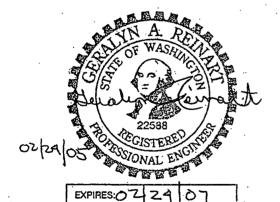
TECHNICAL MEMORANDUM

VISTA VIEW ESTATES TRAFFIC IMPACT ASSESSMENT KITTITAS COUNTY, WASHINGTON

RECEIVED

FEB 2 9 2005
LATITAS COUNTY
CDS

February 2005



Prepared for: Rick Wade

GERALYN REINART, P.E. 1319 DEXTER AVENUE NORTH, SUITE 103 SEATTLE, WASHINGTON 98109 (206) 285-9035



TECHNICAL MEMORANDUM

February 24, 2005

To: Rick Wade

From: Geralyn Reinart, P.E.

Subject: Vista View Estates

Introduction

The purpose of this memorandum is to summarize the anticipated transportation impacts resulting from the development of Vista View Estates in Kittitas County. This report has reviewed the current traffic conditions in the vicinity of the site, the proposed action and its impacts to the transportation system, and developed appropriate mitigation, as necessary.

Although the project is located within unincorporated Kittitas County, it is located within the Urban Growth Area and the majority of its traffic would impact the City of Ellensburg street system. Discussions with John Akers, P.E., at the City of Ellensburg indicated a need to review the intersection of Mountain View Road/Bull Road and to review the project frontage along Kittitas Highway, including the need for turn storage and improvements. Specific details on the project and the analysis of its impacts can be found in the subsequent sections.

Project Description

Vista View Estates is located on the north side of Kittitas Highway east of Bull Road/Willow Street. The parcel totals approximately 42 acres in size, and is currently undeveloped and consists primarily of pastureland. The proposed action would include the development of 167 single-family residential lots on the site. The project proponent is Rick Wade (contact number: 425-417-3548).

Access to the project would be from two locations along Kittitas Highway approximately one-quarter mile (plus or minus) east of Bull Road. A future connection to Seattle Avenue has also been included in the plat layout near the northwesterly

corner of the property. Additionally, street stubs have been incorporated into the design to serve future development(s) to the north and east. A series of public roads internal to the site will provide access to the individual lots. No direct access from Kittitas Highway to any individual lot is proposed.

The area near the site includes a mix of single-family residences and undeveloped parcels. The site was re-zoned to residential use in 1999 and 2000, and no change in zoning is planned. No specific conditions related to transportation associated with the re-zone were noted by the County. Build-out of the project is planned by 2008. Therefore, for purposes of the traffic impact analysis, the year 2008 has been used for the future build-out condition. A vicinity map of the area is shown on Figure 1 and a reduced copy of the site plan has been attached.

The remainder of this report analyzes the effects of the development of the subject property and the traffic-related impacts that can be expected on the adjacent intersections.

Existing Conditions

The proposed Vista View Estates development will primarily impact Kittitas Highway/ Mountain View Avenue, with lesser impacts to Willow Street and Chestnut Street. Seattle Avenue would be impacted in the future when connected. The following describes these roadways, existing traffic volumes, and current operating conditions.

1. Roadways

Kittitas Highway/Mountain View Avenue is an east-west arterial that provides a connection between Canyon Road and Kittitas. The roadway is striped for three lanes between Canyon Road and Ruby Street with curb, gutter, sidewalk and bike lanes. The street then transitions to two lanes, with the bicycle lane continuing on the south side of the street for several hundred feet. The section of Mountain View Avenue east of Ruby Street has curb, gutter, and sidewalk constructed along much of the south side of the street along the frontages of new development. The north side of the street consists mostly of gravel shoulder. East of Bull Road, Kittitas Highway is primarily two lanes with two to three foot paved shoulders and open ditches. The entire section of roadway is straight and flat and the speed limit varies from 25 mph east from Canyon Road to Chestnut Street, increasing to 35 mph east of Chestnut Street, and increasing to 50 mph east of Bull Road. Streets intersecting Mountain View Avenue/Kittitas Highway are required to stop, with traffic signals installed at the Canyon Road, Ruby Street, and Chestnut Street intersections. The adjacent land use is primarily commercial east of Canyon Road, transitioning to residential (single- and multi-family) further to the east, with several undeveloped parcels. The area east of Bull Road becomes increasingly rural in nature.

Chestnut Street is a north-south City arterial that connects Mountain View Avenue with

8th Avenue. Chestnut Street is striped for two lanes, although a left-turn storage lane has been striped on the approach to Mountain View Avenue. The street cross-section includes curb, gutter, and sidewalk on both sides of the street except for a one-block section north of Hobert Avenue where no sidewalk has been constructed. On-street parking is allowed along most sections of the street. The adjacent land use is predominantly single-family residential, with the hospital located north of Spokane Avenue.

Willow Street is a north-south two-lane City street that provides a connection between Mountain View Avenue and Capitol Avenue. Some sidewalk or curb, gutter, and sidewalk have been installed along the frontages of new development on the west side of the street, with gravel shoulder on the east side. The posted speed is 25 mph, with a 20-mph school zone posted near the approach to Capitol Avenue. The adjacent land use is primarily single-family residential and a church.

Seattle Avenue is an east-west local access street that currently dead-ends a few hundred feet east of Locust Street. The section of street between Willow Street and Locust Street is a two-lane impervious roadway with no shoulder. The section east of Locust Street is a dirt lane that serves a single-family residence. The adjacent land use is mainly pasture/undeveloped property.

2. Traffic Volumes

A PM peak hour turning movement count was conducted for this analysis at the intersection of Kittitas Highway/Bull Road/Willow Street. These volumes are shown on Figure 2. The weekday PM peak hour (the highest 60-minute interval between 4:00 and 6:00 PM) is typically considered the most critical time period with respect to both the traffic volumes on the adjacent streets and of a residential development. Daily traffic volumes provided by the City of Ellensburg are also shown on Figure 2.

3. Level of Service

A capacity analysis for the PM peak hour was conducted at the intersection of Kittitas Highway/Bull Road/Willow Street in order to determine the current level of service. This intersection is controlled by stop signs in the north and south directions, consists of one lane on all approaches, and is located within the city limits.

"Level of service" (LOS) is a common term used in the Traffic Engineering profession that is defined as a qualitative measure describing operational conditions within a traffic stream, and its perception by motorists and/or passengers. These conditions are usually described in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. Six levels of service are designated, ranging from "A" to "F", with level of service "A" representing the best operating

conditions and level of service "F" the worst. The City of Ellensburg considers LOS "D" acceptable along major arterials such as Canyon Road, whereas LOS "C" is considered acceptable along Mountain View Avenue, and LOS "B" acceptable along local access streets.

Calculations for the level of service analyses were conducted using the McTrans Highway Capacity Software version 4.1d based on the 2000 Highway Capacity Manual. The manual traffic count described earlier was used in this analysis. The following table shows the current levels of service for the critical movements on the approaches. The critical movements are typically those movements that are controlled by a stop or yield sign, or left-turn movements from the major street. For this specific intersection, the left-turns from Kittitas Highway and the north/south approaches are critical movements. Calculations for the level of service analyses have been attached.

	TABLE 1									
	EXISTING LEVELS OF SERVICE									
	NORTH- BOUND	SOUTH- BOUND	EAST- BOUND	WEST- BOUND	OVERALL					
Kittitas Highway/Bull	LOS B	LOS B	LOS A	LOS A						
Road/Willow Street	12.4 sec.	11.2 sec.	7.7 sec.	7.9 sec.	N.A.					

Note: Bull Road/Willow Street considered the north/south approaches and Kittitas Highway considered the east/west approaches in the capacity analyses.

N.A. - not applicable/available (i.e., calculation not provided for specific analysis)

Where:

LOS	Delay
Α	≤ 10 seconds
В	> 10 & < 15 seconds
С	> 15 & < 25 seconds
D	> 25 & < 35 seconds
E	> 35 & <u><</u> 50 seconds
F	> 50 seconds

Table 1 shows the level of service results for the PM peak hour indicating that all movements at the intersection are operating at level of service "B" or better. The values shown in Table 1 are the total approach delay for the critical movement(s).

4. Non-Motorized Facilities

No pedestrian facilities are currently found in the vicinity of the proposed project due to the rural/semi-rural conditions of the area. Kittitas Highway has limited shoulder area that has inherent limitations for both pedestrian and bicycle use. Sidewalk can be found further to the west along the frontages of new developments within the City of Ellensburg. A short section of bike lane has been installed along Mountain View Avenue between Canyon Road and Ruby Street, which continues eastward for several hundred additional feet on the south side only.

Project Traffic

The development of Vista View Estates into residential lots will generate new traffic onto the adjacent transportation system. The following sections summarize the impacts associated with the proposed action.

1. Trip Generation

The proposed subdivision would generate new traffic onto the adjacent roadways. The <u>ITE Trip Generation Manual</u> (published by the Institute of Transportation Engineers, 2003, 7th Edition) is typically used to estimate the number of trips expected to be generated by a development. Land Use Code 210, Single-Family Detached Housing, best represents the proposed use. Table 2 shows the estimated number of trips for the development using the average trip rates, with the number of lots as the independent variable.

TABLE 2
VISTA VIEW ESTATES
TRIP GENERATION
(167 LOTS)

Time Period	W . D .	2010)		
	Trip Rate	In	Out	Total
Daily	9.57 trips/lot	799	799	1598
AM peak	0.75 trips/lot	31	94	125
PM peak	1.01 trips/lot	106	63	169

2. Trip Distribution/Assignment

New traffic generated by the development of Vista View Estates would be distributed onto the adjacent roadways to gain access to other arterials, into the core of Ellensburg, or to the regional transportation system. Traffic generated by the development of the site will initially use Kittitas Highway, with further distribution onto north-south streets such as Willow Street, Chestnut Street, Ruby Street, or Canyon Road. (Note: All traffic from the site has been routed to Kittitas Highway for the near term. A future connection to Seattle Avenue will divert some of the site traffic from Kittitas Highway,

but until improvements are provided to Seattle Avenue west of the site, all impacts will be to Kittitas Highway.)

The trip distribution/assignment has assumed that the majority of the site traffic would travel to and from Ellensburg, with a minor percentage traveling to and from the east. Figure 3 summarizes the daily trip distribution/assignment for the project by percent and daily volume. Figures 4 and 5 summarize the AM and PM peak hour trip assignments. A review of the figures shows that the project would have its greatest impact on Kittitas Highway to the west of the site.

3. Traffic Volumes

Figures 6 and 7 show the projected daily and PM peak hour traffic volumes for the year 2008 with and without the project trips. The existing peak hour volumes were increased 3% annually for the 2008 volumes to account for miscellaneous background growth in the area over the next three years, at which time the project is expected to be complete and occupied. This growth rate is noted in the City's Comprehensive Plan, and therefore considered a reasonable value for projecting future growth. Additionally, the estimated trips associated with a manufactured housing development on Bull Road south of Kittitas Highway were added into the turning movements to and from Bull Road.

4. Level of Service

Level of service calculations were conducted again for the intersection of Kittitas Highway/Bull Road/Willow Street using the volumes shown on Figures 6 and 7. It was assumed for purposes of analysis that no changes in the geometric conditions or traffic control at the intersection would occur. The results of the future conditions with and without the site trips are shown in Table 3.

TABLE 3 2008 LEVELS OF SERVICE									
W/Out Project BOUND BOUND BOUND WEST- BOUND BOUND BOUND OVER									
Kittitas Highway/Bull	LOS C	LOS B	LOS A	LOS A					
Road/Willow Street	16.6 sec.	12.8 sec.	7.8 sec.	8.0 sec.	N.A.				
With Project									
Kittitas Highway/Bull	LOS C	LOS C	LOS A	LOS A					
Road/Willow Street	20.2 sec.	17.2 sec.	7.9 sec.	8.2 sec.	N.A.				

Note: Bull Road/Willow Street considered the north/south approaches and Kittitas Highway considered the east/west approaches in the capacity analyses.

N.A. - not applicable/available (i.e., calculation not provided for specific analysis)

Where:

LOS	Delay
Α	< 10 seconds
В	> 10 & < 15 seconds
C.	> 15 & < 25 seconds
D	> 25 & < 35 seconds
E	> 35 & < 50 seconds
F	> 50 seconds

The results of the capacity analyses show minor increases in the delay from the existing conditions to the 2008 conditions. All of the critical approaches at the intersection are expected to operate at level of service "C" or better in the future, with or without the project. The proposed project could add up to 4.4 seconds of delay to the 2008 "without project" conditions. As noted in the existing conditions, the values shown in the table are the total approach delay for the critical movement(s). (See attached calculations.)

5. Site Access

The current site plan shows access to the project from Kittitas Highway at two locations east of Bull Road. These accesses are separated from each other by a distance of approximately 1100 feet. The estimated peak hour volumes at the site accesses are shown on Figure 8. (Note: the trips assigned to each access were estimated as follows – 55% of the site trips to/from the west were assigned to the west access and the remaining 45% to the east access. Fifteen percent of the site trips to/from the east were assigned to the west access and 85% to the east access. This estimated assignment was based simply on the internal street layout and number of lots that would likely use the more convenient access to/from the east or west.)

A level of service analysis was completed for the accesses to determine the expected operating conditions. A single-lane approach in all directions was assumed for the analyses. The results of these analyses are shown in Table 4.

TABLE 4 FUTURE LEVELS OF SERVICE – SITE ACCESSES									
	NORTH- BOUND	SOUTH- BOUND	EAST- BOUND	WEST- BOUND	OVERALL				
Kittitas Highway/		LOS A	LOS A						
West Site Access	N.A.	9.9 sec.	7.8 sec:	N.A.	N.A.				
Kittitas Highway/		LOS B	LOS A						
East Site Access	N.A.	10.4 sec.	7.8 sec.	N.A.	N.A				

N.A. - not applicable (i.e., calculation not provided for specific analysis or not a critical/conflicting movement)

Where:

LOS	Delay
A	< 10 seconds
В	> 10 & < 15 seconds
С	> 15 & < 25 seconds
D	> 25 & < 35 seconds
E	> 35 & <u><</u> 50 seconds
F	> 50 seconds

The results of the capacity analyses indicate that all of the critical movements at the intersection will operate at level of service "B" or better during the PM peak hour.

The need for left-turn storage on Kittitas Highway at the site accesses has also been reviewed using Figure 910-9a from the <u>WSDOT Design Manual</u> (figure has been attached in the Appendix). Based on the anticipated volume of left-turns from Kittitas Highway Road at the west site access and the volume of through traffic, the intersection of these two points falls above the curve, indicating that further analysis is recommended. This typically implies the need for turn storage. At the east site access, the intersection of these two points falls below the curve, indicating that storage is not needed. (See further discussion of this issue in subsequent section.)

The project site plan has shown a 10-foot right-of-way dedication along Kittitas Highway along the project frontage. Furthermore, an 80-foot right-of-way has been shown for the north-south street that will serve as the east site access. This street will eventually continue to the north and provide another north-south corridor to serve the expanding urban area. The City of Ellensburg has indicated that a condition associated with requesting city water and sewer would be the signing of a pre-annexation agreement and constructing all street improvements to urban standards. This would include not only the internal streets but also frontage improvements along Kittitas highway.

The site plan has also shown future connections to the east and west that will serve as the extension of Seattle Avenue to serve future development of properties. Until these properties are re-developed, access to the property would be solely from Kittitas Highway.

Project Impacts/Conclusions/Recommendations

The development of Vista View Estates would generate approximately 1600 daily trips, with 169 new trips during the PM peak hour. The majority of site traffic will be destined to and from Ellensburg for employment, social, educational, and shopping opportunities. The intersections reviewed in this analysis show that they would operate at acceptable levels of service upon completion of the proposed project. The additional

traffic generated by Vista View Estates would not result in a significant impact to these intersections such that the level of service standards would be exceeded.

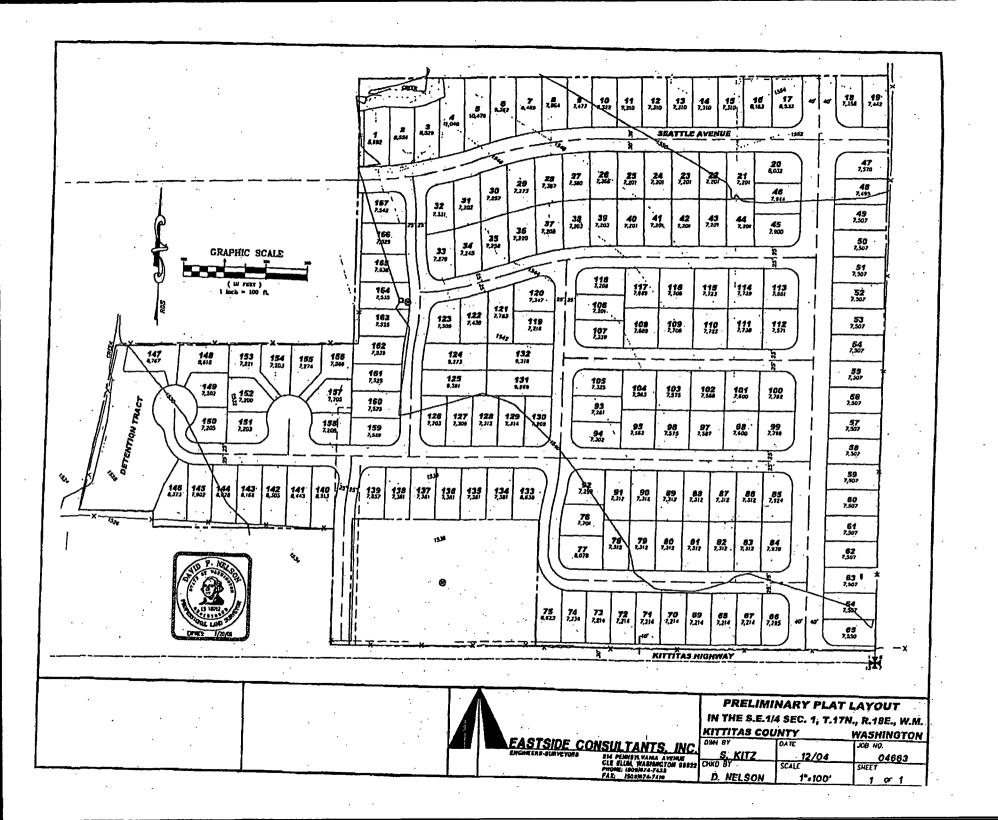
The main traffic impact associated with the proposed project would be to Kittitas Highway. Although the section of roadway adjacent to the project is located within the County, the project site will eventually be annexed into the City of Ellensburg and Kittitas Highway will ultimately be constructed to urban standards. The project site plan has shown a 10-foot right-of-way dedication along its Kittitas Highway frontage. The City of Ellensburg has indicated that a condition associated with requesting city water and sewer would be the signing of a pre-annexation agreement and the construction of all street improvements to urban standards. This would include not only the internal streets but also frontage improvements along Kittitas highway.

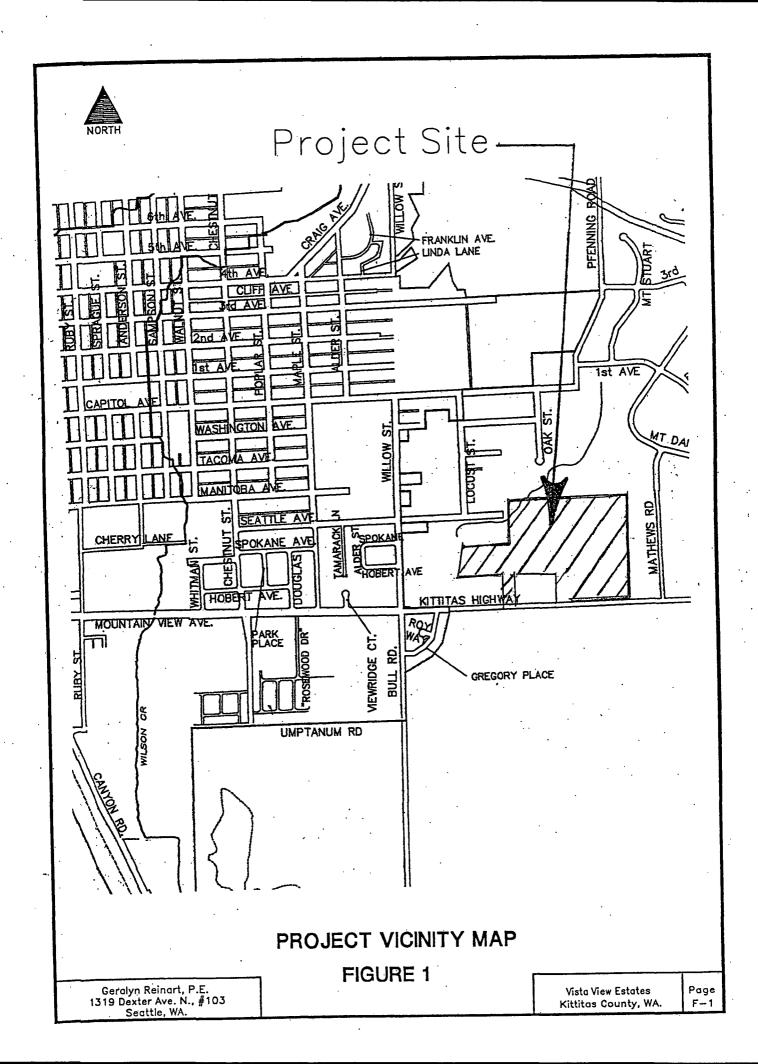
The need for left-turn storage on Kittitas Highway at the site accesses was reviewed as part of this assessment. Based on the anticipated volume of left-turns from Kittitas Highway at the west site access and the volume of through traffic, the intersection of these two points falls above the curve, indicating that further analysis is recommended. This typically implies the need for turn storage. At the east site access, the intersection of these two points falls below the curve, indicating that storage is not needed.

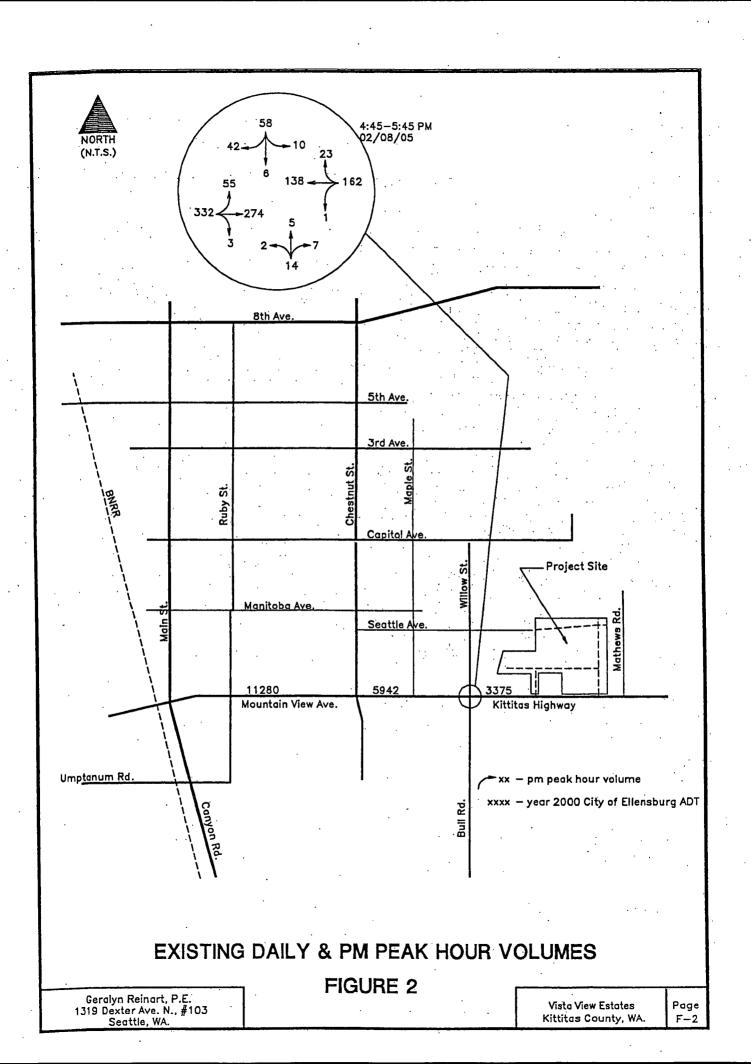
Although the analyses have indicated that left-turn storage is warranted at the west site access, and not at the east access, a possible alternative would be the installation of the left-turn storage at the east access, with right-turn only access at the west access. (Note: the right-turn only restriction could be an interim measure until such time that Kittitas Highway is brought up to an urban standard east of Bull Road, including a two-way leftturn lane.) This alternative would better serve future transportation needs since the east access will eventually extend to the north beyond the project site and ultimately serve additional left-turn volumes. Additionally, the east access could be a better location, from a feasibility perspective, to physically construct the left-turn lane. Roadway widening would be necessary to install the left-turn lane and much of this widening could be incorporated into the frontage improvements that the City of Ellensburg has indicated will be required. (Note: with either alternative, roadway widening beyond the project frontage would likely be needed to accommodate transitions and tapers.) Discussions with Eastside Consultants have indicated that there may be difficulties in providing improvements along Kittitas Highway due to the current construction of the roadway, so further investigation is needed to determine the feasibility of all alternatives (west access versus east access, and symmetrical versus asymmetrical widening), along with discussions with City and County Staff to determine actual requirements.

Frontage improvements and street construction per the current City of Ellensburg road standards should be provided. Due to the limited off-site impacts associated with the project, no other mitigation is recommended.

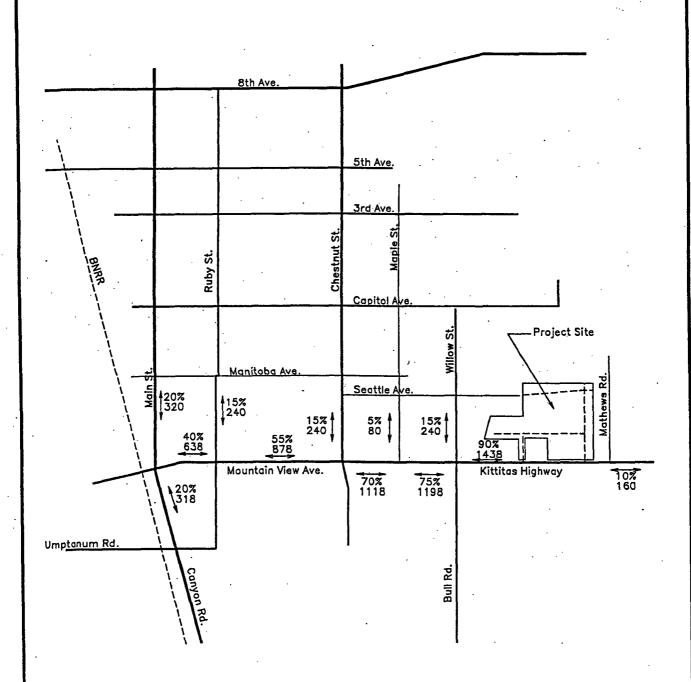
FIGURES/ATTACHMENTS











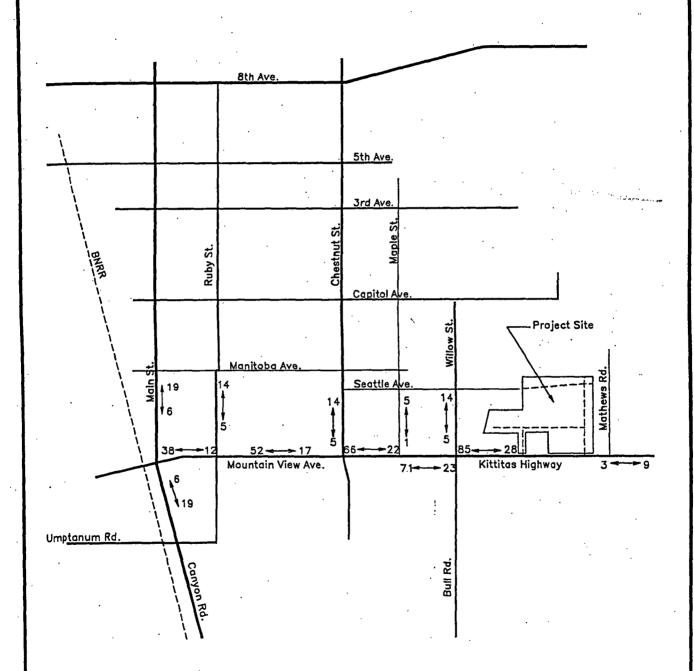
ESTIMATED DAILY TRIP DISTRIBUTION/ASSIGNMENT

Geralyn Reinart, P.E. 1319 Dexter Ave. N., #103 Seattle, WA. FIGURE 3

Vista View Estates Kittitas County, WA.

Page F-3





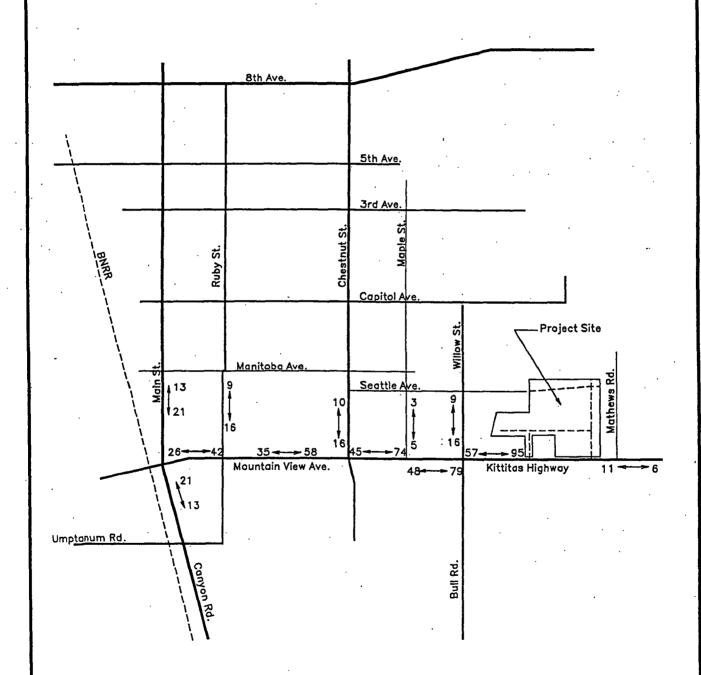
ESTIMATED AM PEAK HOUR TRIP ASSIGNMENT

FIGURE 4

Geralyn Reinart, P.E. 1319 Dexter Ave. N., #103 Seattle, WA.

Vista View Estates Kittitas County, WA. Page F-4

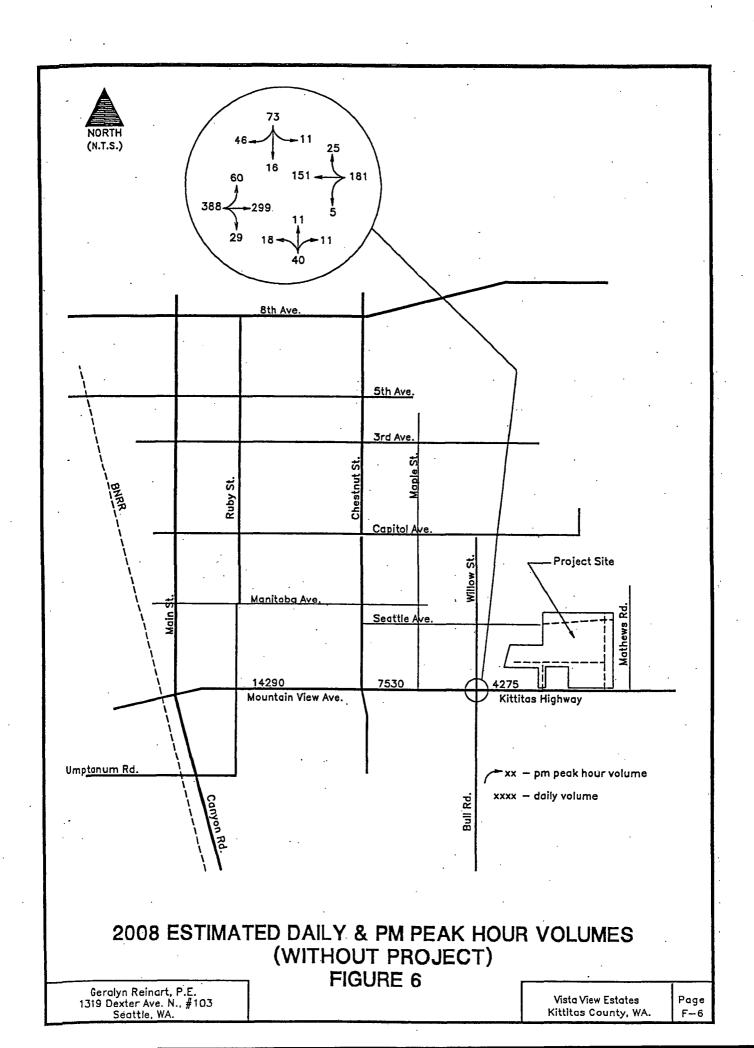


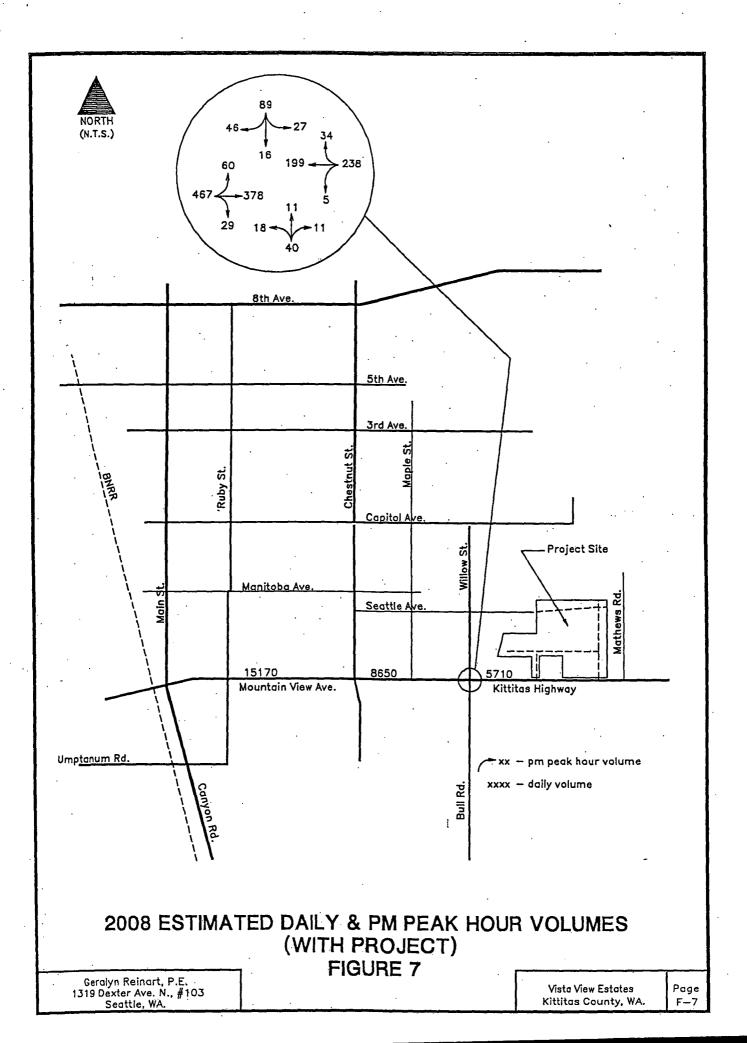


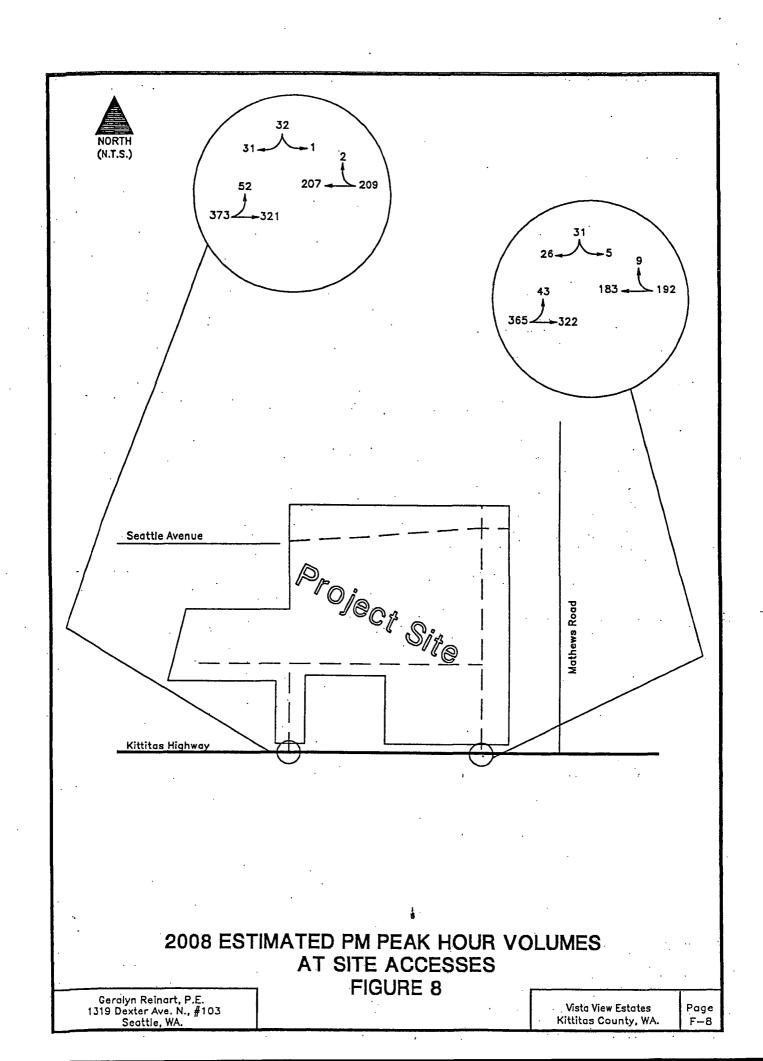
ESTIMATED PM PEAK HOUR TRIP ASSIGNMENT FIGURE 5

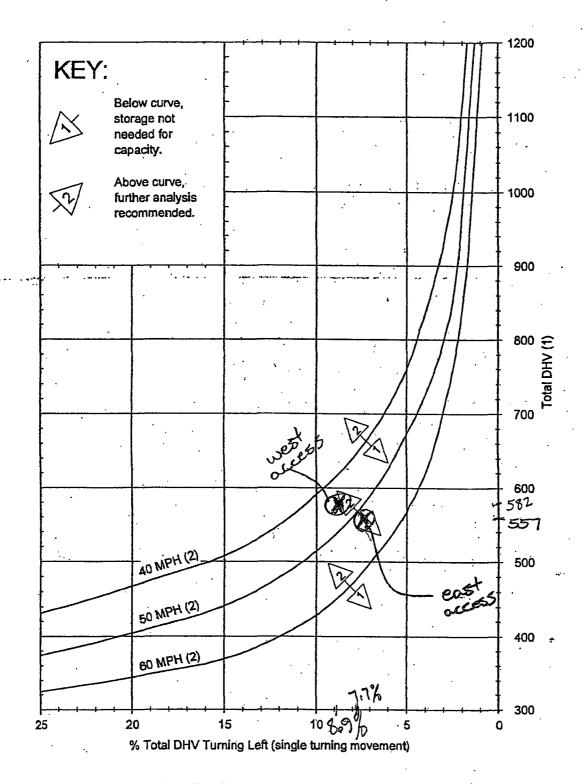
Geralyn Reinart, P.E. 1319 Dexter Ave. N., #103 Seattle, WA.

Vista View Estates Kittitas County, WA. Page ∈ F-5









- (1) DHV is total volume from both directions.
- (2) Speeds are postèd speeds.

Left-Turn Storage Guidelines (Two-Lane, Unsignalized)
Figure 910-9a

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

gr Analyst:

Agency/Co.:

2/17/05

Date Performed:

Analysis Time Period: pm peak hour

Intersection:

Kittitas Highway/Willow Street

Jurisdiction:

City of Ellensburg

Units: U. S. Customary

Analysis Year:

existing

Project ID: Vista View Estates

East/West Street:

Kittitas Highway

North/South Street:

Willow Street/Bull Road

Intersection Orientation: EW

Study period (hrs): 0.25

v	ehicle Volu	mes and	Adjus	tment	S	•			
Major Street: Approach	Eas	tbound	٠, -		Wes	tbound	i		
Movement		2	3	1 4	<u> </u>	5	6		
	${f L}$	Ţ	R	- 1		T	R		•
		<u> </u>							
Volume	55	274	3	1	L	138	23		
Peak-Hour Factor, PHF	0.90	0.90	0.90	(.83	0.83	0.83		
Hourly Flow Rate, HFR	61	304	3 .	1	L	166	27		
Percent Heavy Vehicles	0 .			1	Ĺ				
Median Type/Storage	Undivi	.ded		1.	•				
RT Channelized?				•					
Lanes	0	1 0			0 .	1	0		
Configuration	LI	'R			LT	R			
Upstream Signal?		No		F.		No			
·									
Minor Street: Approach	Nor	thbound			Sou	thbour	nd		
Movement	7.	8.	9	1 1	LO	11	12		
	L	T	R	I	J	T	R		
							•		
Volume	2	5	7	1	LO	. 6	42		•
Peak Hour Factor, PHF	0.70	0.70	0.70	(85	0.85	0.85		
Hourly Flow Rate, HFR	2	7	10	1	L1	7	49		
Percent Heavy Vehicles	0	0	0	. (· ·	0	0		·
Percent Grade (%)	•	0			•	0			
Flared Approach: Exist	s?/Storage		No	/			No	/	
Lanes	Ō	1 0	•		0	1	0		•
Configuration		LTR				LTR			

Approach	_Delay, EB	Queue Le WB	ngth, and Level of Northbound		Southbound	
Movement	l LTR	4 LTR	7 8 9 LTR	10	11 1	2
Lane Config	TITE	TITE 1	LIK		LTR	•
v (vph)	61	1	19		67	,
C(m) (vph)	1392	1259	506		647	
v/c	0.04	0.00	0.04		0.10	
95% queue length	0.14	0.00	0.12		0.34	
Control Delay	7.7	7.9	12.4		11.2	
LOS	A	A	В		B ·	
Approach Delay			12.4	•	11.2	
Approach LOS			В		В	

HCS2000: Unsignalized Intersections Release 4.1d

GERALYN REINART, P.E.

1319 DEXTER AVE. NORTH, SUITE 103 SEATTLE, WA 98109

Phone: 206-285-9035

two-fficairmal alman som

E-Mail: trafficsignals@msn.com

TWO-WAY STOP CONTROL(TWSC) ANALYSIS____

206-285-6345

Fax:

Analyst: gi

Agency/Co.:

Date Performed: 2/17/05

Analysis Time Period: pm peak hour

Intersection: Kittitas Highway/Willow Street

Jurisdiction: City of Ellensburg

Units: U. S. Customary

Analysis Year: existing Project ID: Vista View Estates

East/West Street: Kittitas Highway

North/South Street: Willow Street/Bull Road

Intersection Orientation: EW Study period (hrs): 0.25

				justment			<u></u>
Major Street Movements	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume	55	274	3	1	138	23	
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.83	0.83	0.83	_
Peak-15 Minute Volume	15	76 [.]	1 ·	0 .	42	7	
Hourly Flow Rate, HFR	61	304	3	1	166	27 .	
Percent Heavy Vehicles	0			1			
Median Type/Storage RT Channelized?	Undi	vided	•	/			٠.
Lanes	0	1 ()	0	1 (0	•
Configuration	L'	rr		L'	rr		•
Upstream Signal?		No			No	•	
Minor Street Movements	. 7	8	9	10 ·	11	12 .	
	L	. T	R	L	T	R	•
Volume	2	5	7	10	6 .	42	
Peak Hour Factor, PHF	0.70	0.70	0.70	0.85	0.85	0.85	
Peak-15 Minute Volume	1	2	2 ·	3	. 2	12	٠.
Hourly Flow Rate, HFR	2	7	10	11	7	49	
Percent Heavy Vehicles	0	0	0	0 .	0	0	
Percent Grade (%)		0			0		
Flared Approach: Exists RT Channelized?	s?/Storage	e [.]	No	/	•	· No	/
KI CHAINCIFF	. 0	1 ()	0	1 (O [.]	
Lanes		LTR		-	LTR		

12.0 12.0 12.0 12.0 Lane Width (ft) 4.0 4.0 4.0 4.0 Walking Speed (ft/sec) Percent Blockage 0 0 0 0 Upstream Signal Data Arrival Green Cycle Prog. Distance Prog. Sat Length Speed Flow Flow Type Time to Signal vph . vph sec sec mph feet Left-Turn Through Left-Turn Through. Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles Movement 2 Movement 5 Shared In volume, major th vehicles: 166 304 Shared ln volume, major rt vehicles: 3 27 Sat flow rate, major th vehicles: 1700 1700 . Sat flow rate, major rt vehicles: 1700 1700 Number of major street through lanes: Worksheet 4-Critical Gap and Follow-up Time Calculation Critical Gap Calculation 7 4 8 9 10 11 12 . 1 Movement . **T** L L L R L T R 6.2 4.1 4.1 7.1 6.5 7.1 6.5 6.2 t(c,base) 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 t(c,hv) . 1 0 0 . 0 0 0 Ô P(hv) 0.20 0.20 0.10 0.20 0.20 0.10 t(c,g) 0.00 0.00 0.00 0.00 0.00 0.00 Grade/100 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 t(3,1t) 1-stage 0:00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 t(c,T): 1.00 0.00 2-stage 0.00 1.00 0.00 1.00 1.00 0.00 1-stage 4.1 4.1 7.1 **6.**5 ` 6.2 7.1 6.5 6.2 t(c) 2-stage Follow-Up Time Calculations 7 8 9 10 11 12 1 Movement L Т R L T R 2.20 2.20 3.50 4.00 3.30 3.50 4.00 3.30 t(f,base) 0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.90 t(f,HV) 0 1 0 0 0 0 0 0 P(HV) 3.5 4.0 2.2 3.3 3.5 4.0 3.3 2.2 t(f)

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

Movement 2

Movement 5

V(t) V(1,prot) V(t) V(1,prot)

```
Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)
Computation 2-Proportion of TWSC Intersection Time blocked
                                               Movement 2
                                                                  Movement 5
                                            V(t)
                                                   V(1,prot) V(t) V(1,prot)
alpha
beta
Travel time, t(a) (sec)
Smoothing Factor, F
Proportion of conflicting flow, f
Max platooned flow, V(c, max)
Min platooned flow, V(c,min)
Duration of blocked period, t(p)
Proportion time blocked, p
                                                0.000
                                                                    0.000
Computation 3-Platoon Event Periods
                                           Result.
                                           0.000
p(2)
                                           0.000
p(5)
p(dom)
p(subo)
Constrained or unconstrained?
Proportion
                             (1)
unblocked -
                                              (2)
                                                               (3)
for minor
                        Single-stage
                                               Two-Stage Process
movements, p(x)
                          Process
                                           Stage I
                                                           Stage II
p(1)
p(4)
p(7)
p(8)
p(9)
p(10)
 p(11)
 p(12)
 Computation 4 and 5
 Single-Stage Process
                         1
                                 4
                                        7.
                                                8 -
                                                       9
                                                             . 10
                                                                     11
                                                                             12
 Movement
                                                T,
                         L
                                 L
                                        L
                        193
                                307
                                       638
                                               623
                                                      306
                                                              618
                                                                     611
                                                                             180
 V C, X
 Px
 V c,u,x
 Cr,x
 C plat, x
 Two-Stage Process
```

10

11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
(c,x)		1500		1500		1500		1500
\		1300		1300	,	1300		1300
(x)			•				,	•
(c,u,x)			•				,	
(r,x) (plat,x)								
	·			-	· · · · · · · · · · · · · · · · · · ·			
Vorksheet 6-I	•		eacity Ed	quations				
Step 1: RT fr	om Minor	st.			9		12	
Conflicting F		,			306		180	
Potential Cap					739		868	
Pedestrian Im	pedance	Factor		•	1.00		1.00	
Movement Capa	city				739		868	
Probability o	of Queue	free St.			0.99		0.94	
Step 2: LT fr	om Major	st.		· · · · · · · · · · · · · · · · · · ·	4	·	1	
Conflicting F	lows		- -		307		193	
Potential Cap	acity		•		1259	·	1392	•
Pedestrian Im	pedance	Factor			1.00		1.00	
Movement Capa	city				. 1259	: .	1392	
Probability o	f Oueue	free St.	,		1.00		0.96	
Maj L-Shared	Prob Q f	ree St.			1.00		0.95	
Step 3: TH fr	om Minor	St.	· .	· · · · · · · · · · · · · · · · · · ·	8		11	<u></u>
Conflicting F	lows			•	623		611	·
Potential Cap			•	•	405		411	
Pedestrian Im	pedance.	Factor			1.00		1.00	
Cap. Adj. fac	tor due	to Imped	ling mymr	it	0.95	•	0.95	
Movement Capa	city	•	_		383		389	
Probability o	f Queue	free St.	t.	,	0.98	•	0.98	•
Step 4: LT fr	om Minor	st.		· · · · · · · · · · · · · · · · · · ·	7		10	
Conflicting F	lows				638	 	618	
Potential Cap	acity	•			392	•	404	
Pedestrian Im	pedance	Factor			1.00		1.00	
Maj. L, Min T	'Impedan	ice facto	r		0.93		0.93	
Mai. L. Min T	Adj. In	np Factor			0.95		0.95	
Cap. Adj. fac	tor due	to Imped	ling mvmr	it	0.89	•	0.93	
Movement Capa	city	-			. 350		377	
Worksheet 7-C	omputati	on of th	ne Effect	of Two-	stage Ga	p Accept	ance	•
Step 3: TH fr	om Minor	st.	<u> </u>		8		11	

Part 1 - First Stage
Conflicting Flows
Potential Capacity
Pedestrian Impedance Factor
Cap. Adj. factor due to Impeding mymnt
Movement Capacity
Probability of Queue free St.

Part 2 - Second Stage						
Part 2 - Second Stage Conflicting Flows						
Potential Capacity						
Pedestrian Impedance Factor						
Cap. Adj. factor due to Impeding	mvmnt		•			
Movement Capacity		•				
Part 3 - Single Stage						
Conflicting Flows			623		611	
Potential Capacity			405.	• .	411	.:
Pedestrian Impedance Factor			1.00		1.00	
Cap. Adj. factor due to Impeding	mvmnt	,*	0.95		0.95	
Movement Capacity			383		389	
Result for 2 stage process:						
a						
У						
C t			383		389	
Probability of Queue free St.			0.98	٠	0.98	
						· . -
Step 4: LT from Minor St.			7		10	
Part 1 - First Stage						
Conflicting Flows				•		
Potential Capacity					•	
Pedestrian Impedance Factor		•	•		· · · · ·	
Cap. Adj. factor due to Impeding	mvmnt			•		
Movement Capacity		•			•	•
Part 2 - Second Stage					•	•
Conflicting Flows	•		•			
Potential Capacity					• • •	•
Pedestrian Impedance Factor					•	
Cap. Adj. factor due to Impeding	mvmnt		•			
Movement Capacity						•
Cingle Stage			•	·	···	· · · · · · · · · · · · · · · · · · ·
Part 3 - Single Stage			620 .		610	· •
Conflicting Flows Potential Capacity			638 392		618	
Pedestrian Impedance Factor			1.00		404 1.00	
Maj. L, Min T Impedance factor			0.93		0.93	
Maj. L, Min T Adj. Imp Factor.			0.95		0.95	•
Cap. Adj. factor due to Impeding	mamnt		0.89		0.93	
Movement Capacity	invinite ,		350		377.	
Movement Capacity					311.	
Results for Two-stage process:			,			
a			•			,
У		٠.			<u>.</u>	•
C .t			350		377	
Worksheet 8-Shared Lane Calculat:	ions					
-			<u> </u>		·	····
Movement	7	8	9	10	11	12
•	L	T	R	L	T	R .
Volume (vph)	2	7	10	11	7	49
Movement Capacity (vph)	350	383	739	377	389	868
Shared Lane Capacity (Vph)	250	506	, 5 5	5 / /	647	200
SHOTER PRINC ORDERS (, beat		200	•	·		,
		· · ·				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R.	L	T	R
C sep Volume Delay	 350 2	383 7	739 10	377 11	389 7	868 49
Q sep Q sep +1 round (Qsep +1)						
n max C sh SUM C sep n C act		506			647	

Worksheet 10-Delay, Queue Length, and Level of Service

Movement Lane Config	1 LTR	4 LTR	7	8 LTR	9.	10	11 LTR	12	
hane coming				211			DIK	•	
v (vph)	61	1.		19			67		
C(m) (vph)	1392	1259		506			647		
v/c	0.04	0.00		0.04		•	0.10		
95% queue length	0.14	0.00		0.12	. •	•	0.34		
Control Delay	7.7	7.9		12.4			11.2		
LOS	Α.	Α		В			В	•	+2014
Approach Delay		•		12.4		•	11.2	•	•
Approach LOS		•		B			В		

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.96	1.00
v(il), Volume for stream 2 or 5	304	166
v(i2), Volume for stream 3 or 6	. 3	27
s(il), Saturation flow rate for stream 2 or 5	1700	1700
s(i2), Saturation flow rate for stream 3 or 6	1700	1700
P*(oj)	0.95	1.00
d(M,LT), Delay for stream 1 or 4	7.7	7.9
N, Number of major street through lanes	1 .	1
d(rank, 1) Delay for stream 2 or 5	0.4	0.0

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: Agency/Co.: Date Performed: 2/17/05 Analysis Time Period: pm peak hour Intersection: Kittitas Highway/Willow Street Jurisdiction: City of Ellensburg Units: U. S. Customary Analysis Year: 2008 w/out project Project ID: Vista View Estates East/West Street: Kittitas Highway North/South Street: Willow Street/Bull Road Intersection Orientation: EW Study period (hrs): 0.25 Vehicle Volumes and Adjustments Major Street: Approach Eastbound Westbound . 3 Movement 2 • 5 T . R \mathbf{L} Т R 299 60 29 151 Volume Peak-Hour Factor, PHF 0.90 0.90 0.90 0.83 0.83 0.83 Hourly Flow Rate, HFR 66 332 32 6 181 Percent Heavy Vehicles 0 1 Median Type/Storage Undivided RT Channelized? 1 1 Lanes Configuration LTR LTR Upstream Signal? No No . Minor Street: Northbound Approach Southbound 7 8 9 Movement 1 10 11 12 . L R. I, L Т 18 11 11 11 16 Volume Peak Hour Factor, PHF 0.70 0.70 0.70 0.85 0.85 0.85 Hourly Flow Rate, HFR 25 15 15 · 12 18 54 Percent Heavy Vehicles 0 0 0 Percent Grade (%) 0 Flared Approach: Exists?/Storage No Lanes Configuration LTR Delay, Queue Length, and Level of Service EB WB Northbound Approach Southbound 1 4 8 10 11 Movement LTR LTR | LTR Lane Config LTR 66 55 84 v (vph) 1372 1200 365 545 C(m) (Vph) 0.00 0.15 0.05 0.15 v/c 95% queue length 0.15 0.02 0.53 0.54 Control Delay 7.8 8.0 16.6 12.8

С

16.6

В.

12.8

A

Α

Approach Delay

Approach LOS

HCS2000: Unsignalized Intersections Release 4.1d

GERALYN REINART, P.E.

1319 DEXTER AVE. NORTH, SUITE 103

SEATTLE, WA 98109

Phone: 206-285-9035

E-Mail: trafficsignals@msn.com

Fax: 206-285-6345

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

Analyst: gi

Agency/Co.:

Date Performed: 2/17/05

Analysis Time Period: pm peak hour

Intersection:

Kittitas Highway/Willow Street

Jurisdiction:

City of Ellensburg

Units: U. S. Customary

Analysis Year:

2008 w/out project

Project ID: Vista View Estates

ceet: Kittitas Highway

East/West Street: North/South Street:

Willow Street/Bull Road

Intersection Orientation: EW

Study period (hrs): 0.25

	_Vehicle '		and Ad	justment			<u> </u>
Major Street Movements	1	· 2	3 `	4	. 5	6	
,	L	T	R	r	T .	R	
Volume	60	299	29	5	151	25	
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.83	0.83	0.83	
Peak-15 Minute Volume	17	83	8	2	45	.8	
Hourly Flow Rate, HFR	66	332	32 [.]	6	181	3.0	
Percent Heavy Vehicles	0	- -		1.	·		
Median Type/Storage RT Channelized?	Undi	vided		. /			
Lanes	0	1	0 .	0	1	0	
Configuration	L'	rr		Ľ.	TR		
Upstream Signal?		No		**	No		
Minor Street Movements	7	8	9	10	11.	12	.
	L	T	R	L	T	R	
Volume	18	11	11	11	16	46	· · · · · · · · · · · · · · · · · · ·
Peak Hour Factor, PHF	0.70	0.70	0.70	01.85	0.85	0.85	
Peak-15 Minute Volume	6	4	4	3.	5	14	
Hourly Flow Rate, HFR	25	15	15	12	18	54	•
Percent Heavy Vehicles	· · 0	0 .	0	0 ·	0	0	
Percent Grade (%)		0			0 .		
Flared Approach: Exists RT Channelized?	s?/Storage	е.	No	/		No	/
Lanes	0	1 .	0	0	· 1	0 .	
Configuration	•	LTR			LTR	•	•

Flow (ped/hr) 0 0 0 0 0

Lane Width (ft) 12.0 12.0 12.0 12.0 Walking Speed (ft/sec) 4.0 4.0 4.0 4.0 Percent Blockage 0 0 ٥ Upstream Signal Data Prog. Sat Arrival Green Cycle Distance Proq. Flow Flow Type Time Length Speed to Signal vph vph sec sec mph feet Left-Turn Through Left-Turn Through Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles Movement 2 Movement 5 Shared In volume, major th vehicles: 332 181 Shared In volume, major rt vehicles: 32 30 Sat flow rate, major th vehicles: 1700 1700 Sat flow rate, major rt vehicles: 1700 1700 Number of major street through lanes: Worksheet 4-Critical Gap and Follow-up Time Calculation Critical Gap Calculation 7 • 1 • 4 8 Movement 10 11 Т L R L. R 4.1 4.1 6.5 6.2 7.1 6.5 6.2 t(c,base) 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 t(c,hv) 0 0 0 P(hv) 0.20 0.20 0.10 0.20 0.10 0.20 t(c,g) 0.00 0.00 0.00 Grade/100 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 t(3,1t) 1-stage 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 t(c,T): 2-stage 0.00 0.00 1:00 0.00 1.00 1.00 1.00 0.00 1-stage 4.1 4.1 7.1 6.5 6.2 7.1 6.5 6.2 2-stage Follow-Up Time Calculations Movement 1 4 9 10 11 .12 L \mathbf{L} R L 2.20 2.20 3.50 4.00 3.30 3.50 4.00 3.30 t(f,base) 0.90 0.90 0.90 0.90 0.90 0.90 0.90 t(f,HV) 0.90 0 1 0 0. 0 . Ω. . 0 . 0 P(HV) 2.2 2.2 3.5 4.0 3.3 3.5 t(f) Worksheet 5-Effect of Upstream Signals Computation 1-Queue Clearance Time at Upstream Signal Movement 2 Movement 5 V(t) V(l,prot) V(t) V(l,prot)

```
Total Saturation Flow Rate, s (vph)
 Arrival Type
 Effective Green, g (sec)
 Cycle Length, C (sec)
 Rp (from Exhibit 16-11)
 Proportion vehicles arriving on green P
 q (q1)
 g (q2)
 g (q)
 Computation 2-Proportion of TWSC Intersection Time blocked
                                                   Movement 2
                                                                       Movement 5
                                                V(t)
                                                        V(1,prot)
                                                                    V(t)
                                                                            V(1,prot)
 alpha
 beta
 Travel time, t(a) (sec)
 Smoothing Factor, F
 Proportion of conflicting flow, f
 Max platooned flow, V(c,max)
Min platooned flow, V(c,min)
Duration of blocked period, t(p)
 Proportion time blocked, p
                                                     0.000
                                                                         0.000
 Computation 3-Platoon Event Periods
                                              Result
 p(2)
                                              0.000
 p(5)
                                              0.000
p(dom).
p(subo)
Constrained or unconstrained?
Proportion
unblocked
                               (1)
                                                (2)
                                                                   (3)
for minor
                          Single-stage
                                              Two-Stage Process
movements, p(x)
                            Process
                                             Stage I
                                                               Stage II
p(1)
p(4)
p(7)
p(8)
p(9)
p(10)
p(11)
·p (12)
Computation 4 and 5
Single-Stage Process
Movement
                          1
                                          7
                                                  8
                                                          9
                                                                 10
                                                                         11
                                                                                 12
                          L
                                          L
                                                  {f T}
                                                          R
                                                                  L
                                                                          T
                                                                                  R
V c,x -
                         211
                                 364
                                         724
                                                 703
                                                         348
                                                                 703
                                                                         704
                                                                                 196
Px
V c,u,x
Cr,x
C plat, x
Two-Stage Process
                                        8
                                                         10
                                                                           11
```

11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)	•	1500	-	1500		1500		1500
s P(x) V(c,u,x)		1500		1500		1500		1500
C(r,x) C(plat,x)								
Worksheet 6	-Impedance	and Cap	acity Eq	quations				
Step 1: RT	from Minor	st.		·	9	•	12	· · · · · · · · · · · · · · · · · · ·
Conflicting Potential C Pedestrian Movement Ca Probability	apacity Impedance pacity				348 700 1.00 700 0.98	· .	196 850 1.00 850 0.94	
Step 2: LT			· · · · · · · · · · · · · · · · · · ·		4	· <u>. </u>	1	···
Conflicting Potential C Pedestrian Movement Ca Probability Maj L-Share	Flows apacity Impedance pacity of Queue	Factor			364 1200 1.00 1200 1.00 0.99	:	211 1372 1.00 1372 0.95 0.94	
Step 3: TH	from Minor	St.			8		11	
Conflicting Potential C Pedestrian Cap. Adj. f Movement Ca Probability	apacity Impedance actor due pacity	to Imped		it	703 364 1.00 0.93 340 0.96		704 364 1.00 0.93 340 0.95	
Step 4: LT	from Minor	St.			. 7		10	· · · · · · · · · · · · · · · · · · ·
Conflicting Potential C Pedestrian Maj. L, Min Maj. L, Min Cap. Adj. f Movement Ca	apacity Impedance T Impedan T Adj Im	ce facto p Factor	•	it	724 344 1.00 0.88 0.91 0.85 294		703 355 1.00 0.89 0.92 0.90 319	
Worksheet 7	-Computati	on of th	e Effect	of Two-	stage Ga	p Accept	ance	
Step 3: TH	from Minor	st.			. 8		11	 .
Part 1 - Fi Conflicting Potential C Pedestrian Cap. Adj. f Movement Ca Probability	Flows apacity Impedance actor due pacity	to Imped		it				

Part 2 - Second Stage		,				
Conflicting Flows						
Potential Capacity						
Pedestrian Impedance Factor				•		
Cap. Adj. factor due to Impeding	mvmnt					
Movement Capacity		•				
MOASUGUE orbanal						
Part 3 - Single Stage				····		
Conflicting Flows		7	03		704	
Potential Capacity			64 ·		364	. ;
Pedestrian Impedance Factor		-	.00		1.00	
Cap. Adj. factor due to Impeding	mamnt		.93		0.93	
Movement Capacity			40.		340	.•
Movement capacity		J	10	;	240	÷
Result for 2 stage process:	 					
a	,					
У	• •		40		340	•
C t			.96		0.95	
Probability of Queue free St.		Ū	. 90		0.93	
Step 4: LT from Minor St.			7	 	10	
	 		·		· 	
Part 1 - First Stage						
Conflicting Flows					•	
Potential Capacity		•	•		•	. •
Pedestrian Impedance Factor	,					
Cap. Adj. factor due to Impeding	mvmnt					
Movement Capacity				•		4 "
<u> </u>		·	· · · · · · · · · · · · · · · · · ·			
Part 2 - Second Stage	`			•		• •
Conflicting Flows			•			
Potential Capacity						
Pedestrian Impedance Factor		*	•			
Cap. Adj. factor due to Impeding	mvmnt		• .			•
Movement Capacity	•		•			
	 			·		
Part 3 - Single Stage	•			•	•	
Conflicting Flows			24		703	•
Potential Capacity	•		44		355	
Pedestrian Impedance Factor			.00		1.00	
Maj. L, Min T Impedance factor			.88	• .	0.89	
Mai L. Min T Adj. Imp Factor.		0	.91		0.92	
Cap. Adj. factor due to Impeding	mvmnt	. 0	.85		0.90	•
Movement Capacity		.2	94		319	
•					·	
Results for Two-stage process:				-	•	
a		• •				
У						
C t		. 2	94		319	•
			·	 -		
Worksheet 8-Shared Lane Calculati	ions			·		
MOT VEHEET O PHISTON DON'T OUT OUT OUT OUT			·			
Movement	7	8	9	10	11	12
i	L	T	R	L	T .	R
Volume (vph)	25	15	15	12	18	54
1 + 1 - <u>1</u> 1						
Movement Capacity (vph)	294	340	700	319.	340	850
Movement Capacity (vph) Shared Lane Capacity (vph)	294	340 365	700	319.	340 545	850

Vorksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
-	L	T	R	L	T	R
C sep Volume Delay Q sep	294 25	340 15	700 15	319 12	340 18	850 54
Q sep +1 round (Qsep +1)				•		
n max C sh SUM C sep		365			545	
n C act			•			

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	. 4	7 .	8	9	10	11	12
Lane Config	LTR	LTR	•	LTR	•	•	LTR	
v (vph)	66	6	• • •	55	 		84	
C(m) (vph)	1372	1200		365	•		545	•
v/c	0.05	0.00	•	0.15			0.15	•
95% queue length	0.15	0.02		0.53			0.54	•
Control Delay	7.8	8.0		16.6			12.8	
Los	A	A		C ·			В	•
Approach Delay			•	16.6			12.8	
Approach LOS	•	••		, C		•	В	•

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.95	1.00
v(il), Volume for stream 2 or 5	332	181
v(i2), Volume for stream 3 or 6	32	30
s(il), Saturation flow rate for stream 2 or 5	1700	17.00
s(i2), Saturation flow rate for stream 3 or 6	1700	1700
P*(oj)	0.94	0.99
d(M,LT), Delay for stream 1 or 4	7.8	. 8.0
N, Number of major street through lanes	1	1
d(rank,1) Delay for stream 2 or 5	0.5	0.0

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

gr Analyst:

Agency/Co.:

2/17/05

Date Performed:

Analysis Time Period: pm peak hour

Intersection:

Kittitas Highway/Willow Street

Jurisdiction:

City of Ellensburg

Units: U. S. Customary

Analysis Year:

2008 with project

Project ID: Vista View Estates

East/West Street:

Kittitas Highway

North/South Street:

Willow Street/Bull Road

Intersection Orientation: EW

Study period (hrs):

Vehi	cle Volu	ımes and	Adjus	tments			
Major Street: Approach	Eas	stbound		W	estbound	•	
Movement	1	2	3	1 4	.5	6	
	L	T	R	L	T	R	
•		,		•			
Volume	60	378	29	5	199	34	
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.83	0.83	0.83	
Hourly Flow Rate, HFR	66	420	32	6	239	40	
Percent Heavy Vehicles	. 0			1	 · .		
Median Type/Storage	Undiv	ided	•	/			
RT Channelized?	•						•
Lanes	0	1 0	•	0	1 0	•	
Configuration	, Ly	rr		. 1	LTR		
Upstream Signal?	•	No			No		٠,٠
Minor Street: Approach	Noi	thbound		S	outhbound		
Movement	7	8 .	9	10	11	. ·	
	L	T	R	l· L	T	R	
							٠.
Volume	18	11	11	27	16	46	
Peak Hour Factor, PHF	0.70	0.70	0.70	0.85	0.85	0.85	
Hourly Flow Rate, HFR	25	15	15	·31	18	54	
Percent Heavy Vehicles	0	. 0	0	0		0	
Percent Grade (%)		0			0		
Flared Approach: Exists?/	Storage	·	No.	1 .	N	o ' /	•
Lanes	. 0	1 0		Ó	1 0	-	
Configuration	_	LTR		·	LTR		
CONTIGUE CACAS							

Approach	EB	WB 1	Northbound	Sout	hbound
Movement Lane Config	1 LTR	4 7 LTR	8 9 LTR	•	11 12 LTR
v (vph)	66	6	55		103
C(m) (vph)	1295	1114	291		398
v/c	0.05	0.01	0.19		0.26
95% queue length	0.16	0.02	0.68		1.02
Control Delay	7.9	8.2	20.2		17.2
LOS	Α	A	C		С
Approach Delay		,	20.2	_	17.2
Approach LOS	•		С	•	С

GERALYN REINART, P.E.

1319 DEXTER AVE. NORTH, SUITE 103 SEATTLE, WA 98109

Phone: 206-285-9035

Filone: 200 200 5000

E-Mail: trafficsignals@msn.com

Fax: 206-285-6345

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

Analyst: gr

Agency/Co.:

Date Performed: 2/17/05

Analysis Time Period: pm peak hour

Intersection: Kittitas Highway/Willow Street

Jurisdiction: City of Ellensburg

Units: U. S. Customary

Analysis Year: 2008 with project

Project ID: Vista View Estates

East/West Street: Kittitas Highway

North/South Street: Willow Street/Bull Road

Intersection Orientation: EW Study period (hrs): 0.25

L T R L T R				· 6		5	4			2	1	S	et movements	Major Street Mo
Peak-Hour Factor, PHF 0.90 0.90 0.90 0.83 0.83 0.83 Peak-15 Minute Volume 17 105 8 2 60 10 Hourly Flow Rate, HFR 66 420 32 6 239 40 Percent Heavy Vehicles 0 1 Median Type/Storage Undivided / / RT Channelized? Lanes 0 1 0 0 1 0 Configuration LTR LTR LTR LTR LTR No No No No Minor Street Movements 7 8 9 10 11 12 12 12 12 12 12 13 12 13 11 12 12 12 13 12 13 14		•			•		Ļ.	•	•		Ī.			
Peak-Hour Factor, PHF 0.90 0.90 0.90 0.83 0.83 0.83 Peak-15 Minute Volume 17 105 8 2 60 10 Hourly Flow Rate, HFR 66 420 32 6 239 40 Percent Heavy Vehicles 0 1 Median Type/Storage Undivided / / RT Channelized? Lanes 0 1 0 0 1 0 Configuration LTR LTR LTR LTR No No No Minor Street Movements 7 8 9 10 11 12 12 Volume 18 11 11 27 16 46 <t< td=""><td></td><td></td><td></td><td>. 34</td><td></td><td>199</td><td>5:</td><td></td><td></td><td>378</td><td>60</td><td></td><td></td><td>Volume</td></t<>				. 34		199	5:			378	60			Volume
Peak-15 Minute Volume 17 105 8 2 60 10 Hourly Flow Rate, HFR 66 420 32 6 239 40 Percent Heavy Vehicles 0 1 Median Type/Storage Undivided / / RT Channelized? Lanes 0 1 0 0 1 0 Configuration LTR LTR LTR LTR No No <td< td=""><td>٠.</td><td>٠.</td><td>3 ·</td><td>. –</td><td></td><td>-</td><td></td><td>90</td><td>) (</td><td>0.90</td><td>0.90</td><td></td><td>actor, PHF</td><td>Peak-Hour Facto</td></td<>	٠.	٠.	3 ·	. –		-		90) (0.90	0.90		actor, PHF	Peak-Hour Facto
Hourly Flow Rate, HFR 66 420 32 6 239 40 Percent Heavy Vehicles 0 1 Median Type/Storage Undivided / RT Channelized? Lanes 0 1 0 0 1 0 Configuration LTR LTR Upstream Signal? No No Minor Street Movements 7 8 9 10 11 12 L T R L T R Volume 18 11 11 27 16 46 Peak Hour Factor, PHF 0.70 0.70 0.70 0.85 0.85 Peak-15 Minute Volume 6 4 4 8 5 14 Hourly Flow Rate, HFR 25 15 15 31 18 54 Percent Heavy Vehicles 0 0 0 0 0 0 Percent Grade (%) 0 Flared Approach: Exists?/Storage No / No			٠.						;	105	17 ·		ute Volume	Peak-15 Minute
Percent Heavy Vehicles 0 1 Median Type/Storage Undivided / / RT Channelized? Lanes 0 1 0 0 1 0 Configuration LTR LTR No No No No No Minor Street Movements 7 8 9 10 11 12 12 12 12 12 12 14 12 12 12 12 12 13 12			•		•					420	66 ⁻		Rate, HFR	Hourly Flow Rat
Median Type/Storage Undivided / RT Channelized? 0 1 0 1 0 Lanes 0 1 0 1 0 Configuration LTR LTR No No Wolume Signal? No No No No Minor Street Movements 7 8 9 10 11 12 L T R L T R Volume 18 11 11 27 16 46 Peak Hour Factor, PHF 0.70 0.70 0.70 0.85 0.85 0.85 Peak-15 Minute Volume 6 4 4 8 5 14 Hourly Flow Rate, HFR 25 15 15 31 18 54 Percent Heavy Vehicles 0 0 0 0 0 Flared Approach: Exists?/Storage No / No							1.				0	s .	vy Vehicles	Percent Heavy V
Configuration LTR No			•			· ; ·	_ /		٠.	rided	Undit		/Storage	Median Type/Sto
Upstream Signal? Minor Street Movements 7 8 9 10 11 12 L T R L T R Volume 18 11 11 27 16 46 Peak Hour Factor, PHF 0.70 0.70 0.70 0.85 0.85 0.85 Peak-15 Minute Volume 6 4 4 8 5 14 Hourly Flow Rate, HFR 25 15 15 31 18 54 Percent Heavy Vehicles 0 0 0 0 0 0 Percent Grade (%) 0 0 0 0 0 Flared Approach: Exists?/Storage No / No					C	1	0	•	0	1	. 0			Lanes
Upstream Signal? Minor Street Movements 7 8 9 10 11 12 L T R L T R Volume 18 11 11 27 16 46 Peak Hour Factor, PHF 0.70 0.70 0.70 0.85 0.85 0.85 Peak-15 Minute Volume 6 4 4 8 5 14 Hourly Flow Rate, HFR 25 15 15 31 18 54 Percent Heavy Vehicles 0 0 0 0 0 0 Percent Grade (%) 0 0 0 0 0 Flared Approach: Exists?/Storage No / No			•			rr	. L'			'R	Lī		on	Configuration
Volume 18 11 11 27 16 46 Peak Hour Factor, PHF 0.70 0.70 0.70 0.85 0.85 0.85 Peak-15 Minute Volume 6 4 4 8 5 14 Hourly Flow Rate, HFR 25 15 15 31 18 54 Percent Heavy Vehicles 0 0 0 0 0 0 Percent Grade (%) 0 0 0 0 No Flared Approach: Exists?/Storage No / No	·									No			gnal?	Upstream Signal
Volume 18 11 11 27 16 46 Peak Hour Factor, PHF 0.70 0.70 0.70 0.85 0.85 0.85 Peak-15 Minute Volume 6 4 4 8 5 14 Hourly Flow Rate, HFR 25 15 15 31 18 54 Percent Heavy Vehicles 0 0 0 0 0 Percent Grade (%) 0 0 0 0 Flared Approach: Exists?/Storage No / No				12	٠	11	10			8 .	7	 S	t Movements	Minor Street Mo
Peak Hour Factor, PHF 0.70 0.70 0.70 0.85 0.85 Peak-15 Minute Volume 6 4 4 8 5 14 Hourly Flow Rate, HFR 25 15 15 31 18 54 Percent Heavy Vehicles 0 0 0 0 0 Percent Grade (%) 0 0 0 0 Flared Approach: Exists?/Storage No / No	:		•	R		T	L			, T	\mathbf{L}			
Peak-15 Minute Volume 6 4 4 8 5 14 Hourly Flow Rate, HFR 25 15 15 31 18 54 Percent Heavy Vehicles 0 0 0 0 0 Percent Grade (%) 0 0 0 0 Flared Approach: Exists?/Storage No / No				46		16	27	•						
Hourly Flow Rate, HFR 25 15 15 31 18 54 Percent Heavy Vehicles 0 0 0 0 0 0 Percent Grade (%) 0 0 Flared Approach: Exists?/Storage No / No			5	0.85	5	0.85	0.85	70'	(0.70	0.70			
Percent Heavy Vehicles 0 0 0 0 0 0 0 Percent Grade (%) 0 0 0 0 0 Flared Approach: Exists?/Storage No / No				14		5	8		. 4	4	6 .			
Percent Grade (%) 0 0 Flared Approach: Exists?/Storage No / No				54		18	31		. 1	15	25		Rate, HFR	Hourly Flow Rat
Percent Grade (%) 0 0 Flared Approach: Exists?/Storage No / No				0 '		0	0		(0	0	3		
						0				0			de (୫)	Percent Grade (
	/	/	0	No			/)			torage	sts?/S		Flared Approach RT Channelized?
Lanes 0 1 0 0 1 0					0	1	. 0		0	1	0			Lanes
Configuration LTR LTR	•	•			•					LTR			on	Configuration

Flow (ped/hr) 0 0

Lane Width (ft) Walking Speed (ft/sec) Percent Blockage

12.0 12.0 12.0 12.0 4.0 4.0 4.0 4.0 0 0 0

Upstream Signal Data Distance Sat Arrival Green Cycle Prog. Prog. to Signal . Flow Flow Туре Time Length Speed vph · vph sec sec mph feet

Left-Turn <u>52</u>

Through

Left-Turn **S**5 Through

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5	
Shared in volume, major th vehicles: Shared in volume, major rt vehicles: Sat flow rate, major th vehicles: Sat flow rate, major rt vehicles: Number of major street through lanes:	420 32 1700 1700	239 40 1700 1700	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Movement	Gap Cal	1 L :	4 L	7 L	8 T	9 R	10 L	11 T	12 R	
t(c,base	.)	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2	
t(c,hv)	•	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
P(hv)		- 0	1 .	0.	0 ,	0	0	0	0	
t(c,g)		,		0.20	0.20	0.10	0.20	0.20	0.10	
Grade/10	0 .			0.00	0.00	0.00	0.00	0.00	0.00	
t(3,1t)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
0 (0) - / -	2-stage		0.00	1.00	1.00	0.00	1.00	1.00	0.00	
t(c)	1-stage		4.1	7.1.	6.5	6.2	7.1	6.5	6.2	
J (- /	2-stage					•				•

Follow-Up Time Movement	_ 1	4	. 7	8	9 .	10	- 11	12
	· L	\mathbf{r}_{\cdot}	L	T	R	L	T .	R
(f,base)	2.20	2.20	3.50	4.00	3.30	3.50	4.00	3.30
(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
(HV)	0	1	0	.0	0	0 .	0	0
(f)	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal Movement 5 V(l,prot) V(t) V(t) V(1,prot)

```
Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g (q1)
g (q2)
q(q)
Computation 2-Proportion of TWSC Intersection Time blocked
                                              Movement 2
                                                                Movement 5
                                           V(t) V(l,prot) V(t) V(l,prot)
alpha
beta
Travel time, t(a) (sec)
Smoothing Factor, F
Proportion of conflicting flow, f
Max platooned flow, V(c, max)
Min platooned flow, V(c,min)
Duration of blocked period, t(p)
Proportion time blocked, p
                                                                   0.000
                                                0.000
Computation 3-Platoon Event Periods
                                          Result
                                          0.000
p(2)
                                          0.000
p(5)
p (dom)
p(subo)
Constrained or unconstrained?
 Proportion
                             (1)
                                             (2)
 unblocked:
                                                           (3)
                        Single-stage
 for minor
                                             Two-Stage Process
                                          Stage I Stage II
                          Process
 movements, p(x)
 p(1)
 p(4)...
 p(7)
 (8)g
.p(9)
 p(10)
 p(11)
 p(12)
 Computation 4 and 5
 Single-Stage Process
                       1
                                 4
                                                      9
                                                             10
                                               8
                                                                           12
                                                                    11
 Movement
                                L
                         L
                        279
                                452
                                       875
                                              859
                                                     <del>436</del>
                                                                    855
 V C, X
 s
 Px
 V c,u,x
 Cr,x
 C plat,x
 Two-Stage Process
                                                      10
                                                                       11
```

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x).		1500		1500		1500	· · . · · · · · · · · · · · · · ·	1500
s - ' '		1300		.1500		1300		. 1300
P(x)								
V(c,u,x)			··		•			
C(r,x) C(plat,x)								
								
Worksheet 6-	Impedance	and Cap	acity Ed	quations				•
Step 1: RT f	rom Minor	st.			9		12	
Conflicting	Flows	ı	•		436		259	
Potential Ca		•			625		785	
Pedestrian I	mpedance	Factor			1.00	•	1.00	•
Movement Cap	acity				625		785	
Probability	of Queue	free St.		•	. 0.98		0.93	
Step 2: LT f	rom Major	st.	,	.	4	· 	· 1	
Conflicting	Flows		 _		452		279	· · · · · · · · · · · · · · · · · · ·
Potential Cap	pacity		•		1114		1295	
Pedestrian I	mpedance	Factor			1.00	•	1.00	
Movement Cap	acity				. 1114	•	1295	
Probability	of Oueue	free St.	•	_	0.99		0.95	
Maj L-Shared	Prob Q f	ree St.			0.99		0.93	
Step 3: TH f	rom Minor	st.			8		11	
Conflicting	Flows	· · · · · · · · · · · · · · · · · · ·			859		855	
Potential Cap	pacity				296		. 298	
Pedestrian I	mpedance	Factor			1.00		1.00	
Cap. Adj. fa	ctor due	to Imped	ling mymr	nt	0.92		0.92	
Movement Cap	acity.			•	274		276	*
Probability	of Queue	free St.			0.95		0.93	•
Step 4: LT f	rom Minor	St.			7		10	<u> </u>
Conflicting	Flows				875		854	
Potential Car	pacity				272		281	•
Pedestrian I	mpedance	Factor			1.00		1.00	ı
Maj. L. Min	T Impedan	nce facto	or		0.86		0.87	
Maj. L, Min	T Adi. In	no Factor			0.90	-	0.90	
Cap. Adj. fa	ctor due	to Imped	lina mvmr	nt	0.83		0.88	•
Movement Cap	acity				227		248	
Worksheet 7-	Computati	on of th	ne Effect	of Two-	-stage Ga	p Accept	ance	
Step 3: TH f			· ·	· · ·	8		11	· · · · · · · · · · · · · · · · · · ·
Part 1 - Fir	st Stage							
Conflicting					•	-	•	
Potential Ca	pacity							••

Conflicting Flows
Potential Capacity
Pedestrian Impedance Factor
Cap. Adj. factor due to Impeding mymnt
Movement Capacity
Probability of Queue free St.

		<u> </u>				
Part 2 - Second Stage						
Conflicting Flows			• • •		•	
Potential Capacity						
Pedestrian Impedance Factor						
Cap. Adj. factor due to Impeding	mvmnt					
Movement Capacity	·. ·					
₹						
Part 3 - Single Stage			•			
Conflicting Flows	••		859		855	
Potential Capacity			296		298	
Pedestrian Impedance Factor			1.00	•	1.00	
Cap. Adj. factor due to Impeding :	mvmnt		0.92		0.92	
Movement Capacity			274		276	
					· · · · · · · · · · · · · · · · · · ·	·
Result for 2 stage process:	•					
a					•	
У					-	-
c t		•	274		276	
Probability of Queue free St.			0.95		0.93	
				<u> </u>		
Step 4: LT from Minor St.			7		10	
Part 1 - First Stage						
Conflicting Flows			:			
Potential Capacity						
Pedestrian Impedance Factor	•		•			
Cap. Adj. factor due to Impeding	mymnt		•			•
Cap. Adj. ractor due to impeding r	ii viiui C				•	•
Movement Capacity	••					
Part 2 - Second Stage					· · · · · · · · · · · · · · · · · · ·	
Conflicting Flows				•	•	•
Potential Capacity			• .			
Pedestrian Impedance Factor			•			
Cap. Adj. factor due to Impeding	nxmin # '	. •		•	•	•
Cap. Adj. factor due to impeding i	MVIIII C		•	•		
Movement Capacity				,		
Part 3 - Single Stage			· · · · · · · · · · · · · · · · · · ·			
Conflicting Flows	•		875		. 854	•
Conflicting Flows	•			•		* 4. *
Potential Capacity			272	•	281	
Pedestrian Impedance Factor	•		1.00		1.00	
Maj. L, Min T Impedance factor			0.86		0.87	
Maj. L, Min T Adj. Imp Factor.			0.90		0.90	
Cap. Adj. factor due to Impeding	nvmnt		0.83	٠	0.88	
Movement Capacity	•		227		248	
Results for Two-stage process:						<u> </u>
		•	•			
a					•	
y _		•	227		248	
Ct					440	
			·			
Worksheet 8-Shared Lane Calculation	ons .					
Movement	7	8	9	10	11	12
,	L	Ť	R.	L	T	R
	_	-	,		-	-
				31	18	54
Volume (wh)	25	15	12	\circ	10 .	JŦ
Volume (vph) Movement Canacity (vph)	25 227	15 274	15 625			
Volume (vph) Movement Capacity (vph) Shared Lane Capacity (vph)	25 227	15 274 291	625	248	276 398	785

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep Volume Delay Q sep Q sep +1 round (Qsep +1)	227	274	625	248	276	785
	25	15	15	31	18	54
n max C sh SUM C sep n C act		291			398	

Worksheet 10-Delay, Queue Length, and Level of Service

Movement Lane Config	1 LTR	4 7 LTR	8 9 LTR	10	11 LTR	12
v (vph) C(m) (vph) v/c 95% queue length Control Delay LOS Approach Delay Approach LOS	0.05 0		55 291 0.19 0.68 20.2 C 20.2		103 398 0.26 1.02 17.2 ·C 17.2 C	ea rab

Worksheet 11-Shared Major LT Impedance and Delay

<u> </u>	Movement 2	Movement 5
p(oj) v(il), Volume for stream 2 or 5 v(i2), Volume for stream 3 or 6 s(il), Saturation flow rate for stream 2 or 5 s(i2), Saturation flow rate for stream 3 or 6 P*(oj) d(M,LT), Delay for stream 1 or 4 N, Number of major street through lanes d(rank,1) Delay for stream 2 or 5	0.95 420 32 1700 1700 0.93 7.9 1	0.99 239 40 1700 1700 0.99 8.2 1

TWO-WAY STOP CONTROL SUMMARY

gr Analyst: Agency/Co.: 2/17/05 Date Performed: Analysis Time Period: pm peak hour Kittitas Highway/West Access Intersection: Jurisdiction: Kittitas County Units: U. S. Customary Analysis Year: 2008 with project Project ID: Vista View Estates East/West Street: Kittitas Highway North/South Street: West Site Access Intersection Orientation: EW Study period (hrs): Vehicle Volumes and Adjustments Major Street: Approach Eastbound Westbound 3 4 5 Movement 1 2 6 T $\cdot \mathbf{T}$ L R. 1. L R 52 321 207 2 Volume Peak-Hour Factor, PHF 0.90 0.90 0.83 0.83 Hourly Flow Rate, HFR 57 ... 356 249 2 percent Heavy Vehicles .0 Median Type/Storage Undivided RT Channelized? 0 Lanes Configuration LT TR Upstream Signal? No No Minor Street: Approach Northbound Southbound Movement 8. 9 12 10 11 Т L R L Т R 31 Volume Peak Hour Factor, PHF 0.80 0.80 Hourly Flow Rate, HFR 1 38 Percent Heavy Vehicles 0 0 Percent Grade (%) 0 Flared Approach: Exists?/Storage No Lanes Configuration LR Delay, Queue Length, and Level of Service EB WB Northbound Southbound Approach 1 4 8 12 10 11 Movement LT LR Lane Config 57 39 v (vph) 1326 773` C(m) (vph) 0.04 0.05 v/c 0.13 95% queue length 0.16 7.8 . 9.9 Control Delay Α Α 9:9 Approach Delay

Approach LOS

Α

GERALYN REINART, P.E.

1319 DEXTER AVE. NORTH, SUITE 103

SEATTLE, WA 98109

Phone: 206-285-9035

E-Mail: trafficsignals@msn.com

206-285-6345 Fax:

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

Analyst:

Agency/Co.:

2/17/05

Date Performed: Analysis Time Period: pm peak hour

Kittitas Highway/West Access Intersection:

Jurisdiction: Kittitas County

Units: U. S. Customary

Analysis Year: 2008 with project

Project ID: Vista View Estates

East/West Street: Kittitas Highway North/South Street: West Site Access

reaction Orientation: EW

· \	Vehicle V	Jolumes	and A	Adjustment	ts		
Major Street Movements	1	2	3	4	5	6	
	L	T	·R	L	T	R	عيف ميرد.
Volume	52	321			207	2	· · · · · · · · · · · · · · · · · · ·
Peak-Hour Factor, PHF	0.90	0.90			0.83	0.83	•
Peak-15 Minute Volume	14	89	•		62	1	
Hourly Flow Rate, HFR	57	356			249	2	•
Percent Heavy Vehicles	0					,	
Median Type/Storage	Undiv	<i>r</i> ided		/	•		
RT Channelized?		*					
Lanes	Ó	1			. 1	0	
Configuration	Li	<u>. </u>	•		T	R	:
Upstream Signal?		Ио		•	No		
Minor Street Movements	7	8	9	10	11	12	
	L	T	R	$^{\cdot}$ L	T	R	
Volume				1		31	·
Peak Hour Factor, PHF				0.80		0.80	
Peak-15 Minute Volume				0 .		10	
Hourly Flow Rate, HFR				1		38	
Percent Heavy Vehicles				0		Ο.	. :
Percent Grade (%)		0			0		
Flared Approach: Exists'	?/Storage	e		1		No	/
RT Channelized?				. 0		0	•
Lanes Configuration			,	U	LR	U	
Camfi curation	•				TIE		

Flow (ped/hr)

Walking Speed (f Percent Blockage	ft/sec)		2.0	12.0 4.0 0	12.0 4.0 0	12.0 4.0 0			
		Մյ	pstrea	am Sign	al Data	l			
	Prog. Flow vph	Sat Flow vph				Cycle Length sec	Prog. Speed mph	Distance to Signa feet	
S2 Left-Turn				· · · · · · · · · · · · · · · · · · ·					
Through S5 Left-Turn Through									
Worksheet 3-Data	a for Com	nputing	Effec	t of D	elay to	Major	Street V	ehicles	
						nt 2	Moveme		 .
Shared ln volume Shared ln volume	, major	rt veh:	icles:		356 0				
Sat flow rate, m Sat flow rate, m Number of major	major rt	vehicle	es:	s:	1700 1700 1				
·									
	culation 1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R	· · :
Movement t(c,base) t(c,hv)	1 L 4.1 1.00	4	•	_	R	7.1 1.00			and the second second
t(c,base) t(c,hv) P(hv) t(c,g)	1 L 4.1 1.00	L L	L.	1.00	1.00 0.10	7.1 1.00 0 0.20 0.00	T	R 6.2 1.00 0 0.10 0.00	to the same of the
t(c,base) t(c,hv) P(hv) t(c,g) Grade/100 t(3,lt) t(c,T): 1-stage	1 L 4.1 1.00 0	L L	1.00 0.20	1.00 0.20 0.00	1.00 0.10 0.00	7.1 1.00 0 0.20 0.00 0.70 0.00	1.00 0.20 0.00	R 6.2 1.00 0 0.10 0.00 0.00 0.00	e e e e e e e e e e e e e e e e e e e
Movement t(c,base) t(c,hv) P(hv) t(c,g) Grade/100 t(3,lt) t(c,T): 1-stage 2-stage	1 L 4.1 1.00 0 0.00 0.00 0.00 0.00	1.00 0.00	1.00 0.20 0.00	1.00 0.20 0.00	1.00 0.10 0.00	7.1 1.00 0 0.20 0.00 0.70 0.00	1.00 0.20 0.00	R 6.2 1.00 0 0.10 0.00 0.00	
Movement t(c,base) t(c,hv) P(hv) t(c,g) Grade/100 t(3,lt) t(c,T): 1-stage 2-stage t(c) 1-stage 2-stage Follow-Up Time C	1 L 4.1 1.00 0 0.00 0.00 0.00 4.1	1.00 0.00 0.00	1.00 0.20 0.00	1.00 0.20 0.00	1.00 0.10 0.00	7.1 1.00 0 0.20 0.00 0.70 0.00	1.00 0.20 0.00	R 6.2 1.00 0 0.10 0.00 0.00 0.00 0.00	A de mayor de la companya de la comp
Movement t(c,base) t(c,hv) P(hv) t(c,g) Grade/100 t(3,lt) t(c,T): 1-stage 2-stage t(c) 1-stage 2-stage Follow-Up Time C Movement t(f,base) t(f,HV)	1 L 4.1 1.00 0 0.00 0.00 0.00 4.1 Ealculati 1 L	1.00 0.00 0.00	1.00 0.20 0.00 0.00 1.00	1.00 0.20 0.00 0.00 1.00	R 1.00 0.10 0.00 0.00	1.00 0.20 0.00 0.70 0.00 1.00 6.4	1.00 0.20 0.00 0.00 1.00	R 6.2 1.00 0 0.10 0.00 0.00 0.00 6.2	
t(c,base) t(c,hv) P(hv) t(c,g) Grade/100 t(3,lt) t(c,T): 1-stage 2-stage t(c) 1-stage 2-stage	1 L 4.1 1.00 0 0.00 0.00 0.00 4.1 alculati 1 L	4 L 1.00	1.00 0.20 0.00 0.00 1.00	1.00 0.20 0.00 0.00 1.00	R 1.00 0.10 0.00 0.00	10 0.20 0.20 0.70 0.00 1.00 6.4	1.00 0.20 0.00 0.00 1.00	R 6.2 1.00 0 0.10 0.00 0.00 0.00 6.2	
2-stage t(c) 1-stage 2-stage Follow-Up Time C Movement t(f,base) t(f,HV) P(HV)	1 L 4.1 1.00 0 0.00 0.00 0.00 4.1 2.20 0.90 0 2.2	1.00 0.00 0.00 0.00	1.00 0.20 0.00 0.00 1.00	T 1.00 0.20 0.00 0.00 1.00	R 1.00 0.10 0.00 0.00	1.00 0.20 0.00 0.70 0.00 1.00 6.4	1.00 0.20 0.00 0.00 1.00	R 6.2 1.00 0 0.10 0.00 0.00 0.00 6.2	

```
Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
q (q1)
q(q2)
g (q)
Computation 2-Proportion of TWSC Intersection Time blocked
                                              Movement 2
                                                                 Movement 5
                                           V(t)
                                                  V(l,prot) V(t)
                                                                      V(1,prot)
alpha
beta
Travel time, t(a) (sec)
Smoothing Factor, F
Proportion of conflicting flow, f
Max platooned flow, V(c, max)
Min platooned flow, V(c,min)
Duration of blocked period, t(p)
Proportion time blocked, p
                                                                    0.000
                                                 0.000
Computation 3-Platoon Event Periods
                                          Result
                                          0.000
p(2)
                                          0.000
p(5)
p (dóm)
p(subo)
Constrained or unconstrained?
Proportion
                             (1)
                                              (2)
unblocked
                                                               (3)
                        Single-stage
                                              Two-Stage Process
 for minor
                          Process
 movements, p(x)
                                          Stage I
                                                          · Stage II
 p(1)
 p(4)
 p(7)
 p(8)
 p(9)
p(10)
 p(11)
 p(12)
 Computation 4 and 5
 Single-Stage Process
                         1
                                              . 8
                                                       9
                                                             10
                                                                     11
                                                                            12
 Movement
                         L
                                        L
                                               Т
                                                       R
                                                              L
                                                                             R
                        251
                                                             720
                                                                             250
   C,X
 Px
 V c,u,x
 Cr,x
 C plat, x
 Two-Stage Process
                      7
                                                       10
                                                                        11.
```

2:51

V(c,x)		1500
5		1300
P(x)		
V(c,u,x)		
C(r,x)		
C(plat,x)		•
_	<u> </u>	<u> </u>
C Town of the Control		
Worksheet 6-Impedance and Capacity Equation	ns	
Step 1: RT from Minor St.	9	12
Conflicting Flows		250
Potential Capacity		794
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		794
Probability of Queue free St.	1.00	0.95
•	· · · · · · · · · · · · · · · · · · ·	
Step 2: LT from Major St.	4	<u> </u>
Conflicting Flows		251
Potential Capacity		1326
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1326
Probability of Queue free St.	1.00	0.96
Maj L-Shared Prob Q free St.		0.95
Step 3: TH from Minor St.	8.	11
Conflicting Flows	• •	
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mymnt	0.95	0.95
Movement Capacity		•
	•	•
Probability of Queue free St.	1.00	1.00
Probability of Queue free St.	1.00	•
Probability of Queue free St. Step 4: LT from Minor St.	1.00	10
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows	7	10 720
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity	7	10 720 398
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor	1.00	10 720
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Mai. L, Min T Impedance factor	1.00 0.95	10 720 398
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Mai. L, Min T Adj. Imp Factor.	1.00	10 720 398
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt	1.00 0.95	10 720 398
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Mai. L, Min T Impedance factor	1.00 0.95 0.96	720 398 1.00
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt	1.00 0.95 0.96	720 398 1.00
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt	1.00 0.95 0.96 0.91	720 398 1.00 0.96 381
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt Movement Capacity Worksheet 7-Computation of the Effect of T	7 1.00 0.95 0.96 0.91 wo-stage Ga	720 398 1.00 0.96 381
Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt Movement Capacity	1.00 0.95 0.96 0.91	720 398 1.00 0.96 381
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt Movement Capacity Worksheet 7-Computation of the Effect of T Step 3: TH from Minor St. Part 1 - First Stage	7 1.00 0.95 0.96 0.91 wo-stage Ga	720 398 1.00 0.96 381
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt Movement Capacity Worksheet 7-Computation of the Effect of T Step 3: TH from Minor St. Part 1 - First Stage Conflicting Flows	7 1.00 0.95 0.96 0.91 wo-stage Ga	720 398 1.00 0.96 381
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt Movement Capacity Worksheet 7-Computation of the Effect of T Step 3: TH from Minor St. Part 1 - First Stage Conflicting Flows Potential Capacity	7 1.00 0.95 0.96 0.91 wo-stage Ga	720 398 1.00 0.96 381
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt Movement Capacity Worksheet 7-Computation of the Effect of T Step 3: TH from Minor St. Part 1 - First Stage Conflicting Flows Potential Capacity Pedestrian Impedance Factor	7 1.00 0.95 0.96 0.91 wo-stage Ga	720 398 1.00 0.96 381
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt Movement Capacity Worksheet 7-Computation of the Effect of T Step 3: TH from Minor St. Part 1 - First Stage Conflicting Flows Potential Capacity Pedestrian Impedance Factor	7 1.00 0.95 0.96 0.91 wo-stage Ga	720 398 1.00 0.96 381
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt Movement Capacity Worksheet 7-Computation of the Effect of T Step 3: TH from Minor St. Part 1 - First Stage Conflicting Flows Potential Capacity Pedestrian Impedance Factor Cap. Adj. factor due to Impeding mymnt	7 1.00 0.95 0.96 0.91 wo-stage Ga	720 398 1.00 0.96 381
Probability of Queue free St. Step 4: LT from Minor St. Conflicting Flows Potential Capacity Pedestrian Impedance Factor Maj. L, Min T Impedance factor Maj. L, Min T Adj. Imp Factor. Cap. Adj. factor due to Impeding mymnt Movement Capacity Worksheet 7-Computation of the Effect of T Step 3: TH from Minor St. Part 1 - First Stage Conflicting Flows Potential Capacity Pedestrian Impedance Factor	7 1.00 0.95 0.96 0.91 wo-stage Ga	720 398 1.00 0.96 381

n+ 2 - Second Stage	•						
Part 2 - Second Stage Conflicting Flows	•	•					
Potential Capacity						•	
Pedestrian Impedance	Factor	•					
Cap. Adj. factor due	to Impeding	mxmmt					•
Cap. Adj. ractor due	to impeding	III VIIII L					
Movement Capacity							MAN
Part 3 - Single Stage							
Conflicting Flows							la.
Potential Capacity	•						`#.
Pedestrian Impedance	Factor	•		1.00		1.00	
Cap. Adj. factor due	to Impeding	mvmnt		0.95	•	0.95	
Movement Capacity	•					•	
Result for 2 stage pr	ocess:						
•						•	
a 							•
y c t	•						•
Probability of Queue	free St.	•		1.00		1.00	
Propability of Queue	1100 00.			1.00		. 1.00	
Step 4: LT from Minor	St.			7	•	10	· .
Part 1 - First Stage						<u> </u>	
Conflicting Flows	•				•		
Potential Capacity	•						
Pedestrian Impedance	Factor	•	•				
Cap. Adj. factor due	to Impeding	mymnt			•		:
Movement Capacity		,					(2 d)
Movement orbital							
Part 2 - Second Stage	 }						
Conflicting Flows	•			•		-	
Potential Capacity							
Potential Capacity	Factor				•		
Potential Capacity Pedestrian Impedance	Factor to Impeding	mvmnt			•		
Potential Capacity Pedestrian Impedance Cap. Adj. factor due	Factor to Impeding	mvmnt	·	·		· ·	
Potential Capacity Pedestrian Impedance	Factor to Impeding	mvmnt	:			· :	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage	to Impeding	mvmnt	· :			÷	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage	to Impeding	mvmnt	·			720	· · · · · · · · · · · · · · · · · · ·
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity	to Impeding	mvmnt			······································	720 398	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance	to Impeding	mvmnt	· :	1.00	·		
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L. Min T Impedance	to Impeding Factor factor factor	mvmnt	·	1.00 0.95		398	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L. Min T Adj. Im	Factor factor factor factor.	·	· · · · · · · · · · · · · · · · · · ·			398	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L. Min T Adj. Im	Factor factor factor factor.	·		0.95		398	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due	Factor factor factor factor.	·		0.95 0.96		398 1.00	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity	Factor nce factor np Factor. to Impeding	·	· · · · · ·	0.95 0.96		398 1.00 0.96	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity	Factor nce factor np Factor. to Impeding	·		0.95 0.96		398 1.00 0.96	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage	Factor nce factor np Factor. to Impeding	·	•	0.95 0.96		398 1.00 0.96	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a	Factor nce factor np Factor. to Impeding	·	í	0.95 0.96		398 1.00	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a Y	Factor nce factor np Factor. to Impeding	·	4	0.95 0.96		398 1.00	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a	Factor nce factor np Factor. to Impeding	·	1	0.95 0.96		398 1.00 0.96 381	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a Y C t	Factor nce factor np Factor. to Impeding	mvmnt	•	0.95 0.96		398 1.00 0.96 381	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a Y C t Worksheet 8-Shared La	Factor nce factor np Factor. to Impeding	mvmnt	•	0.95 0.96 0.91		398 1.00 0.96 381	
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a Y C t	Factor nce factor np Factor. to Impeding	mvmnt Lons	8	0.95 0.96 0.91	10	398 1.00 0.96 381 381	12
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a Y C t Worksheet 8-Shared La	Factor nce factor np Factor. to Impeding	mvmnt	, 8 T	0.95 0.96 0.91	10 L	398 1.00 0.96 381	12 R
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a Y C t Worksheet 8-Shared La Movement	Factor nce factor np Factor. to Impeding	mvmnt Lons	_	0.95 0.96 0.91	L	398 1.00 0.96 381 381	• R •
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a Y C t Worksheet 8-Shared La Movement Volume (vph)	Factor nce factor np Factor to Impeding process:	mvmnt Lons	_	0.95 0.96 0.91	L 1	398 1.00 0.96 381 381	R
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a Y C t Worksheet 8-Shared La Movement Volume (vph) Movement Capacity (vp	Factor nce factor np Factor to Impeding process:	mvmnt Lons	_	0.95 0.96 0.91	L	398 1.00 0.96 381 381	• R •
Potential Capacity Pedestrian Impedance Cap. Adj. factor due Movement Capacity Part 3 - Single Stage Conflicting Flows Potential Capacity Pedestrian Impedance Maj. L, Min T Impedan Maj. L, Min T Adj. Im Cap. Adj. factor due Movement Capacity Results for Two-stage a Y C t Worksheet 8-Shared La Movement Volume (vph)	Factor nce factor np Factor to Impeding process:	mvmnt Lons	_	0.95 0.96 0.91	L 1	398 1.00 0.96 381 381	R

~~~

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

| fovement                                                                                        |                                              |         | 7<br>L |      | 8<br>T | 9<br>R | 10<br>L  | 11<br>.T                              | 12<br>R |
|-------------------------------------------------------------------------------------------------|----------------------------------------------|---------|--------|------|--------|--------|----------|---------------------------------------|---------|
| Sep                                                                                             |                                              | ·<br>   | •      |      |        |        | 381<br>1 |                                       | 794     |
| Volume                                                                                          |                                              |         |        | ,    |        | •      | 1        |                                       | 38      |
| Delay                                                                                           |                                              |         |        |      |        |        |          | •                                     |         |
| ) sep                                                                                           |                                              |         |        |      |        | •      |          |                                       |         |
| 2 sep +1                                                                                        | *                                            |         |        |      |        | ·      |          | •                                     |         |
| round (Qsep +1)                                                                                 |                                              | •       |        |      |        |        |          |                                       |         |
| n max                                                                                           | <del></del>                                  |         |        |      |        |        |          |                                       | •       |
| C sh                                                                                            |                                              |         |        | _    |        |        |          | 773                                   |         |
| SUM C sep                                                                                       |                                              |         |        |      |        | •      | •        |                                       |         |
|                                                                                                 |                                              |         |        |      |        |        |          |                                       |         |
| n                                                                                               |                                              |         |        |      |        |        |          |                                       |         |
| C act                                                                                           |                                              |         |        |      |        |        |          | <del> </del>                          |         |
|                                                                                                 | , Queue<br>1<br>LT                           | Length, | and L  | evel | of Se  | ervice | 10       | 11<br>LR                              | 12      |
| C act<br>Worksheet 10-Delay<br>Movement<br>Lane Config                                          | 1<br>LT                                      |         | and L  |      | of Se  |        |          | LR                                    | 12      |
| Worksheet 10-Delay Movement Lane Config                                                         | 1<br>LT<br>57                                |         | and L  |      | of Se  |        |          | 1R<br>39                              | 12      |
| C act Worksheet 10-Delay Movement Lane Config V (vph) C(m) (vph)                                | 1<br>LT                                      |         | and L  |      | of Se  |        |          | 1R<br>39<br>773                       | 12      |
| Worksheet 10-Delay Movement Lane Config  v (vph) C(m) (vph) v/c 95% gueue length                | 1<br>LT<br>57<br>1326                        |         | and L  |      | of Se  |        |          | 1R<br>39                              | 12      |
| Worksheet 10-Delay Movement Lane Config  v (vph) C(m) (vph) v/c 95% gueue length                | 1<br>LT<br>57<br>1326<br>0.04                |         | and L  |      | of Se  |        |          | 1R<br>39<br>773<br>0.05               | 12      |
| Worksheet 10-Delay  Movement Lane Config  V (vph) C(m) (vph) v/c 95% queue length Control Delay | 1<br>LT<br>57<br>1326<br>0.04<br>0.13        |         | and L  |      | of Se  |        |          | 39<br>773<br>0.05<br>0.16<br>9.9<br>A | 12      |
| Worksheet 10-Delay Movement Lane Config  v (vph) C(m) (vph) v/c 95% queue length Control Delay  | 1<br>LT<br>57<br>1326<br>0.04<br>0.13<br>7.8 |         | and L  |      | of Se  |        |          | 39<br>773<br>0.05<br>0.16<br>9.9      | 12      |

## Worksheet 11-Shared Major LT Impedance and Delay

| p(oj) v(il), Volume for stream 2 or 5 v(i2), Volume for stream 3 or 6 s(i1), Saturation flow rate for stream 2 or 5 s(i2), Saturation flow rate for stream 3 or 6 P*(oj) d(M,LT), Delay for stream 1 or 4 N, Number of major street through lanes d(rank.1) Delay for stream 2 or 5 0.96 1.00 0.96 1.00 0.96 0.700 0.95 1.00 0.95 0.95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                               | Movement 2 | Movement 5 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------|------------|
| v(i2), Volume for stream 3 or 6 s(i1), Saturation flow rate for stream 2 or 5 s(i2), Saturation flow rate for stream 3 or 6 1700 P*(oj) d(M,LT), Delay for stream 1 or 4 N. Number of major street through lanes 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | p(oj)                                         |            | 1.00       |
| v(i2), Volume for stream 3 or 6 s(i1), Saturation flow rate for stream 2 or 5 s(i2), Saturation flow rate for stream 3 or 6 1700 P*(oj) d(M,LT), Delay for stream 1 or 4 N. Number of major street through lanes  0 1700 7.8 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | v(il), Volume for stream 2 or 5               | 356        |            |
| s(i1), Saturation flow rate for stream 2 or 5 1700 s(i2), Saturation flow rate for stream 3 or 6 1700 P*(oj) 0.95 d(M,LT), Delay for stream 1 or 4 7.8 N. Number of major street through lanes 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                               | . 0        |            |
| s(i2), Saturation flow rate for stream 3 or 6 1700 P*(oj) 0.95 d(M,LT), Delay for stream 1 or 4 7.8 N. Number of major street through lanes 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | s(il), Saturation flow rate for stream 2 or 5 | 1700       | •          |
| P*(oj) d(M,LT), Delay for stream 1 or 4 N. Number of major street through lanes 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | s(i2), Saturation flow rate for stream 3 or 6 | 1700       |            |
| d(M,LT), Delay for stream 1 or 4 7.8  N. Number of major street through lanes 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | • • •                                         | 0.95       |            |
| N. Number of major street through lanes 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | d(M.LT), Delay for stream 1 or 4              | 7.8        |            |
| d(rank.1) Delay for stream 2 or 5 0.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | N. Number of major street through lanes       | 1          |            |
| CONTRACTOR | d(rank, 1) Delay for stream 2 or 5            | 0.4        | •          |

### TWO-WAY STOP CONTROL SUMMARY

Analyst: gr Agency/Co.: Date Performed: 2/17/05 Analysis Time Period: pm peak hour Kittitas Highway/East Access Intersection: Jurisdiction: Kittitas County Units: U. S. Customary Analysis Year: 2008 with project Project ID: Vista View Estates East/West Street: Kittitas Highway North/South Street: East Acres Intersection Orientation: EW Study period (hrs): 0.25 \_Vehicle Volumes and Adjustments Major Street: Approach Eastbound Westbound Movement 1 2 3 4 5 6 L Т L Т R Volume 43 322 183 9 Peak-Hour Factor, PHF 0.90 0.90 0.83 0.83 Hourly Flow Rate, HFR 47 357. 220 -10 Percent Heavy Vehicles 0 Median Type/Storage Undivided RT Channelized? Lanes 0 1 1 0 Configuration LT TR. Upstream Signal? No. No Minor Street: Approach Northbound Southbound Movement 7 8 10 11 12 L T R L T R Volume . 5 26 Peak Hour Factor, PHF 0.80 0.80 Hourly Flow Rate, HFR 6 32 Percent Heavy Vehicles 0 0 Percent Grade (%) 0 Flared Approach: Exists?/Storage No " Lanes 0 Configuration LR Delay, Queue Length, and Level of Service Approach EB Northbound Southbound Movement 1 10 11 . 12 Lane Config LT LR v (vph) 47 38 C(m) (vph) 1350 706 v/c 0.03 0.05 95% queue length 0.11 0.17 Control Delay 7.8 10.4 LOS A В Approach Delay 10.4 Approach LOS

В.

GERALYN REINART, P.E.

1319 DEXTER AVE. NORTH, SUITE 103

SEATTLE, WA 98109

Phone: 206-285-9035

E-Mail: trafficsignals@msn.com

Fax: 206-285-6345

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

gr Analyst:

Agency/Co.:

Date Performed:

2/17/05

Analysis Time Period: pm peak hour

Intersection:

Kittitas Highway/East Access

Jurisdiction:

Kittitas County

Units: U. S. Customary

Analysis Year:

2008 with project

Project ID: Vista View Estates East/West Street:

Kittitas Highway

North/South Street:

torsection Orientation: EW

| Intersection Orientation | Study period (hrs): 0.25 |         |               |                |          |             |     |              |
|--------------------------|--------------------------|---------|---------------|----------------|----------|-------------|-----|--------------|
|                          | Vehicle                  | Volumes | and Ad        | ljustment      | ts ·     |             |     |              |
| Major Street Movements   | 1                        | . 2     | , <b>3</b> .  | 4              | 5        | 6           |     | •            |
| -                        | L                        | T       | R.            | L              | T        | R           |     |              |
|                          | 43                       | 322     |               |                | 183      | 9           | •   |              |
| Volume Pastor Bur        | 0.90                     | 0.90    |               |                | 0.83     |             |     |              |
| Peak-Hour Factor, PHF    | 12                       | 89      |               | •              |          | 3           |     |              |
| Peak-15 Minute Volume    |                          |         |               |                | 55       | _           |     |              |
| Hourly Flow Rate, HFR    | 47                       | 357     |               |                | 220      | -10         |     |              |
| Percent Heavy Vehicles   | 0                        |         |               |                |          |             |     |              |
| Median Type/Storage      | nuġī                     | vided   |               | /              | :        |             | •   | ٠.           |
| RT Channelized?          |                          |         |               |                |          |             |     |              |
| Lanes                    | 0                        | 1       | •             | •              | 1        | 0           |     | •            |
| Configuration            | _ L                      |         |               |                |          | TR          |     |              |
| Upstream Signal?         | •                        | No      | •             |                | No       | •           | •   | •            |
| Minor Street Movements   | 7                        | 8       | 9             | 10 .           | 11       | 12          |     | <u></u>      |
| •••                      | L                        | T       | R.            | · T            | T        | . R         |     |              |
| Volume                   |                          |         |               | 5              | •• •• •• | 26          |     |              |
| Peak Hour Factor, PHF    | •                        |         |               | 0.80           | •        | 0.80        |     |              |
| Peak-15 Minute Volume    |                          |         |               | 2              |          | 8 -         |     |              |
| Hourly Flow Rate, HFR    |                          |         |               | 6              | •        | 32          |     |              |
| Percent Heavy Vehicles   |                          | ٠       |               | 0              |          | 0           |     | •            |
| Percent Grade (%)        |                          | 0       |               | •              | 0        | O           |     | •            |
| Flared Approach: Exists  | 27/Storag                | •       |               | `/             |          | No          | . , |              |
| RT Channelized?          | ·                        |         |               | <b>,</b>       |          | NO          |     |              |
| Lanes                    |                          |         |               | 0              |          | 0 .         |     |              |
| Configuration            |                          | 1       | •             |                | LR       |             |     |              |
|                          | edestrian                |         | · 7           | al 4 a. 4      | <u> </u> |             |     |              |
|                          | idestrian<br>13          | 14      | s and A<br>15 | ajustmer<br>16 | 105      | <del></del> |     |              |
| Movements                | 7.3                      | 7.4     | 10            | Τ.Ω            |          |             |     |              |
| Flow (ped/hr)            | . 0                      | 0       | 0             | 0              |          |             |     | <del>.</del> |
| • =                      |                          |         |               |                |          |             |     |              |

| Lane Width (ft)<br>Walking Speed (f<br>Percent Blockage                                         | t/sec)                        |                    | . 0                  | 12.0<br>4.0<br>0 | 12.0<br>4.0<br>0         | 12.0<br>4.0<br>0          |                       |                            |     |
|-------------------------------------------------------------------------------------------------|-------------------------------|--------------------|----------------------|------------------|--------------------------|---------------------------|-----------------------|----------------------------|-----|
|                                                                                                 | •                             | ξŢι                | ostrea               | m Signa          | l Data                   |                           | •                     |                            |     |
|                                                                                                 | Prog.<br>Flow<br>vph          | Sat<br>Flow<br>vph | Arri                 | val G<br>e I     | reen                     | Cycle<br>Length<br>sec    | Prog.<br>Speed<br>mph | Distand<br>to Sign<br>feet |     |
| S2 Left-Turn Through S5 Left-Turn Through                                                       |                               |                    |                      |                  |                          |                           |                       |                            |     |
| Worksheet 3-Data                                                                                | for Cor                       | mputing            | Effec                | t of De          | lay to                   | Major S                   | Street V              | ehicles                    |     |
| · · · · · · · · · · · · · · · · · · ·                                                           |                               |                    |                      |                  | Moveme                   | nt 2                      | Moveme                | nt 5                       |     |
| Shared in volume<br>Shared in volume<br>Sat flow rate, m<br>Sat flow rate, m<br>Number of major | , major<br>ajor th<br>ajor rt | rt vehicle vehicle | icles:<br>es:<br>es: |                  | 357<br>0<br>1700<br>1700 | ••                        |                       |                            |     |
| Worksheet 4-Crit                                                                                | ical Gar                      | and F              | ollow-               | up Time          | Calcu                    | lation                    |                       | ţ                          | ja. |
| Critical Gap Cal<br>Movement                                                                    | culation<br>1<br>L            | 4<br>L             | 7<br>L               | 8<br>T           | 9<br>R                   | 10<br>L                   | 11<br>T               | 12<br>R                    |     |
| t(c,base)<br>t(c,hv)<br>P(hv)                                                                   | 4.1<br>1.00<br>0              | 1.00               | 1.00                 | 1.00             | 1.00                     | 7.1<br>1.00<br>0          | 1.00                  | 6.2<br>1.00<br>0           | · . |
| t(c,g)<br>Grade/100<br>t(3,lt)                                                                  | 0.00                          |                    | 0.20                 | 0.20             | 0.10                     |                           | 0.20<br>0.00          | 0.10<br>0.00<br>0.00       |     |
| t(c,T): 1-stage<br>2-stage<br>t(c) 1-stage<br>2-stage                                           | 4.1                           | 0.00               | 0.00                 | 0.00             | 0.00                     |                           | 0.00                  | 0.00<br>0.00<br>6.2        |     |
| Follow-Up Time C<br>Movement                                                                    | alculat:<br>1<br>L            | lons<br>4<br>L     | 7<br>L               | 8<br>T ·         | 9<br>R                   | 10.<br>L                  | 11<br>T               | 12<br>R                    |     |
| t(f,base)<br>t(f,HV)<br>P(HV)<br>t(f)                                                           | 2.20<br>0.90<br>0<br>2.2      | 0.90               | 0.90                 | 0.90             | 0.90                     | 3.50<br>0.90<br>0<br>3.5  | 0.90                  | 3.30<br>0.90<br>0<br>3.3   |     |
| Worksheet 5-Effe                                                                                | ct of Up                      | stream             | Signa                | ls               | <del></del>              |                           |                       |                            |     |
| Computation 1-Qu                                                                                | eue Clea                      | irance '           | Time a               |                  | Movem                    | gnal<br>ent 2<br>(1,prot) |                       | vement 5<br>V(1,pr         |     |

```
Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g (q1)
g (q2)
g (q)
Computation 2-Proportion of TWSC Intersection Time blocked
                                               Movement 2
                                                                  Movement 5
                                            V(t)
                                                   V(1,prot) \cdot V(t)
                                                                       V(1,prot)
alpha
beta
Travel time, t(a) (sec)
Smoothing Factor, F
Proportion of conflicting flow, f
Max platooned flow, V(c, max)
Min platooned flow, V(c,min)
Duration of blocked period, t(p)
Proportion time blocked, p
                                                 0.000
                                                                    0.000
Computation 3-Platoon Event Periods
                                           Result.
                                           0.000
p(2)
                                           0.000
p(5)
p(dom)
p(subo)
 Constrained or unconstrained?
 Proportion
 unblocked
                             (1)
                                            . (2)
 for minor
                         Single-stage
                                               Two-Stage Process
                           Process
 movements, p(x)
                                           Stage I
                                                            Stage II
 p(1)
 p(4)
 p(7)
 p(8)
 p(9)
 p(10)
 p(11)
 p(12)
 Computation 4 and 5
 Single-Stage Process
                          1
                                                8
                                                       . 9
                                                              10
                                                                      11
                                                                             12
 Movement
                          L
                                                Т
                                                       R
                                                               L.
                                                                              R
                         230
                                                                             225
 V c,x
 s
 Рx
 V c,u,x
 Cr,x
 C plat, x
 Two-Stage Process
                                                       10
                                                                         11
```

|                                               | <del></del> |                                       |
|-----------------------------------------------|-------------|---------------------------------------|
| $\overline{V}(c,x)$                           |             | •                                     |
| S                                             | 15          | 500                                   |
| P(x)                                          | •           |                                       |
|                                               |             |                                       |
| V(c, u, x)                                    |             |                                       |
|                                               |             | ·                                     |
| C(r,x)                                        |             | •                                     |
| C(plat,x)                                     |             |                                       |
| C (braci.                                     |             |                                       |
|                                               | ·           | <del></del>                           |
|                                               |             |                                       |
| Worksheet 6-Impedance and Capacity Equations  |             |                                       |
|                                               | ·           |                                       |
| Step 1: RT from Minor St.                     | 9           | 12                                    |
|                                               |             |                                       |
| Conflicting Flows                             |             | 225                                   |
| CONTITICING TIOMS                             |             |                                       |
| Potential Capacity                            |             | 819                                   |
| Pedestrian Impedance Factor                   | 1.00        | 1.00                                  |
| Movement Capacity                             |             | 819                                   |
| Probability of Queue free St.                 | 1.00        | 0.96                                  |
|                                               |             | •                                     |
| Step 2: LT from Major St.                     | 4           | 1                                     |
| preh v. m. rrow molor po.                     | . 3         | <b>-</b>                              |
|                                               | <del></del> |                                       |
| Conflicting Flows                             | •           | 230                                   |
| Potential Capacity                            | •           | 1350                                  |
| Pedestrian Impedance Factor                   | 1.00        | 1.00                                  |
| Movement Capacity                             |             | 1350                                  |
| Probability of Queue free St.                 | 1.00        | 0.97                                  |
| Propagitity of Quede free bt.                 | 1.00        | 1                                     |
| Maj L-Shared Prob Q free St.                  |             | 0.96                                  |
|                                               | ·           | <u> </u>                              |
| Step 3: TH from Minor St.                     | 8           | 11                                    |
|                                               |             | ***                                   |
| Conflicting Flows                             |             | · · · · · · · · · · · · · · · · · · · |
| Potential Capacity                            |             | ·                                     |
| Pedestrian Impedance Factor                   | 1.00        | 1 00                                  |
| pedestrian impedance ractor                   |             | 1.00                                  |
| Cap. Adj. factor due to Impeding mymnt        | 0.96        | 0.96                                  |
| Movement Capacity                             |             |                                       |
| Probability of Queue free St.                 | 1.00        | 1.00                                  |
|                                               |             |                                       |
| Step 4: LT from Minor St.                     | 7           | 10                                    |
| Step 4. ht from hinor be.                     | . '         | 10                                    |
|                                               | <del></del> | · · · · · · · · · · · · · · · · · · · |
| Conflicting Flows                             |             | 676                                   |
| Potential Capacity                            |             | 422                                   |
| Pedestrian Impedance Factor                   | 1.00        | 1.00                                  |
| Maj. L, Min T Impedance factor                | 0.96        | · .                                   |
| Maj. L, Min T Adj. Imp Factor.                | 0.97        |                                       |
| Cap. Adj. factor due to Impeding mymnt        | 0.93        | 0.97                                  |
| Cap. Adj. Tactor due to impeding mount        | 0.95        |                                       |
| Movement Capacity                             | •           | 407                                   |
|                                               |             | <u> </u>                              |
|                                               |             | •                                     |
| Worksheet 7-Computation of the Effect of Two- | stage Gap A | Acceptance                            |
|                                               |             | •                                     |
| Step 3: TH from Minor St.                     | 8           | 11                                    |
| Step 3. In from Minor St.                     | •           | **                                    |
|                                               |             |                                       |
| Part 1 - First Stage                          |             |                                       |
| Conflicting Flows                             |             | •                                     |
| Potential Capacity                            | ٠.          | •                                     |
| Pedestrian Impedance Factor                   |             |                                       |
| Cap. Adj. factor due to Impeding mymnt        | ·           |                                       |
|                                               | •           |                                       |
| Movement Capacity                             | •           |                                       |
| Probability of Queue free St.                 |             | •                                     |
| 1.                                            |             |                                       |

| Part 2 - Second Stage<br>Conflicting Flows<br>Potential Capacity<br>Pedestrian Impedance<br>Cap. Adj. factor due<br>Movement Capacity | Factor                                | mvmnt                                 |     |      |                                       |             |             |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|-----|------|---------------------------------------|-------------|-------------|
| Part 3 - Single Stage                                                                                                                 | · · · · · · · · · · · · · · · · · · · | · · · · · · · · · · · · · · · · · · · |     |      | ·                                     | <u>.</u>    |             |
| Conflicting Flows                                                                                                                     |                                       |                                       |     |      |                                       |             |             |
| Potential Capacity                                                                                                                    | Fostor                                |                                       |     | 1.00 | •                                     | 1.00        |             |
| Pedestrian Impedance<br>Cap. Adj. factor due                                                                                          | to Impeding                           | mvmnt                                 |     | 0.96 | × •                                   | 0.96        |             |
| Movement Capacity                                                                                                                     |                                       |                                       |     |      | •                                     |             |             |
| Result for 2 stage pr                                                                                                                 | OCESS!                                |                                       |     | ·    | · · · · · · · · · · · · · · · · · · · | <del></del> | <del></del> |
| a                                                                                                                                     |                                       |                                       | •   |      |                                       |             | •           |
| У                                                                                                                                     |                                       |                                       |     |      |                                       |             |             |
| Ct                                                                                                                                    | formation of                          |                                       |     | 1 00 |                                       | 1 00        | :           |
| Probability of Queue                                                                                                                  | iree St.                              | · •                                   | •   | 1.00 |                                       | 1.00        |             |
| Step 4: LT from Minor                                                                                                                 | st.                                   |                                       |     | 7    |                                       | 10          |             |
| Part 1 - First Stage                                                                                                                  |                                       |                                       |     |      |                                       | • • •       |             |
| Conflicting Flows                                                                                                                     |                                       |                                       |     |      | •                                     |             |             |
| Potential Capacity                                                                                                                    | Footon                                |                                       |     |      |                                       |             | :. · .      |
| Pedestrian Impedance<br>Cap. Adj. factor due                                                                                          | to Impeding                           | mymnt                                 |     |      |                                       |             |             |
| Movement Capacity                                                                                                                     | ·                                     |                                       |     |      |                                       | •           | · · · · · · |
| - Grand Stage                                                                                                                         |                                       |                                       |     |      | <del></del>                           | ·           |             |
| Part 2 - Second Stage<br>Conflicting Flows                                                                                            | <b>,</b>                              | •                                     |     |      | •                                     | •           | ,           |
| Potential Capacity                                                                                                                    |                                       | ·                                     |     | •    |                                       |             |             |
| Pedestrian Impedance                                                                                                                  | Factor                                |                                       |     |      | •                                     | •           |             |
| Cap. Adj. factor due                                                                                                                  | to Impeding                           | mvmnt                                 | ·   | : .  | •                                     | ::          | <b></b>     |
| Movement Capacity                                                                                                                     | •                                     |                                       |     | ,    |                                       |             |             |
| Part 3 - Single Stage                                                                                                                 | <u> </u>                              |                                       |     |      | <del></del>                           |             | <del></del> |
| Conflicting Flows                                                                                                                     |                                       | •                                     |     | •    |                                       | 676         |             |
| Potential Capacity<br>Pedestrian Impedance                                                                                            | Factor                                | •                                     |     | 1.00 | ·                                     | 422<br>1.00 |             |
| Maj. L, Min T Impedant                                                                                                                | ce factor                             |                                       |     | 0.96 | •                                     | 1.00        |             |
| Mai L. Min T Adj. Im                                                                                                                  | p Factor.                             |                                       |     | 0.97 |                                       | :           |             |
| Cap. Adj. factor due                                                                                                                  | to Impeding                           | mvmnt                                 |     | 0.93 |                                       | 0.97        |             |
| Movement Capacity                                                                                                                     |                                       |                                       | •   |      |                                       | .407        | :           |
| Results for Two-stage                                                                                                                 | process:                              |                                       | ·   |      |                                       |             |             |
| <sup>`</sup> a                                                                                                                        |                                       | •                                     | •   |      |                                       |             | •           |
| У                                                                                                                                     | • •                                   |                                       |     |      |                                       | <br>407     |             |
| C t                                                                                                                                   | · · · · · · · · · · · · · · · · · · · |                                       |     |      | •                                     | ±07,        |             |
| Worksheet 8-Shared La                                                                                                                 | ne Calculati                          | lons                                  |     |      | •                                     |             |             |
| Movement                                                                                                                              |                                       | 7                                     | 8   | 9    | 10                                    | 11          | 12          |
| 124 Y WANTED TO 1                                                                                                                     |                                       | L                                     | T   | R    | . <b>L</b>                            | T           | R           |
| Traliuma (rmh)                                                                                                                        |                                       |                                       | ·   |      | 6                                     |             | 32          |
| Volume (vph) Movement Capacity (vp                                                                                                    | oh)                                   |                                       |     | •    | 407                                   | •           | 819         |
| Shared Lane Capacity                                                                                                                  | (vph)                                 |                                       | • • |      | •                                     | 706         |             |
|                                                                                                                                       |                                       |                                       |     | ·    |                                       |             |             |

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

| Movement            |              |         |     | 7     | 8          | 9       | 10  | 11   | 12                                    |
|---------------------|--------------|---------|-----|-------|------------|---------|-----|------|---------------------------------------|
|                     |              |         |     | L     | Т          | R<br>·  | L   | T    | R                                     |
| C sep               |              |         |     |       | <u> </u>   | ·       | 407 |      | 819                                   |
| Volume .            |              |         |     |       |            |         | 6   |      | . 32                                  |
| Delay ·             |              |         |     |       |            | •       |     |      | N4.                                   |
| Q sep               |              |         |     |       |            |         |     |      |                                       |
| Q sep +1            |              | •       |     |       |            |         |     |      |                                       |
| round (Qsep +1)     |              |         |     |       |            |         |     |      | •                                     |
|                     | <del> </del> | •       |     |       |            |         |     |      |                                       |
| n max               |              |         |     |       |            |         |     |      |                                       |
| C sh                |              |         |     |       |            |         |     | 706  | •                                     |
| SUM C sep           |              |         |     |       |            | •       |     |      | 2                                     |
| n<br>C act          |              | •       |     |       |            |         |     |      |                                       |
|                     |              |         |     | •     |            |         |     |      |                                       |
| - 1 1 - 10 D-1-     |              | _       | •   | ٠.    |            |         |     |      |                                       |
| Worksheet 10-Delay, | Queue        | Length, | and | Level | of         | Service |     | •    | · .                                   |
| Movement            | 1            | 4       | 7   | 8     | <u>_</u> _ | 9       | 10  | 11   | 12                                    |
| Lane Config         | LT           |         |     |       |            |         |     | LR   | 12                                    |
|                     |              |         |     | •     |            |         |     | . ЦК |                                       |
| v (vph)             | 47           |         |     |       |            |         |     | 38   | · · · · · · · · · · · · · · · · · · · |
| C(m) (vph)          | 1350         |         |     |       |            |         |     | 706  |                                       |
| v/c                 | 0.03         | •       |     |       |            |         |     | 0.05 |                                       |
| 95% queue length    | 0.11         |         |     |       |            |         |     | 0.17 | 77.                                   |
| Control Delay       | 7.8          | •       |     |       |            |         |     | 10.4 | • •                                   |
| 7.09                | 20           | •       |     |       |            | •       |     |      |                                       |

## Worksheet 11-Shared Major LT Impedance and Delay

Los

Approach Delay Approach LOS

|                                                                    | Movement 2 | Movement 5 |
|--------------------------------------------------------------------|------------|------------|
| p(oj)                                                              | 0.97       | 1.00       |
| v(il), Volume for stream 2 or 5<br>v(i2), Volume for stream 3 or 6 | 357~       | •          |
|                                                                    | 0          |            |
| s(il), Saturation flow rate for stream 2 or 5                      | 1700       |            |
| s(i2), Saturation flow rate for stream 3 or 6                      | 1700       |            |
| P*(oj)                                                             | 0.96       |            |
| d(M,LT), Delay for stream 1 or 4                                   | 7.8        |            |
| N, Number of major street through lanes                            | 1          | •          |
| d(rank,1) Delay for stream 2 or 5                                  | 0.3        |            |

В

10.4