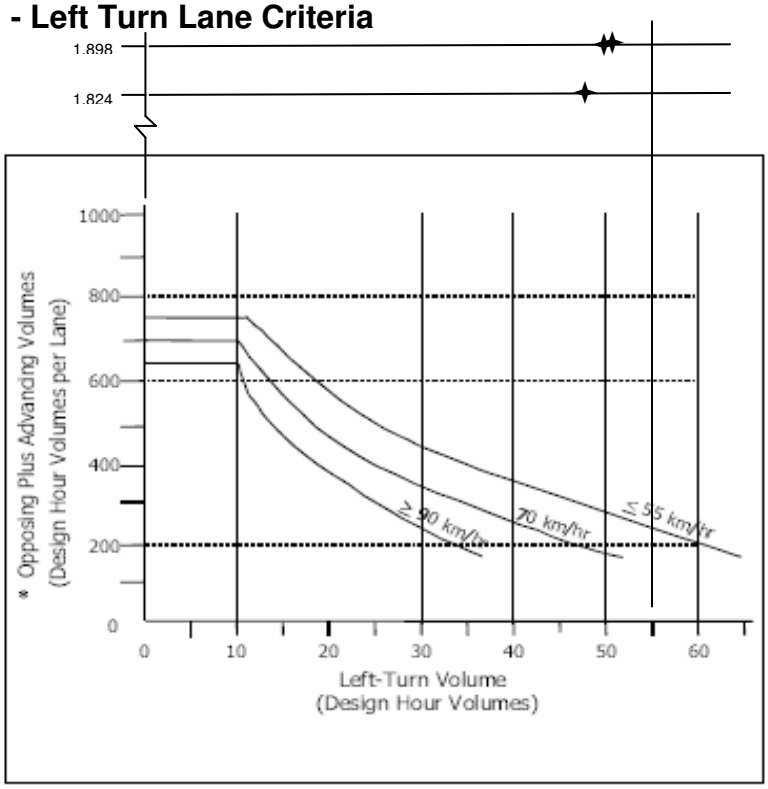
Count Period: 7:00 AM to 9:00 AM

Oregon Department of Transportation - Left Turn Lane Criteria

I. Criterion 1: Vehicular Volume

The vehicular volume criterion is intended for application where the volume of intersecting traffic is the principal reason for considering installation of a left turn lane. The volume criteria is determined by the Texas Transportation Institute (TTI) curves in Figure 1.

The criteria is not met from zero to ten left turn vehicles per hour, but indicates that careful consideration be given to installing a left turn lane due to the increased potential for accidents in the through lanes. While the turn volumes are low, the adverse safety and operations impacts may require installation of a left turn lane. The final determination will be based on a field study.



* ((Advancing volume/number of advancing through lanes) + (opposing volume/ number of opposing through lanes))

FIGURE 1

Intersection	Mov't	Analysis Period	Speed	Opposing plus Advancing Volume (vph per lane)	Left Turns in Advancing Volume (vph)	Storage Req'd?
Lynnfield Lane & Walker Road	EB LT	2014 Extg Traffic, AM Peak	35 mph (56 kmh)	1824	48	Yes
		2018 Bkgd Traffic, AM Peak		1897	50	Yes
		2018 Total Traffic-Opt. 1, AM Peak		1898	50	Yes
		2018 Total Traffic-Opt. 2, AM Peak		1899	51	Yes
		2018 Total Traffic-Opt. 3, AM Peak		1898	50	Yes

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	*MEO*	Intersection	*Walker Road and Lynnfield Lane*
Agency or Co.	*Charbonneau Engineering LLC*	Area Type	*All other areas*
Date Performed	*05/13/2014*	Jurisdiction	*Washington County*
Time Period	*Weekday AM Peak Hour*	Analysis Year	*2014 Existing Traffic*
		Project ID	*#13-28 Cedar Hills Community Park*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	0	0	1	0	0	0	0	0	0	0
Lane group		LT			TR						LR	
Volume, V (vph)	48	747			970	59				12		32
% Heavy vehicles, %HV	0	0			0	0				0		0
Peak-hour factor, PHF	0.96	0.96			0.96	0.96				0.96		0.96
Pretimed (P) or actuated (A)	P	A			A	A				A		A
Start-up lost time, l_1		2.0			2.0						2.0	
Extension of effective green, e		2.0			2.0						2.0	
Arrival type, AT		3			3						3	
Unit extension, UE		3.0			3.0						3.0	
Filtering/metering, I		1.000			1.000						1.000	
Initial unmet demand, Q_b		0.0			0.0						0.0	
Ped / Bike / RTOR volumes				0		0	0			0	0	0
Lane width		12.0			12.0						12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N		N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0						0	
Min. time for pedestrians, G_p				3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	SB Only	06	07	08
Timing	G = 48.0	G =	G =	G =	G = 4.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		828			1071						46	
Lane group capacity, c		1376			1508						113	
v/c ratio, X		0.60			0.71						0.41	
Total green ratio, g/C		0.80			0.80						0.07	
Uniform delay, d_1		2.3			2.8						26.9	
Progression factor, PF		1.000			1.000						1.000	
Delay calibration, k		0.19			0.27						0.11	
Incremental delay, d_2		0.7			1.6						2.4	
Initial queue delay, d_3												
Control delay		3.1			4.4						29.2	
Lane group LOS		A			A						C	
Approach delay	3.1			4.4						29.2		
Approach LOS	A			A						C		
Intersection delay	4.4			X_C = 0.69			Intersection LOS			A		

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HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	*MEO*	Intersection	*Walker Road and Lynnfield Lane*
Agency or Co.	*Charbonneau Engineering LLC*	Area Type	*All other areas*
Date Performed	*05/13/2014*	Jurisdiction	*Washington County*
Time Period	*Weekday AM Peak Hour*	Analysis Year	*2018 Background Traffic*
		Project ID	*#13-28 Cedar Hills Community Park*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	0	0	1	0	0	0	0	0	0	0
Lane group		LT			TR						LR	
Volume, V (vph)	50	777			1009	61				12		33
% Heavy vehicles, %HV	0	0			0	0				0		0
Peak-hour factor, PHF	0.96	0.96			0.96	0.96				0.96		0.96
Pretimed (P) or actuated (A)	P	A			A	A				A		A
Start-up lost time, l_1		2.0			2.0						2.0	
Extension of effective green, e		2.0			2.0						2.0	
Arrival type, AT		3			3						3	
Unit extension, UE		3.0			3.0						3.0	
Filtering/metering, I		1.000			1.000						1.000	
Initial unmet demand, Q_b		0.0			0.0						0.0	
Ped / Bike / RTOR volumes				0		0	0			0	0	0
Lane width		12.0			12.0						12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N		N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0						0	
Min. time for pedestrians, G_p				3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	SB Only	06	07	08
Timing	G = 48.0	G =	G =	G =	G = 4.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		861			1115						47	
Lane group capacity, c		1367			1508						113	
v/c ratio, X		0.63			0.74						0.42	
Total green ratio, g/C		0.80			0.80						0.07	
Uniform delay, d_1		2.4			2.9						26.9	
Progression factor, PF		1.000			1.000						1.000	
Delay calibration, k		0.21			0.30						0.11	
Incremental delay, d_2		0.9			2.0						2.5	
Initial queue delay, d_3												
Control delay		3.4			4.9						29.4	
Lane group LOS		A			A						C	
Approach delay	3.4			4.9						29.4		
Approach LOS	A			A						C		
Intersection delay	4.8			X_C = 0.71			Intersection LOS			A		

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HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	*MEO*	Intersection	*Walker Road and Lynnfield Lane*
Agency or Co.	*Charbonneau Engineering LLC*	Area Type	*All other areas*
Date Performed	*05/13/2014*	Jurisdiction	*Washington County*
Time Period	*Weekday AM Peak Hour*	Analysis Year	*2018 Total - Opt. 1*
		Project ID	*#13-28 Cedar Hills Community Park*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	0	0	1	0	0	0	0	0	0	0
Lane group		LT			TR						LR	
Volume, V (vph)	50	777			1009	62				13		33
% Heavy vehicles, %HV	0	0			0	0				0		0
Peak-hour factor, PHF	0.96	0.96			0.96	0.96				0.96		0.96
Pretimed (P) or actuated (A)	P	A			A	A				A		A
Start-up lost time, l_1		2.0			2.0						2.0	
Extension of effective green, e		2.0			2.0						2.0	
Arrival type, AT		3			3						3	
Unit extension, UE		3.0			3.0						3.0	
Filtering/metering, I		1.000			1.000						1.000	
Initial unmet demand, Q_b		0.0			0.0						0.0	
Ped / Bike / RTOR volumes				0		0	0			0	0	0
Lane width		12.0			12.0						12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N		N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0						0	
Min. time for pedestrians, G_p				3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	SB Only	06	07	08
Timing	G = 48.0	G =	G =	G =	G = 4.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		861			1116						48	
Lane group capacity, c		1367			1508						113	
v/c ratio, X		0.63			0.74						0.42	
Total green ratio, g/C		0.80			0.80						0.07	
Uniform delay, d_1		2.4			2.9						26.9	
Progression factor, PF		1.000			1.000						1.000	
Delay calibration, k		0.21			0.30						0.11	
Incremental delay, d_2		0.9			2.0						2.6	
Initial queue delay, d_3												
Control delay		3.4			4.9						29.5	
Lane group LOS		A			A						C	
Approach delay	3.4			4.9						29.5		
Approach LOS	A			A						C		
Intersection delay	4.8			X_C = 0.72			Intersection LOS			A		

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HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	*MEO*	Intersection	*Walker Road and Lynnfield Lane*
Agency or Co.	*Charbonneau Engineering LLC*	Area Type	*All other areas*
Date Performed	*05/13/2014*	Jurisdiction	*Washington County*
Time Period	*Weekday AM Peak Hour*	Analysis Year	*2018 Total - Opt. 1 MITIGATED*
		Project ID	*#13-28 Cedar Hills Community Park*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	1	1	0	0	1	0	0	0	0	0	0	0
Lane group	L	T			TR						LR	
Volume, V (vph)	50	777			1009	62				13		33
% Heavy vehicles, %HV	0	0			0	0				0		0
Peak-hour factor, PHF	0.96	0.96			0.96	0.96				0.96		0.96
Pretimed (P) or actuated (A)	P	P			P	P				A		A
Start-up lost time, l_1	2.0	2.0			2.0						2.0	
Extension of effective green, e	2.0	2.0			2.0						2.0	
Arrival type, AT	3	3			3						3	
Unit extension, UE	3.0	3.0			3.0						3.0	
Filtering/metering, I	1.000	1.000			1.000						1.000	
Initial unmet demand, Q_b	0.0	0.0			0.0						0.0	
Ped / Bike / RTOR volumes				0		0	0			0	0	0
Lane width	12.0	12.0			12.0						12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N		N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0	0			0						0	
Min. time for pedestrians, G_p				3.2			3.2			3.2		

Phasing	EB Only	Thru & RT	03	04	SB Only	06	07	08
Timing	G = 4.0	G = 40.0	G =	G =	G = 4.0	G =	G =	G =
	Y = 4	Y = 4	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	52	809			1116						48	
Lane group capacity, c	120	1520			1257						113	
v/c ratio, X	0.43	0.53			0.89						0.42	
Total green ratio, g/C	0.07	0.80			0.67						0.07	
Uniform delay, d_1	26.9	2.1			8.2						26.9	
Progression factor, PF	1.000	1.000			1.000						1.000	
Delay calibration, k	0.50	0.50			0.50						0.11	
Incremental delay, d_2	11.0	1.3			9.5						2.6	
Initial queue delay, d_3												
Control delay	37.9	3.4			17.7						29.5	
Lane group LOS	D	A			B						C	
Approach delay	5.5			17.7						29.5		
Approach LOS	A			B						C		
Intersection delay	12.8			X_C = 0.81			Intersection LOS			B		

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HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	*MEO*	Intersection	*Walker Road and Lynnfield Lane*
Agency or Co.	*Charbonneau Engineering LLC*	Area Type	*All other areas*
Date Performed	*05/13/2014*	Jurisdiction	*Washington County*
Time Period	*Weekday AM Peak Hour*	Analysis Year	*2018 Total - Opt. 2*
		Project ID	*#13-28 Cedar Hills Community Park*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	0	0	1	0	0	0	0	0	0	0
Lane group		LT			TR						LR	
Volume, V (vph)	51	777			1009	62				13		34
% Heavy vehicles, %HV	0	0			0	0				0		0
Peak-hour factor, PHF	0.96	0.96			0.96	0.96				0.96		0.96
Pretimed (P) or actuated (A)	P	A			A	A				A		A
Start-up lost time, l_1		2.0			2.0						2.0	
Extension of effective green, e		2.0			2.0						2.0	
Arrival type, AT		3			3						3	
Unit extension, UE		3.0			3.0						3.0	
Filtering/metering, I		1.000			1.000						1.000	
Initial unmet demand, Q_b		0.0			0.0						0.0	
Ped / Bike / RTOR volumes				0		0	0			0	0	0
Lane width		12.0			12.0						12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N		N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0						0	
Min. time for pedestrians, G_p				3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	SB Only	06	07	08
Timing	G = 48.0	G =	G =	G =	G = 4.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		862			1116						49	
Lane group capacity, c		1363			1508						113	
v/c ratio, X		0.63			0.74						0.43	
Total green ratio, g/C		0.80			0.80						0.07	
Uniform delay, d_1		2.4			2.9						26.9	
Progression factor, PF		1.000			1.000						1.000	
Delay calibration, k		0.21			0.30						0.11	
Incremental delay, d_2		1.0			2.0						2.7	
Initial queue delay, d_3												
Control delay		3.4			4.9						29.6	
Lane group LOS		A			A						C	
Approach delay	3.4			4.9						29.6		
Approach LOS	A			A						C		
Intersection delay	4.9			X_C = 0.72			Intersection LOS			A		

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HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	*MEO*	Intersection	*Walker Road and Lynnfield Lane*
Agency or Co.	*Charbonneau Engineering LLC*	Area Type	*All other areas*
Date Performed	*05/13/2014*	Jurisdiction	*Washington County*
Time Period	*Weekday AM Peak Hour*	Analysis Year	*2018 Total - Opt. 2 MITIGATED*
		Project ID	*#13-28 Cedar Hills Community Park*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	1	1	0	0	1	0	0	0	0	0	0	0
Lane group	L	T			TR						LR	
Volume, V (vph)	51	777			1009	62				13		34
% Heavy vehicles, %HV	0	0			0	0				0		0
Peak-hour factor, PHF	0.96	0.96			0.96	0.96				0.96		0.96
Pretimed (P) or actuated (A)	P	P			P	P				A		A
Start-up lost time, l_1	2.0	2.0			2.0						2.0	
Extension of effective green, e	2.0	2.0			2.0						2.0	
Arrival type, AT	3	3			3						3	
Unit extension, UE	3.0	3.0			3.0						3.0	
Filtering/metering, I	1.000	1.000			1.000						1.000	
Initial unmet demand, Q_b	0.0	0.0			0.0						0.0	
Ped / Bike / RTOR volumes				0		0	0			0	0	0
Lane width	12.0	12.0			12.0						12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N		N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0	0			0						0	
Min. time for pedestrians, G_p				3.2			3.2			3.2		

Phasing	EB Only	Thru & RT	03	04	SB Only	06	07	08
Timing	G = 4.0	G = 40.0	G =	G =	G = 4.0	G =	G =	G =
	Y = 4	Y = 4	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	53	809			1116						49	
Lane group capacity, c	120	1520			1257						113	
v/c ratio, X	0.44	0.53			0.89						0.43	
Total green ratio, g/C	0.07	0.80			0.67						0.07	
Uniform delay, d_1	26.9	2.1			8.2						26.9	
Progression factor, PF	1.000	1.000			1.000						1.000	
Delay calibration, k	0.50	0.50			0.50						0.11	
Incremental delay, d_2	11.4	1.3			9.5						2.7	
Initial queue delay, d_3												
Control delay	38.3	3.4			17.7						29.6	
Lane group LOS	D	A			B						C	
Approach delay	5.6			17.7						29.6		
Approach LOS	A			B						C		
Intersection delay	12.8			X_C = 0.81			Intersection LOS			B		

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HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	*MEO*	Intersection	*Walker Road and Lynnfield Lane*
Agency or Co.	*Charbonneau Engineering LLC*	Area Type	*All other areas*
Date Performed	*05/13/2014*	Jurisdiction	*Washington County*
Time Period	*Weekday AM Peak Hour*	Analysis Year	*2018 Total - Opt. 3*
		Project ID	*#13-28 Cedar Hills Community Park*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	0	0	1	0	0	0	0	0	0	0
Lane group		LT			TR						LR	
Volume, V (vph)	50	777			1009	62				13		34
% Heavy vehicles, %HV	0	0			0	0				0		0
Peak-hour factor, PHF	0.96	0.96			0.96	0.96				0.96		0.96
Pretimed (P) or actuated (A)	P	A			A	A				A		A
Start-up lost time, l_1		2.0			2.0						2.0	
Extension of effective green, e		2.0			2.0						2.0	
Arrival type, AT		3			3						3	
Unit extension, UE		3.0			3.0						3.0	
Filtering/metering, I		1.000			1.000						1.000	
Initial unmet demand, Q_b		0.0			0.0						0.0	
Ped / Bike / RTOR volumes				0		0	0			0	0	0
Lane width		12.0			12.0						12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N		N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0						0	
Min. time for pedestrians, G_p				3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	SB Only	06	07	08
Timing	G = 48.0	G =	G =	G =	G = 4.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		861			1116						49	
Lane group capacity, c		1367			1508						113	
v/c ratio, X		0.63			0.74						0.43	
Total green ratio, g/C		0.80			0.80						0.07	
Uniform delay, d_1		2.4			2.9						26.9	
Progression factor, PF		1.000			1.000						1.000	
Delay calibration, k		0.21			0.30						0.11	
Incremental delay, d_2		0.9			2.0						2.7	
Initial queue delay, d_3												
Control delay		3.4			4.9						29.6	
Lane group LOS		A			A						C	
Approach delay	3.4			4.9						29.6		
Approach LOS	A			A						C		
Intersection delay	4.9			X_C = 0.72			Intersection LOS			A		

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HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	*MEO*	Intersection	*Walker Road and Lynnfield Lane*
Agency or Co.	*Charbonneau Engineering LLC*	Area Type	*All other areas*
Date Performed	*05/13/2014*	Jurisdiction	*Washington County*
Time Period	*Weekday AM Peak Hour*	Analysis Year	*2018 Total - Opt. 3 MITIGATED*
		Project ID	*#13-28 Cedar Hills Community Park*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	1	1	0	0	1	0	0	0	0	0	0	0
Lane group	L	T			TR						LR	
Volume, V (vph)	50	777			1009	62				13		34
% Heavy vehicles, %HV	0	0			0	0				0		0
Peak-hour factor, PHF	0.96	0.96			0.96	0.96				0.96		0.96
Pretimed (P) or actuated (A)	P	A			P	P				A		A
Start-up lost time, l_1	2.0	2.0			2.0						2.0	
Extension of effective green, e	2.0	2.0			2.0						2.0	
Arrival type, AT	3	3			3						3	
Unit extension, UE	3.0	3.0			3.0						3.0	
Filtering/metering, I	1.000	1.000			1.000						1.000	
Initial unmet demand, Q_b	0.0	0.0			0.0						0.0	
Ped / Bike / RTOR volumes				0		0	0			0	0	0
Lane width	12.0	12.0			12.0						12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N		N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0	0			0						0	
Min. time for pedestrians, G_p				3.2			3.2			3.2		

Phasing	EB Only	Thru & RT	03	04	SB Only	06	07	08
Timing	G = 4.0	G = 40.0	G =	G =	G = 4.0	G =	G =	G =
	Y = 4	Y = 4	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	52	809			1116						49	
Lane group capacity, c	120	1520			1257						113	
v/c ratio, X	0.43	0.53			0.89						0.43	
Total green ratio, g/C	0.07	0.80			0.67						0.07	
Uniform delay, d_1	26.9	2.1			8.2						26.9	
Progression factor, PF	1.000	1.000			1.000						1.000	
Delay calibration, k	0.50	0.14			0.50						0.11	
Incremental delay, d_2	11.0	0.4			9.5						2.7	
Initial queue delay, d_3												
Control delay	37.9	2.5			17.7						29.6	
Lane group LOS	D	A			B						C	
Approach delay	4.6			17.7						29.6		
Approach LOS	A			B						C		
Intersection delay	12.4			X_C = 0.81			Intersection LOS			B		

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Cedar Hiills Community Park Addendum
Charbonneau Engineering LLC, Project #13-28
2014 Existing Traffic, Weekday AM Peak Hour

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #1 Lynnfield Lane and Walker Road

Cycle (sec): 60 Critical Vol./Cap. (X): 0.690
Loss Time (sec): 8 (Y+R = 4 sec) Average Delay (sec/veh): 4.4
Optimal Cycle: 43 Level Of Service: A

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Protected				Permitted				Permitted				Permitted			
Rights:	Include				Include				Include				Include			
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0	0	0	0	0	0	0	1!	0	0	0	1	0	0	0	1
Volume Module:																
Base Vol:	0	0	0	12	0	32	48	747	0	0	970	59				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	0	0	0	12	0	32	48	747	0	0	970	59				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96				
PHF Volume:	0	0	0	13	0	33	50	778	0	0	1010	61				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
Reduced Vol:	0	0	0	13	0	33	50	778	0	0	1010	61				
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Final Vol.:	0	0	0	13	0	33	50	778	0	0	1010	61				
Saturation Flow Module:																
Sat/Lane:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Adjustment:	1.00	1.00	1.00	0.81	1.00	0.81	0.91	0.91	1.00	1.00	0.99	0.99				
Lanes:	0.00	0.00	0.00	0.27	0.00	0.73	0.06	0.94	0.00	0.00	0.94	0.06				
Final Sat.:	0	0	0	422	0	1124	104	1617	0	0	1777	108				
Capacity Analysis Module:																
Vol/Sat:	0.00	0.00	0.00	0.03	0.00	0.03	0.48	0.48	0.00	0.00	0.57	0.57				
Crit Moves:				****							****					
Green/Cycle:	0.00	0.00	0.00	0.07	0.00	0.07	0.80	0.80	0.00	0.00	0.80	0.80				
Volume/Cap:	0.00	0.00	0.00	0.44	0.00	0.44	0.60	0.60	0.00	0.00	0.71	0.71				
Delay/Veh:	0.0	0.0	0.0	30.0	0.0	30.0	3.1	3.1	0.0	0.0	4.4	4.4				
User DelAdj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
AdjDel/Veh:	0.0	0.0	0.0	30.0	0.0	30.0	3.1	3.1	0.0	0.0	4.4	4.4				
DesignQueue:	0	0	0	0	0	1	0	6	0	0	8	0				

Cedar Hiills Community Park Addendum
Charbonneau Engineering LLC, Project #13-28
2018 Background Traffic, Weekday AM Peak Hour

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #1 Lynnfield Lane and Walker Road

Cycle (sec): 60 Critical Vol./Cap. (X): 0.717
Loss Time (sec): 8 (Y+R = 4 sec) Average Delay (sec/veh): 4.8
Optimal Cycle: 45 Level Of Service: A

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Protected				Permitted				Permitted				Permitted			
Rights:	Include				Include				Include				Include			
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0	0	0	0	0	0	0	1!	0	0	0	1	0	0	0	1
Volume Module:																
Base Vol:	0	0	0	12	0	33	50	777	0	0	1009	61				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	0	0	0	12	0	33	50	777	0	0	1009	61				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96				
PHF Volume:	0	0	0	13	0	34	52	809	0	0	1051	64				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
Reduced Vol:	0	0	0	13	0	34	52	809	0	0	1051	64				
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Final Vol.:	0	0	0	13	0	34	52	809	0	0	1051	64				
Saturation Flow Module:																
Sat/Lane:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Adjustment:	1.00	1.00	1.00	0.81	1.00	0.81	0.90	0.90	1.00	1.00	0.99	0.99				
Lanes:	0.00	0.00	0.00	0.27	0.00	0.73	0.06	0.94	0.00	0.00	0.94	0.06				
Final Sat.:	0	0	0	413	0	1135	103	1607	0	0	1777	107				
Capacity Analysis Module:																
Vol/Sat:	0.00	0.00	0.00	0.03	0.00	0.03	0.50	0.50	0.00	0.00	0.59	0.59				
Crit Moves:				****							****					
Green/Cycle:	0.00	0.00	0.00	0.07	0.00	0.07	0.80	0.80	0.00	0.00	0.80	0.80				
Volume/Cap:	0.00	0.00	0.00	0.45	0.00	0.45	0.63	0.63	0.00	0.00	0.74	0.74				
Delay/Veh:	0.0	0.0	0.0	30.1	0.0	30.1	3.4	3.4	0.0	0.0	4.9	4.9				
User DelAdj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
AdjDel/Veh:	0.0	0.0	0.0	30.1	0.0	30.1	3.4	3.4	0.0	0.0	4.9	4.9				
DesignQueue:	0	0	0	0	0	1	0	6	0	0	8	0				

Cedar Hiills Community Park Addendum
Charbonneau Engineering LLC, Project #13-28
2018 Total Traffic - Option 1, Weekday AM Peak Hour

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #1 Lynnfield Lane and Walker Road

Cycle (sec): 60 Critical Vol./Cap. (X): 0.719
Loss Time (sec): 8 (Y+R = 4 sec) Average Delay (sec/veh): 4.9
Optimal Cycle: 46 Level Of Service: A

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Protected				Permitted				Permitted				Permitted			
Rights:	Include				Include				Include				Include			
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0	0	0	0	0	0	0	1!	0	0	0	1	0	0	0	1
Volume Module:																
Base Vol:	0	0	0	13	0	33	50	777	0	0	1009	62				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	0	0	0	13	0	33	50	777	0	0	1009	62				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96				
PHF Volume:	0	0	0	14	0	34	52	809	0	0	1051	65				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
Reduced Vol:	0	0	0	14	0	34	52	809	0	0	1051	65				
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Final Vol.:	0	0	0	14	0	34	52	809	0	0	1051	65				
Saturation Flow Module:																
Sat/Lane:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Adjustment:	1.00	1.00	1.00	0.81	1.00	0.81	0.90	0.90	1.00	1.00	0.99	0.99				
Lanes:	0.00	0.00	0.00	0.28	0.00	0.72	0.06	0.94	0.00	0.00	0.94	0.06				
Final Sat.:	0	0	0	435	0	1105	103	1607	0	0	1776	109				
Capacity Analysis Module:																
Vol/Sat:	0.00	0.00	0.00	0.03	0.00	0.03	0.50	0.50	0.00	0.00	0.59	0.59				
Crit Moves:				****							****					
Green/Cycle:	0.00	0.00	0.00	0.07	0.00	0.07	0.80	0.80	0.00	0.00	0.80	0.80				
Volume/Cap:	0.00	0.00	0.00	0.47	0.00	0.47	0.63	0.63	0.00	0.00	0.74	0.74				
Delay/Veh:	0.0	0.0	0.0	30.3	0.0	30.3	3.4	3.4	0.0	0.0	4.9	4.9				
User DelAdj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
AdjDel/Veh:	0.0	0.0	0.0	30.3	0.0	30.3	3.4	3.4	0.0	0.0	4.9	4.9				
DesignQueue:	0	0	0	0	0	1	0	6	0	0	8	1				

Cedar Hiills Community Park Addendum
Charbonneau Engineering LLC, Project #13-28
2018 Total Traffic - Option 1, Weekday AM Peak Hour

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #2 Lynnfield Lane and Walker Road with EB LT

Cycle (sec): 60 Critical Vol./Cap. (X): 0.815
Loss Time (sec): 12 (Y+R = 4 sec) Average Delay (sec/veh): 12.1
Optimal Cycle: 65 Level Of Service: B

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Protected				Permitted				Protected				Protected			
Rights:	Include				Include				Include				Include			
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0	0	0	0	0	0	0	1!	0	0	1	0	1	0	0	0
Volume Module:																
Base Vol:	0	0	0	13	0	33	50	777	0	0	1009	62				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	0	0	0	13	0	33	50	777	0	0	1009	62				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96				
PHF Volume:	0	0	0	14	0	34	52	809	0	0	1051	65				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
Reduced Vol:	0	0	0	14	0	34	52	809	0	0	1051	65				
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Final Vol.:	0	0	0	14	0	34	52	809	0	0	1051	65				
Saturation Flow Module:																
Sat/Lane:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Adjustment:	1.00	1.00	1.00	0.81	1.00	0.81	0.95	1.00	1.00	1.00	0.99	0.99				
Lanes:	0.00	0.00	0.00	0.28	0.00	0.72	1.00	1.00	0.00	0.00	0.94	0.06				
Final Sat.:	0	0	0	435	0	1105	1805	1900	0	0	1776	109				
Capacity Analysis Module:																
Vol/Sat:	0.00	0.00	0.00	0.03	0.00	0.03	0.03	0.43	0.00	0.00	0.59	0.59				
Crit Moves:				****			****				****					
Green/Cycle:	0.00	0.00	0.00	0.07	0.00	0.07	0.07	0.73	0.00	0.00	0.67	0.67				
Volume/Cap:	0.00	0.00	0.00	0.47	0.00	0.47	0.43	0.58	0.00	0.00	0.89	0.89				
Delay/Veh:	0.0	0.0	0.0	30.3	0.0	30.3	29.4	4.3	0.0	0.0	16.2	16.2				
User DelAdj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
AdjDel/Veh:	0.0	0.0	0.0	30.3	0.0	30.3	29.4	4.3	0.0	0.0	16.2	16.2				
DesignQueue:	0	0	0	0	0	1	2	8	0	0	14	1				

Cedar Hiills Community Park Addendum
Charbonneau Engineering LLC, Project #13-28
2018 Total Traffic - Option 2, Weekday AM Peak Hour

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #1 Lynnfield Lane and Walker Road

Cycle (sec): 60 Critical Vol./Cap. (X): 0.720
Loss Time (sec): 8 (Y+R = 4 sec) Average Delay (sec/veh): 4.9
Optimal Cycle: 46 Level Of Service: A

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Protected				Permitted				Permitted				Permitted			
Rights:	Include				Include				Include				Include			
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0	0	0	0	0	0	0	1!	0	0	0	1	0	0	0	1
Volume Module:																
Base Vol:	0	0	0	13	0	34	51	777	0	0	1009	62				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	0	0	0	13	0	34	51	777	0	0	1009	62				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96				
PHF Volume:	0	0	0	14	0	35	53	809	0	0	1051	65				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
Reduced Vol:	0	0	0	14	0	35	53	809	0	0	1051	65				
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Final Vol.:	0	0	0	14	0	35	53	809	0	0	1051	65				
Saturation Flow Module:																
Sat/Lane:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Adjustment:	1.00	1.00	1.00	0.81	1.00	0.81	0.90	0.90	1.00	1.00	0.99	0.99				
Lanes:	0.00	0.00	0.00	0.28	0.00	0.72	0.06	0.94	0.00	0.00	0.94	0.06				
Final Sat.:	0	0	0	427	0	1116	105	1598	0	0	1776	109				
Capacity Analysis Module:																
Vol/Sat:	0.00	0.00	0.00	0.03	0.00	0.03	0.51	0.51	0.00	0.00	0.59	0.59				
Crit Moves:				****							****					
Green/Cycle:	0.00	0.00	0.00	0.07	0.00	0.07	0.80	0.80	0.00	0.00	0.80	0.80				
Volume/Cap:	0.00	0.00	0.00	0.48	0.00	0.48	0.63	0.63	0.00	0.00	0.74	0.74				
Delay/Veh:	0.0	0.0	0.0	30.4	0.0	30.4	3.4	3.4	0.0	0.0	4.9	4.9				
User DelAdj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
AdjDel/Veh:	0.0	0.0	0.0	30.4	0.0	30.4	3.4	3.4	0.0	0.0	4.9	4.9				
DesignQueue:	0	0	0	0	0	1	0	6	0	0	8	1				

Cedar Hiills Community Park Addendum
Charbonneau Engineering LLC, Project #13-28
2018 Total Traffic - Option 2, Weekday AM Peak Hour

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #2 Lynnfield Lane and Walker Road with EB LT

Cycle (sec): 60 Critical Vol./Cap. (X): 0.816
Loss Time (sec): 12 (Y+R = 4 sec) Average Delay (sec/veh): 12.2
Optimal Cycle: 66 Level Of Service: B

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Protected				Permitted				Protected				Protected			
Rights:	Include				Include				Include				Include			
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0	0	0	0	0	0	0	1!	0	0	1	0	1	0	0	0	0	0	1	0
Volume Module:																
Base Vol:	0	0	0	13	0	34	51	777	0	0	1009	62				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	0	0	0	13	0	34	51	777	0	0	1009	62				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96				
PHF Volume:	0	0	0	14	0	35	53	809	0	0	1051	65				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
Reduced Vol:	0	0	0	14	0	35	53	809	0	0	1051	65				
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Final Vol.:	0	0	0	14	0	35	53	809	0	0	1051	65				
Saturation Flow Module:																
Sat/Lane:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Adjustment:	1.00	1.00	1.00	0.81	1.00	0.81	0.95	1.00	1.00	1.00	0.99	0.99				
Lanes:	0.00	0.00	0.00	0.28	0.00	0.72	1.00	1.00	0.00	0.00	0.94	0.06				
Final Sat.:	0	0	0	427	0	1116	1805	1900	0	0	1776	109				
Capacity Analysis Module:																
Vol/Sat:	0.00	0.00	0.00	0.03	0.00	0.03	0.03	0.43	0.00	0.00	0.59	0.59				
Crit Moves:				****			****				****					
Green/Cycle:	0.00	0.00	0.00	0.07	0.00	0.07	0.07	0.73	0.00	0.00	0.67	0.67				
Volume/Cap:	0.00	0.00	0.00	0.48	0.00	0.48	0.44	0.58	0.00	0.00	0.89	0.89				
Delay/Veh:	0.0	0.0	0.0	30.4	0.0	30.4	29.5	4.3	0.0	0.0	16.2	16.2				
User DelAdj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
AdjDel/Veh:	0.0	0.0	0.0	30.4	0.0	30.4	29.5	4.3	0.0	0.0	16.2	16.2				
DesignQueue:	0	0	0	0	0	1	2	8	0	0	14	1				

Cedar Hills Community Park Addendum
Charbonneau Engineering LLC, Project #13-28
2018 Total Traffic - Option 3, Weekday AM Peak Hour

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #1 Lynnfield Lane and Walker Road

Cycle (sec): 60 Critical Vol./Cap. (X): 0.720
Loss Time (sec): 8 (Y+R = 4 sec) Average Delay (sec/veh): 4.9
Optimal Cycle: 46 Level Of Service: A

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Protected				Permitted				Permitted				Permitted			
Rights:	Include				Include				Include				Include			
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0	0	0	0	0	0	0	1!	0	0	0	1	0	0	0	1
Volume Module:																
Base Vol:	0	0	0	13	0	34	50	777	0	0	1009	62				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	0	0	0	13	0	34	50	777	0	0	1009	62				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96				
PHF Volume:	0	0	0	14	0	35	52	809	0	0	1051	65				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
Reduced Vol:	0	0	0	14	0	35	52	809	0	0	1051	65				
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Final Vol.:	0	0	0	14	0	35	52	809	0	0	1051	65				
Saturation Flow Module:																
Sat/Lane:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Adjustment:	1.00	1.00	1.00	0.81	1.00	0.81	0.90	0.90	1.00	1.00	0.99	0.99				
Lanes:	0.00	0.00	0.00	0.28	0.00	0.72	0.06	0.94	0.00	0.00	0.94	0.06				
Final Sat.:	0	0	0	427	0	1116	103	1607	0	0	1776	109				
Capacity Analysis Module:																
Vol/Sat:	0.00	0.00	0.00	0.03	0.00	0.03	0.50	0.50	0.00	0.00	0.59	0.59				
Crit Moves:				****							****					
Green/Cycle:	0.00	0.00	0.00	0.07	0.00	0.07	0.80	0.80	0.00	0.00	0.80	0.80				
Volume/Cap:	0.00	0.00	0.00	0.48	0.00	0.48	0.63	0.63	0.00	0.00	0.74	0.74				
Delay/Veh:	0.0	0.0	0.0	30.4	0.0	30.4	3.4	3.4	0.0	0.0	4.9	4.9				
User DelAdj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
AdjDel/Veh:	0.0	0.0	0.0	30.4	0.0	30.4	3.4	3.4	0.0	0.0	4.9	4.9				
DesignQueue:	0	0	0	0	0	1	0	6	0	0	8	1				

Cedar Hills Community Park Addendum
Charbonneau Engineering LLC, Project #13-28
2018 Total Traffic - Option 3, Weekday AM Peak Hour

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #2 Lynnfield Lane and Walker Road with EB LT

Cycle (sec): 60 Critical Vol./Cap. (X): 0.816
Loss Time (sec): 12 (Y+R = 4 sec) Average Delay (sec/veh): 12.1
Optimal Cycle: 66 Level Of Service: B

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Protected				Permitted				Protected				Protected			
Rights:	Include				Include				Include				Include			
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0	0	0	0	0	0	0	1!	0	0	1	0	1	0	0	0
Volume Module:																
Base Vol:	0	0	0	13	0	34	50	777	0	0	1009	62				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	0	0	0	13	0	34	50	777	0	0	1009	62				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96				
PHF Volume:	0	0	0	14	0	35	52	809	0	0	1051	65				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
Reduced Vol:	0	0	0	14	0	35	52	809	0	0	1051	65				
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Final Vol.:	0	0	0	14	0	35	52	809	0	0	1051	65				
Saturation Flow Module:																
Sat/Lane:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Adjustment:	1.00	1.00	1.00	0.81	1.00	0.81	0.95	1.00	1.00	1.00	0.99	0.99				
Lanes:	0.00	0.00	0.00	0.28	0.00	0.72	1.00	1.00	0.00	0.00	0.94	0.06				
Final Sat.:	0	0	0	427	0	1116	1805	1900	0	0	1776	109				
Capacity Analysis Module:																
Vol/Sat:	0.00	0.00	0.00	0.03	0.00	0.03	0.03	0.43	0.00	0.00	0.59	0.59				
Crit Moves:				****			****				****					
Green/Cycle:	0.00	0.00	0.00	0.07	0.00	0.07	0.07	0.73	0.00	0.00	0.67	0.67				
Volume/Cap:	0.00	0.00	0.00	0.48	0.00	0.48	0.43	0.58	0.00	0.00	0.89	0.89				
Delay/Veh:	0.0	0.0	0.0	30.4	0.0	30.4	29.4	4.3	0.0	0.0	16.2	16.2				
User DelAdj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
AdjDel/Veh:	0.0	0.0	0.0	30.4	0.0	30.4	29.4	4.3	0.0	0.0	16.2	16.2				
DesignQueue:	0	0	0	0	0	1	2	8	0	0	14	1				