TRANSPORTATION IMPACT STUDY

FOR

VALENTINA'S VILLAS

CORDUROY ROAD SOUTH OF HARRIS STREET

CITY OF KELSO, WASHINGTON

12/26/2024

PREPARED BY

KELLY ENGINEERING

December 2024

TRANSPORTATION IMPACT STUDY

Valentina's Villas

City of Kelso, Washington

December 26, 2024

Prepared for:

Jonathan Christopher
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TRANSPORTATION IMPACT STUDY

VALENTINA'S VILLAS

December 26, 2024

INTRODUCTION

A transportation impact study (TIS) for the Valentina's Villas apartment complex was conducted to determine the potential traffic related impacts of the development to the surrounding roadway system. The development will consist of a 50 unit apartment complex. The Valentina's Villas TIS was based on correspondence with representatives from the City of Kelso.

The site is located on the east side of Corduroy Road between Harris Street and Allen Street (Parcel 243570101) in the City of Kelso. The site is undeveloped with no existing buildings or structures.

Land uses in the vicinity of the site consist of single and multi family homes and undeveloped land. The Highlander Place senior living facility is to the south and the Cowlitz PUD substation is to the west. The Coweeman Middle School and Kelso High School are both located to the west of the site on the south side of Allen Street. A vicinity map, aerial photograph and preliminary site plan are shown in Figures 1a and 1b.

Roadway Characteristics

The site will have access onto Corduroy Road through two driveways. Corduroy Road is a 24 foot wide two lane paved roadway with no shoulders. Double yellow striping is along the centerline of the roadway indicating that passing is prohibited. The posted speed limit is 25 mph.

Intersections

The study area intersections are controlled by stop signs on the minor street approaches. The lane configurations are shown in Figure 2.

Traffic Volumes

The traffic counts in this report were conducted from 7:00 to 9:00 am during June 2024. School was in session when the traffic counts were conducted. An analysis of the AM peak hour was requested by the City of Kelso because of the two schools located on Allen Street. The AM peak hour occurred between approximately 7:00 to 8:0 am. The peak hour at the intersections is the one hour time period when traffic on the adjacent streets are the highest and congestion is most likely to occur. The existing traffic volumes are shown in Figure 3. The raw traffic count data is shown in Appendix A.

Trip Generation/Distribution

The Valentina's Villas will generate approximately 337 trips per day, ITE Trip Generation Manual, 11th edition. A trip is a one directional vehicle movement. 20 trips will occur during the AM peak hour and 26 trips will occur during the PM peak hour. The trip generation rates are shown in Table 1.

Table 1
Site Traffic Generation

Land Use	ITE code	Dwelling Units	Daily Trips	AM Peak Hour Trips	PM Peak Hour Trips
Multifamily Housing (Low-Rise)	220	50	337	20 (in-5, out-15)	26 (in-16, out-10)

The directional distribution of traffic generated by the development was assigned to the study area intersections. The distribution was based on a survey conducted in the area during the AM and PM peak hours. Based on the survey 75% of the site traffic will travel to and from the south on Corduroy Road and 25% will travel to and from the north. The site traffic distribution and assignment diagram is shown in Figure 5.

Peak Hour Traffic Operations

The scope of the transportation impact study was based on correspondence with the City of Kelso staff. Based on the discussions and notes an analysis was conducted at the following intersections and site access(s) during the weekday AM peak hours:

(1) Corduroy Road & Harris Street Road
(2) Corduroy Road & Allen Street
(3) Corduroy Road & site driveways

The study area intersections were analyzed to determine existing, year 2027 without project and year 2027 with project conditions. The assumption was made that build out of the Valentina's Villas will occur within three years. The year 2027 traffic volumes without and with the project are shown in Figures 4 and 6.

The intersection operational analysis was conducted using the procedures in the 2010 Highway Capacity Manual. These procedures describe the operation of an intersection in terms of its level of service (LOS). The LOS criteria ranges from "A", which indicates little, if any, delay to "F", which indicates that vehicles experience very long delays. The LOS criteria with the corresponding delay in seconds per vehicle is shown in Table 2. The capacity analysis summary is shown in Table 3 on page 4.

Table 2
Level of Service Criteria

Level of Service (LOS)	A	B	C	D	E	F
Unsignalized intersections Average Delay (seconds per vehicle)	≤10	>10 - 15	>15 - 25	>25 - 35	>35 - 50	>50

Table 3
Capacity Analysis Summary

	AM Peak Hour	
	LOS	Delay (sec/veh)
Corduroy Road & Harris Street Road		
Existing	A	8.6
Year 2027 w/o Project	A	8.6
Year 2027 with Project	A	8.6
Corduroy Road & Allen Street		
Existing	B	10.6
Year 2027 w/o Project	B	10.9
Year 2027 with Project	B	11.0
Corduroy Road & northern D/W		
Existing	n/a	
Year 2027 w/o Project	n/a	
Year 2027 with Project	A	8.7
Corduroy Road & southern D/W		
Existing	n/a	
Year 2027 w/o Project	n/a	
Year 2027 with Project	A	9.0

Based on the findings of this TIS the study area intersections will operate at acceptable levels with build out of the Valentina's Villas. The LOS computer printouts are included in Appendix C.

Pedestrian/Bicycle/Transit Considerations

Low pedestrian and no bicycle activities were observed within the vicinity of the site. The site is not served directly by public transit service. The nearest transit service is located to the south on Allen Street. A bus stop is located on the southwest corner of the Corduroy Road/Allen Street intersection.

Collision Data

Collision data was obtained from the WSDOT for the most recent three years of available data. Based on the data no accidents have been reported at the study area intersections. A letter from the WSDOT is included in Appendix B.

Turn Lanes

The requirement for additional turn lanes was evaluated at the study area intersections as based on guidelines in the Washington State Design Manual. Based on the findings additional turn lanes are not required.

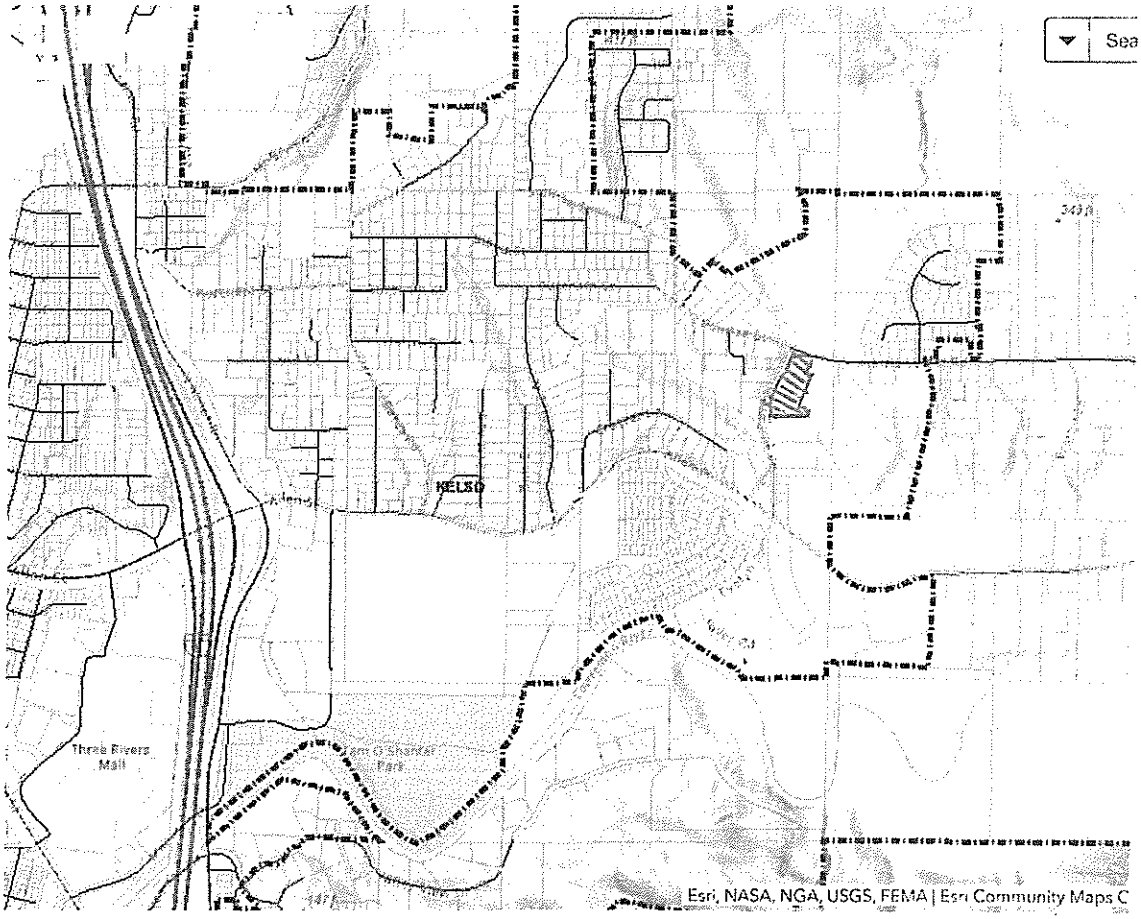
Sight Distance

Sight distance was measured at the location of both site driveways onto Corduroy Road. The sight distance is slightly obstructed by vegetation along the site frontage at the southern driveway when looking northbound and southbound. Based on the posted speed limit of 25 mph on Corduroy Road and the criteria in AASHTO, A Policy on Geometric Design of Highways and Streets the recommended corner sight distance is 280 feet. This distance will be met with the removal of the vegetation which will occur with build out of the development. The sight distance at the northern driveway when looking northbound extended to Harris Street Road. The sight distance when looking southbound was over 280 feet. Therefore, the sight distance is met at the northern driveway.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this transportation impact study the surrounding roadway system can adequately accommodate traffic from the Valentina's Villas apartment complex. No off site transportation improvements or traffic control devices were identified to accommodate the development.

Adequate sight distance should be maintained at the site access(s) onto Corduroy Road. Obstructions by signs, vegetation or other objects should not be allowed.


Sea
KELSO
Three Rivers Mall
Esri, NASA, NGA, USGS, FEMA | Esri Community Maps C

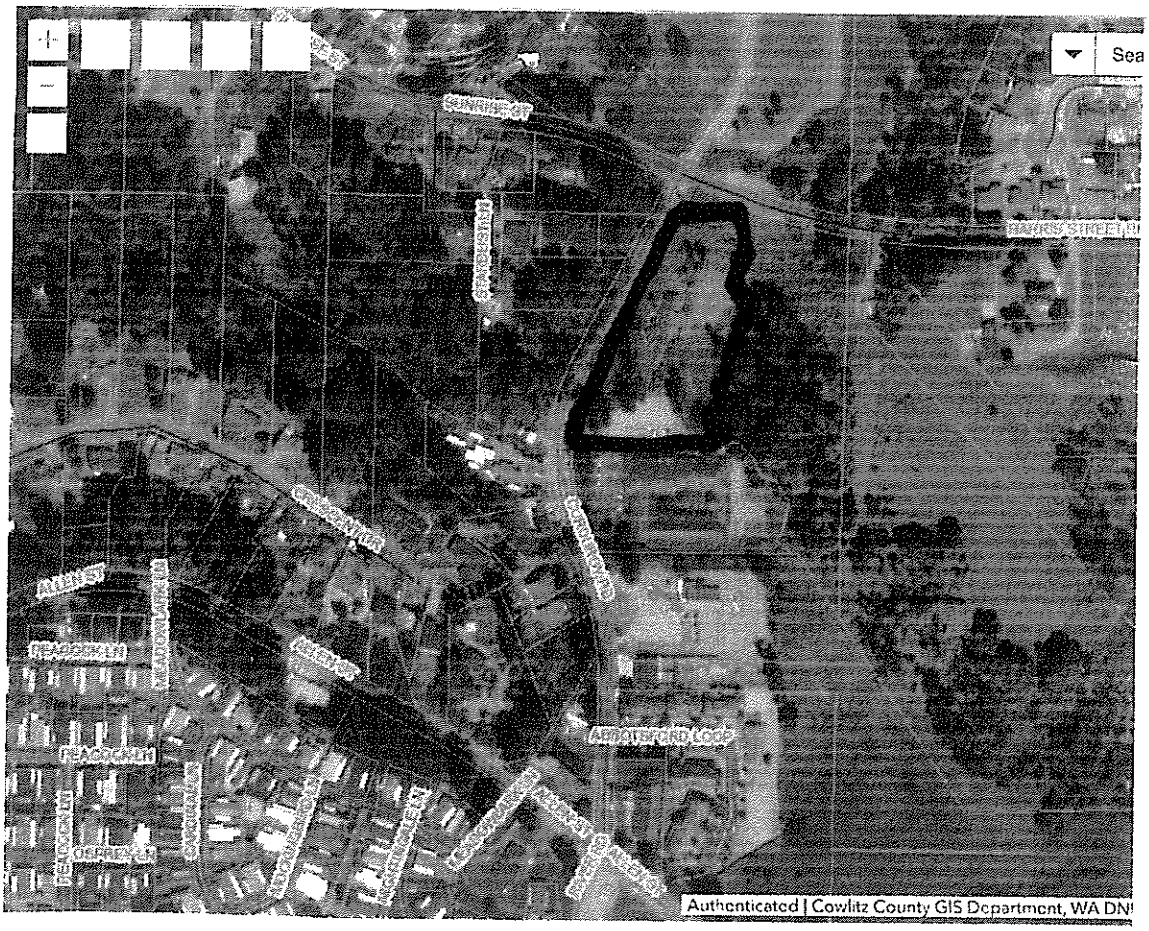
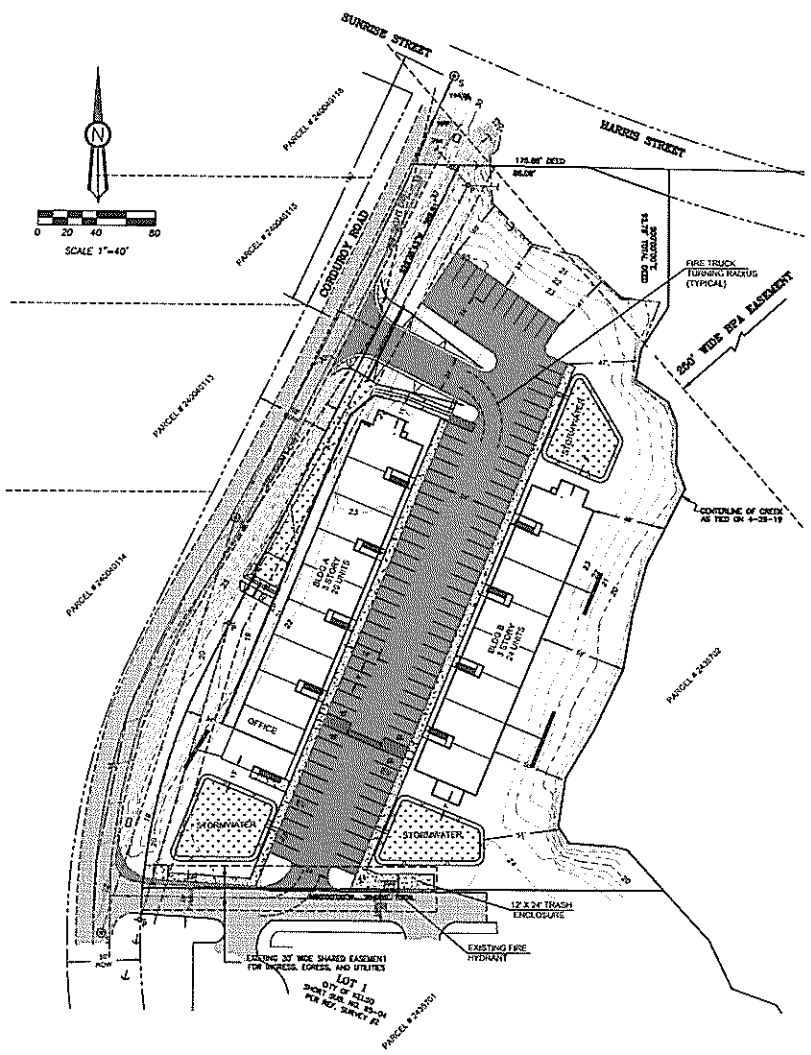
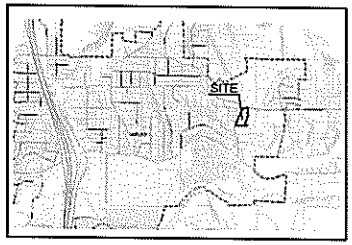

Sea
ABBOTSFORD LOOP
Authenticated | Cowlitz County GIS Department, WA DN

FIGURE 1a





VICINITY MAP

EXISTING SITE INFORMATION:

PARCEL NUMBERS	243570191
CURRENT USE	VACANT
ZONING DESIGNATION	RMF (RESIDENTIAL, MULTI-FAMILY)
GROSS SITE AREA	2.52 ACRES

PROPOSED SITE INFORMATION:

PROPOSED USE	50 UNITS TOTAL IN (TWO) 3 STORY APARTMENT BUILDINGS WITH OFFICE.

DEVELOPMENT STANDARDS:

MINIMUM LOT AREA	1,250 SF
MINIMUM LOT WIDTH	25'
FRONT YARD SETBACK	20'
SIDE YARD SETBACK	5'
STREET SIDE YARD SETBACK	7'
REAR YARD SETBACK	10'
MAXIMUM LOT COVERAGE	70%
MAXIMUM BUILDING HEIGHT	35'
MINIMUM LANDSCAPE AREA	30%

STORMWATER MANAGEMENT

TREATMENT	STORMWATER TREATMENT BY BIO-FILTRATION SYSTEMS OR OTHER APPROVED BMP'S.
DISPOSAL	TREATED STORMWATER WILL BE DISCHARGED TO WESTERLY ROADSIDE DITCH AND TO EASTERLY CREEK.

PARKING REQUIREMENTS:

PARKING SPACES REQUIRED	(1.5/UNIT) 50 X 1.5 = 75 SPACES REQUIRED
PARKING SPACES PROPOSED:	FULL SIZE - 83 ADA ACCESSIBLE - 4 ELECTRIC VEHICLE - 2 TOTAL = 89 SPACES

PROPERTY OWNER:
VAN A. HANSON
3335 GRAND AVE.
ASTORIA, OR 97103

APPLICANT:
JONATHAN CHRISTOPHER
PO BOX 1690
BRUSH PRAIRIE WA 98606
360-910-2597

CONTACT PERSON:
CARPENTER ENGINEERING INC
ATTN: BOB CARPENTER
4114 NW 122ND STREET
VANCOUVER, WA 98685
360-574-6028
bcarped@comcast.net

BUILDING OCCUPANCY CLASSIFICATION	R-2 APARTMENT HOUSES, B OFFICE — sec 310.1
BUILDING CONSTRUCTION TYPE:	TYPE V-A — TABLE 601
BUILDING STORIES:	sec 602.5
ALLOWED	3 - STORIES — TABLE 504.4
SPRINKLER INCREASE	NOT TO EXCEED 4 STORIES
ACTUAL # OF STORIES	3 - STORIES
BUILDING AREA:	
ALLOWED (NON-SPRINKLED)	9000 S.F. PER STORY — TABLE 503
SPRINKLER INCREASE for NFPA 13R sidewall sprinkler system in accordance with section 903.3.1.2	12000 S.F./STORY — 506.2
AREAS OR AGGREGATE AREAS:	sec 504
BUILDING A	8210 S.F. PER STORY.
BUILDING B	9825 S.F. PER STORY.
BUILDING HT:	
SPRINKLER INCREASE	NOT TO EXCEED 60 FT. — sec 504.3
ACTUAL HT.	34' - 10"

SET DATE: 10/28/2024

NEW	DATE	REVISION DESCRIPTION	DESIGNER / REVIEWER

CARPENTER ENGINEERING INC
Civil Engineering & Consulting
Land Development & Surveying Coordination

CEI PROJECT NO: 23-003
CONTRACT NO: -----

THIS LINE IS 1" LONG AT THE CORRECT SCALE

10-28-2024

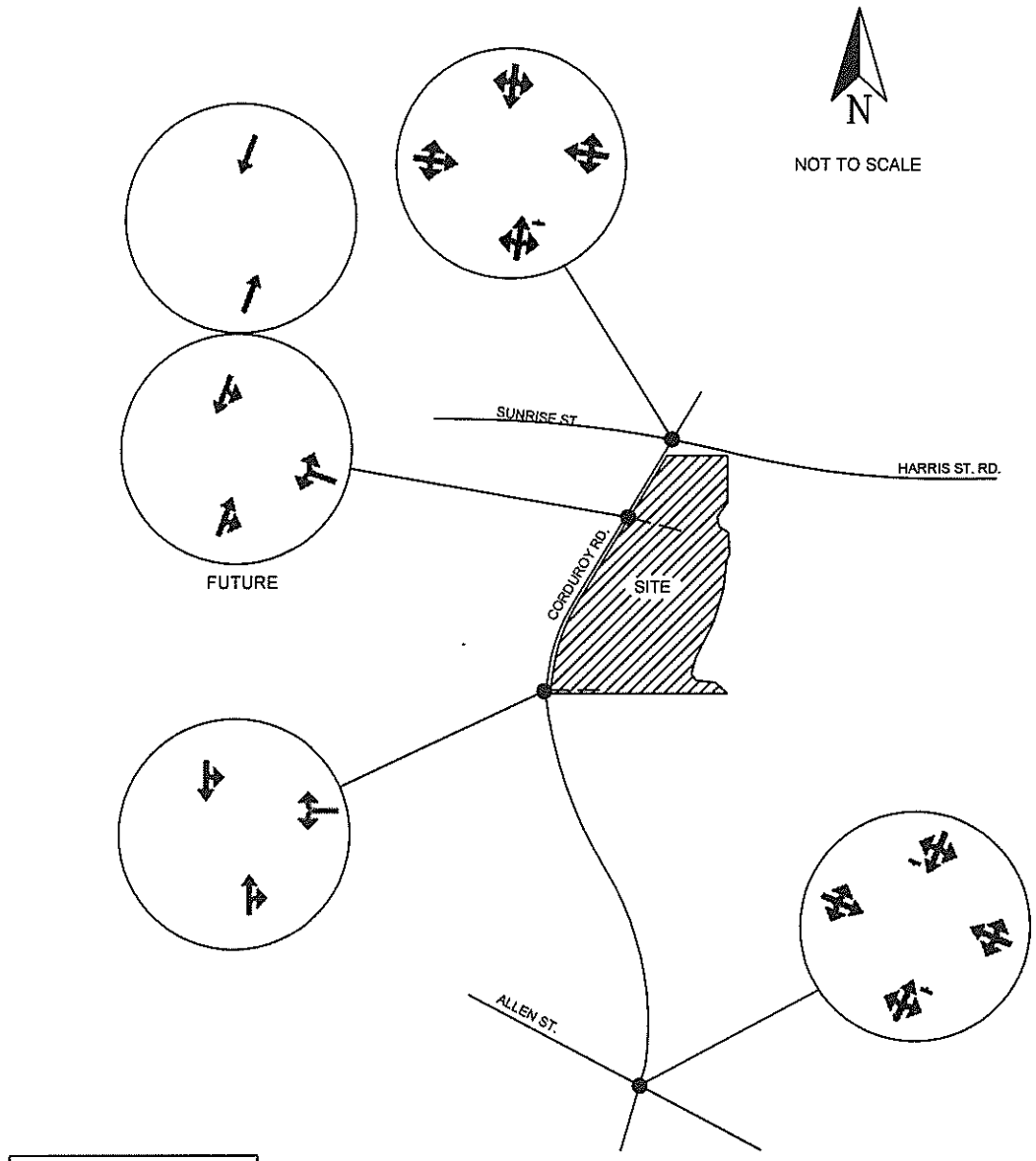
VALENTINA'S VILLAS
PRELIMINARY SITE PLAN

JONATHAN CHRISTOPHER
PO BOX 1690
BRUSH PRAIRIE, WA. 98606

REVISION 0

1
1 / 5

FIGURE 1b

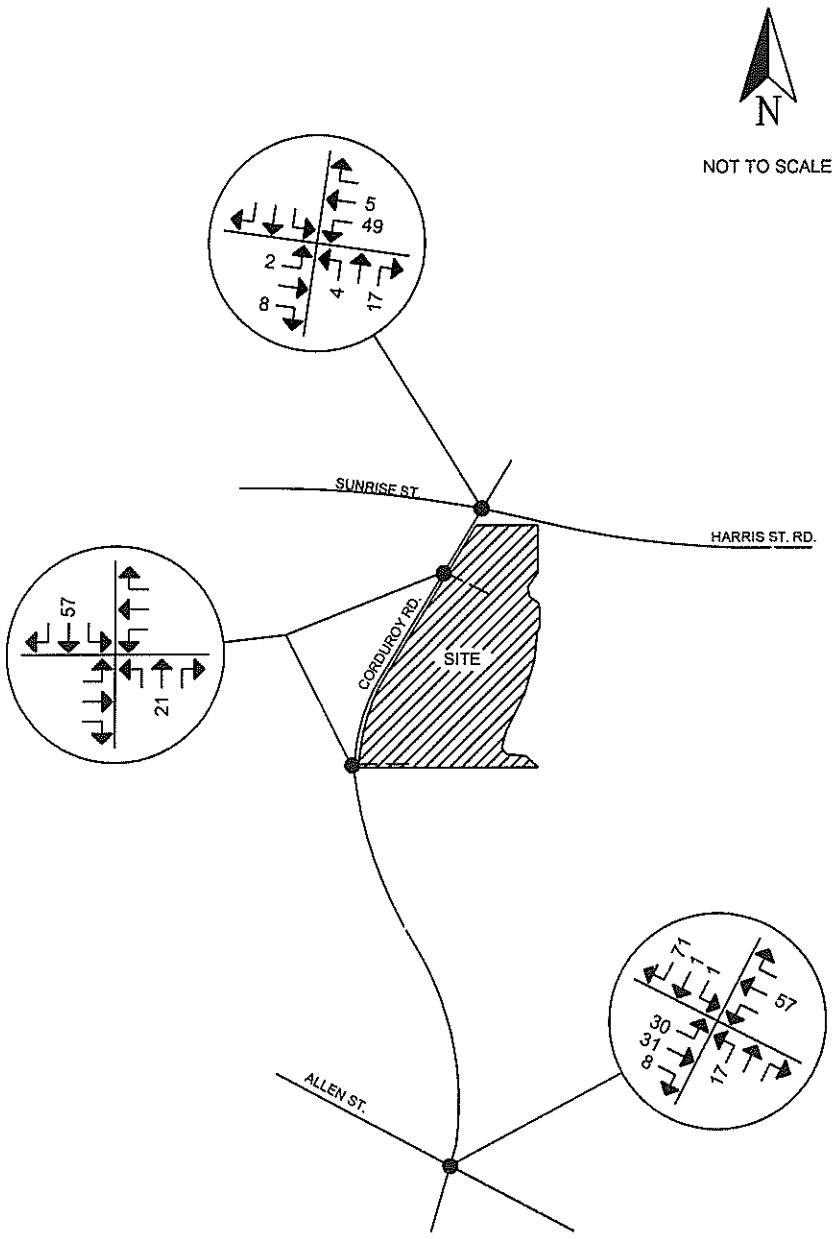


EXISTING CONDITIONS UNLESS NOTED

VALENTINA'S VILLAS

FIGURE 2
LANE CONFIGURATIONS

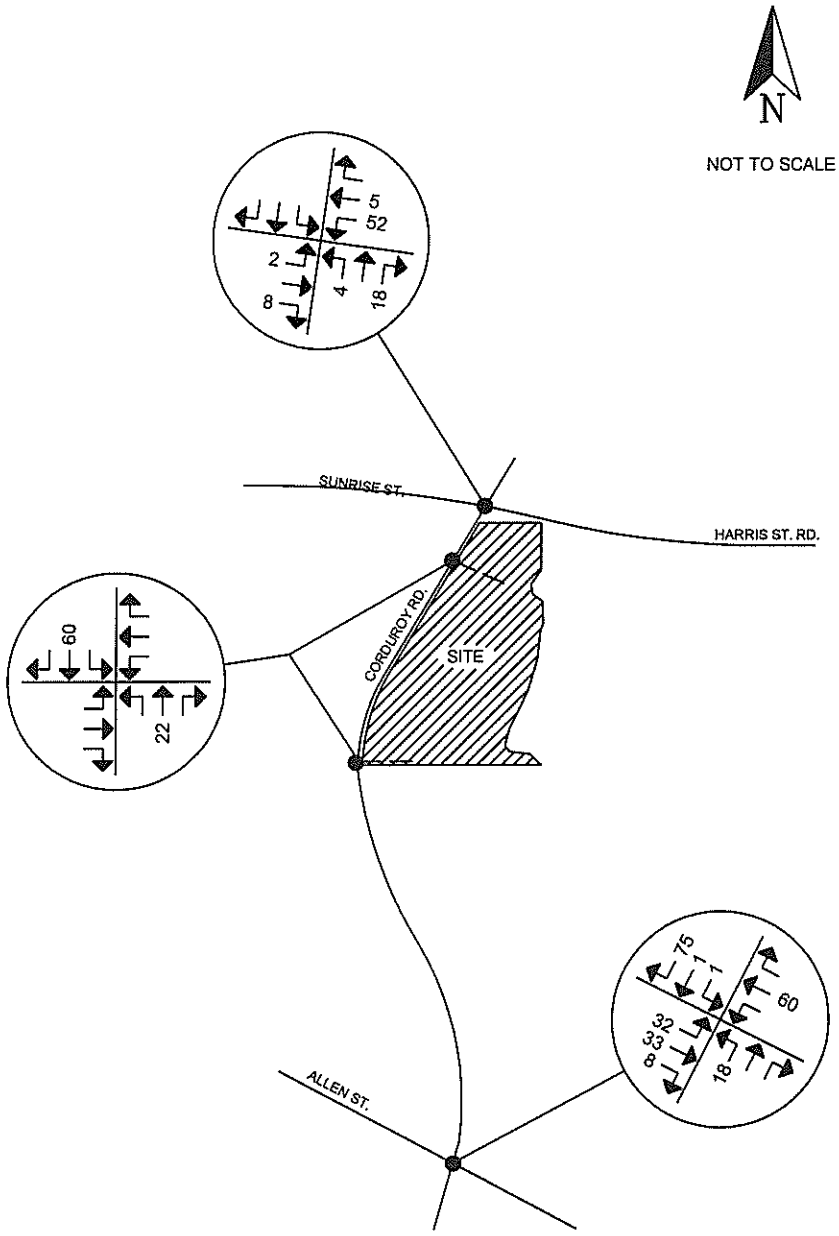
KELLY ENGINEERING
1805 NE 94th St. No. 19, Vancouver, WA 98665
Phone: 360-433-7530



VALENTINA'S VILLAGE

FIGURE 3
EXISTING TRAFFIC VOLUMES
AM PEAK HOUR

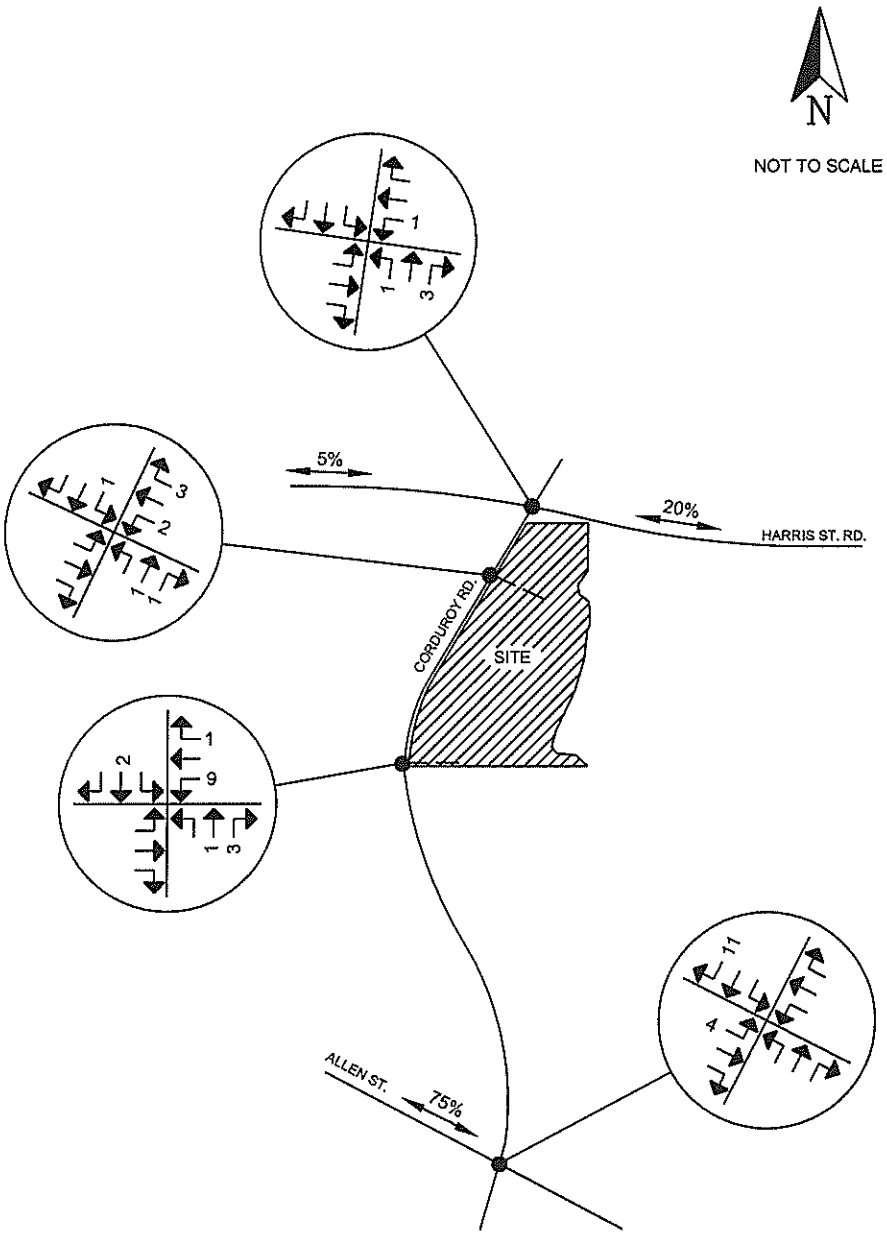
KELLY ENGINEERING
1805 NE 94th St. No. 19, Vancouver, WA 98665
Phone: 360-433-7530



VALENTINA'S VILLAS

FIGURE 4
YEAR 2027 TRAFFIC VOLUMES
W/O PROJECT, AM PEAK HOUR

KELLY ENGINEERING
1805 NE 94th St. No. 19, Vancouver, WA 98665
Phone: 360-433-7530



AM PEAK HOUR SITE TRIPS
IN-5, OUT-15

VALENTINA'S VILLAS

FIGURE 5
SITE TRAFFIC DISTRIBUTION/ ASSIGNMENT, AM PEAK HOUR

KELLY ENGINEERING
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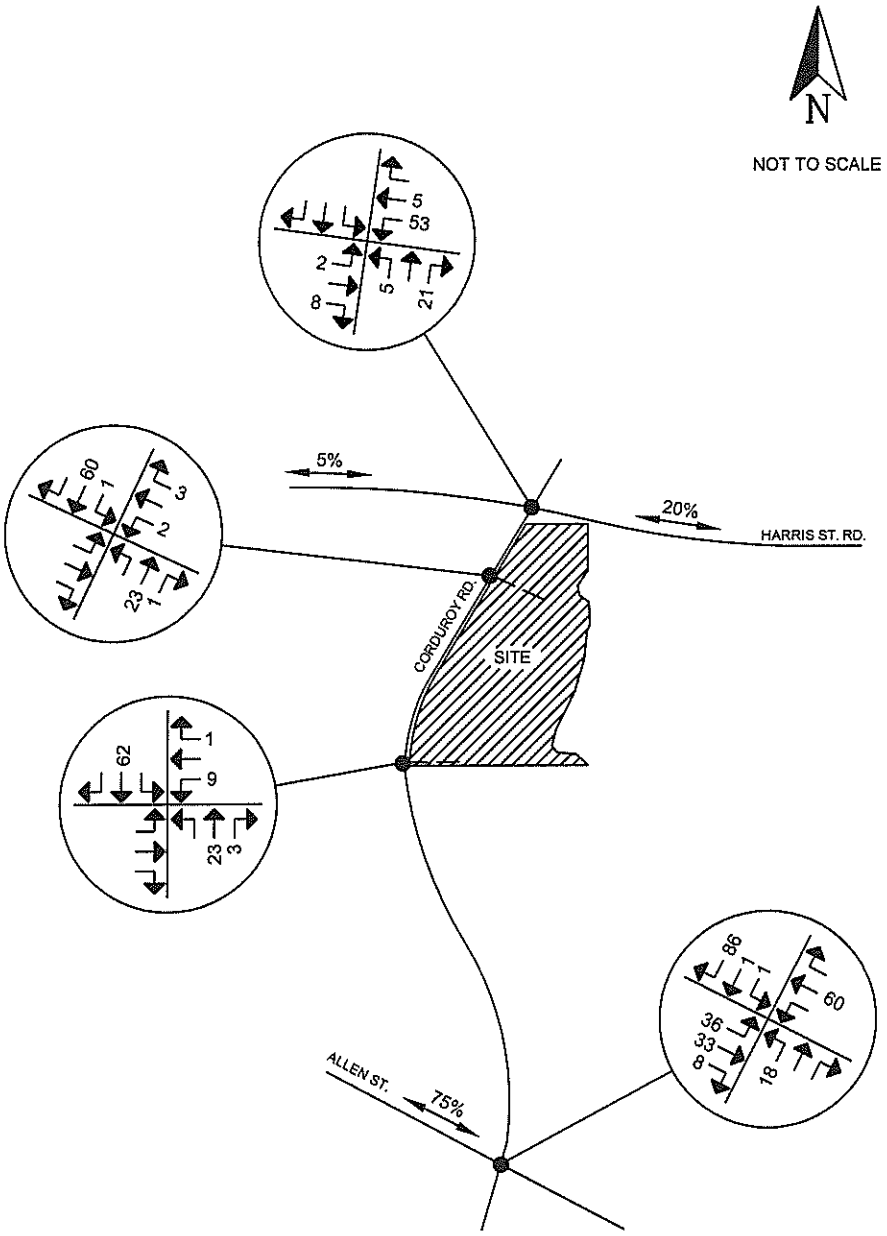
Phone: 360-433-7530



VALENTINA'S VILLAS

FIGURE 6
YEAR 2027 TRAFFIC VOLUMES
WITH PROJECT, AM PEAK HOUR

KELLY ENGINEERING
1805 NE 94th St. No. 19, Vancouver, WA 98665
Phone: 360-433-7530

APPENDIX A

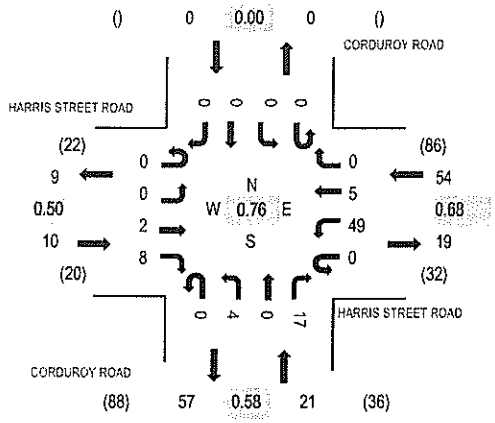
RAW TRAFFIC COUNT DATA

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

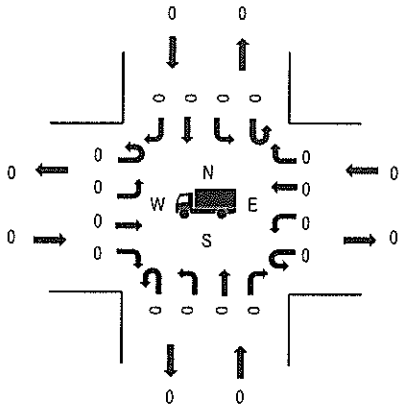
Location: 1 CORDUROY ROAD & HARRIS STREET ROAD AM
Date: Thursday, June 13, 2024
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:40 AM - 07:55 AM

Peak Hour

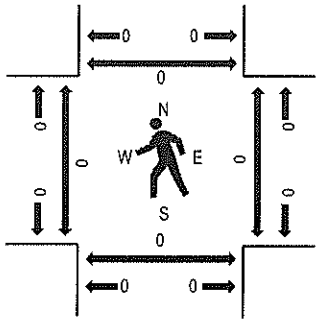
Motorized Vehicles



Heavy Vehicles



Pedestrians



Note: Total study counts contained in parentheses.

	HV%	PHF
EB	0.0%	0.50
WB	0.0%	0.68
NB	0.0%	0.58
SB	0.0%	0.00
All	0.0%	0.76

Traffic Counts - Motorized Vehicles

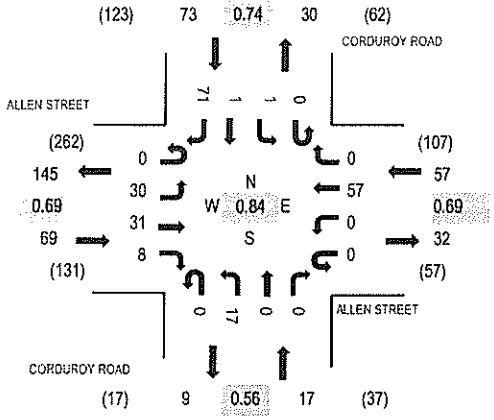
Interval Start Time	HARRIS STREET ROAD Eastbound U-Turn	Left	Thru	Right	HARRIS STREET ROAD Westbound U-Turn	Left	Thru	Right	CORDUROY ROAD Northbound U-Turn	Left	Thru	Right	CORDUROY ROAD Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
7:00 AM	0	0	1	1	0	4	0	0	0	0	0	2	0	0	0	0	8	85
7:05 AM	0	0	0	1	0	4	0	0	0	0	0	0	0	0	0	0	5	81
7:10 AM	0	0	0	1	0	2	0	0	0	0	0	2	0	0	0	0	5	81
7:15 AM	0	0	0	0	0	4	2	0	0	1	0	0	0	0	0	0	7	80
7:20 AM	0	0	0	0	0	6	1	0	0	0	0	2	0	0	0	0	9	79
7:25 AM	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	7	73
7:30 AM	0	0	1	1	0	2	0	0	0	0	0	3	0	0	0	0	7	72
7:35 AM	0	0	0	0	0	4	0	0	0	1	0	1	0	0	0	0	6	69
7:40 AM	0	0	0	0	0	7	1	0	0	2	0	2	0	0	0	0	12	70
7:45 AM	0	0	0	0	0	1	1	0	0	0	0	3	0	0	0	0	5	68
7:50 AM	0	0	0	3	0	7	0	0	0	0	0	1	0	0	0	0	11	63
7:55 AM	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	3	58
8:00 AM	0	0	0	1	0	2	1	0	0	0	0	0	0	0	0	0	4	57
8:05 AM	0	0	0	1	0	0	3	0	0	1	0	0	0	0	0	0	5	
8:10 AM	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	4	
8:15 AM	0	0	0	0	0	1	1	0	0	0	0	4	0	0	0	0	6	
8:20 AM	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	3	
8:25 AM	0	0	1	2	0	0	2	0	0	1	0	0	0	0	0	0	6	
8:30 AM	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	4	
8:35 AM	0	0	0	2	0	2	0	0	0	1	0	2	0	0	0	0	7	
8:40 AM	0	0	0	1	0	9	0	0	0	0	0	0	0	0	0	0	10	
8:45 AM	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	2	
8:50 AM	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	4	
8:55 AM	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2	
Count Total	0	0	3	17	0	71	15	0	0	7	0	29	0	0	0	0	142	
Peak Hour	0	0	2	8	0	49	5	0	0	4	0	17	0	0	0	0	85	

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

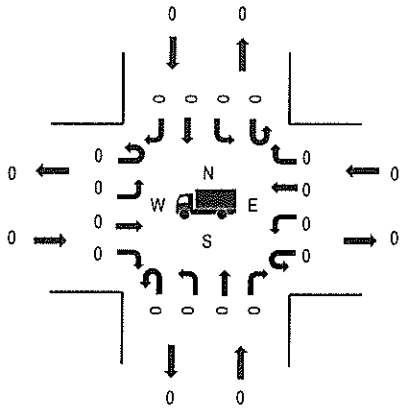
Location: 2 CORDUROY ROAD & ALLEN STREET AM
Date: Thursday, June 13, 2024
Peak Hour: 07:05 AM - 08:05 AM
Peak 15-Minutes: 07:10 AM - 07:25 AM

Peak Hour

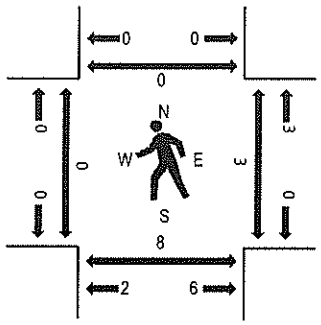
Motorized Vehicles



Heavy Vehicles



Pedestrians



Note: Total study counts contained in parentheses.

	HV%	PHF
EB	0.0%	0.69
WB	0.0%	0.69
NB	0.0%	0.56
SB	0.0%	0.74
All	0.0%	0.84

Traffic Counts - Motorized Vehicles

Interval Start Time	ALLEN STREET Eastbound U-Turn	Left	Thru	Right	ALLEN STREET Westbound U-Turn	Left	Thru	Right	CORDUROY ROAD Northbound U-Turn	Left	Thru	Right	CORDUROY ROAD Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
7:00 AM	0	3	2	0	0	0	3	0	0	2	0	0	0	0	0	4	14	214
7:05 AM	0	1	1	1	0	0	8	0	0	0	0	0	0	0	0	6	17	216
7:10 AM	0	3	0	2	0	0	7	0	0	3	0	0	0	0	0	7	22	216
7:15 AM	0	0	2	3	0	0	6	0	0	2	0	0	0	0	0	11	24	208
7:20 AM	0	5	4	0	0	0	4	0	0	2	0	0	0	0	0	3	18	200
7:25 AM	0	6	5	0	0	0	3	0	0	0	0	0	0	1	0	6	21	203
7:30 AM	0	3	3	0	0	0	4	0	0	1	0	0	0	0	0	10	21	198
7:35 AM	0	2	2	0	0	0	4	0	0	2	0	0	0	0	0	3	13	199
7:40 AM	0	3	2	0	0	0	2	0	0	2	0	0	0	0	0	12	21	198
7:45 AM	0	1	6	0	0	0	5	0	0	3	0	0	0	0	1	4	20	190
7:50 AM	0	1	2	0	0	0	6	0	0	0	0	0	0	0	0	5	14	176
7:55 AM	0	2	3	1	0	0	2	0	0	0	0	0	0	0	0	1	9	180
8:00 AM	0	3	1	1	0	0	6	0	0	2	0	0	0	0	0	3	16	184
8:05 AM	0	3	1	2	0	0	5	0	0	0	0	0	0	0	0	6	17	
8:10 AM	0	3	1	0	0	0	6	0	0	2	0	0	0	0	0	2	14	
8:15 AM	0	0	4	0	0	0	8	0	0	0	0	0	0	1	0	3	16	
8:20 AM	0	4	5	1	0	0	7	0	0	1	1	0	0	0	0	2	21	
8:25 AM	0	3	3	1	0	0	1	0	0	1	0	0	0	0	0	7	16	
8:30 AM	0	1	1	1	0	0	5	0	0	2	0	0	0	0	0	12	22	
8:35 AM	0	2	2	2	0	0	4	0	0	1	0	0	0	0	0	1	12	
8:40 AM	0	3	3	0	0	0	3	0	0	1	0	0	0	0	0	3	13	
8:45 AM	0	1	0	0	0	0	4	0	0	1	0	0	0	0	0	0	6	
8:50 AM	0	4	2	0	0	0	2	0	0	6	0	0	0	0	0	4	18	
8:55 AM	0	4	0	0	0	0	2	0	0	2	0	0	0	0	1	4	13	
Count Total	0	61	55	15	0	0	107	0	0	36	1	0	0	2	2	119	398	
Peak Hour	0	30	31	8	0	0	57	0	0	17	0	0	0	1	1	71	216	

APPENDIX B

COLLISION DATA

WSDOT <wsdot@mycusthelp.net> 6/18/2024 5:31 PM

[Records Center] Public Disclosure Request :: P015424-061124

To kellyengineer@comcast.net <kellyengineer@comcast.net>

--- Please respond above this line ---

Washington State Department of Transportation

RE: Public Disclosure Request of June 11, 2024, Reference #P015424-061124

Dear David,

In response to your request for records Reference # P015424-061124 dated June 11, 2024, concerning:

I need accident data at two intersections in the City of Kelso for a traffic study I am conducting. The data I need is for the most recent 3 years you would have on record. The 2 intersections are:

1. Harris Street & Corduroy Road
2. Allen Street & Corduroy Road

Thanks,
David Kelly, P.E.
Transportation Engineer
Phone: 360-433-7530

We've done a thorough search of agency records and no responsive records were located. There were no reported crashes found for the search location/date described.

With this communication your request is considered closed.

If you have any questions, please reply to this email. Thank you and hope you have a great rest of your day.

Sincerely,

Dawn Roberts
Public Disclosure Coordinator
Washington State Department of Transportation

To monitor the progress or update this request please log into the Public Disclosure Request Center

APPENDIX C

LEVEL OF SERVICE COMPUTER PRINTOUTS

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*DSK*	Intersection	*Harris St. Rd. & Corduroy Rd.*
Agency/Co.	*Kelly Engineering*	Jurisdiction	*City of Kelso*
Date Performed	*6/25/2024*	Analysis Year	*2024*
Analysis Time Period	*AM Peak Hour*		

Project Description *Existing*	
East/West Street: *Harris Street Road*	North/South Street: *Corduroy Road*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*2*	*0*	*8*	*49*	*5*	*0*
Peak-Hour Factor, PHF	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*
Hourly Flow Rate, HFR (veh/h)	*2*	*0*	*10*	*64*	*6*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*	*0*	*17*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*22*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*2*	*64*		*27*			*0*	
C (m) (veh/h)	*1628*	*1623*		*1019*				
v/c	*0.00*	*0.04*		*0.03*				
95% queue length	*0.00*	*0.12*		*0.08*				
Control Delay (s/veh)	*7.2*	*7.3*		*8.6*				
LOS	*A*	*A*		*A*				
Approach Delay (s/veh)	--	--	*8.6*					
Approach LOS	--	--	*A*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*DSK*	Intersection	*Harris St. Rd. & Corduroy Rd.*
Agency/Co.	*Kelly Engineering*	Jurisdiction	*City of Kelso*
Date Performed	*6/25/2024*	Analysis Year	*2027*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Year 2027 w/o Project*
East/West Street:	*Harris Street Road*
North/South Street:	*Corduroy Road*
Intersection Orientation:	*East-West*
Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*2*	*0*	*8*	*52*	*5*	*0*
Peak-Hour Factor, PHF	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*
Hourly Flow Rate, HFR (veh/h)	*2*	*0*	*10*	*68*	*6*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*	*0*	*18*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*23*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*2*	*68*		*28*			*0*	
C (m) (veh/h)	*1628*	*1623*		*1018*				
v/c	*0.00*	*0.04*		*0.03*				
95% queue length	*0.00*	*0.13*		*0.08*				
Control Delay (s/veh)	*7.2*	*7.3*		*8.6*				
LOS	*A*	*A*		*A*				
Approach Delay (s/veh)	--	--	*8.6*					
Approach LOS	--	--	*A*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*DSK*	Intersection	*Harris St. Rd. & Corduroy Rd.*
Agency/Co.	*Kelly Engineering*	Jurisdiction	*City of Kelso*
Date Performed	*6/25/2024*	Analysis Year	*2027*
Analysis Time Period	*AM Peak Hour*		

Project Description *Year 2027 with Project*

East/West Street: *Harris Street Road* | North/South Street: *Corduroy Road*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*2*	*0*	*8*	*53*	*5*	*0*
Peak-Hour Factor, PHF	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*
Hourly Flow Rate, HFR (veh/h)	*2*	*0*	*10*	*69*	*6*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*	*0*	*21*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*	*0.76*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*27*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*2*	*69*		*32*			*0*	
C (m) (veh/h)	*1628*	*1623*		*1025*				
v/c	*0.00*	*0.04*		*0.03*				
95% queue length	*0.00*	*0.13*		*0.10*				
Control Delay (s/veh)	*7.2*	*7.3*		*8.6*				
LOS	*A*	*A*		*A*				
Approach Delay (s/veh)	--	--	*8.6*					
Approach LOS	--	--	*A*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*DSK*	Intersection	*Allen St. & Corduroy Rd.*
Agency/Co.	*Kelly Engineering*	Jurisdiction	*City of Kelso*
Date Performed	*6/25/2024*	Analysis Year	*2024*
Analysis Time Period	*AM Peak Hour*		

Project Description *Existing*	
East/West Street: *Allen Street*	North/South Street: *Corduroy Road*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*30*	*31*	*8*	*0*	*57*	*0*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*35*	*36*	*9*	*0*	*67*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*17*	*0*	*0*	*1*	*1*	*71*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*20*	*0*	*0*	*1*	*1*	*84*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*35*	*0*		*20*			*86*	
C (m) (veh/h)	*1547*	*1576*		*665*			*994*	
v/c	*0.02*	*0.00*		*0.03*			*0.09*	
95% queue length	*0.07*	*0.00*		*0.09*			*0.28*	
Control Delay (s/veh)	*7.4*	*7.3*		*10.6*			*9.0*	
LOS	*A*	*A*		*B*			*A*	
Approach Delay (s/veh)	--	--	*10.6*			*9.0*		
Approach LOS	--	--	*B*			*A*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*DSK*	Intersection	*Allen St. & Corduroy Rd.*
Agency/Co.	*Kelly Engineering*	Jurisdiction	*City of Kelso*
Date Performed	*6/25/2024*	Analysis Year	*2027*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Year 2027 w/o Project*
East/West Street: *Allen Street*	North/South Street: *Corduroy Road*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*32*	*33*	*8*	*0*	*60*	*0*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*38*	*39*	*9*	*0*	*71*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*18*	*0*	*0*	*1*	*1*	*75*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*21*	*0*	*0*	*1*	*1*	*89*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*38*	*0*		*21*			*91*	
C (m) (veh/h)	*1542*	*1572*		*645*			*989*	
v/c	*0.02*	*0.00*		*0.03*			*0.09*	
95% queue length	*0.08*	*0.00*		*0.10*			*0.30*	
Control Delay (s/veh)	*7.4*	*7.3*		*10.8*			*9.0*	
LOS	*A*	*A*		*B*			*A*	
Approach Delay (s/veh)	--	--	*10.8*			*9.0*		
Approach LOS	--	--	*B*			*A*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*DSK*	Intersection	*Allen St. & Corduroy Rd.*
Agency/Co.	*Kelly Engineering*	Jurisdiction	*City of Kelso*
Date Performed	*6/25/2024*	Analysis Year	*2027*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Year 2027 with Project*
East/West Street: *Allen Street*	North/South Street: *Corduroy Road*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*36*	*33*	*8*	*0*	*60*	*0*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*42*	*39*	*9*	*0*	*71*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*18*	*0*	*0*	*1*	*1*	*86*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*21*	*0*	*0*	*1*	*1*	*102*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*42*	*0*		*21*			*104*	
C (m) (veh/h)	*1542*	*1572*		*621*			*989*	
v/c	*0.03*	*0.00*		*0.03*			*0.11*	
95% queue length	*0.08*	*0.00*		*0.10*			*0.35*	
Control Delay (s/veh)	*7.4*	*7.3*		*11.0*			*9.1*	
LOS	*A*	*A*		*B*			*A*	
Approach Delay (s/veh)	--	--	*11.0*			*9.1*		
Approach LOS	--	--	*B*			*A*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*DSK*	Intersection	*Corduroy Rd. @ Northern D/W*
Agency/Co.	*Kelly Engineering*	Jurisdiction	*City of Kelso*
Date Performed	*12/26/2024*	Analysis Year	*2027*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Year 2027 with Project*
East/West Street: *Northern D/W*	North/South Street: *Corduroy Rd.*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*23*	*1*	*1*	*60*	
Peak-Hour Factor, PHF	*1.00*	*0.80*	*0.80*	*0.80*	*0.80*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*28*	*1*	*1*	*74*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*2*		*3*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.80*	*1.00*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*2*	*0*	*3*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*1*		*5*				
C (m) (veh/h)		*1597*		*985*				
v/c		*0.00*		*0.01*				
95% queue length		*0.00*		*0.02*				
Control Delay (s/veh)		*7.3*		*8.7*				
LOS		*A*		*A*				
Approach Delay (s/veh)	--	--	*8.7*					
Approach LOS	--	--	*A*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*DSK*	Intersection	*Corduroy Rd. @ Sorthern D/W*
Agency/Co.	*Kelly Engineering*	Jurisdiction	*City of Kelso*
Date Performed	*12/26/2024*	Analysis Year	*2027*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Year 2027 with Project*
East/West Street: *Southern D/W*	North/South Street: *Corduroy Rd.*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*23*	*3*	*0*	*62*	
Peak-Hour Factor, PHF	*1.00*	*0.80*	*0.80*	*0.80*	*0.80*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*28*	*3*	*0*	*77*	*0*
Percent Heavy Vehicles	*0*	–	–	*0*	–	–
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*9*		*1*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.80*	*1.00*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*11*	*0*	*1*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*0*		*12*				
C (m) (veh/h)		*1595*		*906*				
v/c		*0.00*		*0.01*				
95% queue length		*0.00*		*0.04*				
Control Delay (s/veh)		*7.3*		*9.0*				
LOS		*A*		*A*				
Approach Delay (s/veh)	--	–	*9.0*					
Approach LOS	--	–	*A*					

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APPENDIX D

REFERENCES

References

1. Trip Generation Manual, 11th Edition, 2021, Institute of Transportation Engineers.

2. Highway Capacity Manual, 2000 and 2010, Transportation Research Board, National Research Council.