

**MEMORANDUM**

Date: April 24, 2017

To: Heidi Rosenberg  
Director, Capital Programs  
Camas School District  
841 NE 22<sup>nd</sup> Avenue  
Camas WA 98607

From: Frank Charbonneau, PE, PTOE

Subject: NE 232<sup>nd</sup> Avenue at 28<sup>th</sup> Street Transportation Analysis FL1750  
**Lacamas Heights Elementary School**  
City of Camas

As requested Charbonneau Engineering has reviewed the traffic analysis and subsequent documentation prepared for the Lacamas Heights Elementary School project pertaining to the intersection of NE 232<sup>nd</sup> Avenue at 28<sup>th</sup> Street. Previously the study found that no mitigation would be necessary at the failing intersection despite the proposed development adding trips to the failing northbound approach. We have also reviewed the additional documentation presented by the Green Mountain representatives arguing against the District not having to participate in the intersection's mitigation. At this time Charbonneau Engineering is not changing our recommendation and still supports not obligating the District towards improving the intersection.

We would like to point out the following traffic analysis conditions to help clarify the recommendation.

- The year 2018 total traffic scenario results in intersection failure at LOS 'F' with 89 seconds delay per vehicle on the northbound stop approach where there is only one approach lane. In this scenario there are 163 left turn vehicles and 142 right turn vehicles. No cars travel straight through the intersection on the northbound approach.
- The northbound left turn traffic represents the critical volume and movement within the approach lane as the LOS analysis finds that without left turn traffic the northbound approach operates with an acceptable LOS 'B' and delay of 11 seconds. Conversely if there were no right turn vehicles and only left turn traffic the intersection fails at LOS 'F' and 66 seconds delay.
- The elementary school development project will distribute only three trips to the northbound left turn movement that causes the intersection to fail.

Therefore, it is our interpretation of code section 40.350.020(G)(1)(c) that the proposed development shall not be required to mitigate or contribute towards the cost for mitigation at 232<sup>nd</sup> Avenue and 28<sup>th</sup> Street because less than five peak period trips are added to the movement causing the intersection to fail.

Supporting LOS documentation is attached to this memo.

If you should have any questions, please contact Frank Charbonneau, PE, PTOE at 503.293.1118 or email [Frank@CharbonneauEngineer.com](mailto:Frank@CharbonneauEngineer.com).

HCM 2010 TWSC  
3: 232nd Ave & 28th St

04/24/2017

Intersection

Int Delay, s/veh 25.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	169	165	172	295	0	163	0	142	0	0	4
Future Vol, veh/h	0	169	165	172	295	0	163	0	142	0	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Yield	Yield	Yield
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	1	1	1	4	4	4	0	0	0
Mvmt Flow	0	186	181	189	324	0	179	0	156	0	0	4

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	324	0	0	367	0	0	978	978	276
Stage 1	-	-	-	-	-	-	276	276	-
Stage 2	-	-	-	-	-	-	702	702	-
Critical Hdwy	4.13	-	-	4.11	-	-	6.44	6.54	6.24
Critical Hdwy Stg 1	-	-	-	-	-	-	5.44	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.44	5.54	-
Follow-up Hdwy	2.227	-	-	2.209	-	-	3.536	4.036	3.336
Pot Cap-1 Maneuver	1230	-	-	1197	-	-	275	248	758
Stage 1	-	-	-	-	-	-	766	678	-
Stage 2	-	-	-	-	-	-	488	437	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1230	-	-	1197	-	-	222	0	758
Mov Cap-2 Maneuver	-	-	-	-	-	-	222	0	-
Stage 1	-	-	-	-	-	-	766	0	-
Stage 2	-	-	-	-	-	-	394	0	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.2	89.2
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	331	1230	-	-	1197	-	-
HCM Lane V/C Ratio	1.013	-	-	-	0.158	-	-
HCM Control Delay (s)	89.2	0	-	-	8.6	0	-
HCM Lane LOS	F	A	-	-	A	A	-
HCM 95th %tile Q(veh)	11.5	0	-	-	0.6	-	-

HCM 2010 TWSC  
3: 232nd Ave & 28th St

04/24/2017

Intersection

Int Delay, s/veh 3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	169	165	172	295	0	0	0	142	0	0	4
Future Vol, veh/h	0	169	165	172	295	0	0	0	142	0	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Yield	Yield	Yield
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	1	1	1	4	4	4	0	0	0
Mvmt Flow	0	186	181	189	324	0	0	0	156	0	0	4

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	324	0	0	367	0	0	978	978	276
Stage 1	-	-	-	-	-	-	276	276	-
Stage 2	-	-	-	-	-	-	702	702	-
Critical Hdwy	4.13	-	-	4.11	-	-	6.44	6.54	6.24
Critical Hdwy Stg 1	-	-	-	-	-	-	5.44	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.44	5.54	-
Follow-up Hdwy	2.227	-	-	2.209	-	-	3.536	4.036	3.336
Pot Cap-1 Maneuver	1230	-	-	1197	-	-	275	248	758
Stage 1	-	-	-	-	-	-	766	678	-
Stage 2	-	-	-	-	-	-	488	437	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1230	-	-	1197	-	-	222	0	758
Mov Cap-2 Maneuver	-	-	-	-	-	-	222	0	-
Stage 1	-	-	-	-	-	-	766	0	-
Stage 2	-	-	-	-	-	-	394	0	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.2	11
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	758	1230	-	-	1197	-	-
HCM Lane V/C Ratio	0.206	-	-	-	0.158	-	-
HCM Control Delay (s)	11	0	-	-	8.6	0	-
HCM Lane LOS	B	A	-	-	A	A	-
HCM 95th %tile Q(veh)	0.8	0	-	-	0.6	-	-

HCM 2010 TWSC  
3: 232nd Ave & 28th St

04/24/2017

Intersection

Int Delay, s/veh 12.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	169	165	172	295	0	163	0	0	0	0	4
Future Vol, veh/h	0	169	165	172	295	0	163	0	0	0	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Yield	Yield	Yield
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	1	1	1	4	4	4	0	0	0
Mvmt Flow	0	186	181	189	324	0	179	0	0	0	0	4

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	324	0	0	367	0	0	978	978	276
Stage 1	-	-	-	-	-	-	276	276	-
Stage 2	-	-	-	-	-	-	702	702	-
Critical Hdwy	4.13	-	-	4.11	-	-	6.44	6.54	6.24
Critical Hdwy Stg 1	-	-	-	-	-	-	5.44	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.44	5.54	-
Follow-up Hdwy	2.227	-	-	2.209	-	-	3.536	4.036	3.336
Pot Cap-1 Maneuver	1230	-	-	1197	-	-	275	248	758
Stage 1	-	-	-	-	-	-	766	678	-
Stage 2	-	-	-	-	-	-	488	437	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1230	-	-	1197	-	-	222	0	758
Mov Cap-2 Maneuver	-	-	-	-	-	-	222	0	-
Stage 1	-	-	-	-	-	-	766	0	-
Stage 2	-	-	-	-	-	-	394	0	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.2	65.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	222	1230	-	-	1197	-	-
HCM Lane V/C Ratio	0.807	-	-	-	0.158	-	-
HCM Control Delay (s)	65.9	0	-	-	8.6	0	-
HCM Lane LOS	F	A	-	-	A	A	-
HCM 95th %tile Q(veh)	5.9	0	-	-	0.6	-	-