

MEMORANDUM

Date: June 17, 2016

To: Jeremy Fick, PE
Robertson Engineering, PC
610 Esther Street
Vancouver WA 98660

copy: Heidi Rosenberg
Camas School District

From: Frank Charbonneau, PE, PTOE

Subject: **NE 232nd Avenue & 9th Street Intersection Analysis**
City of Camas & Lacamas Heights Elementary School

FL1666

Charbonneau Engineering has completed the traffic analyses for the NE 232nd Avenue and 9th Street intersection proposal being planned in Camas.

The traffic work included a level of service (LOS) analysis for the realignment of 232nd Avenue at 9th Street and the access for the still unbuilt Lacamas Heights Elementary School. The concept plan developed by Robertson Engineering includes a new northbound stop approach that will tee into the 232nd Avenue and 9th Street curved alignment. Figure `a` attached to this memo illustrates the intersection layout and traffic control.

To complete the traffic analyses it was necessary to implement volume data established from the Lacamas Heights Elementary School traffic study completed in May 2016. The total traffic volumes included on Figure 7 in the report were used as the basis for the year 2025 conditions. These numbers included the in-process traffic and the school's trip generation. The data was considered sufficient for this analysis and is supported by City engineering staff, Jim Carothers, PE.

Figures 1-3 represent the year 2025 traffic flow conditions at the study intersection for the AM, mid-afternoon, and PM peak hours. Synchro v9 traffic software applying the year 2010 Highway Capacity Manual methodology was used to determine the LOS results for each of the peak hour periods. Under stop control on the northbound approach the intersection will operate at acceptable LOS `B` or better during the peak hours (City's minimum LOS standard is LOS `D`). The queuing analysis based on the 95th percentile value demonstrated that queues of one to two vehicles will occur on the stop approach. No queuing issues will occur on 232nd Avenue in conjunction with the left turn movement to head south.

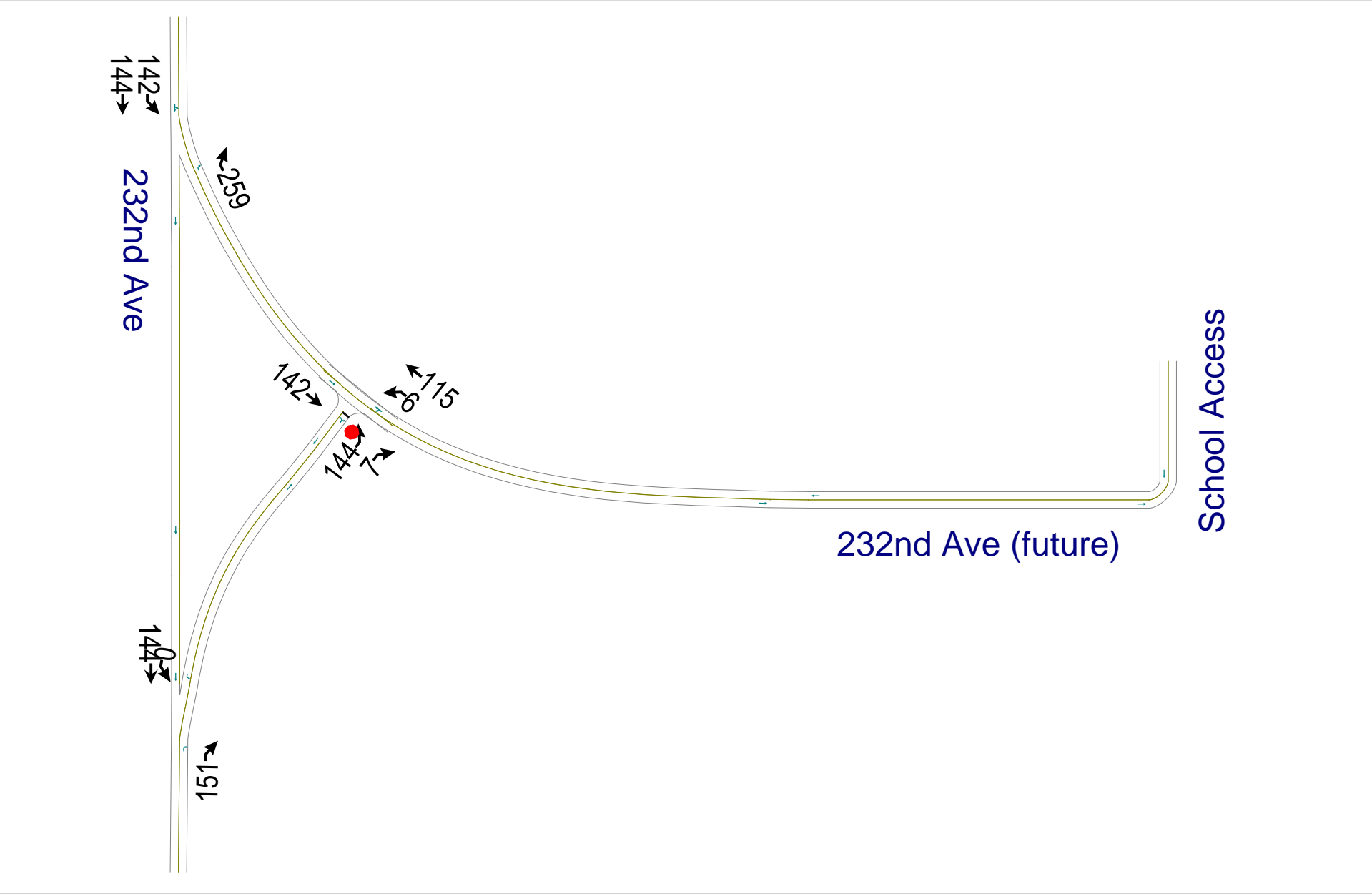
The traffic analysis results documented that the intersection will operate at satisfactory levels well into the future and it is therefore recommended that the City of Camas support the proposed design.

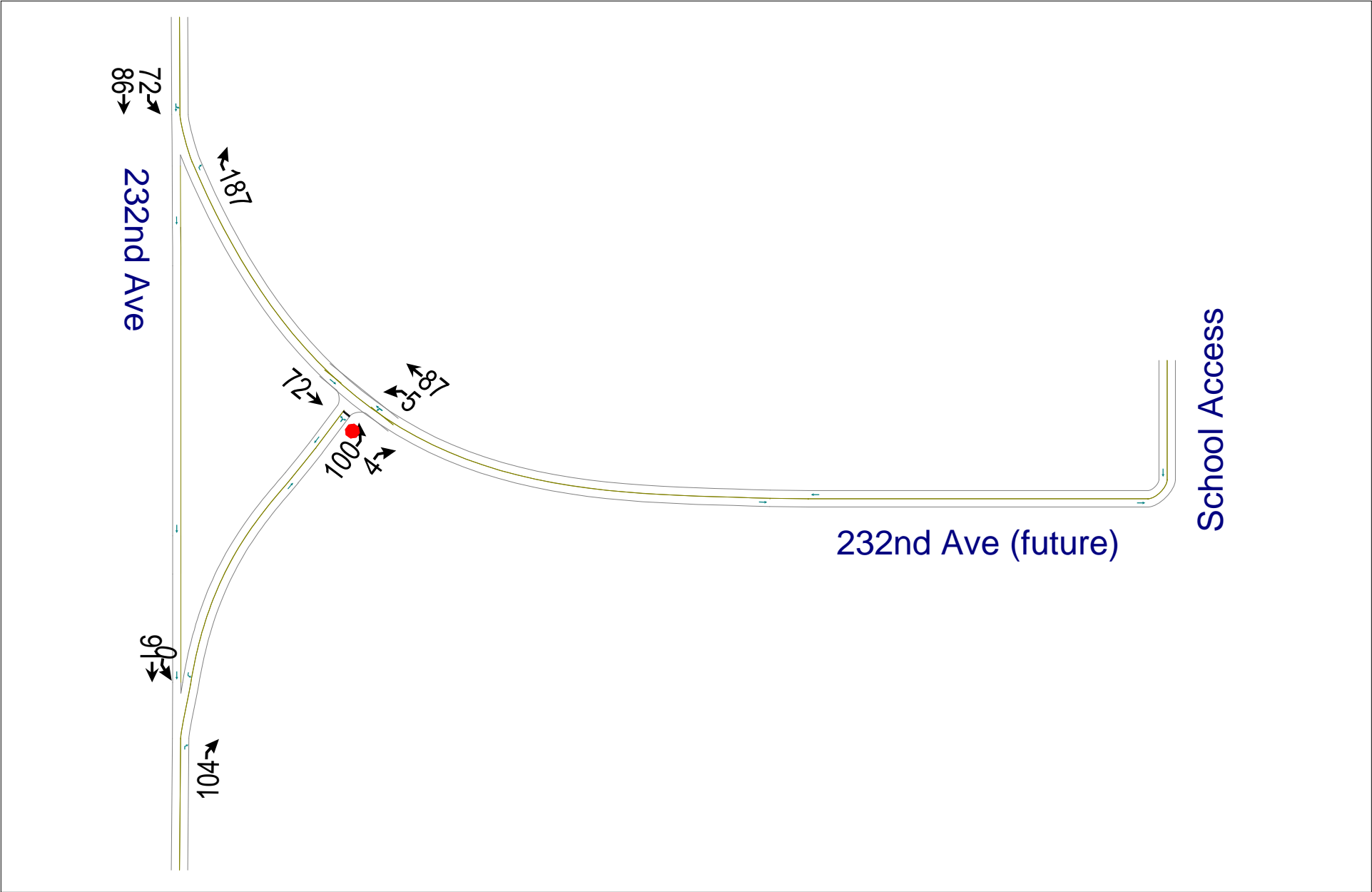
If you should have any questions, please contact Frank Charbonneau, PE, PTOE at 503.293.1118 or email Frank@CharbonneauEngineer.com.

Attachments

- Figure `a` Future Traffic Control
- Figure 1 Year 2025 Traffic AM Peak Hour
- Figure 2 Year 2025 Traffic Mid-Afternoon Peak Hour
- Figure 3 Year 2025 Traffic PM Peak Hour
- Synchro v10 LOS Printouts
- Figure 7 Year 2018 Total Traffic (Lacamas Heights Elementary School traffic analysis report, May 2016)
- Intersection Concept Plan (Robertson Engineering, 6/16/16)

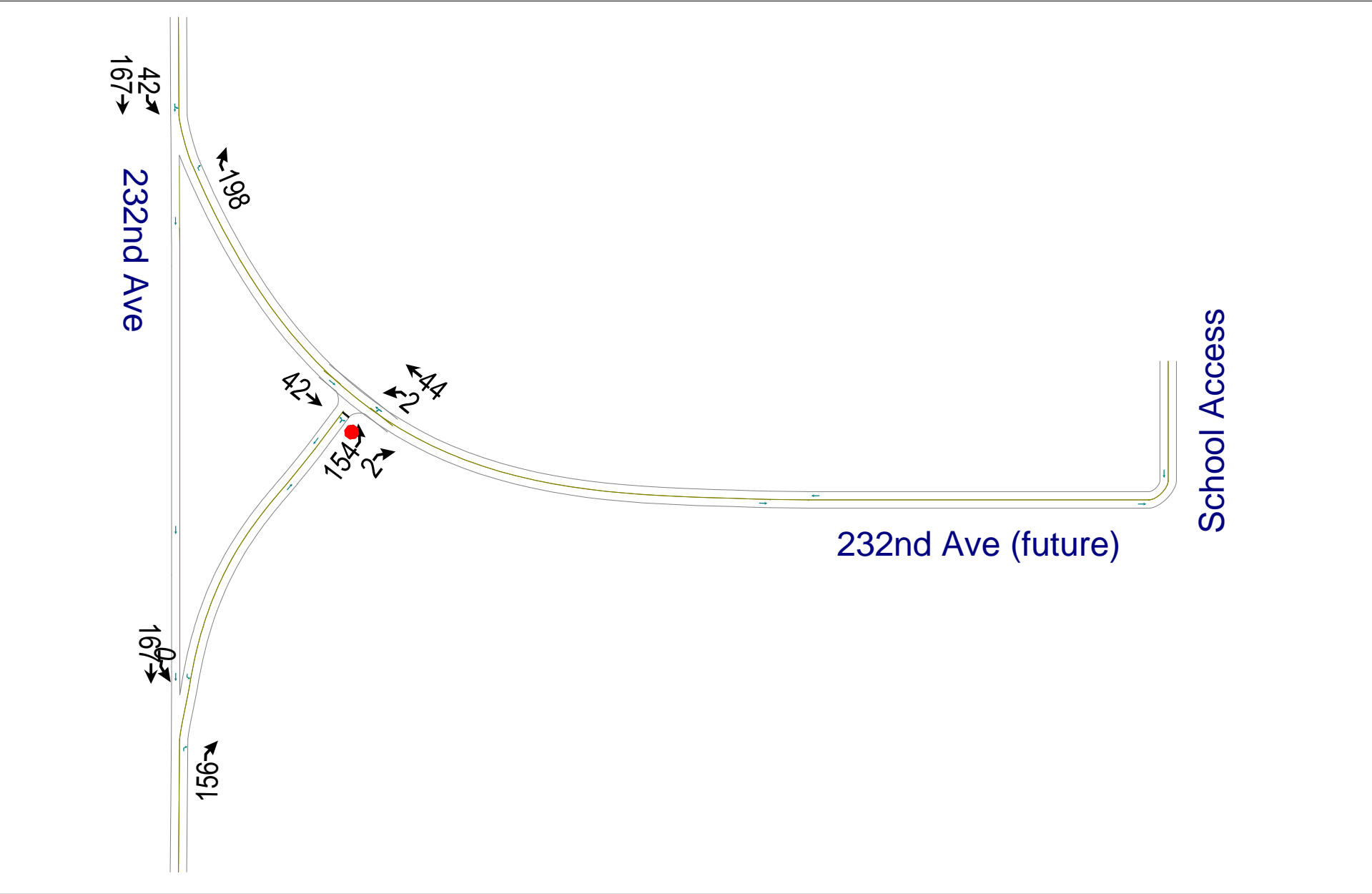






Proj #15-46
Lacamas Heights Elem Sch

Figure 2
Yr 2025 Tot Traffic Mid Pk Hr






Proj #15-46
Lacamas Heights Elem Sch

Figure 3
Yr 2025 Tot Traffic PM Pk Hr

12:

Intersection

Int Delay, s/veh 4.4




Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	142	0	6	115	144	7
Future Vol, veh/h	142	0	6	115	144	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	10	2	20	15	2	15
Mvmt Flow	154	0	7	125	157	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	154	0	292	154
Stage 1	-	-	-	-	154	-
Stage 2	-	-	-	-	138	-
Critical Hdwy	-	-	4.3	-	6.42	6.35
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.38	-	3.518	3.435
Pot Cap-1 Maneuver	-	0	1324	-	699	859
Stage 1	-	0	-	-	874	-
Stage 2	-	0	-	-	889	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	1324	-	695	859
Mov Cap-2 Maneuver	-	-	-	-	695	-
Stage 1	-	-	-	-	874	-
Stage 2	-	-	-	-	884	-

Approach	SE	NW	NE
HCM Control Delay, s	0	0.4	11.7
HCM LOS			B




Minor Lane/Major Mvmt	NELn1	NWL	NWT	SET
Capacity (veh/h)	701	1324	-	-
HCM Lane V/C Ratio	0.234	0.005	-	-
HCM Control Delay (s)	11.7	7.7	0	-
HCM Lane LOS	B	A	A	-
HCM 95th %tile Q(veh)	0.9	0	-	-

12:

Intersection						
Int Delay, s/veh	4.1					
Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	72	0	5	87	100	4
Future Vol, veh/h	72	0	5	87	100	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	15	2	2	15	2	10
Mvmt Flow	78	0	5	95	109	4
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	78	0	183	78
Stage 1	-	-	-	-	78	-
Stage 2	-	-	-	-	105	-
Critical Hdwy	-	-	4.12	-	6.42	6.3
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.39
Pot Cap-1 Maneuver	-	0	1520	-	806	961
Stage 1	-	0	-	-	945	-
Stage 2	-	0	-	-	919	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	1520	-	804	961
Mov Cap-2 Maneuver	-	-	-	-	804	-
Stage 1	-	-	-	-	945	-
Stage 2	-	-	-	-	916	-
Approach	SE		NW		NE	
HCM Control Delay, s	0		0.4		10.2	
HCM LOS	B					
Minor Lane/Major Mvmt	NELn1	NWL	NWT	SET		
Capacity (veh/h)	809	1520	-	-		
HCM Lane V/C Ratio	0.14	0.004	-	-		
HCM Control Delay (s)	10.2	7.4	0	-		
HCM Lane LOS	B	A	A	-		
HCM 95th %tile Q(veh)	0.5	0	-	-		

Intersection

Int Delay, s/veh 6.4

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	42	0	2	44	154	2
Future Vol, veh/h	42	0	2	44	154	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	5	2	2	5	2	2
Mvmt Flow	46	0	2	48	167	2

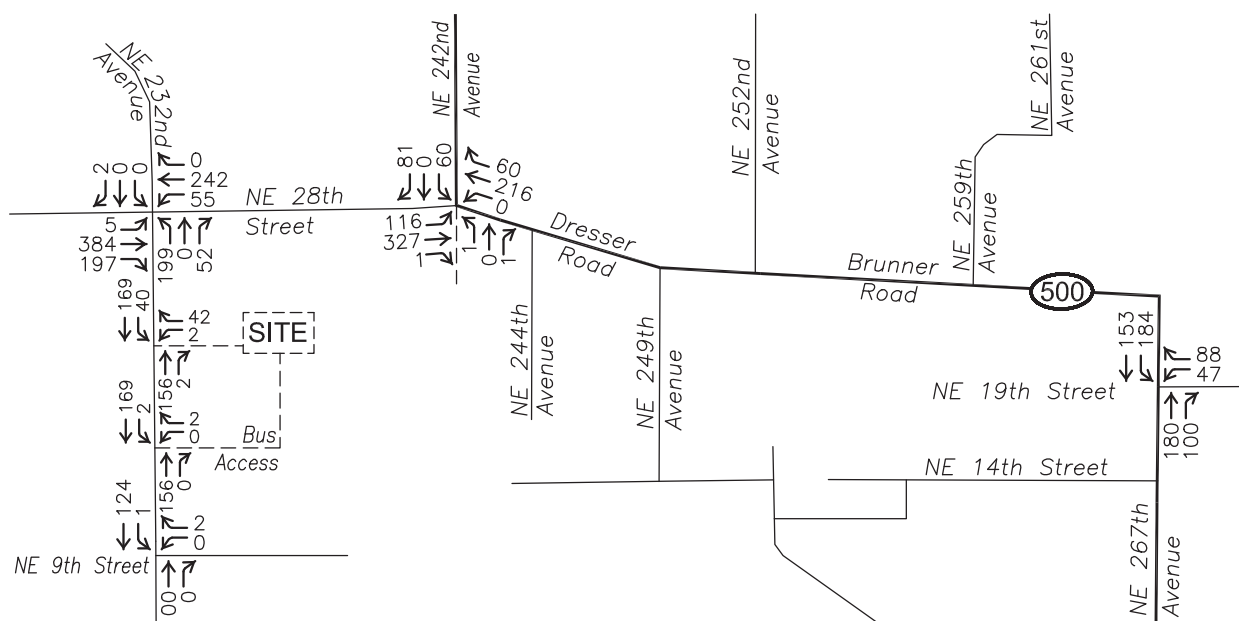
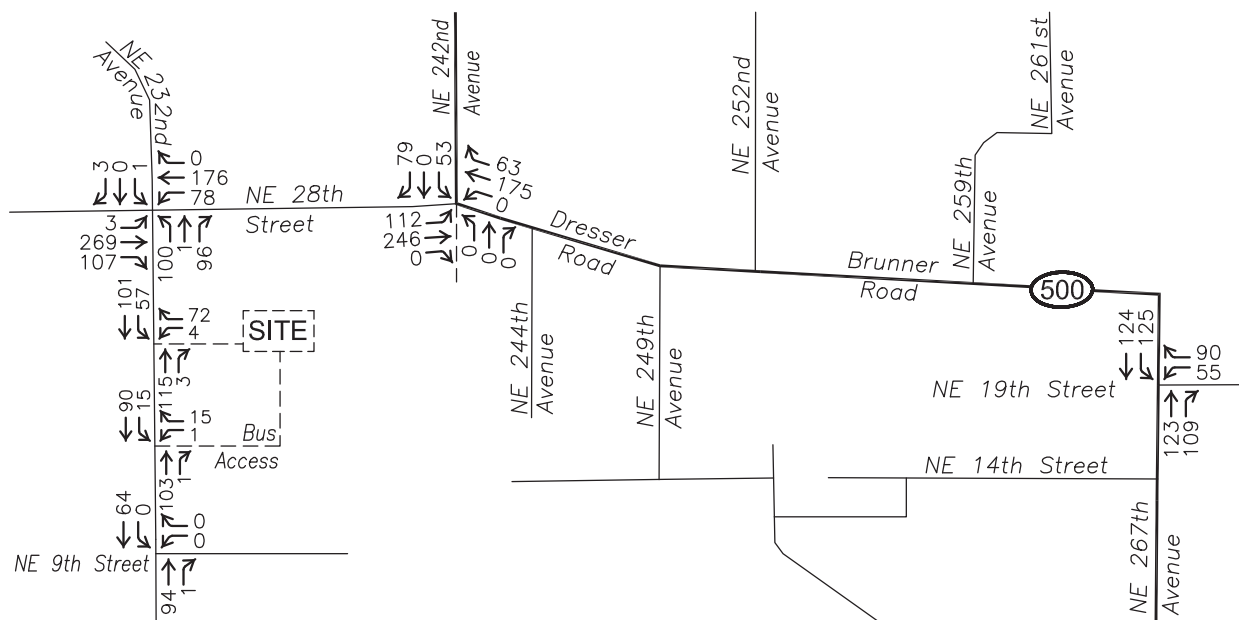
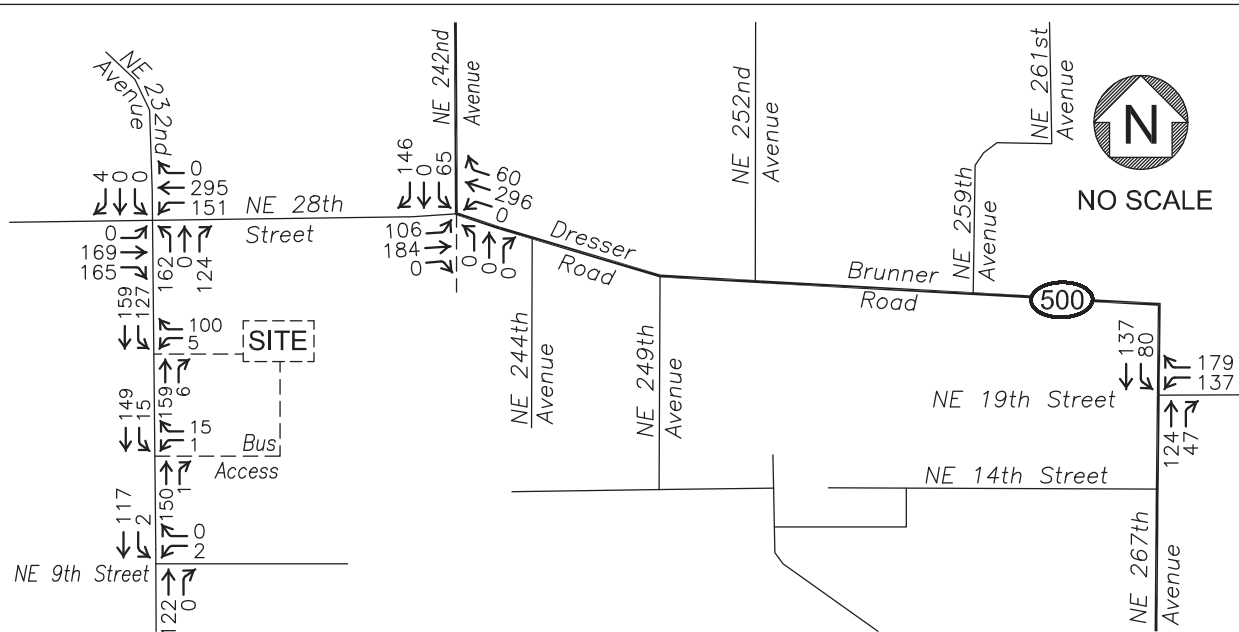
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	46	0	98	46
Stage 1	-	-	-	-	46	-
Stage 2	-	-	-	-	52	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	0	1562	-	901	1023
Stage 1	-	0	-	-	976	-
Stage 2	-	0	-	-	970	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	1562	-	900	1023
Mov Cap-2 Maneuver	-	-	-	-	900	-
Stage 1	-	-	-	-	976	-
Stage 2	-	-	-	-	969	-

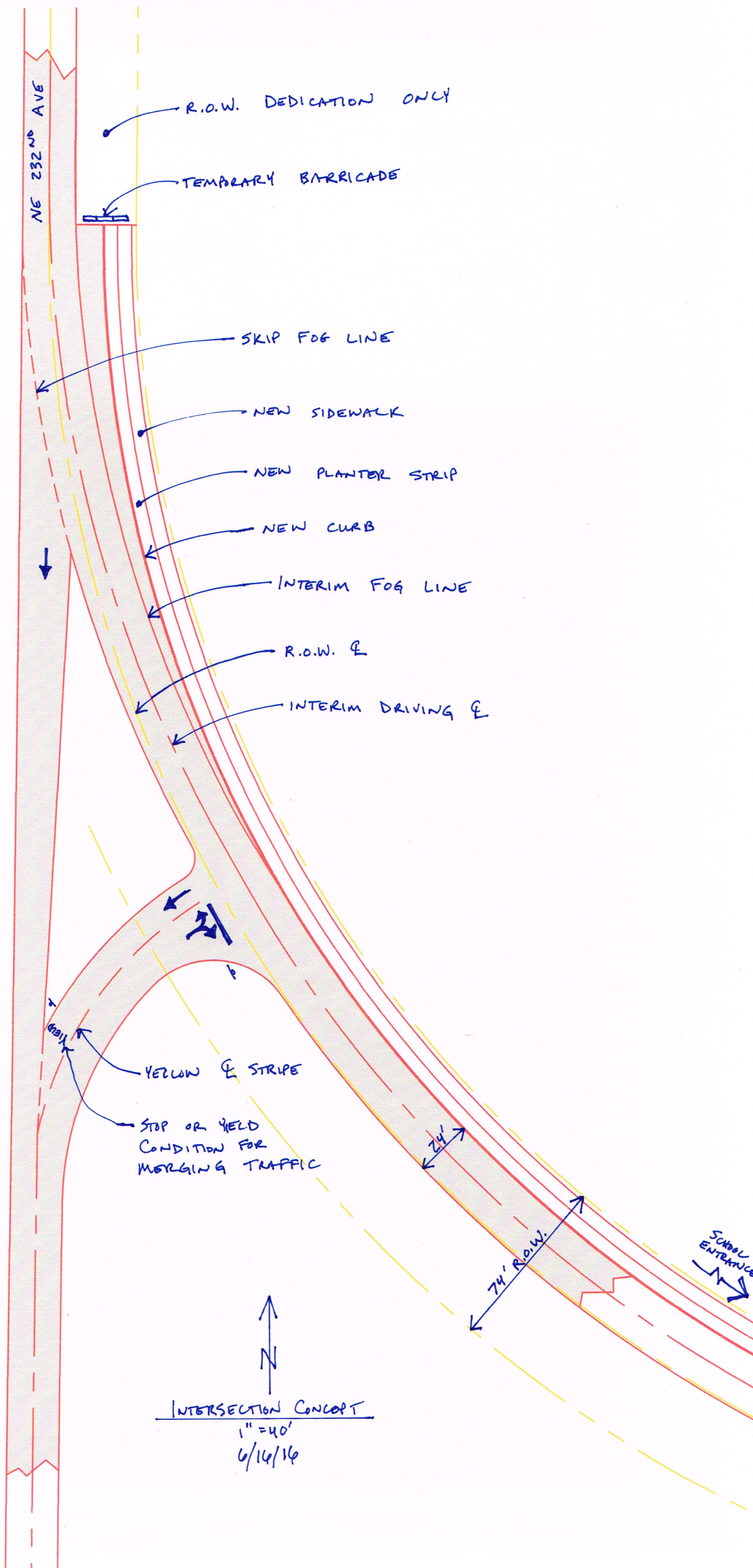
Approach	SE	NW	NE
HCM Control Delay, s	0	0.3	9.9
HCM LOS			A

Minor Lane/Major Mvmt	NELn1	NWL	NWT	SET
Capacity (veh/h)	901	1562	-	-
HCM Lane V/C Ratio	0.188	0.001	-	-
HCM Control Delay (s)	9.9	7.3	0	-
HCM Lane LOS	A	A	A	-
HCM 95th %tile Q(veh)	0.7	0	-	-

FILE NAME: 1546flow2.dwg

PLOT DATE: 05.19.16





NE 232ND AVE

R.O.W. DEDICATION ONLY

TEMPORARY BARRICADE

SKIP FOG LINE

NEW SIDEWALK

NEW PLANTER STRIP

NEW CURB

INTERIM FOG LINE

R.O.W. &

INTERIM DRIVING &

YELLOW & STRIPE

STOP OR YIELD
CONDITION FOR
MERGING TRAFFIC

24'

74' R.O.W.

SCHOOL
ENTRANCE

N

INTERSECTION CONCEPT

1" = 40'

6/14/16