



MEMORANDUM

TO: COURTNEY PALUMBO

FROM: BILL WUENSCH, P.E., PTOE;
WEI HE

ORGANIZATION: REGENTS SCHOOL

DATE: OCTOBER 12, 2018

PHONE NUMBER:

SENDER'S REFERENCE NUMBER:

RE: TRAFFIC ASSESSMENT – REGENTS SCHOOL SITE

YOUR REFERENCE NUMBER:

☐ URGENT ☒ FOR YOUR USE ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

The purpose of this memorandum is to summarize a “due diligence” level traffic assessment for the proposed Regents school site. This document is not expected to be a substitute for a fully documented traffic impact study, but instead this initial research and analysis was performed to see if there is an approach to managing traffic while awaiting the ultimate desired diverging diamond improvements. To accomplish this goal, EPR conducted an assessment of trip generation potential, and then examined traffic impacts and mitigation strategies to offset the school’s traffic impacts. The following provides a brief summary of this information.

Trip Generation

Two methods were utilized to examine likely trip generation. These include direct calculation per the ITE Trip Generation Manual, and also a calculation based on actual expected trip making potential per known historical bus operations, car pooling, and consideration of employees with students. Trips were calculated for year 2028 with 230 students, and then also for year 2038 with 460 students.

Per the ITE Trip Generation Manual, the trip generation was calculated based on the land use of private K-12 school and code of 536. **Table 1** below summarizes the land use, code, units, and trips.

Table 1 Trip Generation per the ITE Trip Generation Manual

Scenario	Land Use	Code	Unit (Students)	Weekday	AM TOTAL	AM IN	AM OUT	PM TOTAL	PM IN	PM OUT
2028 (230)	Private K-12	536	230	570	186	113	73	133	56	77
2038 (460)	Private K-12	536	460	1141	373	227	146	267	112	155

Per the actual expected trip making potential, the trip generation was calculated based on the historical bus operations, car pooling, and consideration of employees with students. The

information that the school provided shows that the current Regents School has 160 students and 22 full-time and 6 part-time employees. These 160 students are from 94 families, within which 24 families take the school bus, 49 families car pool, three families have employees of the school, and 18 families drive individually.

Based on the above student information, the total current student trips are as in **Table 2**.

Table 2 Current Total Student Trips

Travel Type	Take Bus	Car Pool	Take Employee's Vehicle	Drive Individually	Total
Families	24	49	3	18	94
Trips	1	25	0	18	44

The result as shown in Table 2 indicates that the current 160 students have in total 44 trips and the rate is 0.275 trips/student. Applying this rate to years 2028 and 2038 **results in 63 total student trips in year 2028 and 127 total student trips in year 2038**. It should be noted that student trips will arrive, drop off, and leave the school in AM and arrive, pick up, and leave the school in PM.

Based on the above employee information, this memo assumed a daily pattern that full-time employees and half of the part-time employees will arrive the school in AM and leave the school in the PM, which results in 25 trips total for the current employees.

This memo assumed that employee student ratio will be the same in years 2028 and 2038.

Table 3 summaries the estimated employees and trips in years 2028 and 2038.

Table 3 Estimated Employees in the Years 2028 and 2038

Year	2018	2028	2038
Students	160	230	460
Full Time Employee	22	32	64
Part Time Employee	6	9	18
Trips	25	37	73

Per the above calculation, in year 2028, there will be 63 student trips arriving, dropping off, and leaving the school in AM and arriving, picking up, and leaving the school in PM and 37 employees arriving the school in AM and leaving the school in PM; in year 2038, there will be 127 student trips arriving, dropping off, and leaving the school in AM and arriving, picking up, and leaving the school in PM and 73 employees arriving the school in AM and leaving the school in PM.

Considering school's arriving the leaving pattern, most of the trips will arrive within the school AM peak hour, but fewer trips will leave within the school PM peak hour while others will have after school activities. Examining the ITE trip generation pattern, this memo assumed all trips will arrive within the school AM peak hour and about 71.5% of the trips will leave within the

school PM peak hour. **Table 4** summarizes the estimated trip generation for years 2028 and 2038 per the actual expected trip making potential.

Table 4 Estimated Trip Generation for the Years 2028 and 2038 per the Actually Expected Trip Making Potential

Scenario	2028 AM		2028 PM		2038 AM		2038 PM	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Student Trips	63	63	45	45	127	127	91	91
Employee Trips	37	0	0	27	73	0	0	52
Total Trips	100	63	45	72	200	127	91	143

Comparing the two methods, the one per the actual expected trip making potential is based on the Regents School and can be considered as more accurate for this analysis. The ITE Trip Generation is based on a wide variety of school types with varying land use contexts. Thus, the analysis for Regents will use the trip generation method per the calculated (actual) expected trip making potential for the following analysis.

Background Traffic

The background AM and PM peak hour traffic counts at the two ramp intersections with Fontaine Avenue were taken from a recent traffic study performed by VHB for VDOT for the diverging diamond interchange. Also, growth rates from that same report were utilized for this analysis. The following figures illustrate the existing, year 2028, and year 2038 AM and PM peak hour traffic counts.

Figure 1 Existing Traffic Volumes



Figure 2 2028 No Build Traffic Volumes

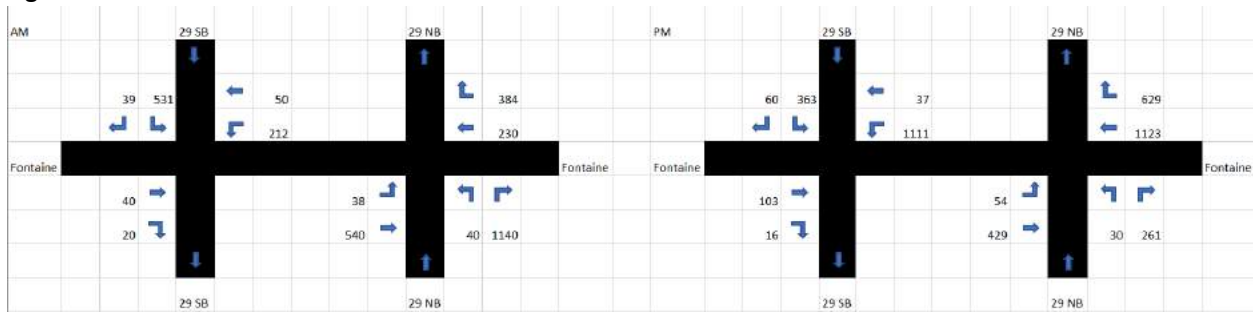


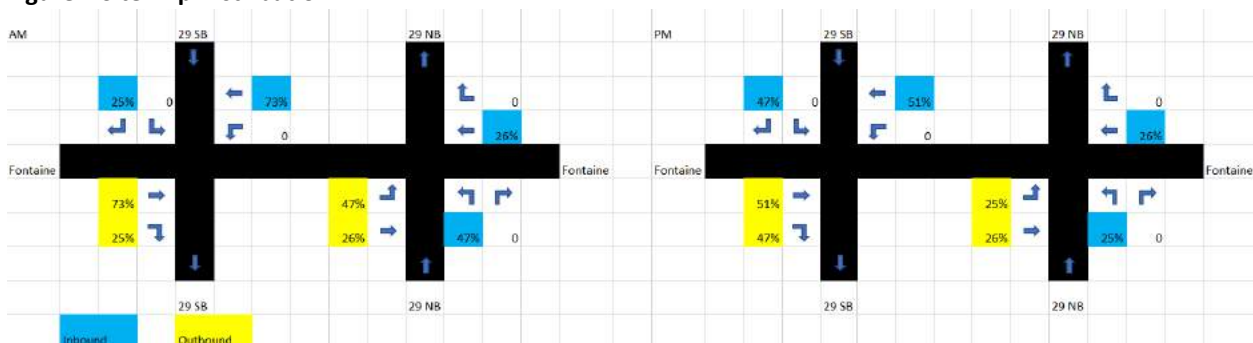
Figure 3 2038 No Build Traffic Volumes



Site Trip Distribution and Assignment

Trip distribution is based on consideration of trip patterns at Regents school in a previous study, and also consideration of population distribution throughout the region. The following illustrates the assumed trip distribution. It should be noted that 2% of the trips (2 trips in year 2028 and 4 trips in year 2038) were assumed from/to the local residential area along Buckingham Circle, Reservoir Road, and Foxhaven Farm

Figure 4 Site Trip Distribution



The site trips were assigned to the road network based on the trip generation and the distribution as noted above. The build condition site trips for both year 2028 with 230 students and year 2038 with 460 students are shown below.

Figure 5 2028 Site Trips



Figure 6 2038 Site Trips



Build Condition Traffic Volumes

Combining the background traffic with the site trips as previously shown, the following illustrates the build condition traffic volumes. It should be noted that in build conditions only AM traffic volumes were shown, since the school traffic is very minimal in the regular PM peak hour (i.e. 4:30 to 6:00PM).

Figure 7 2028 Build Traffic Volumes

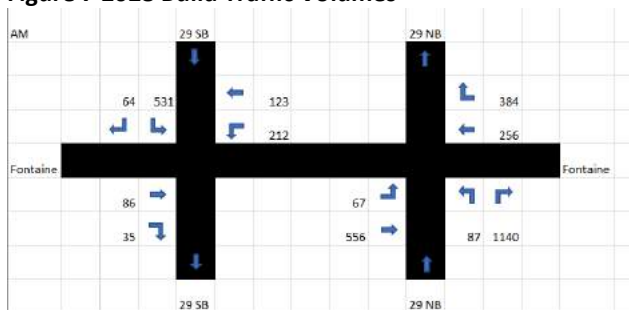
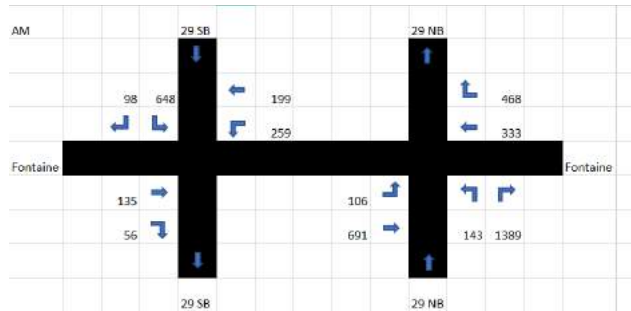


Figure 8 2038 Build Traffic Volumes



Traffic Analysis

The no build and build condition traffic was analyzed as needed to compare future build conditions with future no build conditions. The worst impacts were found to be at the southbound ramp, thus various mitigation strategies were examined including:

- Adding an exclusive right turn lane to the southbound ramp
- Adding an exclusive westbound left turn lane at the southbound ramp and an additional westbound through lane at the northbound ramp.
- Signalizing the southbound ramp (with no additional lanes)
- Signalizing the southbound ramp and adding an exclusive right turn lane to the southbound ramp, adding an exclusive westbound left turn lane at the southbound ramp and an additional westbound through lane at the northbound ramp

For the signalized scenario, the future no build PM traffic volumes were analyzed with the signalized configuration to test to see if there were adverse impacts or if the signal could also work in the regular PM.

The following tables summarize the traffic analysis results per the following scenarios:

1. AM Existing conditions

		Existing AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL/T		SBL/R		
	Movement LOS/Delay	A/1.3		A/2.1		C/16.3		B
	Approach LOS/Delay	A/1.3		A/2.1		C/16.3		11.1
	Movement Queue	0		51		316		
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/3.0	A/0.9	A/0.3	A/3.3	A/9.6	A/7.4	A
	Approach LOS/Delay	A/1.1		A/2.2		A/7.4		4.6
	Movement Queue	29	0	0	48	61	0	

2. AM Year 2028 no build conditions

		Year 2028 No Build AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL/T		SBL/R		
	Movement LOS/Delay	A/1.5		A/2.3		E/45.4		D
	Approach LOS/Delay	A/1.5		A/2.3		E/45.4		30.1
	Movement Queue	4		57		> 500		
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/3.1	A/1.0	A/0.4	A/3.6	B/11.7	A/9.5	A
	Approach LOS/Delay	A/1.2		A/2.4		A/9.6		5.7
	Movement Queue	31	0	0	72	58	0	

3. AM Year 2028 build conditions (230 students)

		Year 2028 Build AM							
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall	
		EBT/R		WBL/T		SBL/R			
	Movement LOS/Delay	A/1.7		A/2.7		F/115.7		F	
	Approach LOS/Delay	A/1.7		A/2.7		F/115.7		64.5	
	Movement Queue	8		73		> 500			
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall	
		EBL	EBT	WBT	WBR	NBL	NBR		
	Movement LOS/Delay	A/3.4	A/1.0	A/0.6	A/3.9	B/13.2	A/9.5	A	
	Approach LOS/Delay	A/1.2		A/2.6		A/9.8		5.9	
	Movement Queue	42	0	0	111	76	0		

4. AM Year 2028 build conditions (230 students) with an exclusive right turn lane at the southbound ramp

		Year 2028 Mitigation #1 AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL/T		SBL	SBR	
	Movement LOS/Delay	A/1.8		A/2.7		F/113.6	B/12.2	F
	Approach LOS/Delay	A/1.8		A/2.7		F/103.5		59.0
	Movement Queue	9		75		> 500	> 300	
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/3.3	A/1.0	A/0.6	A/3.9	B/13.7	A/9.5	A
	Approach LOS/Delay	A/1.3		A/2.6		A/9.8		5.9
	Movement Queue	37	0	0	125	80	0	

5. AM Year 2028 build conditions (230 students) with an exclusive right turn lane at the southbound ramp and an exclusive westbound left turn lane at the southbound ramp (i.e. WBL and WBT versus the shared lane) and an additional westbound through lane at the northbound ramp

		Year 2028 Mitigation #2 AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL	WBT	SBL	SBR	
	Movement LOS/Delay	A/1.9		A/2.9	A/0.5	F/79.4	D/31.0	F
	Approach LOS/Delay	A/1.9		A/2.0		F/74.5		43.4
	Movement Queue	1		67	0	> 500	> 300	
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/3.3	A/1.0	A/0.8	A/4.2	B/14.8	A/9.6	A
	Approach LOS/Delay	A/1.3		A/2.9		A/9.9		6.0
	Movement Queue	40	4	2	151	85	0	

6. AM Year 2028 build conditions (230 students) with traffic signal at southbound ramp intersection

		Year 2028 Mitigation #3 AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL/T		SBL/R		
	Movement LOS/Delay	A/8.0		C/15.4		B/15.0		B
	Approach LOS/Delay	A/8.0		C/15.4		B/15.0		14.3
	Movement Queue	87		208		340		
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/3.6	A/1.2	A/0.6	A/4.0	B/14.5	A/9.5	A
	Approach LOS/Delay	A/1.5		A/2.6		A/9.9		5.9
	Movement Queue	42	0	0	163	89	0	

7. AM Year 2038 no build conditions

		Year 2038 No Build AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL/T		SBL/R		
	Movement LOS/Delay	A/1.5		A/2.5		F/115.1		F
	Approach LOS/Delay	A/1.5		A/2.5		F/115.1		59.1
	Movement Queue	0		64		> 500		
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/3.5	A/1.0	A/0.5	A/4.3	B/15.0	B/12.5	A
	Approach LOS/Delay	A/1.2		A/2.9		B/12.6		7.5
	Movement Queue	38	0	0	129	64	0	

8. AM Year 2038 build conditions (460 students)

		Year 2038 Build AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL/T		SBL/R		
	Movement LOS/Delay	A/1.8		A/3.5		F/175.7		F
	Approach LOS/Delay	A/1.8		A/3.5		F/175.7		69.7
	Movement Queue	13		102		> 500		
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/3.6	A/0.9	A/0.8	A/4.8	C/17.6	B/13.0	A
	Approach LOS/Delay	A/1.3		A/3.1		B/13.4		8.3
	Movement Queue	42	0	6	200	110	0	

9. AM Year 2038 build conditions (460 students) with an exclusive right turn lane at the southbound ramp

		Year 2038 Mitigation #1 AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL/T		SBL	SBR	
	Movement LOS/Delay	A/1.8		A/2.7		F/189.3	C/18.8	F
	Approach LOS/Delay	A/1.8		A/3.5		F/167.4		68.9
	Movement Queue	11		108		> 500	> 300	
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/3.8	A/0.9	A/0.8	A/4.8	C/17.8	B/13.1	A
	Approach LOS/Delay	A/1.3		A/3.1		B/13.5		8.4
	Movement Queue	48	0	6	165	114	0	

10. AM Year 2038 build conditions (460 students) with an exclusive right turn lane at the southbound ramp and an exclusive westbound left turn lane at the southbound ramp (i.e. WBL and WBT versus the shared lane) and an additional westbound through lane at the northbound ramp

		Year 2038 Mitigation #2 AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL	WBT	SBL	SBR	
	Movement LOS/Delay	A/1.9		A/3.5	A/0.6	F/156.7	F/72.5	F
	Approach LOS/Delay	A/1.9		A/2.2		F/145.4		63.7
	Movement Queue	6		79	6	> 500	> 300	
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/3.7	A/1.0	A/1.2	A/5.4	C/18.2	B/13.0	A
	Approach LOS/Delay	A/1.3		A/3.6		B/13.5		8.4
	Movement Queue	47	2	0	190	110	0	

11. AM Year 2038 build conditions (460 students) with traffic signal at southbound ramp intersection

		Year 2038 Mitigation #3 AM							
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall	
		EBT/R		WBL/T		SBL/R			
	Movement LOS/Delay	B/10.8		D/33.3		F/51.2		E	
	Approach LOS/Delay	B/10.8		D/33.3		F/51.2		39.6	
	Movement Queue	128		405		> 500			
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall	
		EBL	EBT	WBT	WBR	NBL	NBR		
	Movement LOS/Delay	A/4.7	A/1.6	A/1.0	A/6.2	D/27.9	B/13.1	A	
	Approach LOS/Delay	A/2.0		A/4.0		B/14.5		8.6	
	Movement Queue	67	0	6	263	147	0		

12. AM Year 2038 build conditions (460 students) with traffic signal at southbound ramp intersection and with an exclusive right turn lane at the southbound ramp, an exclusive westbound left turn lane at the southbound ramp (i.e. WBL and WBT versus the shared lane) and an additional westbound through lane at the northbound ramp

		Year 2038 Mitigation #4 AM						
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall
		EBT/R		WBL	WBT	SBL	SBR	
	Movement LOS/Delay	C/19.8		C/19.5	B/12.2	C/18.1	A/6.1	C
	Approach LOS/Delay	C/19.8		C/16.1		C/16.5		16.8
	Movement Queue	149		195	149	402	255	
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall
		EBL	EBT	WBT	WBR	NBL	NBR	
	Movement LOS/Delay	A/4.4	A/1.6	A/1.2	A/6.2	D/25.1	B/12.8	A
	Approach LOS/Delay	A/2.0		A/4.1		B/14.0		8.4
	Movement Queue	59	0	34	234	141	0	

13. PM Year 2028 build conditions (230 students) with traffic signal at southbound ramp intersection. No school traffic was added and PM Year 2028 no build condition traffic volumes were used since the school traffic is very minimal in the PM peak hour (i.e. 4:30 to 6:00PM). This analysis is just to see if there were adverse impacts or if the signal could also work in the background PM peak hour.

		Year 2028 Build PM							
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 SB		Overall	
		EBT/R		WBL/T		SBL/R			
	Movement LOS/Delay	A/6.4		E/47.6		F/181.7		F	
	Approach LOS/Delay	A/6.4		E/47.6		F/181.7		78.0	
	Movement Queue	80		> 500		> 500			
2. Rte 29/Fontaine NB	Movement/Approach	Fontaine EB		Fontaine WB		Rte 29 NB		Overall	
		EBL	EBT	WBT	WBR	NBL	NBR		
	Movement LOS/Delay	A/6.9	A/1.3	F/88.7	D/25.1	F/652.5	A/5.8	F	
	Approach LOS/Delay	A/2.0		F/65.9		F/70.8		54.7	
	Movement Queue	52	0	> 1000	> 1000	262	207		

Findings

1. The additional lanes by themselves do not get the LOS/delay/queuing back down to a level equaling the no build conditions
2. In year 2028, the traffic signal at the southbound ramp does work well in the morning as a mitigation measure. However, it does not work in the PM peak hour traffic due to the very high left turn volume accessing the southbound on-ramp.
3. In year 2038, the traffic signal at the southbound ramp does get the LOS/delay/queuing back down to a level equaling the no build conditions in the morning; however, in order to get the traffic working well in the morning, the mitigation measure should include the traffic signal at southbound ramp intersection with an exclusive right turn lane at the southbound ramp, and an exclusive westbound left turn lane at the southbound ramp (i.e. WBL and WBT versus the shared lane) and an additional westbound through lane at the northbound ramp. The same as in year 2028, it does not work in the PM peak hour traffic due to the very high left turn volume accessing the southbound on-ramp.
4. If the signal were to be operated as an actuated signal in the AM peak hour, and then put into flash mode for the PM peak hour, traffic conditions could be manageable in year 2028, although this traffic signal scheme is not typically used.
5. In year 2038, the signal should be combined with an exclusive right turn lane at the southbound ramp and an exclusive westbound left turn lane at the southbound ramp (i.e. WBL and WBT versus the shared lane) and an additional westbound through lane at the northbound ramp to maintain the traffic conditions manageable. Note that this only works for the AM peak hour and the PM peak hour would need to be in flash operation.

The FHWA MUTCD notes:***Section 4D.28 Flashing Operation of Traffic Control Signals – General Standard:***

01 The light source of a flashing signal indication shall be flashed continuously at a rate of not less than 50 or more than 60 times per minute.

02 The displayed period of each flash shall be a minimum of 1/2 and a maximum of 2/3 of the total flash cycle.

03 Flashing signal indications shall comply with the requirements of other Sections of this Manual regarding visibility-limiting or positioning of conflicting signal indications, except that flashing yellow signal indications for through traffic shall not be required to be visibility-limited or positioned to minimize visual conflict for road users in separately controlled turn lanes.

04 Each traffic control signal shall be provided with an independent flasher mechanism that operates in compliance with this Section.

05 The flashing operation shall not be terminated by removal or turn off of the controller unit or of the conflict monitor (malfunction management unit) or both.

06 A manual switch, a conflict monitor (malfunction management unit) circuit, and, if appropriate, automatic means shall be provided to initiate the flashing mode.

Option: 07 Based on engineering study or engineering judgment, traffic control signals may be operated in the flashing mode on a scheduled basis during one or more periods of the day rather than operated continuously in the steady (stop-and-go) mode.

Going forward, the concept of a temporary traffic signal installation (while awaiting the full interchange improvements if funded) operating in stop-go mode in the AM peak hour and flashing operation all other hours of the day for year 2028.

Looking out to year 2038 would require the signal combined with an exclusive right turn lane at the southbound ramp and an exclusive westbound left turn lane at the southbound ramp (i.e. WBL and WBT versus the shared lane) and an additional westbound through lane at the northbound ramp.

Depending on the outcome of that coordination, full traffic impact study documentation can be prepared.

CC: Ashley Davies – Williams Mullen

Valerie Long – Williams Mullen

Justin Shimp – Shimp Engineering



MEMORANDUM

TO: JUSTIN SHIMP, P.E.

FROM: BILL WUENSCH, P.E., PTOE;
WEI HE

ORGANIZATION: SHIMP ENGINEERING

DATE: MARCH 6, 2019

PHONE NUMBER:

SENDER'S REFERENCE NUMBER:

RE: REGENTS SCHOOL SITE TRAFFIC ASSESSMENT
SUPPLEMENT

YOUR REFERENCE NUMBER:

☐ URGENT ☒ FOR YOUR USE ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

The purpose of this memorandum is to summarize a supplemental traffic assessment for the proposed Regents School Site. This document was performed to examine the impact of the proposed Regents School on Fontaine Avenue/Route 29 Southbound Ramp intersection assuming the school with the start time of 7:45 AM.

To accomplish the goal, this analysis examined the future year 2028 conditions and assumed that all school trips arrived in the morning between 7:15-7:45AM. The no build and build conditions were analyzed as needed to compare future build conditions with future no build conditions. The future build conditions were also compared to the future build conditions from the prior Regents School Site Traffic Assessment (10/12/2018) which summarized the impact of the proposed Regents School on the AM peak hour.

The following provides a brief summary of this information.

Trip Generation

The trip generation was obtained from the prior Regents School Site Traffic Assessment (10/12/2018) and summarized below.

Table 1 Trip Generation

Scenario	2028 AM		2028 PM		2038 AM		2038 PM	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Total Trips	100	63	45	72	200	127	91	143

Traffic Volumes

Existing Traffic Volumes

The existing traffic counts were performed at Fontaine Avenue/Route 29 Southbound Ramp intersection on Thursday, February 7th, 2019, a typical weekday when no special events occurred. The traffic count document is attached.

For analysis purposes, this effort examined the traffic volumes between 7:15-7:45AM and doubled the traffic volumes between 7:15-7:45AM for Synchro traffic analysis as needed for a design hour volume equivalent. **Figure 1** illustrates the traffic volume calculation and the traffic volumes (hour) that were analyzed.

Figure 1 Existing Traffic Volumes

[illegible]

2028 No Build Traffic Volumes

Also, growth rates from the prior Regents School Site Traffic Assessment (10/12/2018) were utilized for this analysis. **Figure 2** illustrates the year 2028 no build traffic volume calculation.

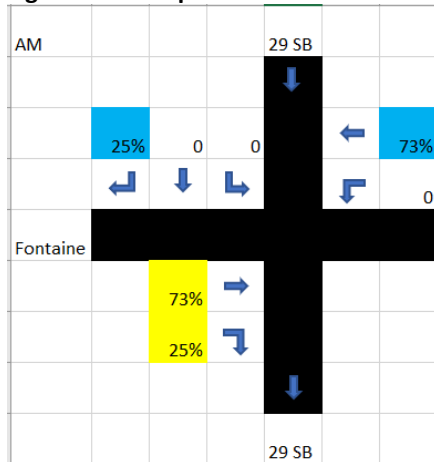
Figure 2 2028 No Build Traffic Volumes

[illegible]

Site Trip Distribution and Assignment

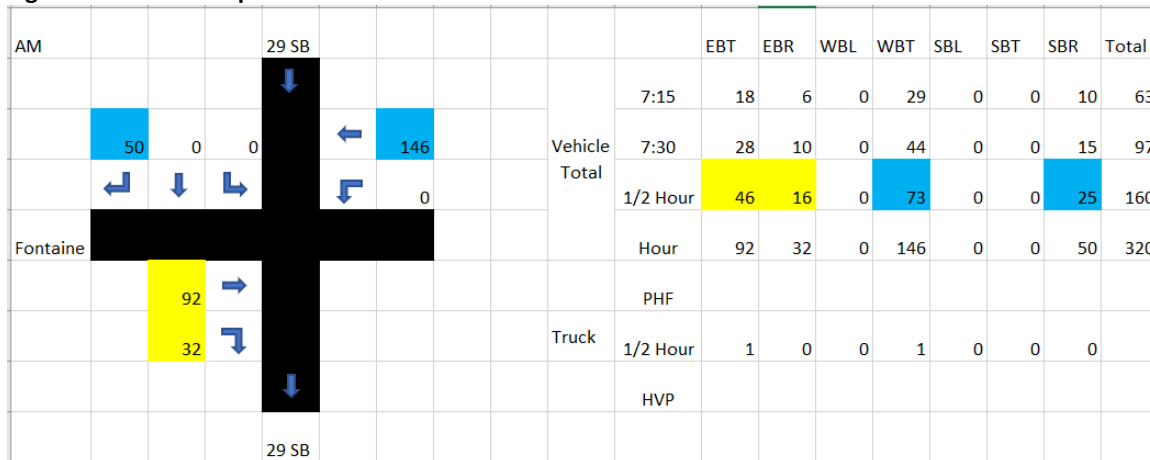
Trip distribution was also obtained from the prior Regents School Site Traffic Assessment (10/12/2018). **Figure 3** illustrates the assumed trip distribution. It should be noted that 2% of the trips were assumed from/to the local residential area along Buckingham Circle, Reservoir Road, and Foxhaven Farm.

Figure 3 Site Trip Distribution



The site trips were assigned to the road network based on the trip generation and the distribution as noted above. The build condition site trips for the future year 2028 with 230 students are summarized and doubled for Synchro traffic analysis as illustrated in **Figure 4**.

Figure 4 2028 Site Trips



2028 Build Traffic Volumes

Combining the background traffic with the site trips as shown, **Figure 5** illustrates the build condition traffic volume calculation.

Figure 5 2028 Build Traffic Volumes

[illegible]

Traffic Impact Assessment of the Proposed Regents School on 7:15-7:45AM

The future year 2028 no build and build conditions were analyzed as needed to compare future build conditions with future no build conditions. It should be noted that, the same as in the prior Regents School Site Traffic Assessment (10/12/2018), SimTraffic was utilized for the level of service, delay, and queue analyses. **The following tables summarize the analysis results:**

Existing AM

		Existing AM			
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB	Fontaine WB	Rte 29 SB	Overall
		EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/0.7	A/2.1	A/8.2	A
	Approach LOS/Delay	A/0.7	A/2.1	A/8.2	5.3
	Movement Queue	0	35	118	

2028 No Build AM

		Year 2028 No Build AM			
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB	Fontaine WB	Rte 29 SB	Overall
		EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/0.8	A/2.3	B/10.3	A
	Approach LOS/Delay	A/0.8	A/2.3	B/10.3	6.6
	Movement Queue	0	53	159	

2028 Build AM

		Year 2028 Build AM			
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB	Fontaine WB	Rte 29 SB	Overall
		EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/1.5	A/2.8	C/22.1	B
	Approach LOS/Delay	A/1.5	A/2.8	C/22.1	10.4
	Movement Queue	4	80	297	

Based on the analysis results, the traffic operation in the future year 2028 build conditions will be acceptable with the proposed Regents School with the start time of 7:45AM. The overall intersection level of service will be LOS B, the level of service for Fontaine Avenue will be at LOS A, and the level of service for Route 29 Southbound Ramp will be LOS C. The queue on Route 29 Southbound Ramp will be manageable at approximately 300 feet.

Comparison to the Impact of the Proposed Regents School on the AM Peak Hour

The future year 2028 no build and build conditions traffic analysis results were obtained from the prior Regents School Site Traffic Assessment (10/12/2018) for comparison purpose. The following tables summarize the analysis results from the prior Regents School Site Traffic Assessment (10/12/2018):

Existing AM

		Existing AM			
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB	Fontaine WB	Rte 29 SB	Overall
		EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/1.3	A/2.1	C/16.3	B
	Approach LOS/Delay	A/1.3	A/2.1	C/16.3	11.1
	Movement Queue	0	51	316	

2028 No Build AM

		Year 2028 No Build AM			
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB	Fontaine WB	Rte 29 SB	Overall
		EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/1.5	A/2.3	E/45.4	D
	Approach LOS/Delay	A/1.5	A/2.3	E/45.4	30.1
	Movement Queue	4	57	> 500	

2028 Build AM

		Year 2028 Build AM			
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB	Fontaine WB	Rte 29 SB	Overall
		EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/1.7	A/2.7	F/115.7	F
	Approach LOS/Delay	A/1.7	A/2.7	F/115.7	64.5
	Movement Queue	8	73	> 500	

Based on the results above, assuming the school start time at background traffic peak hour, in the future year 2028 build conditions, the overall intersection level of service will be a failing level of service LOS F, the level of service for the Fontaine Avenue approach will be at LOS A, and the level of service for Route 29 Southbound Ramp will be LOS F. The queue on Route 29 Southbound Ramp will spill back onto Route 29.

Comparing the traffic impacts of the proposed Regents School on 7:15-7:45AM and on AM peak hour, the impact on 7:15-7:45AM is minor and manageable.

Findings

Based on the analysis performed in this memorandum, the principal findings are as followings –

1. The traffic operations in the future year 2028 build conditions will be acceptable with the proposed Regents School with the start time of 7:45AM. The overall intersection level of service will be LOS B, the level of service for Fontaine Avenue will be at LOS A, and the level of service for Route 29 Southbound Ramp will be LOS C. The queue on Route 29 Southbound Ramp will be manageable at approximately 300 feet.
2. Assuming the school start time at during the background traffic peak hour (after 7:45AM), in the future year 2028 build conditions, the overall intersection level of service will be failing level of service LOS F, the level of service for Fontaine Avenue will be at LOS A, and the level of service for Rte 29 Southbound Ramp will be LOS F. The queue on Rte 29 Southbound Ramp will spill back onto Rte 29.
3. Comparing the traffic impacts of the proposed Regents School on 7:15-7:45AM and on AM peak hour, the impact on 7:15-7:45AM is minor and manageable.

End of Memorandum - Attachment: Traffic Count Document

Turn Count Summary

Location: Fontaine at Ramp ,
 GPS Coordinates: Lat=38.027072, Lon=-78.530188
 Date: 2019-02-07
 Day of week: Thursday
 Weather:
 Analyst:

Total vehicle traffic

Interval starts	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:02	24	4	0	0	0	0	0	3	0	32	0	1	64
07:15	34	4	0	0	0	0	0	4	3	55	0	0	100
07:30	45	3	0	0	0	0	0	7	2	64	1	1	123
07:45	49	11	0	0	0	0	0	6	2	123	0	7	198
08:00	37	19	0	0	0	0	0	12	2	99	0	4	173
08:15	41	10	0	0	0	0	0	13	5	106	0	10	185
08:30	37	22	0	0	0	0	0	12	9	90	0	11	181
08:45	30	25	0	0	0	0	0	27	11	79	0	24	196
09:00	0	1	0	0	0	0	0	0	0	1	0	0	2

Car traffic

Interval starts	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:02	23	4	0	0	0	0	0	3	0	32	0	1	63
07:15	34	3	0	0	0	0	0	3	3	54	0	0	97
07:30	45	3	0	0	0	0	0	7	2	63	0	1	121
07:45	48	11	0	0	0	0	0	6	2	122	0	7	196
08:00	36	18	0	0	0	0	0	12	2	94	0	4	166
08:15	38	9	0	0	0	0	0	13	4	106	0	10	180
08:30	35	21	0	0	0	0	0	11	9	90	0	11	177
08:45	29	25	0	0	0	0	0	27	11	79	0	24	195
09:00	0	1	0	0	0	0	0	0	0	1	0	0	2

Truck traffic

Interval starts	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:02	1	0	0	0	0	0	0	0	0	0	0	0	1
07:15	0	1	0	0	0	0	0	1	0	1	0	0	3
07:30	0	0	0	0	0	0	0	0	0	1	1	0	2
07:45	1	0	0	0	0	0	0	0	0	1	0	0	2
08:00	1	1	0	0	0	0	0	0	0	5	0	0	7
08:15	3	1	0	0	0	0	0	0	1	0	0	0	5
08:30	2	1	0	0	0	0	0	1	0	0	0	0	4
08:45	1	0	0	0	0	0	0	0	0	0	0	0	1
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0

2 of 3

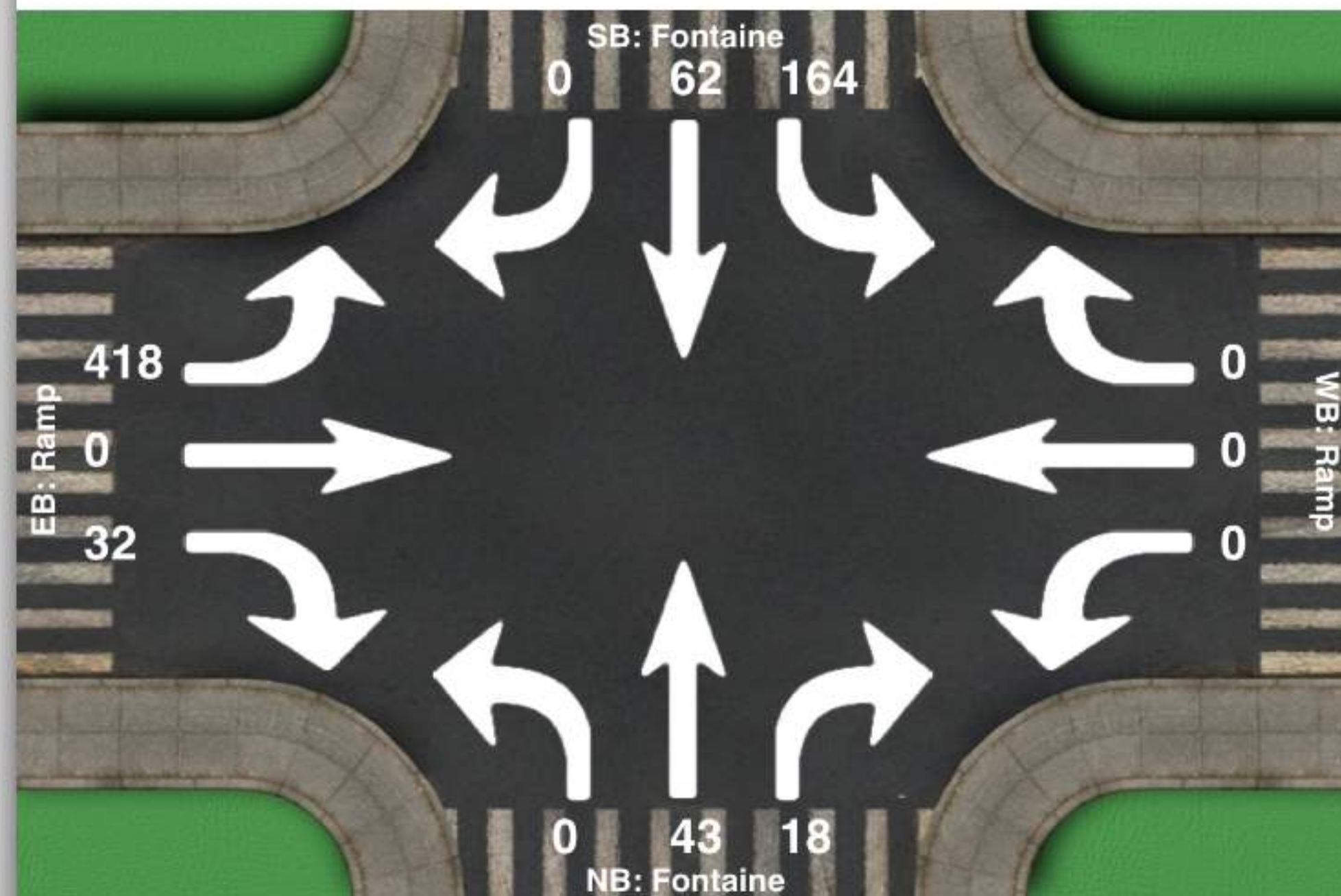
Intersection Peak Hour

07:45 - 08:45

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	164	62	0	0	0	0	0	43	18	418	0	32	737
Factor	0.84	0.70	0.00	0.00	0.00	0.00	0.00	0.83	0.50	0.85	0.00	0.73	0.93
Approach Factor	0.94			0.00			0.73			0.87			

Peak Hour Vehicle Summary

Vehicle	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	157	59	0	0	0	0	0	42	17	412	0	32	719
Truck	7	3	0	0	0	0	0	1	1	6	0	0	18



Intersection Peak Hour

07:45 - 08:45

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	164	62	0	0	0	0	0	43	18	418	0	32	737
Factor	0.84	0.70	0.00	0.00	0.00	0.00	0.00	0.83	0.50	0.85	0.00	0.73	0.93
Approach Factor	0.94			0.00			0.73			0.87			



MEMORANDUM

TO: JUSTIN SHIMP, P.E.

FROM: BILL WUENSCH, P.E., PTOE;
WEI HE

ORGANIZATION: SHIMP ENGINEERING

DATE: JUNE 14, 2019

PHONE NUMBER:

SENDER'S REFERENCE NUMBER:

RE: REGENTS SCHOOL SITE TRAFFIC ASSESSMENT
SUPPLEMENT_YEAR 2028 WITH 280 STUDENTS

YOUR REFERENCE NUMBER:

☐ URGENT ☒ FOR YOUR USE ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

The purpose of this memorandum is to summarize a supplemental traffic analysis for the proposed Regents School Site to examine the impact of the proposed Regents School with 280 students on Fontaine Avenue/Route 29 Southbound Ramp intersection in the future year 2028.

To accomplish the goal, this analysis assumed the school start time being 7:45 AM and all school trips arriving in the morning between 7:15-7:45 AM to examine the future year 2028 build conditions between 7:15-7:45 AM. The proposed Regents School was assumed to have 280 students in the future year 2028. The future year 2028 build conditions between 7:15-7:45 AM were then compared to the future year 2028 no build conditions in the commuter AM peak hour, which was obtained from the prior Regents School Site Traffic Assessment (10/12/2018), which evaluated the impact of the proposed Regents School with 280 students in the future year 2028 during the typical commuter peak hour.

The following provides a brief summary of this information.

Trip Generation

The trip generation of the proposed Regents School with 280 students was calculated using the same methodology as in the prior Regents School Site Traffic Assessment (10/12/2018) and summarized in **Table 1** below.

Table 1 Trip Generation with 280 Students

Scenario	2028 AM w/ 280 students		2028 PM w/ 280 students	
	Inbound	Outbound	Inbound	Outbound
Total Trips	121	77	55	87

Traffic Volumes

2028 No Build Traffic Volumes between 7:15-7:45 AM

2028 no build traffic volumes between 7:15-7:45 AM was obtained from a prior supplement (3/6/2019) and illustrated in **Figure 1** below.

Figure 1 2028 No Build Traffic Volumes between 7:15-7:45 AM

[illegible]

Site Trip Distribution and Assignment

Trip distribution was also obtained from the prior supplement (3/6/2019) and illustrated in **Figure 2** below. It should be noted that 2% of the trips were assumed from/to the local residential area along Buckingham Circle, Reservoir Road, and Foxhaven Farm.

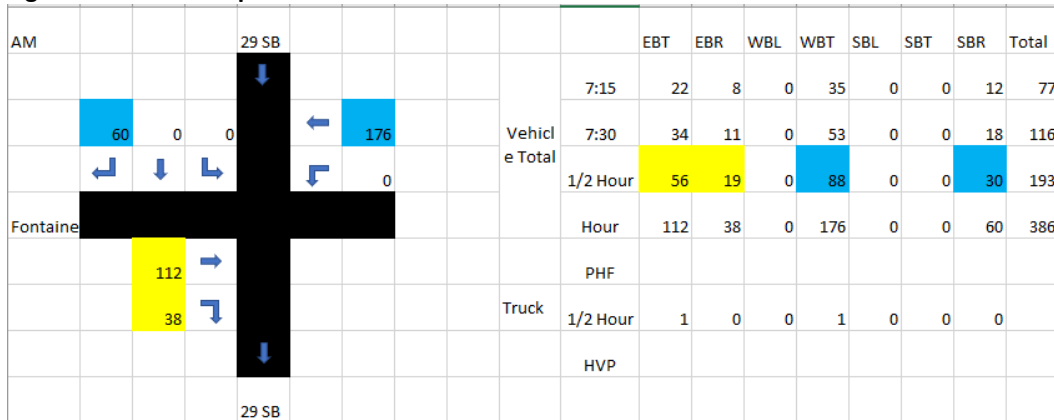
Figure 2 Site Trip Distribution

The diagram shows a crossroad intersection with a central black cross. The horizontal road is labeled 'Fontaine' on the left. The vertical road has 'AM' at the top and '29 SB' at the bottom. Traffic flow data is shown in colored boxes: blue for the horizontal road and yellow for the vertical road. Arrows indicate the direction of traffic flow.

Direction	Flow Type	Percentage	Count
Horizontal (Left to Right)	Blue	25%	0
Horizontal (Right to Left)	Blue	73%	0
Vertical (Top to Bottom)	Yellow	73%	25%

The site trips were assigned to the road network based on the trip generation and the distribution as noted above. The build condition site trips for the future year 2028 with 280 students are summarized and doubled for Synchro traffic analysis purpose as illustrated in **Figure 3** below.

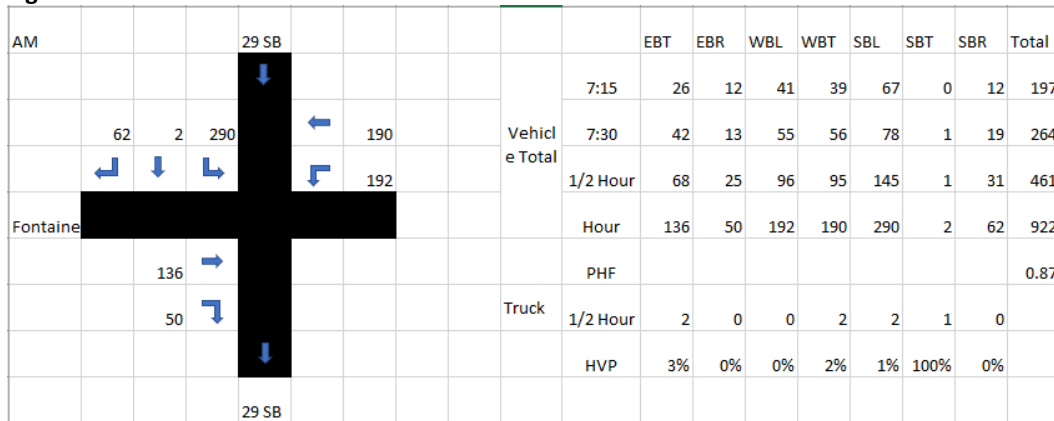
Figure 3 2028 Site Trips with 280 Students



2028 Build Traffic Volumes between 7:15-7:45 AM

Combining the background traffic with the site trips as shown, **Figure 4** below illustrates the build condition traffic volume calculation.

Figure 4 2028 Build Traffic Volumes between 7:15-7:45 AM



2028 Build Conditions between 7:15-7:45 AM

The future year 2028 build conditions between 7:15-7:45 AM were analyzed in Synchro/SimTraffic 9.2. It should be noted that, the same as in the prior Regents School Site Traffic Assessment (10/12/2018) and prior supplements, SimTraffic was utilized for the level of service, delay, and queue analyses. **The following Table 2 summarizes the analysis results:**

Table 2 2028 Build Conditions between 7:15-7:45 AM

		Year 2028 Build AM			
1. Rte 29/Fontaine SB	Movement/Approach	Fontaine EB	Fontaine WB	Rte 29 SB	Overall
		EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/1.7	A/3.2	D/27.7	B
	Approach LOS/Delay	A/1.7	A/3.2	D/27.7	12.0
	Movement Queue	11	87	350	

2028 No Build Conditions in Commuter AM Peak Hour

The future year 2028 no build conditions traffic analysis results were obtained from the prior Regents School Site Traffic Assessment (10/12/2018) for comparison purpose. The following **Table 3** summarizes the analysis results:

Table 3 2028 No Build Conditions in Commuter AM Peak Hour

		Year 2028 No Build AM			Overall
		Fontaine EB	Fontaine WB	Rte 29 SB	
1. Rte 29/Fontaine SB	Movement/Approach	EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/1.5	A/2.3	E/45.4	D
	Approach LOS/Delay	A/1.5	A/2.3	E/45.4	30.1
	Movement Queue	4	57	> 500	

Finding: comparison of 2028 Build Conditions between 7:15-7:45 AM and 2028 No Build Conditions in Commuter AM Peak Hour

Comparing analysis results above, the finding of this study effort is – the traffic operation in the future year 2028 build conditions between 7:15-7:45 AM is better than in the future year 2028 no build conditions in commuter AM peak hour:

- The overall intersection level of service is LOS B in the future year 2028 build conditions between 7:15-7:45 AM, while it is LOS D in the future year 2028 no build conditions in commuter AM peak hour.
- The overall intersection delay is 12.0-seconds in the future year 2028 build conditions between 7:15-7:45 AM, while it is 30.1-seconds in the future year 2028 no build conditions in commuter AM peak hour.
- Route 29 southbound ramp delay is 27.7-seconds, which falls at the lower end of LOS D, in the future year 2028 build conditions between 7:15-7:45 AM, while it is 45.4-seconds, which falls at the upper end of LOS E, in the future year 2028 no build conditions in commuter AM peak hour.
- Route 29 southbound ramp queue is 350 feet in the future year 2028 build conditions between 7:15-7:45 AM, while it is longer than 500 feet in the future year 2028 no build conditions in commuter AM peak hour.

End of Memorandum

Attachment: 2028 Build Conditions Between 7:15-7:45 AM SimTraffic Reports

1: Rte 29 SB On-Ramp/Rte 29 SB Off-Ramp & Fontaine Performance by lane

Lane	EB	WB	SB	All
Movements Served	TR	LT	LTR	
Denied Del/Veh (s)				0.4
Total Del/Veh (s)	1.7	3.2	27.7	12.0

Total Network Performance

Denied Del/Veh (s)		0.4
Total Del/Veh (s)		12.7

Intersection: 1: Rte 29 SB On-Ramp/Rte 29 SB Off-Ramp & Fontaine

Movement	EB	WB	SB
Directions Served	TR	LT	LTR
Maximum Queue (ft)	11	87	350
Average Queue (ft)	0	32	125
95th Queue (ft)	5	69	268
Link Distance (ft)	708	507	520
Upstream Blk Time (%)			0
Queuing Penalty (veh)			0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

MEMORANDUM

TO: JUSTIN SHIMP, P.E.

FROM: BILL WUENSCH, P.E., PTOE;
WEI HE

ORGANIZATION: SHIMP ENGINEERING

DATE: JULY 01, 2019

PHONE NUMBER:

SENDER'S REFERENCE NUMBER:

RE: REGENTS SCHOOL SITE TRAFFIC ASSESSMENT
SUPPLEMENT #4_BY-RIGHT DEVELOPMENT ANALYSIS

YOUR REFERENCE NUMBER:

☐ URGENT ☒ FOR YOUR USE ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

The purpose of this memorandum is to summarize a supplemental traffic analysis for the proposed Regents School Site to examine the impact of the by-right development, 23 single family homes, at the proposed Regents School Site on Fontaine Avenue/Route 29 Southbound Ramp intersection in the future year 2028 AM peak hour.

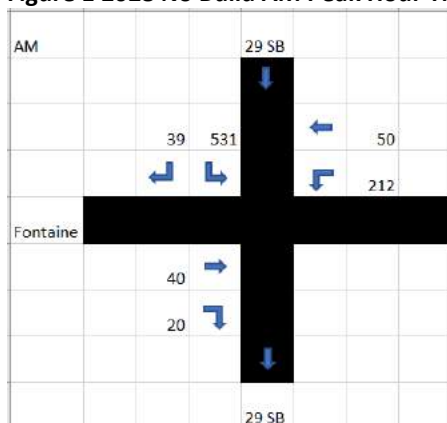
To accomplish the goal, this analysis obtained the 2028 no build AM peak hour traffic volumes and traffic performance results from the prior Regents School Site Traffic Assessment (10/12/2018), added in site trips generated by the by-right development, and analyzed the 2028 build AM peak hour traffic performance results with the 23 single family homes.

The following provides a brief summary of this information.

2028 No Build AM Peak Hour Traffic Volumes

2028 no build AM peak hour traffic volumes were obtained from the prior Regents School Site Traffic Assessment (10/12/2018) and are illustrated in **Figure 1** below.

Figure 1 2028 No Build AM Peak Hour Traffic Volumes



2028 No Build AM Peak Hour Traffic Performance

2028 no build AM peak hour traffic performance results were obtained from the prior Regents School Site Traffic Assessment (10/12/2018). The following **Table 1** summarizes the analysis results:

Table 1 2028 No Build AM Peak Hour Traffic Performance Results

	Movement/Approach	2028 No Build AM			Overall
		Fontaine EB	Fontaine WB	Rte 29 SB	
1. Rte 29/Fontaine SB		EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/1.5	A/2.3	E/45.4	D
	Approach LOS/Delay	A/1.5	A/2.3	E/45.4	30.1
	Movement Queue	4	57	> 500	

Trip Generation

The trip generation of the by-right development, 23 single family homes, was calculated using web-based ITE Trip Generation Manual (10th edition) and is summarized in **Table 2** below.

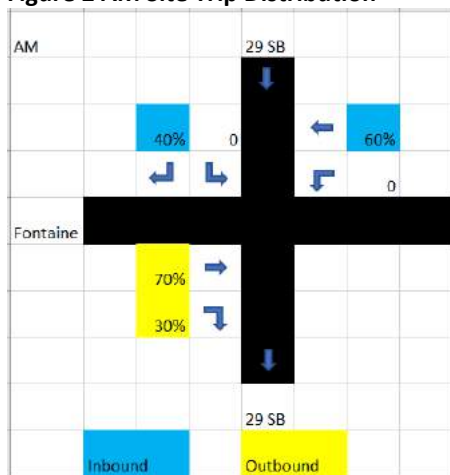
Table 2 By-right Development Trip Generation

By-right Development Trip Generation									
	LU CODE	Units	Weekday	AM Total	AM IN	AM OUT	PM Total	PM IN	PM OUT
2028	210	23	269	21	5	16	25	16	9

AM Site Trip Distribution and Assignment

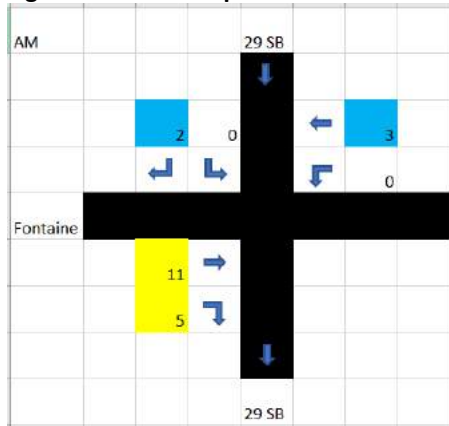
AM Trip distribution was assumed as per the existing traffic pattern and is illustrated in **Figure 2** below.

Figure 2 AM Site Trip Distribution



The AM site trips as summarized in Table 2 were assigned to the road network based on the distribution as noted above. **Figure 3** illustrates the AM site trips generated by the by-right development, 23 single family homes.

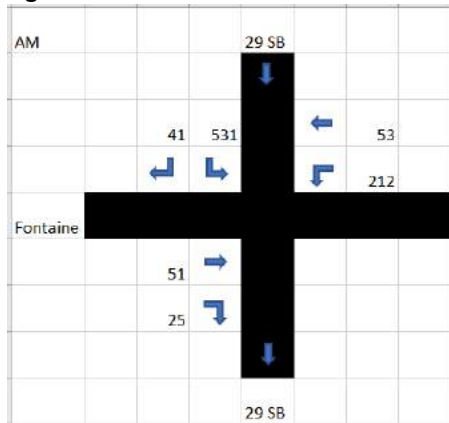
Figure 3 AM Site Trips



2028 Build AM Peak Hour Traffic Volumes

The AM site trips as shown in Figure 3 were added to the 2028 no build AM peak hour traffic volumes as shown in Figure 1 resulting the 2028 build AM peak hour traffic volumes. **Figure 4** illustrates the 2028 build AM peak hour traffic volumes.

Figure 4 2028 Build AM Peak Hour Traffic Volumes



2028 Build AM Peak Hour Traffic Performance

2028 build AM peak hour traffic performance was analyzed in Synchro/SimTraffic 9.2. It should be noted that, the same as in the prior Regents School Site Traffic Assessment (10/12/2018) and prior supplements, SimTraffic results were utilized for the level of service, delay, and queue analyses. **The following Table 3 summarizes the traffic performance results for 2028 build AM peak hour.**

Table 3 2028 Build AM Peak Hour Traffic Performance Results

		2028 Build AM			
		Fontaine EB	Fontaine WB	Rte 29 SB	Overall
1. Rte 29/Fontaine SB	Movement/Approach	EBT/R	WBL/T	SBL/R	
	Movement LOS/Delay	A/1.6	A/2.4	F/50.6	D
	Approach LOS/Delay	A/1.6	A/2.4	F/50.6	32.8
	Movement Queue	0	62	> 500	

Findings

Comparing the traffic performance results above for 2028 build AM peak hour to the traffic performance results for 2028 no build AM peak hour, the impact of the site trips generated by the by-right development, 23 single family homes, is minor on Fontaine Avenue/Route 29 Southbound Ramp intersection in the future year 2028 AM peak hour – the overall delay at the intersection is 2.7 seconds longer, the delay on Fontaine Avenue is 0.1 second longer for both eastbound and westbound, and the delay on Route 29 Southbound Ramp is 5.2 second longer.

End of Memorandum

Attachment: 2028 Build Peak Hour SimTraffic Reports

1: Rte 29 SB On-Ramp/Rte 29 SB Off-Ramp & Fontaine Performance by lane

Lane	EB	WB	SB	All
Movements Served	TR	LT	LTR	
Denied Del/Veh (s)				5.8
Total Del/Veh (s)	1.6	2.4	50.6	32.8

Intersection: 1: Rte 29 SB On-Ramp/Rte 29 SB Off-Ramp & Fontaine

Movement	WB	SB
Directions Served	LT	LTR
Maximum Queue (ft)	62	541
Average Queue (ft)	16	285
95th Queue (ft)	47	553
Link Distance (ft)	486	525
Upstream Blk Time (%)		13
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		