

Exhibit C-1

Traffic Analysis for Title 4

Traffic Analysis for Title 4

Background

Title 4 of Metro's Urban Growth Management Functional Plan (UGMFP) "seeks to provide and protect a supply of sites for employment by limiting the types and scale of non-industrial uses in Regionally Significant Industrial Areas (RSIAs), Industrial and Employment Areas." 3.07.450.H. establishes the criteria by which Metro Council can amend the Employment and Industrial Areas Map for proposed Comprehensive and Zoning map amendment that exceed 20 acres for Industrial Areas.

The Comprehensive and Zoning Map amendments proposed to be-readopted with the Northwest District Plan (NWDP) Remand Project beginning in June 2010, proposes to change the Title 4 designation of more than 20 acres from "Industrial Area" to "Employment Area." Therefore, the approval criteria listed in 3.07.450.H must be met.

The purpose of this Traffic Analysis is to address one of those criteria 3.07.450.H.2. The other criteria in 3.07.450.H are addressed in the Ordinance.

Criterion and Analysis

Criterion 3.07.450.H.2 requires that the map amendment: "Would not allow uses that would reduce off-peak performance on Major Roadway Routes and Roadway Connectors shown on Metro's 2004 Regional Freight System Map below standards in the Regional Transportation Plan ("RTP"), or exceed volume-to-capacity ratios on Table 7 of the 1999 Oregon Highway Plan ("OHP") for state highways, unless mitigating action is taken that will restore performance to RTP and OHP standards within two years after approval of uses."

In the Regional Transportation Plan (RTP), Interstate 405 is classified as a Main Freight Roadway and NW Nicolai Street is identified as a Freight Road Connector. A traffic analysis was conducted to evaluate the impact of projected development on the off-peak hour traffic operational conditions of those facilities. This document summarizes findings that address the requirements of Title 4.

According to Title 4 3.07.450 C-4, it is sufficient to satisfy the requirement if the changes proposed in the NWDP Remand Project meets either criterion in Table 1.

Table 1. Off-Peak Performance Standards

		Standards
Criteria 1	Metro RTP Standards ¹ in Level of Service (LOS)	E
Criteria 2	ODOT 1999 OHP ² in v/c	0.99

1. Metro's RTP Table 2.4, Regional Mobility Policy

2. ODOT's 1999 Oregon Highway Plan, Table 7.

Analysis of the following three intersections is summarized below:

- NW Nicolai Street at NW Wardway Street / NW 29th Avenue
- NW Nicolai Street at US 30
- NW Vaughn Street at NW 23rd Avenue / I-405 ramps

Findings

All three intersections currently operate at a LOS that exceeds the standards specified in Title 4.

The analysis finds that off-peak hour operations at all three intersection will continue to exceed the Title 4 standards in the 2030 plan year (See Table 2).

Table 2. Off-Peak Operational Conditions in LOS

	2010	2030
NW Nicolai St at NW Wardway St	C	C
NW Nicolai St at US 30	B	B
NW Vaughn St at NW 23rd Ave	D	D

Methodology

No off-peak turning movement counts (TMCs) were collected when the initial NWDP Remand Project traffic analysis was performed. For this Title 4 analysis, fresh 2010 off-peak TMCs were collected¹ in order to evaluate current conditions. The City of Portland does not have an off-peak demand model to predict the future off-peak demands for the NWDP Remand traffic analysis. The future off-peak traffic demands were estimated from the projected future PM demands by the formula:

$$V_{2030\text{offpeak}} = V_{2010\text{off-peak}} + \Delta V_{\text{pm}2030\text{-pm}2007} \times (V_{\text{offpeak}} / V_{\text{pmpeak}})$$

Where Δ is the model projected PM traffic growth in turning movements from 2007 to 2030.

Synchro software was used in the operational analysis to derive the LOS and V/C data. All three signals were evaluated as the controller of Actuated & Uncoordinated, which are the specifications of current signal timing plans on the site. All other current signal settings are applied in the analysis. Intersection geometric configurations coded in the model match current street layouts.

The LOS measures were extracted from Synchro's HCM (Highway Capacity Manual) Signalized Intersection Capacity Analysis Reports.

Traffic Data



















Table 3 lists the 2010 turning movement counts and projected 2030 traffic demands for the three intersections supporting the analysis.

Table 3. Off-Peak Hour Turning Movement Volumes

		eastbound			westbound			northbound			southbound			total
		L	T	R	L	T	R	L	T	R	L	T	R	
Nicolai / US30	2010	85	15	305	40	25	70	150	885	45	45	985	115	2765
	2030	85	15	345	70	25	70	560	1090	85	45	1270	115	3775
Nicolai / Wardway	2010	5	220	225	20	185	20	210	45	15	25	55	5	1030
	2030	10	345	335	20	310	20	255	45	15	25	55	5	1440
Vaughn / 23rd	2010	0	495	85	165/ 305	475	155	100	65	420	120	60	25	2470
	2030	0	555	85	180/ 360	510	340	100	65	455	155	75	25	2905





















¹ NW 29th Avenue at N/NW Nicolai Street is currently closed to through traffic due to construction. Because this is an important leg of the intersection, an effort was made to estimate the turning movement counts based on other data collected at the intersection. 24-hour link counts on all three other major approaching legs were collected and the current TMC was estimated from the time of day factor and two AM / PM TMCs collected in 2007. The time of the day factor is calculated at approach level, and the formula of (am+pm)/2 was used to distribute the turn movements.













Appendix A: Synchro Highway Capacity Manual Reports

												
Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	NBR2
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0	4.0			4.0		
Lane Util. Factor	1.00	1.00	1.00			1.00	1.00			1.00		
Frt	1.00	1.00	0.85			1.00	0.99			0.88		
Flt Protected	0.95	1.00	1.00			0.95	1.00			0.99		
Satd. Flow (prot)	1770	1863	1583			1770	1835			1634		
Flt Permitted	0.55	1.00	1.00			0.95	1.00			0.96		
Satd. Flow (perm)	1024	1863	1583			1770	1835			1580		
Volume (vph)	5	220	225	5	5	20	185	20	3	0	5	13
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	239	245	5	5	22	201	22	3	0	5	14
RTOR Reduction (vph)	0	0	0	0	0	0	3	0	0	12	0	0
Lane Group Flow (vph)	5	239	250	0	0	27	220	0	0	10	0	0
Turn Type	pm+pt		custom		Prot		Prot		Perm			
Protected Phases	1	3 6	6 7		5	5	2 3			4		
Permitted Phases	3 6								4			
Actuated Green, G (s)	35.9	34.3	36.6			2.0	32.5			8.5		
Effective Green, g (s)	36.1	33.3	38.4			1.0	31.5			8.7		
Actuated g/C Ratio	0.49	0.45	0.52			0.01	0.43			0.12		
Clearance Time (s)	5.2					3.0				4.2		
Vehicle Extension (s)	3.0					3.0				3.0		
Lane Grp Cap (vph)	531	844	827			24	786			187		
v/s Ratio Prot	c0.00	c0.13	c0.16			c0.02	0.12					
v/s Ratio Perm	0.00									0.01		
v/c Ratio	0.01	0.28	0.30			1.12	0.28			0.05		
Uniform Delay, d1	9.6	12.6	9.9			36.2	13.6			28.7		
Progression Factor	1.00	1.00	1.00			1.00	1.00			1.00		
Incremental Delay, d2	0.0	0.2	0.2			225.0	0.2			0.1		
Delay (s)	9.6	12.8	10.2			261.2	13.8			28.9		
Level of Service	A	B	B			F	B			C		
Approach Delay (s)		11.4					40.5			28.9		
Approach LOS		B					D			C		
Intersection Summary												
HCM Average Control Delay			24.8			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.44									
Actuated Cycle Length (s)			73.5			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			54.2%			ICU Level of Service				A		
Analysis Period (min)			15									
c Critical Lane Group												





















Movement	SBL2	SBL	SBT	SBR	NWL	NWR	NWR2
Lane Configurations			↔		↗	↗	↗
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0		4.0	4.0	4.0
Lane Util. Factor			1.00		1.00	1.00	1.00
Frt			0.98		1.00	0.85	0.85
Flt Protected			0.96		0.95	1.00	1.00
Satd. Flow (prot)			1758		1770	1583	1583
Flt Permitted			0.74		0.95	1.00	1.00
Satd. Flow (perm)			1351		1770	1583	1583
Volume (vph)	25	55	1	10	210	45	15
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	60	1	11	228	49	16
RTOR Reduction (vph)	0	0	5	0	0	0	13
Lane Group Flow (vph)	0	0	94	0	228	49	3
Turn Type	Perm	Perm				Prot	Prot
Protected Phases			4		7	7	7
Permitted Phases	4	4					
Actuated Green, G (s)			8.5		13.3	13.3	13.3
Effective Green, g (s)			8.7		14.5	14.5	14.5
Actuated g/C Ratio			0.12		0.20	0.20	0.20
Clearance Time (s)			4.2		5.2	5.2	5.2
Vehicle Extension (s)			3.0		3.0	3.0	3.0
Lane Grp Cap (vph)			160		349	312	312
v/s Ratio Prot					c0.13	0.03	0.00
v/s Ratio Perm			c0.07				
v/c Ratio			0.59		0.65	0.16	0.01
Uniform Delay, d1			30.7		27.2	24.4	23.7
Progression Factor			1.00		1.00	1.00	1.00
Incremental Delay, d2			5.4		4.3	0.2	0.0
Delay (s)			36.1		31.5	24.7	23.7
Level of Service			D		C	C	C
Approach Delay (s)			36.1		30.0		
Approach LOS			D		C		
Intersection Summary							

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		0.97	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		0.99		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		0.99	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.95		0.93		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.96	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1777	1770		1682		3433	5042		1770	3539	1549
Flt Permitted		0.60	1.00		0.88		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1102	1770		1495		3433	5042		1770	3539	1549
Volume (vph)	85	15	305	40	25	70	150	885	45	45	985	115
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	89	16	321	42	26	74	158	932	47	47	1037	121
RTOR Reduction (vph)	0	0	0	0	48	0	0	5	0	0	0	57
Lane Group Flow (vph)	0	105	321	0	94	0	158	974	0	47	1037	64
Confl. Peds. (#/hr)	4						4	8		4	4	8
Turn Type	Perm	custom		Perm			Prot			Prot	custom	
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8		5 6 8	4								6
Actuated Green, G (s)		12.2	81.2		12.2		14.4	40.8		11.9	39.4	40.8
Effective Green, g (s)		13.8	81.2		13.8		14.5	42.8		12.6	40.9	42.8
Actuated g/C Ratio		0.17	1.00		0.17		0.18	0.53		0.16	0.50	0.53
Clearance Time (s)		5.6			5.6		4.1	6.0		4.7	5.5	6.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		187	1770		254		613	2658		275	1783	816
v/s Ratio Prot							c0.05	0.19		0.03	c0.29	
v/s Ratio Perm		c0.10	c0.18		0.06							0.04
v/c Ratio		0.56	0.18		0.37		0.26	0.37		0.17	0.58	0.08
Uniform Delay, d1		30.9	0.0		29.8		28.7	11.3		29.8	14.1	9.5
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		3.8	0.0		0.9		1.0	0.4		1.3	1.4	0.2
Delay (s)		34.7	0.0		30.8		29.7	11.6		31.1	15.5	9.7
Level of Service		C	A		C		C	B		C	B	A
Approach Delay (s)		8.6			30.8			14.2			15.6	
Approach LOS		A			C			B			B	
Intersection Summary												
HCM Average Control Delay		14.7			HCM Level of Service			B				
HCM Volume to Capacity ratio		0.51										
Actuated Cycle Length (s)		81.2			Sum of lost time (s)			12.0				
Intersection Capacity Utilization		64.2%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												






















												
Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↑↑			↓	↑↑	↑	↓	↑	↑	↓	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95			1.00	0.95	1.00	1.00	0.95	0.95	1.00	1.00
Frpb, ped/bikes		0.99			1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.98			1.00	1.00	0.85	1.00	0.89	0.85	1.00	0.96
Flt Protected		1.00			0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		3430			1770	3539	1583	1770	1570	1504	1770	1746
Flt Permitted		1.00			0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		3430			1770	3539	1583	1770	1570	1504	1770	1746
Volume (vph)	0	495	85	165	305	475	155	100	65	420	120	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	521	89	174	321	500	163	105	68	442	126	63
RTOR Reduction (vph)	0	12	0	0	0	0	69	0	0	0	0	13
Lane Group Flow (vph)	0	598	0	0	495	500	94	105	276	234	126	76
Confl. Peds. (#/hr)	1		16		16		1	40				
Turn Type				Prot	Prot		Prot	Prot		Prot	Prot	
Protected Phases		2		1	1	6	6	3	8	8	7	4
Permitted Phases												
Actuated Green, G (s)		20.6			29.5	54.1	54.1	8.2	20.0	20.0	7.7	19.5
Effective Green, g (s)		20.6			29.5	54.1	54.1	8.2	20.0	20.0	7.7	19.5
Actuated g/C Ratio		0.22			0.31	0.58	0.58	0.09	0.21	0.21	0.08	0.21
Clearance Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		753			557	2041	913	155	335	321	145	363
v/s Ratio Prot		c0.17			c0.28	0.14	0.06	0.06	c0.18	0.16	c0.07	0.04
v/s Ratio Perm												
v/c Ratio		0.79			0.89	0.24	0.10	0.68	0.82	0.73	0.87	0.21
Uniform Delay, d1		34.6			30.6	9.8	8.9	41.5	35.2	34.4	42.6	30.8
Progression Factor		1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		5.8			15.8	0.1	0.0	11.1	15.0	8.0	38.6	0.3
Delay (s)		40.4			46.4	9.8	9.0	52.7	50.3	42.4	81.2	31.0
Level of Service		D			D	A	A	D	D	D	F	C
Approach Delay (s)		40.4				25.4			47.7			60.4
Approach LOS		D				C			D			E
Intersection Summary												
HCM Average Control Delay		37.1			HCM Level of Service				D			
HCM Volume to Capacity ratio		0.80										
Actuated Cycle Length (s)		93.8			Sum of lost time (s)				12.0			
Intersection Capacity Utilization		80.0%			ICU Level of Service				D			
Analysis Period (min)		15										
c Critical Lane Group												













Movement	SBR
Lane Configurations	
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frbp, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Volume (vph)	25
Peak-hour factor, PHF	0.95
Adj. Flow (vph)	26
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	40
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

												
Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	NBR2
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0	4.0			4.0		
Lane Util. Factor	1.00	1.00	1.00			1.00	1.00			1.00		
Frt	1.00	1.00	0.85			1.00	0.99			0.88		
Flt Protected	0.95	1.00	1.00			0.95	1.00			0.99		
Satd. Flow (prot)	1770	1863	1583			1770	1846			1634		
Flt Permitted	0.47	1.00	1.00			0.95	1.00			0.96		
Satd. Flow (perm)	866	1863	1583			1770	1846			1578		
Volume (vph)	10	345	335	5	5	20	310	20	3	0	5	13
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	375	364	5	5	22	337	22	3	0	5	14
RTOR Reduction (vph)	0	0	1	0	0	0	2	0	0	12	0	0
Lane Group Flow (vph)	11	375	368	0	0	27	357	0	0	10	0	0
Turn Type	pm+pt		custom		Prot		Prot		Perm			
Protected Phases	1	3 6	6 7		5	5	2 3			4		
Permitted Phases	3 6								4			
Actuated Green, G (s)	32.9	32.4	34.2			2.0	33.9			8.6		
Effective Green, g (s)	31.4	31.4	36.0			1.0	32.9			8.8		
Actuated g/C Ratio	0.43	0.43	0.49			0.01	0.45			0.12		
Clearance Time (s)	3.0					3.0				4.2		
Vehicle Extension (s)	3.0					3.0				3.0		
Lane Grp Cap (vph)	368	793	772			24	823			188		
v/s Ratio Prot		c0.20	0.23			c0.02	0.19					
v/s Ratio Perm	0.01									0.01		
v/c Ratio	0.03	0.47	0.48			1.12	0.43			0.05		
Uniform Delay, d1	12.3	15.2	12.6			36.4	14.0			28.8		
Progression Factor	1.00	1.00	1.00			1.00	1.00			1.00		
Incremental Delay, d2	0.0	0.4	0.5			225.0	0.4			0.1		
Delay (s)	12.4	15.7	13.1			261.4	14.4			28.9		
Level of Service	B	B	B			F	B			C		
Approach Delay (s)		14.4					31.7			28.9		
Approach LOS		B					C			C		
Intersection Summary												
HCM Average Control Delay			23.4			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			73.8			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			56.7%			ICU Level of Service				B		
Analysis Period (min)			15									
c Critical Lane Group												



Movement	SBL2	SBL	SBT	SBR	NWL	NWR	NWR2
Lane Configurations			↔		↗	↗	↗
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0		4.0	4.0	4.0
Lane Util. Factor			1.00		1.00	1.00	1.00
Frt			0.98		1.00	0.85	0.85
Flt Protected			0.96		0.95	1.00	1.00
Satd. Flow (prot)			1758		1770	1583	1583
Flt Permitted			0.74		0.95	1.00	1.00
Satd. Flow (perm)			1351		1770	1583	1583
Volume (vph)	25	55	1	10	255	45	15
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	60	1	11	277	49	16
RTOR Reduction (vph)	0	0	5	0	0	0	12
Lane Group Flow (vph)	0	0	94	0	277	49	4
Turn Type	Perm	Perm				Prot	Prot
Protected Phases			4		7	7	7
Permitted Phases	4	4					
Actuated Green, G (s)			8.6		15.4	15.4	15.4
Effective Green, g (s)			8.8		16.6	16.6	16.6
Actuated g/C Ratio			0.12		0.22	0.22	0.22
Clearance Time (s)			4.2		5.2	5.2	5.2
Vehicle Extension (s)			3.0		3.0	3.0	3.0
Lane Grp Cap (vph)			161		398	356	356
v/s Ratio Prot					c0.16	0.03	0.00
v/s Ratio Perm			c0.07				
v/c Ratio			0.58		0.70	0.14	0.01
Uniform Delay, d1			30.8		26.3	22.9	22.2
Progression Factor			1.00		1.00	1.00	1.00
Incremental Delay, d2			5.3		5.2	0.2	0.0
Delay (s)			36.0		31.5	23.1	22.2
Level of Service			D		C	C	C
Approach Delay (s)			36.0		29.9		
Approach LOS			D		C		
Intersection Summary							

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		0.97	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		0.99		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.95		0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1787	1770		1698		3433	5020		1770	3539	1548
Flt Permitted		0.56	1.00		0.78		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1051	1770		1351		3433	5020		1770	3539	1548
Volume (vph)	85	15	345	70	25	70	560	1090	85	45	1270	115
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	89	16	363	74	26	74	589	1147	89	47	1337	121
RTOR Reduction (vph)	0	0	0	0	30	0	0	9	0	0	0	45
Lane Group Flow (vph)	0	105	363	0	144	0	589	1227	0	47	1337	76
Confl. Peds. (#/hr)	4					4	8		4	4		8
Turn Type	Perm	custom		Perm			Prot			Prot	custom	
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8		5 6 8	4								6
Actuated Green, G (s)		12.3	88.0		12.3		19.9	53.5		5.9	40.6	53.5
Effective Green, g (s)		13.9	88.0		13.9		20.0	55.5		6.6	42.1	55.5
Actuated g/C Ratio		0.16	1.00		0.16		0.23	0.63		0.08	0.48	0.63
Clearance Time (s)		5.6			5.6		4.1	6.0		4.7	5.5	6.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		166	1770		213		780	3166		133	1693	976
v/s Ratio Prot							c0.17	0.24		0.03	c0.38	
v/s Ratio Perm		0.10	0.21		c0.11							0.05
v/c Ratio		0.63	0.21		0.67		0.76	0.39		0.35	0.79	0.08
Uniform Delay, d1		34.7	0.0		34.9		31.7	7.9		38.7	19.2	6.3
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		7.6	0.1		8.2		6.7	0.4		7.2	3.8	0.2
Delay (s)		42.3	0.1		43.1		38.4	8.3		45.9	23.1	6.5
Level of Service		D	A		D		D	A		D	C	A
Approach Delay (s)		9.5			43.1			18.0			22.5	
Approach LOS		A			D			B			C	
Intersection Summary												
HCM Average Control Delay		19.8					HCM Level of Service			B		
HCM Volume to Capacity ratio		0.76										
Actuated Cycle Length (s)		88.0					Sum of lost time (s)			12.0		
Intersection Capacity Utilization		77.4%					ICU Level of Service			D		
Analysis Period (min)		15										
c Critical Lane Group												

												
Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↑↑			↓	↑↑	↑	↓	↑	↓	↓	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95			1.00	0.95	1.00	1.00	0.95	0.95	1.00	1.00
Frpb, ped/bikes		0.99			1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.98			1.00	1.00	0.85	1.00	0.88	0.85	1.00	0.96
Flt Protected		1.00			0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		3437			1770	3539	1583	1770	1565	1504	1770	1760
Flt Permitted		1.00			0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		3437			1770	3539	1583	1770	1565	1504	1770	1760
Volume (vph)	0	555	85	180	360	510	340	100	65	455	155	75
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	584	89	189	379	537	358	105	68	479	163	79
RTOR Reduction (vph)	0	11	0	0	0	0	151	0	0	0	0	10
Lane Group Flow (vph)	0	662	0	0	568	537	207	105	296	251	163	95
Confl. Peds. (#/hr)	1		16		16		1	40				
Turn Type				Prot	Prot		Prot	Prot		Prot	Prot	
Protected Phases		2		1	1	6	6	3	8	8	7	4
Permitted Phases												
Actuated Green, G (s)		23.0			35.7	62.7	62.7	9.3	22.5	22.5	11.0	24.2
Effective Green, g (s)		23.0			35.7	62.7	62.7	9.3	22.5	22.5	11.0	24.2
Actuated g/C Ratio		0.21			0.33	0.58	0.58	0.09	0.21	0.21	0.10	0.22
Clearance Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		731			584	2051	917	152	325	313	180	394
v/s Ratio Prot		c0.19			c0.32	0.15	0.13	0.06	c0.19	0.17	c0.09	0.05
v/s Ratio Perm												
v/c Ratio		0.91			0.97	0.26	0.23	0.69	0.91	0.80	0.91	0.24
Uniform Delay, d1		41.5			35.8	11.3	11.0	48.1	41.9	40.7	48.1	34.5
Progression Factor		1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		14.7			30.2	0.1	0.1	12.7	28.4	13.7	41.0	0.3
Delay (s)		56.3			66.0	11.3	11.1	60.8	70.2	54.5	89.1	34.8
Level of Service		E			E	B	B	E	E	D	F	C
Approach Delay (s)		56.3				32.5			62.6			67.8
Approach LOS		E				C			E			E
Intersection Summary												
HCM Average Control Delay		47.3			HCM Level of Service				D			
HCM Volume to Capacity ratio		0.93										
Actuated Cycle Length (s)		108.2			Sum of lost time (s)				16.0			
Intersection Capacity Utilization		88.9%			ICU Level of Service				E			
Analysis Period (min)		15										
c Critical Lane Group												

Movement	SBR
Lane Configurations	
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frbp, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Volume (vph)	25
Peak-hour factor, PHF	0.95
Adj. Flow (vph)	26
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	40
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

Appendix B: 2010 Off-peak Turning Movement Counts

Cldy 55f By: CDB/RC For: Zhou

NW NICOLAI ST @ NW YEON AVE/I405 RAMPS

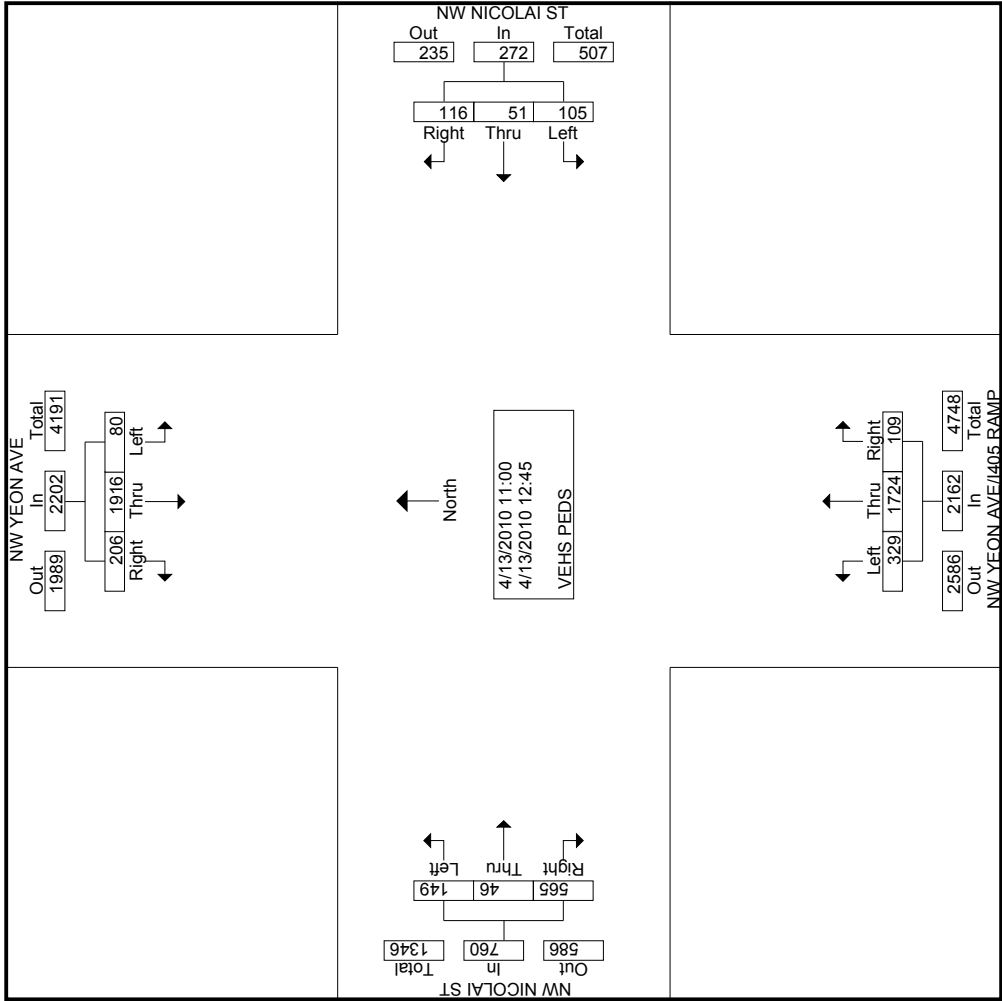
Groups Printed- VEHS PEDS

NW YEON AVE Southbound														NW NICOLAI ST Westbound														NW YEON AVE/I405 RAMP Northbound														NW NICOLAI ST Eastbound													
Start Time	Left		Thru		Right		Peds		App. Total		Left		Thru		Right		Peds		App. Total		Left		Thru		Right		Peds		App. Total		Exclu. Total		Indu. Total		Int. Total																				
11:00	8	216	17	0	241					14	7	8	0	29	46	201	12	0	259		16	7	68	0	91		0	620	620																										
11:15	9	230	21	0	260					17	3	9	0	29	40	225	18	0	283		7	10	68	0	85		0	657	657																										
11:30	5	239	35	0	279					24	12	8	0	44	39	182	15	0	236		19	9	72	1	100		1	659	660																										
11:45	9	264	20	0	293					17	12	6	0	35	31	250	14	0	295		15	3	76	0	94		0	717	717																										
Total	31	949	93	0	1073					72	34	31	0	137	156	858	59	0	1073		57	29	284	1	370		1	2653	2654																										
12:00	7	231	22	0	260					13	8	17	0	38	41	201	6	0	248		20	3	96	0	119		0	665	665																										
12:15	12	248	31	0	291					8	2	26	0	36	45	216	13	0	274		24	7	72	0	103		0	704	704																										
12:30	17	243	41	0	301					3	1	21	0	25	35	219	12	0	266		24	4	62	0	90		0	682	682																										
12:45	13	245	19	0	277					9	6	21	0	36	52	230	19	0	301		24	3	51	0	78		0	692	692																										
Total	49	967	113	0	1129					33	17	85	0	135	173	866	50	0	1089		92	17	281	0	390		0	2743	2743																										
Grand Total	80	1916	206	0	2202					105	51	116	0	272	329	1724	109	0	2162		149	46	565	1	760		1	5396	5397																										
Apprch %	3.6	87	9.4							38.6	18.8	42.6			15.2	79.7	5				19.6	6.1	74.3																																
Total %	1.5	35.5	3.8		40.8					1.9	0.9	2.1		5	6.1	31.9	2		40.1		2.8	0.9	10.5		14.1		0	100																											

NOTE: NW 29TH AVE CLOSED YEON TO NICOLAI

Cldy 55f By: CDB/RC For: Zhou

NW NICOLAI ST @ NW YEON AVE/I405 RAMPS



Cldy 55f By: CDB/RC For: Zhou

File Name : 100413TOB
Site Code : 00000000
Start Date : 4/13/2010
Page No : 3

NW NICOLAI ST @ NW YEON AVE/I405 RAMPS

Start Time	NW YEON AVE Southbound					NW NICOLAI ST Westbound					NW YEON AVE/I405 RAMP Northbound					NW NICOLAI ST Eastbound				
	Left	Thru	Right	App. Total		Left	Thru	Right	App. Total		Left	Thru	Right	App. Total		Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 11:00 to 12:45 - Peak 1 of 1																				
Peak Hour for Entire Intersection Begins at 11:45																				
11:45	9	264	20	293		17	12	6	35		31	250	14	295		15	3	76	94	717
12:00	7	231	22	260		13	8	17	38		41	201	6	248		20	3	96	119	665
12:15	12	248	31	291		8	2	26	36		45	216	13	274		24	7	72	103	704
12:30	17	243	41	301		3	1	21	25		35	219	12	266		24	4	62	90	682
Total Volume	45	986	114	1145		41	23	70	134		152	886	45	1083		83	17	306	406	2768
% App. Total	3.9	86.1	10			30.6	17.2	52.2			14	81.8	4.2			20.4	4.2	75.4		
PHF	.662	.934	.695	.951		.603	.479	.673	.882		.844	.886	.804	.918		.865	.607	.797	.853	.965

O'cast by: CDB For: Zhou

File Name : 100407TOB
Site Code : 00000000
Start Date : 4/7/2010
Page No : 1

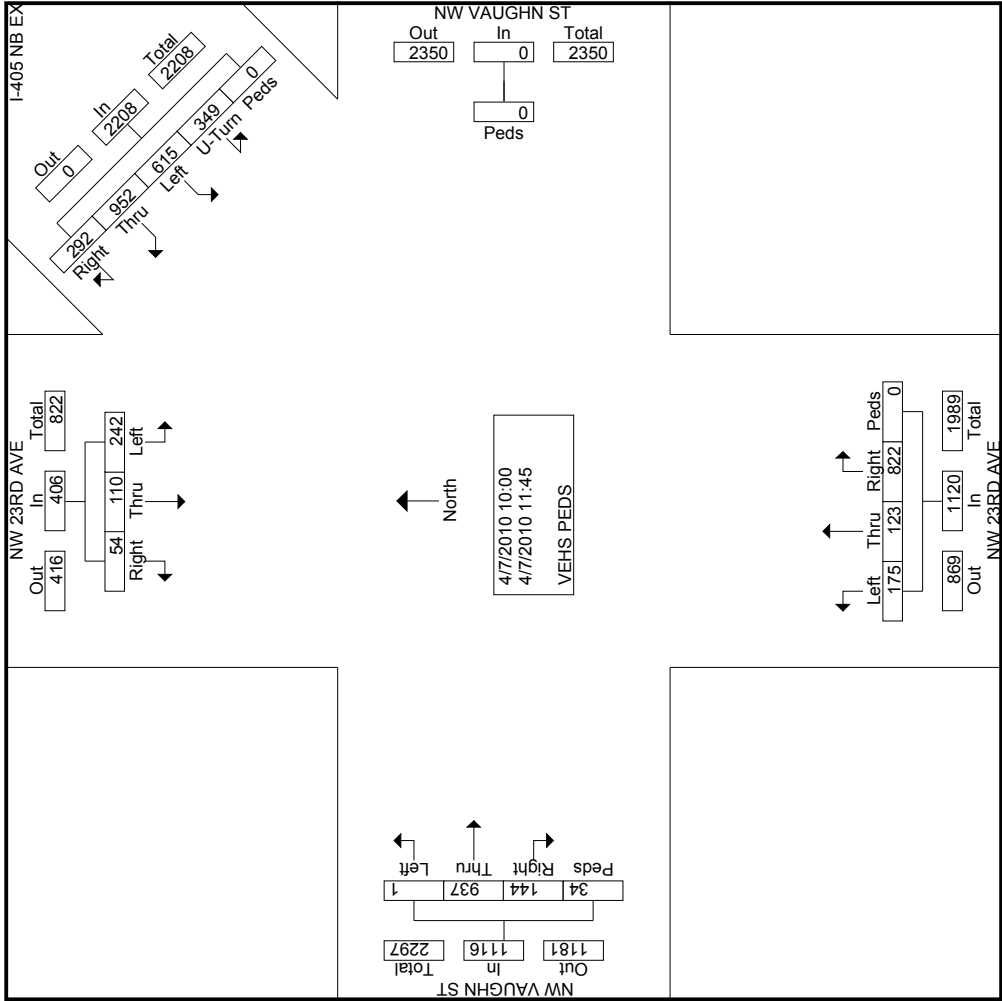
NW 23RD AVE/VAUGHN ST/I405 NB EX

Groups Printed- VEHS PEDS

Groups Filtered - VLN1917.FLS																																			
NW 23RD AVE Southbound										I-405 NB EX Southwestbound										NW VAUGHN ST Westbound				NW 23RD AVE Northbound						NW VAUGHN ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	U-Turn	Left	Thru	Right	Peds	App. Total	NW VAUGHN ST Westbound			NW 23RD AVE Northbound			NW VAUGHN ST Eastbound			Exclu. Total	Inclu. Total	Int. Total												
												Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru				Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total				
10:00	23	6	7	0	36	43	87	118	28	0	276	0	0	8	10	88	0	106	0	123	4	123	0	541	541										
10:15	34	17	5	1	56	41	77	120	39	0	277	0	0	24	15	130	0	169	0	106	0	106	1	608	609										
10:30	28	15	6	1	49	51	77	106	36	0	270	0	0	20	13	95	0	128	0	134	1	134	1	581	582										
10:45	37	13	11	0	61	48	68	132	35	0	283	0	0	22	22	89	0	133	0	153	7	153	0	630	630										
Total	122	51	29	2	202	183	309	476	138	0	1106	0	0	74	60	402	0	536	0	516	12	516	2	2360	2362										
11:00	24	15	10	4	49	44	88	116	31	0	279	0	0	23	14	102	0	139	0	159	3	159	4	626	630										
11:15	26	19	2	2	47	39	51	126	47	0	263	0	0	22	17	111	0	150	0	153	5	153	2	613	615										
11:30	32	14	6	2	52	39	71	120	38	0	268	0	0	31	12	93	0	136	1	158	14	158	2	614	616										
11:45	38	11	7	0	56	44	96	114	38	0	292	0	0	25	20	114	0	159	0	130	17	130	0	637	637										
Total	120	59	25	8	204	166	306	476	154	0	1102	0	0	101	63	420	0	584	1	600	22	600	8	2490	2498										
Grand Total	242	110	54	10	406	349	615	952	292	0	2208	0	0	175	123	822	0	1120	1	1116	34	1116	10	4850	4860										
Apprch %	59.6	27.1	13.3			15.8	27.9	43.1	13.2	0			15.6	11	73.4	0			0.1	84	12.9	3													
Total %	5	2.3	1.1		8.4	7.2	12.7	19.6	6	0	45.5	0	0	3.6	2.5	16.9	0	23.1	0	19.3	3	0.7	23	0.2	99.8										

O'cast by: CDB For: Zhou

NW 23RD AVE/VAUGHN ST/I405 NB EX



O'cast by: CDB For: Zhou

NW 23RD AVE/VAUGHN ST/I405 NB EX

NW 23RD AVE Southbound					I-405 NB EX Southwestbound					NW VAUGHN ST Westbound			NW 23RD AVE Northbound					NW VAUGHN ST Eastbound						
Start Time	Left	Thru	Right	App. Total	U-Turn	Left	Thru	Right	Peds	App. Total	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total	
Peak Hour Analysis From 10:00 to 11:45 - Peak 1 of 1																								
Peak Hour for Entire Intersection Begins at 11:00																								
11:00	24	15	10	49	44	88	116	31	0	279	0	0	23	14	102	0	139	0	135	21	3	159	626	
11:15	26	19	2	47	39	51	126	47	0	263	0	0	22	17	111	0	150	0	131	17	5	153	613	
11:30	32	14	6	52	39	71	120	38	0	268	0	0	31	12	93	0	136	1	115	28	14	158	614	
11:45	38	11	7	56	44	96	114	38	0	292	0	0	25	20	114	0	159	0	113	17	0	130	637	
Total Volume	120	59	25	204	166	306	476	154	0	1102	0	0	101	63	420	0	584	1	494	83	22	600	2490	
% App. Total	58.8	28.9	12.3		15.1	27.8	43.2	14	0		0	0	17.3	10.8	71.9	0		0.2	82.3	13.8	3.7			
PHF	.789	.776	.625	.911	.943	.797	.944	.819	.000	.943	.000	.000	.815	.788	.921	.000	.918	.250	.915	.741	.393		.943	.977

Appendix C: 24-hour Counts for NW Nicolai St at NW Wardway St

Traffic Volume Report

LOCATION

Location: NW WARDWAY ST E of 29TH AVE / NICOLAI ST

Bound: N **Channels:** 1

Date: From 4/12/2010 10:45:00 AM (MON) to 4/14/2010 12:30:00 PM (WED)

CountID: 10041221.VL1

NOTES

Excpt Type: Obstruction

Conditions:

Comment: **NW 29TH AVE CLOSED N/NICOLAI

Count Loc: NW WARD WAY S/NW NICOLAI ST

SUMMARY DATA

	AM	PM	Daily
Total Volume:	1520	2125	3645
Peak Hour Volume:	269	302	302
Peak Hour Start:	6:45	16:15	16:15
Peak Hour Factor:	0.862	0.878	

INTERVAL DATA

Hour	Min: 00-15	Min: 16-30	Min: 31-45	Min: 46-60	Total
0	4	8	5	4	21
1	2	1	6	4	13
2	5	5	7	3	20
3	4	6	2	3	15
4	6	4	10	15	35
5	16	20	27	38	101
6	40	40	51	68	199
7	55	68	78	65	266
8	52	50	62	56	220
9	54	56	55	38	203
10	55	50	48	52	205
11	45	59	58	60	222
12	58	67	73	69	267
13	84	59	68	61	272
14	67	61	64	60	252
15	61	72	80	64	277
16	68	66	66	86	286
17	84	66	64	59	273
18	46	46	38	40	170
19	41	24	16	26	107
20	19	14	17	23	73
21	16	14	14	18	62
22	15	11	15	12	53
23	10	8	8	7	33

Traffic Volume Report

LOCATION

Location: NW NICOLAI ST W of 29TH AVE / WARDWAY ST

Bound: E

Channels: 1

Date: From 4/12/2010 10:30:00 AM (MON) to 4/14/2010 12:30:00 PM (WED)

CountID: 10041222.VL1

NOTES

Excpt Type: Obstruction

Conditions:

Comment: **NW 29TH AVE CLOSED N/NICOLAI

Count Loc: NW NICOLAI ST W/NW WARD WAY

SUMMARY DATA

	AM	PM	Daily
Total Volume:	2745	3105	5850
Peak Hour Volume:	582	526	582
Peak Hour Start:	7:30	16:0	7:30
Peak Hour Factor:	0.887	0.854	

INTERVAL DATA

Hour	Min: 00-15	Min: 16-30	Min: 31-45	Min: 46-60	Total
0	9	9	11	10	39
1	9	5	6	7	27
2	7	6	13	10	36
3	9	23	5	9	46
4	11	12	14	16	53
5	19	32	43	47	141
6	39	58	74	108	279
7	84	109	164	152	509
8	122	144	118	101	485
9	107	83	87	94	371
10	86	67	100	79	332
11	96	102	120	109	427
12	119	98	108	123	448
13	101	107	97	111	416
14	111	85	97	87	380
15	98	99	125	89	411
16	147	120	154	105	526
17	147	96	79	67	389
18	57	54	45	45	201
19	33	38	30	17	118
20	21	25	20	15	81
21	20	8	12	12	52
22	15	14	10	12	51
23	7	11	4	10	32

Traffic Volume Report

LOCATION

Location: NW NICOLAI ST E of 29TH AVE / WARDWAY ST

Bound: W

Channels: 1

Date: From 4/12/2010 10:30:00 AM (MON) to 4/14/2010 12:15:00 PM (WED)

CountID: 10041227.VL1

NOTES

Excpt Type: Obstruction

Conditions:

Comment: **NW 29TH AVE CLOSED N/NICOLAI

Count Loc: NW NICOLAI ST E/NW WARD WAY

SUMMARY DATA

	AM	PM	Daily
Total Volume:	1506	1316	2822
Peak Hour Volume:	273	231	273
Peak Hour Start:	7:0	12:45	7:0
Peak Hour Factor:	0.822	0.902	

INTERVAL DATA

Hour	Min: 00-15	Min: 16-30	Min: 31-45	Min: 46-60	Total
0	7	7	3	8	25
1	6	7	12	3	28
2	9	6	4	4	23
3	10	1	7	7	25
4	5	14	12	12	43
5	10	15	21	36	82
6	33	35	60	67	195
7	56	83	56	78	273
8	53	62	54	47	216
9	50	53	52	54	209
10	44	51	47	50	192
11	56	41	57	41	195
12	67	52	41	62	222
13	43	62	64	51	220
14	50	49	52	47	198
15	40	36	54	40	170
16	45	32	38	32	147
17	52	37	34	21	144
18	19	17	9	11	56
19	8	8	11	6	33
20	5	7	12	10	34
21	10	9	9	7	35
22	8	8	8	8	32
23	9	4	7	5	25