KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING
610 SW Alder Street, Suite 700, Portland, OR 97205 P 503.228.5230 F 503.273.8169

TECHNICAL MEMORANDUM

Date:	November 4, 2016	Project #: 19890.2
To:	Jim Whynot and Jacque Betz, City of Gladstone Gail Curtis, Oregon Department of Transportation, Region 1	
From:	Matthew Bell and Molly McCormick, Kittelson & Associates, Inc.	
Project:	Gladstone Transportation System Plan (TSP) Update	
Subject:	Final Tech Memo 4: TSP Methodology and Assumptions (Subtask 2.7)	

This memorandum documents the methodology and assumptions associated with the existing and future transportation system operations analyses for the Gladstone Transportation System Plan (TSP) Update. The methodology and assumptions included in this memorandum are based on guidance provided in the Oregon Department of Transportation (ODOT) Transportation System Plan Guidelines (Reference 1), the ODOT Analysis Procedures Manual (APM – Reference 2), and direction provided by City and ODOT staff. The analyses described in this memorandum will help identify potential deficiencies in the transportation system, including:

- Traffic operations at the study intersection under existing and future traffic conditions,
- Traffic safety at the study intersections and along study area roadways,
- Gaps and deficiencies in the bicycle and pedestrian network,
- Gaps and deficiencies in the transit service (service frequency, hours, coverage, etc.), and
- Gaps and deficiencies in other travel modes.

This information will serve as a baseline for identifying a comprehensive list needs and deficiencies to be addressed as part of the TSP update. It will also serve as a baseline for identifying and evaluating potential solutions and developing a prioritized list of improvements for the TSP update.

STUDY INTERSECTIONS

The study intersections for the Gladstone TSP Update were determined by the City and ODOT prior to the development of the scope of the work. There are a total of eight study intersections located along City and ODOT facilities, including six signalized and two unsignalized intersections. Figure 1 illustrates the location of the study intersections. The following provides information related to the traffic counts conducted at the study intersections and how they will be used to develop existing and future traffic volumes. The eight study intersections include:

- OR 99E/S Arlington Street
- OR 99E/W Gloucester Street
- OR 99E/Glen Echo Avenue
- Oatfield Road/SE 82nd Drive
- Oatfield Road/Ridgegate Drive-Collins Crest Street
- Oatfield Road/Glen Echo Avenue
- I-205 Southbound Ramp Terminal/ SE 82nd Drive
- I-205 Northbound Ramp Terminal/SE 82nd Drive

Additional consideration will be given to traffic operations and safety at the Oatfield Road/Webster Road and Oatfield Road/Gloucester Street intersections. Per discussion with the project team and advisory committees, several of the study intersections have operational and/or safety issues today.

Traffic Counts

Manual turning movement counts were conducted at the study intersections in June 2016. The counts were conducted on a typical mid-week day during the evening (4:00 to 6:00 p.m.) peak period. The counts include the total number of pedestrians, bicyclists, and motor vehicles that entered the study intersections in 5-minute intervals. *The traffic count worksheets are provided in Attachment A.*

Peak Hour Development

The traffic counts were reviewed to determine individual and system-wide peak hours for the operational analyses. The system-wide peak hour for the study intersections was identified as 4:30 to 5:30 p.m. Although a system-wide peak hour was identified, individual intersection peak hours will be used to complete the operational analyses because the system-wide peak hour is not consistent with the individual peak hours. Table 1 summarizes the study intersections, the individual intersection peak hours, and the percent difference in peak hour total entering volume (TEV) between the individual intersection and system-wide peak hours.

Table 1: Study Intersection Peak Hours

Map ID	Intersection	Intersection Peak Hour	Total Entering Volume (TEV)	% Difference from System Peak Hour
1	OR 99E/S Arlington Street	4:35 to 5:35 p.m.	3,764	-0.6
2	OR 99E/W Gloucester Street	4:55 to 5:55 p.m.	3,256	-2.2
3	OR 99E/Glen Echo Avenue	4:55 to 5:55 p.m.	3,301	-0.3
4	Oatfield Road/SE 82nd Drive	4:10 to 5:10 p.m.	2,238	-0.2
5	Oatfield Road/Ridgegate Drive-Collins Crest Street	4:05 to 5:05 p.m.	990	-3.0
6	Oatfield Road/Glen Echo Avenue	4:00 to 5:00 p.m.	984	-0.6
7	I-205 Southbound Ramp Terminal/SE 82nd Drive	4:00 to 5:00 p.m.	2,546	-2.7
8	I-205 Northbound Ramp Terminal/SE 82nd Drive	4:30 to 5:30 p.m.	2,308	0.0

Study Intersections Gladstone, Oregon

Figure 1

H:\projfile\19890 - Gladstone TSP Update\gis\TM11_Study Intersections.mxd - mbell - 3:11 PM 9/23/2016

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Oregon Department of Transportation, Portland Metro Data Resource Center

Seasonal Factors

30th Hour Volumes (30 HV) for the Gladstone TSP Update will be developed based on the traffic counts collected at the study intersections and the application of seasonal adjustment factors consistent with the methodology identified in the APM. The APM identifies three methods for identifying seasonal adjustment factors for highway traffic volumes. All three methods utilize information provided by Automatic Traffic Recorders (ATRs) located in select locations throughout the State Highway System that collect traffic data 24-hours a day, 365 days a year. Each method was evaluated to determine the most appropriate method for the study intersections. Based on the evaluations, the Seasonal Trend Table method will be used to develop 30 HV volumes at the ODOT study intersections. The results of the evaluation are summarized below.

Seasonal Trend Table Method

The Seasonal Trend Table Method uses average values from the ATR Characteristic Table for each seasonal traffic trend. Based on a review of the regional and local traffic trends, a combination of the Interstate Urbanized and Commuter seasonal traffic trend values were used to determine the seasonal adjustment factors for the study intersections. Table 2 summarizes the average values for the seasonal traffic trends during the count month of June and the peak period as provided in the ODOT Seasonal Trend Table.

Table 2: Seasonal Trend Table

Trend	1-June	15-June	Peak Period Seasonal Factor	Seasonal Adjustment Factor
Interstate Urbanized	0.9381	0.9195	0.9164	1.0129
Commuter	0.9495	0.9586	0.9149	1.0432

The seasonal adjustment factor shown in Table 2 for Interstate Urbanized facilities (1.0129) will be used to derive 30 HV volumes at the Interstate 205 (I-205) Ramp Terminals, while the seasonal adjustment factor for Commuter facilities will be used to derive 30 HV at all other ODOT study intersections.

Historical Factors

All of the traffic counts were conducted in 2016; therefore, no historical factors are needed to adjust traffic volumes.

Forecast Traffic Volumes

Forecast traffic volumes for the Gladstone TSP Update will be developed for the study intersections based on the methodology identified in the National Cooperative Highway Research Program (NCHRP) Report 255 *Highway Traffic Data for Urbanized Area Project Planning and Design*. The methodology combines the year 2016 30 HV traffic volumes developed at the study intersections with base year 2010 and future year 2040 traffic volume forecasts from the current Metro travel demand model developed for the adopted 2014 Regional Transportation Plan (RTP).

Intersection Operational Standards

City Facilities

The City of Gladstone uses Level of Service (LOS) to assess intersection operations. The City's current TSP sets a maximum LOS standard of E for all signalized and unsignalized intersections. Table 3 summarizes the LOS standards that will be used to identify existing and potential future operational issues at the City study intersections.

Table 3: City Mobility Standards

Map ID	Intersection	Traffic Control	Mobility Standard
5	Oatfield Road/Ridgegate Drive-Collins Crest Street	TWSC	LOS E
6	Oatfield Road/Glen Echo Avenue	TWSC	LOS E

TWSC: Two-way Stop Control

ODOT Facilities

ODOT uses volume-to-capacity (V/C) ratio to assess intersections operations. Table 7 of the *Oregon Highway Plan* (OHP - Reference 3) and Table 10-2 of the *Oregon Highway Design Manual* (HDM – Reference 4) provide maximum volume-to-capacity ratios for all signalized and unsignalized intersections within the Portland metropolitan area Urban Growth Boundary (UGB). The OHP ratios are used to evaluate existing and future no-build conditions, while the HDM ratios are used in the creation of future TSP alternatives which involve projects along state highways. The ODOT controlled intersections within the study area are located along OR 99E, at the I-205 ramp terminals, and along SE 82nd Drive. Table 4 summarizes the v/c ratios that will be used to identify existing and potential future operational issues at the ODOT study intersections.

Table 4: ODOT Mobility Standards

Map ID	Intersection	Traffic Control	OHP Mobility Targets		HDM Standard
			1st Hour	2nd Hour	
1	OR 99E/S Arlington Street	Signal	1.1	0.99	0.85
2	OR 99E/W Gloucester Street	Signal	1.1	0.99	0.85
3	OR 99E/Glen Echo Avenue	Signal	1.1	0.99	0.85
4	Oatfield Road/SE 82nd Drive	Signal	0.99	0.99	0.85
7	I-205 Southbound Ramp Terminal /SE 82nd Drive	Signal	0.85*		0.75
8	I-205 Northbound Ramp Terminal /SE 82nd Drive	Signal	0.85*		0.75

* This v/c ratio may be increased to 0.90 if it can be determined that vehicles queues will not extend onto the mainline or into the portion of the ramp needed to safely accommodate deceleration; and if an adopted Interchange Area Management Plan (IAMP) is present or can be developed.

Traffic operations at the study intersection will be evaluated based the mobility standards shown in Tables 3 and 4. Potential solutions will be identified and evaluated for the study intersections that are found to exceed the mobility standards under existing and/or future traffic conditions.

ANALYSIS MODEL PARAMETERS

The bullets below identify the specific sources of data and methodologies proposed to conduct the operational analyses. Analyses of all state facilities will be conducted according to the APM, unless otherwise agreed upon by the City and ODOT.

1. *Intersection/Roadway Geometry* (lane numbers and arrangements, cross-section elements, signal phasing, etc.) will be collected through aerial photography and confirmed through a site visit. Available as-built data may also be used to verify existing roadway geometry. The analysis models will be built on scaled roadway line work from GIS or aerial photography.
2. *Operational Data* (such as posted speeds, intersection control, parking, transit stops, rail crossings, right-turn on red, etc.) will be collected through a site visit. Data will be reviewed and supplemented by available GIS data, traffic count DVDs, aerials, and photos.
3. *Peak Hour Factors* (PHF) will be calculated for each intersection and applied to the existing conditions analyses. PHFs of 0.95 will be used for the year 2040 analysis for high-order facilities (arterials), with 0.90 applied to medium-order facilities (collectors) and 0.85 applied to local roads. If the existing PHF is greater than these default future values, the existing PHF will be applied.
4. *Traffic Volume* development is described above.
5. *Signal Timing Data* will be requested from ODOT for use in the existing conditions analysis. Signal parameters such as Flash Don't Walk, Walk, and Minimum Times will be retained in the forecast analysis with the signal splits optimized to better serve the future traffic volume patterns. Optimized signal cycle lengths may range between 60 and 120 seconds.
6. Traffic Operations
    a. The 2000 Highway Capacity Manual (HCM 2000) methodology will be used to analyze traffic operations at the signalized intersections while the HCM 2010 methodology will be used to analyze traffic operations at the unsignalized intersections.
    b. The existing and future no-build traffic operations analyses will use Synchro 9 software using HCM 2000 reports for signalized intersections and HCM 2010 reports for unsignalized intersections.
    c. Queuing analysis methodology will be based on Synchro 95th percentile queue lengths. Microsimulation is not proposed as part of this long-range planning effort.

TRAFFIC ANALYSIS SOFTWARE AND INPUT ASSUMPTIONS

Synchro 9 software will be used for the intersection analysis. The reported results will be the level of service, intersection delay, and v/c ratios generated by the HCM report. Analysis assumptions are listed in Table 5.

Table 5: Synchro Operations Parameters/Assumptions

Arterial Intersection Parameters	Existing Conditions
Peak Hour Factor	From traffic counts
Conflicting Bikes and Pedestrian per Hour	From traffic counts, as available
Area Type	Other
Ideal Saturation Flow Rate (for all movements)	1,750 passenger cars per hour green per lane
Lane Width	12 feet unless field observations suggest otherwise
Percent Heavy Vehicles	From traffic counts by movement, as available
Percent Grade	Estimated based on field observations
Parking Maneuvers per Hour	Estimated based on field observations
Bus Blockages	Estimated based on frequency of service
Intersection signal phasing and coordination	From ODOT/County/City
Intersection signal timing optimization limits	Maximum cycle length = 120 seconds
Minimum Green time	From timing plans
Yellow and all-red time	From timing plans
95^{th} percentile vehicle queues	Synchro HCM summary output

MULTI-MODAL ANALYSIS

The multimodal analysis will be performed in accordance with the methodologies identified in Chapter 14 of the APM and identify the needs associated with public transportation, pedestrian, and bicycle facilities and services. The pedestrian and bicycle analyses will be supplemented by a Pedestrian Level of Traffic Stress (PLTS) analysis and a Bicycle Level of Traffic Street (BLTS) analysis, consistent with the APM. All analysis results will be presented both in a tabular format and as part of a GIS map. Both PLTS and BLTS methods group facilities into four different stress levels for segments, intersection approaches and intersection crossings. Facilities with an LTS 1 rating have little to no traffic stress, require less attention, and are suitable for all users. Facilities with an LTS 2 rating have little traffic stress, but require more attention and therefore, may or may not be suitable for small children. Facilities with an LTS 3 rating have moderate traffic stress and are suitable for adults. Facilities with an LTS 4 rating have high traffic stress and are only suitable for able-bodied adults with limited options.

CRASH ANALYSIS

The five most recent years of crash data will be reviewed at the study intersections and along the City's roadway segments consistent with the methodologies outlined in the APM. The data will be analyzed for number, type, severity, and location to identify potential crash patterns and million entering vehicle (MEV) crash rates. Intersection crash rates will be compared to the published 90^{th} percentile crash rates in Exhibit 4.1 of the APM and segment crash rates will be compared to Table II in the current ODOT Crash Rate Tables. In addition, ODOT's top 10% ODOT Safety Priority System sites will be reviewed, as appropriate. Any identified potential countermeasures (and any resulting crash percentage reduction) will be taken from the All Roads Transportation Safety (ARTS) Crash Reduction Factors (CRF) listing or the CRF Appendix.

2014 REGIONAL TRANSPORTATION PLAN PERFORMANCE MEASURES

Metro's Regional Transportation Plan (RTP) establishes performance targets for safety, congestion, freight reliability, climate change, active transportation, sidewalk/trail/transit infrastructure, clean air, travel, affordability, and access to daily needs. These performance targets were used to inform the project goals and objectives as well as project evaluation criteria identified in Tech Memo 2. The TSP update will address each of these performance targets and identify how the City will help the region move closer to meeting the targets on a local and regional level.

REFERENCES

1. Oregon Department of Transportation. *Transportation System Plan Guidelines*, 2008.
2. Oregon Department of Transportation. *Analysis Procedures Manual*, 2012.
3. Oregon Department of Transportation. *Oregon Highway Plan*, 2012.
4. Oregon Department of Transportation. *Highway Design Manual*, 2012.
5. Transportation Research Board, Nation Research Council. *TCRP Report 100: Transit Capacity and Quality of Service Manual*, 2003.

ATTACHMENTS

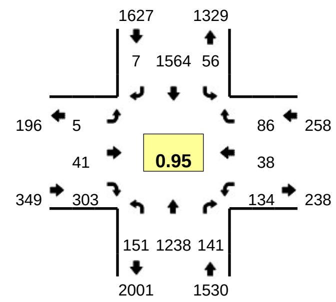
A. Traffic Counts

Attachment A Traffic Counts

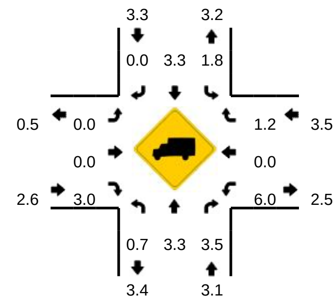
Type of peak hour being reported: Intersection Peak — Method for determining peak hour: Total Entering Volume

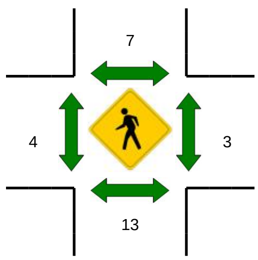
LOCATION: OR-99E -- W Arlington St — **QC JOB #:** 13837102

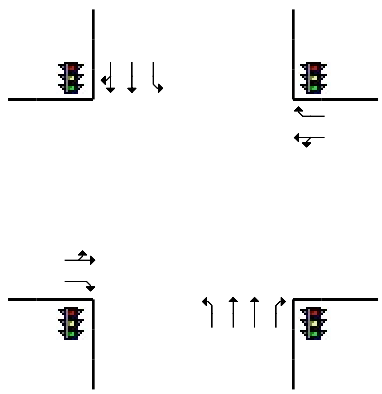
CITY/STATE: Gladstone, OR — **DATE:** Wed, Jun 08 2016

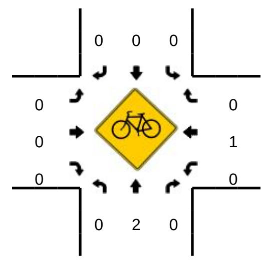


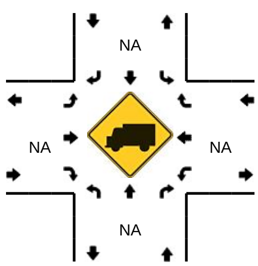
Peak-Hour: 4:35 PM -- 5:35 PM
Peak 15-Min: 5:05 PM -- 5:20 PM

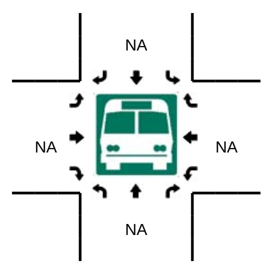












5-Min Count Period Beginning At	OR-99E (Northbound) Left	Thru	Right	U	OR-99E (Southbound) Left	Thru	Right	U	W Arlington St (Eastbound) Left	Thru	Right	U	W Arlington St (Westbound) Left	Thru	Right	U	Total	Hourly Totals
4:00 PM	8	95	13	0	5	129	0	0	0	1	22	0	13	2	4	0	292	
4:05 PM	6	104	6	0	3	134	2	0	0	0	22	0	13	4	6	0	300	
4:10 PM	13	67	12	0	4	127	1	0	0	3	16	0	13	7	4	0	267	
4:15 PM	9	89	10	0	8	131	1	0	0	4	27	0	13	4	11	0	307	
4:20 PM	17	107	9	0	2	101	0	0	2	3	17	0	9	2	4	0	273	
4:25 PM	15	95	8	0	3	117	0	0	2	4	23	0	16	3	8	0	294	
4:30 PM	13	94	8	0	4	101	0	0	0	4	27	0	12	4	14	0	281	
4:35 PM	11	104	18	0	4	140	1	0	0	3	30	0	8	2	3	0	324	
4:40 PM	16	80	9	0	6	121	0	0	1	1	23	0	14	5	9	0	285	
4:45 PM	14	98	15	0	5	126	0	0	1	0	25	0	13	5	5	0	307	
4:50 PM	15	95	10	0	4	119	0	0	1	5	37	0	12	3	11	0	312	
4:55 PM	12	108	11	0	1	153	1	0	0	2	19	0	8	3	5	0	323	3565
5:00 PM	13	100	12	0	6	110	1	0	0	6	34	0	2	1	10	0	295	3568
5:05 PM	8	119	9	0	6	140	0	0	0	5	23	0	12	1	11	0	334	3602
5:10 PM	17	99	14	0	3	128	1	0	0	4	29	0	17	7	11	0	330	3665
5:15 PM	7	115	12	0	5	155	0	0	0	5	13	0	11	2	3	0	328	3686
5:20 PM	12	98	9	0	7	117	1	0	1	4	30	0	15	0	7	0	301	3714
5:25 PM	10	107	14	0	5	137	2	0	1	4	20	0	14	5	1	0	320	3740
5:30 PM	16	115	8	0	4	118	0	0	0	2	20	0	8	4	10	0	305	3764
5:35 PM	7	95	10	0	3	121	0	0	1	2	23	0	13	6	3	0	284	3724
5:40 PM	17	113	9	0	9	102	1	0	1	3	34	0	10	4	6	0	309	3748
5:45 PM	10	101	13	0	5	127	0	0	0	3	11	0	6	7	4	0	287	3728
5:50 PM	16	117	10	0	4	131	0	0	1	4	27	0	6	1	10	0	327	3743
5:55 PM	10	99	8	0	4	110	1	0	0	3	19	0	15	5	7	0	281	3701

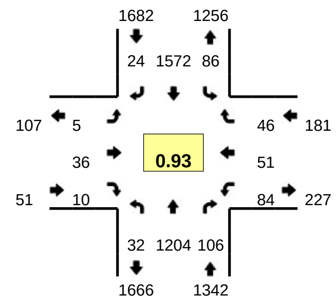
Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	128	1332	140	0	56	1692	4	0	0	56	260	0	160	40	100	0	3968
Heavy Trucks	0	32	12		0	44	0		0	0	8		4	0	0		100
Pedestrians		4				0				8				8			20
Bicycles	0	1	0		0	0	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

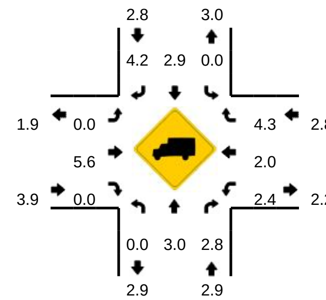
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

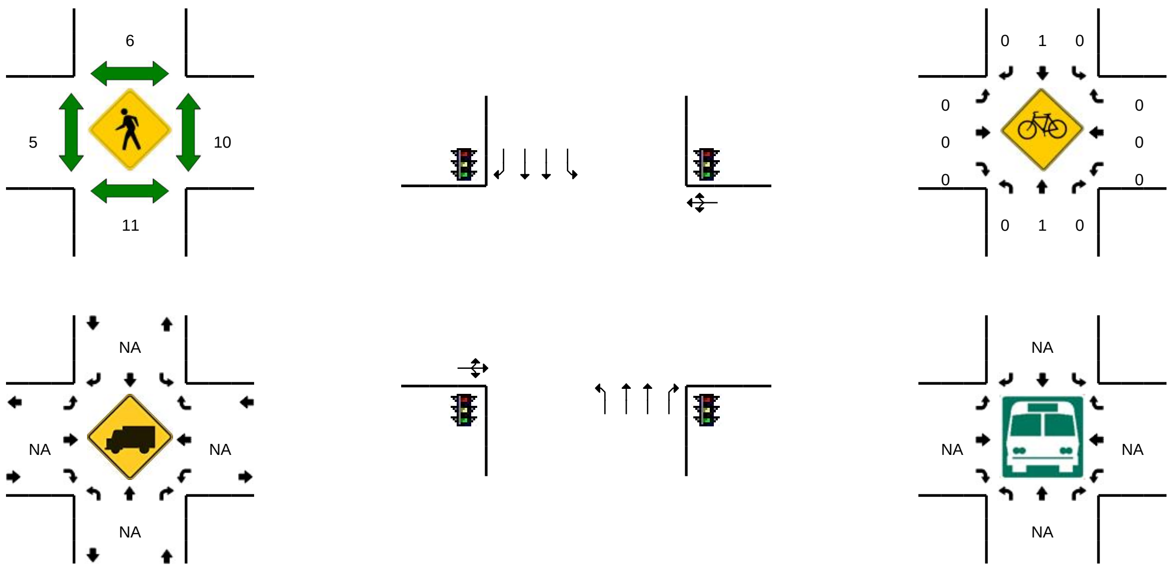
LOCATION: OR-99E -- W Gloucester St | **QC JOB #:** 13837104

CITY/STATE: Gladstone, OR | **DATE:** Wed, Jun 08 2016



Peak-Hour: 4:55 PM -- 5:55 PM
Peak 15-Min: 5:05 PM -- 5:20 PM





5-Min Count Period Beginning At	OR-99E (Northbound) Left	Thru	Right	U	OR-99E (Southbound) Left	Thru	Right	U	W Gloucester St (Eastbound) Left	Thru	Right	U	W Gloucester St (Westbound) Left	Thru	Right	U	Total	Hourly Totals
4:00 PM	1	110	9	0	9	109	4	0	1	1	0	0	7	4	3	0	258	
4:05 PM	4	85	7	0	4	154	0	0	1	2	2	0	4	2	2	0	267	
4:10 PM	3	75	8	0	7	138	4	0	1	4	3	0	7	8	4	0	262	
4:15 PM	2	78	8	0	10	129	2	0	1	3	3	0	6	4	4	0	250	
4:20 PM	2	95	9	0	2	86	0	0	0	3	3	0	9	10	5	0	224	
4:25 PM	2	88	9	0	4	120	5	0	3	2	1	0	5	3	7	0	249	
4:30 PM	0	108	5	0	2	110	2	0	2	3	0	0	6	2	3	0	243	
4:35 PM	3	77	3	0	7	143	0	0	0	3	4	0	8	1	7	0	256	
4:40 PM	2	99	5	0	6	107	3	0	3	3	1	0	5	5	4	0	243	
4:45 PM	1	94	2	0	5	151	1	0	1	3	2	0	6	2	2	0	270	
4:50 PM	1	98	1	0	7	100	3	0	2	4	1	0	6	4	4	0	231	
4:55 PM	5	87	7	0	6	159	4	0	1	2	0	0	5	2	3	0	281	3034
5:00 PM	2	84	6	0	6	118	3	0	1	1	1	0	10	5	7	0	244	3020
5:05 PM	2	124	7	0	6	149	3	0	0	1	0	0	6	4	6	0	308	3061
5:10 PM	3	116	10	0	9	132	2	0	0	10	3	0	6	1	2	0	294	3093
5:15 PM	1	78	10	0	15	151	2	0	0	1	0	0	6	4	2	0	270	3113
5:20 PM	3	117	10	0	4	132	2	0	1	2	1	0	17	7	2	0	298	3187
5:25 PM	1	88	9	0	9	126	2	1	1	3	1	0	3	1	2	0	247	3185
5:30 PM	6	108	9	0	7	109	1	0	0	4	0	0	4	6	1	0	255	3197
5:35 PM	4	81	12	0	6	133	1	0	0	5	0	0	4	5	7	0	258	3199
5:40 PM	3	116	10	0	6	111	3	0	0	1	0	0	7	7	6	0	270	3226
5:45 PM	2	91	8	0	5	123	1	0	1	4	1	0	6	4	4	0	250	3206
5:50 PM	0	114	8	0	6	129	0	0	0	2	3	0	10	5	4	0	281	3256
5:55 PM	2	91	8	0	7	108	1	0	1	8	0	0	1	5	4	0	236	3211

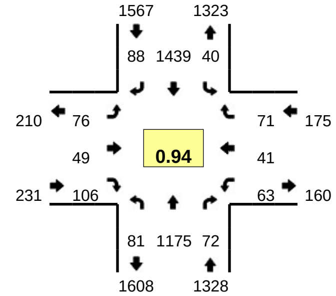
Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	24	1272	108	0	120	1728	28	0	0	48	12	0	72	36	40	0	3488
Heavy Trucks	0	32	8		0	44	4		0	0	0		0	0	0		88
Pedestrians		16				4				8				12			40
Bicycles	0	1	0		0	0	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

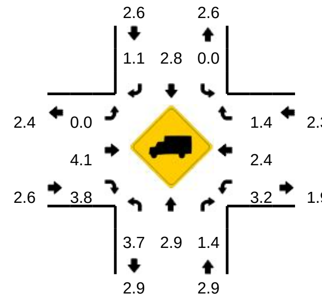
Report generated on 8/15/2016 1:52 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

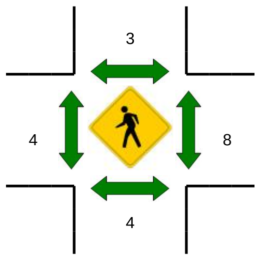
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

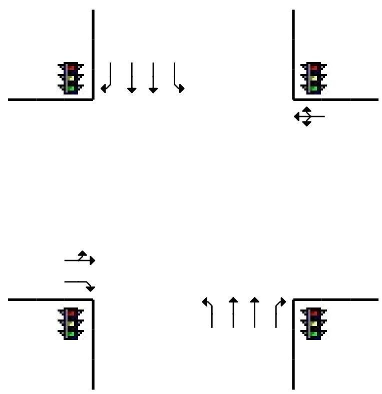
LOCATION: OR-99E -- Glen Echo Ave | **QC JOB #:** 13837106
CITY/STATE: Gladstone, OR | **DATE:** Wed, Jun 08 2016

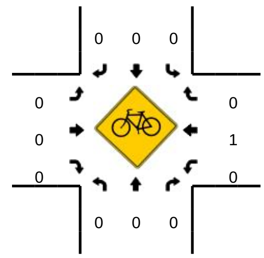


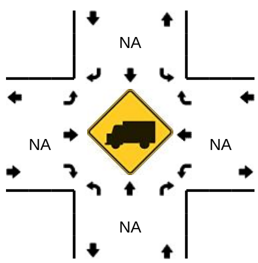
Peak-Hour: 4:55 PM -- 5:55 PM
Peak 15-Min: 5:10 PM -- 5:25 PM

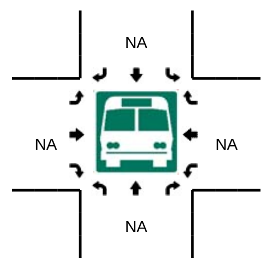












5-Min Count Period Beginning At	OR-99E (Northbound) Left	Thru	Right	U	OR-99E (Southbound) Left	Thru	Right	U	Glen Echo Ave (Eastbound) Left	Thru	Right	U	Glen Echo Ave (Westbound) Left	Thru	Right	U	Total	Hourly Totals
4:00 PM	6	95	5	0	7	125	8	0	7	0	7	0	7	4	4	0	275	
4:05 PM	6	91	4	0	0	119	7	0	6	4	14	0	1	7	7	0	266	
4:10 PM	4	76	2	0	5	138	8	0	1	5	10	0	11	3	4	0	267	
4:15 PM	5	91	6	0	2	106	6	0	7	2	14	0	2	8	2	0	251	
4:20 PM	11	85	1	0	2	98	8	0	4	5	2	0	2	3	3	0	224	
4:25 PM	8	103	5	0	2	96	6	0	3	6	9	0	0	3	10	0	251	
4:30 PM	5	91	5	0	3	124	11	0	8	1	5	0	4	2	8	0	267	
4:35 PM	9	94	4	0	0	108	7	0	2	3	13	0	5	6	4	0	255	
4:40 PM	3	82	5	0	3	132	5	0	7	2	7	0	7	1	9	0	263	
4:45 PM	4	105	10	0	2	117	6	0	5	4	9	0	7	2	7	0	278	
4:50 PM	8	79	3	0	2	131	7	0	7	4	1	0	5	4	10	0	261	
4:55 PM	10	98	4	0	4	128	8	0	4	7	16	0	2	2	10	0	293	3151
5:00 PM	1	95	6	0	5	118	7	0	5	2	13	0	6	10	5	0	273	3149
5:05 PM	8	115	8	0	1	113	6	0	6	3	7	0	5	3	8	0	283	3166
5:10 PM	5	109	5	0	3	140	7	1	5	6	10	0	4	2	5	0	302	3201
5:15 PM	5	82	6	0	0	124	9	0	7	3	5	0	7	4	5	0	257	3207
5:20 PM	5	95	8	0	3	160	10	0	10	7	7	0	3	3	4	0	315	3298
5:25 PM	11	87	5	0	3	94	6	0	7	3	8	0	9	4	6	0	243	3290
5:30 PM	7	100	3	0	3	112	7	0	4	4	4	0	4	0	6	0	254	3277
5:35 PM	7	95	4	0	4	108	8	0	4	1	7	0	4	4	7	0	253	3275
5:40 PM	7	82	10	0	5	124	11	0	6	6	9	0	7	2	3	0	272	3284
5:45 PM	7	121	5	0	2	93	5	0	7	5	8	0	8	5	6	0	272	3278
5:50 PM	8	96	8	0	6	125	4	0	11	2	12	0	4	2	6	0	284	3301
5:55 PM	5	97	8	0	1	89	7	0	9	2	3	0	5	3	11	0	240	3248

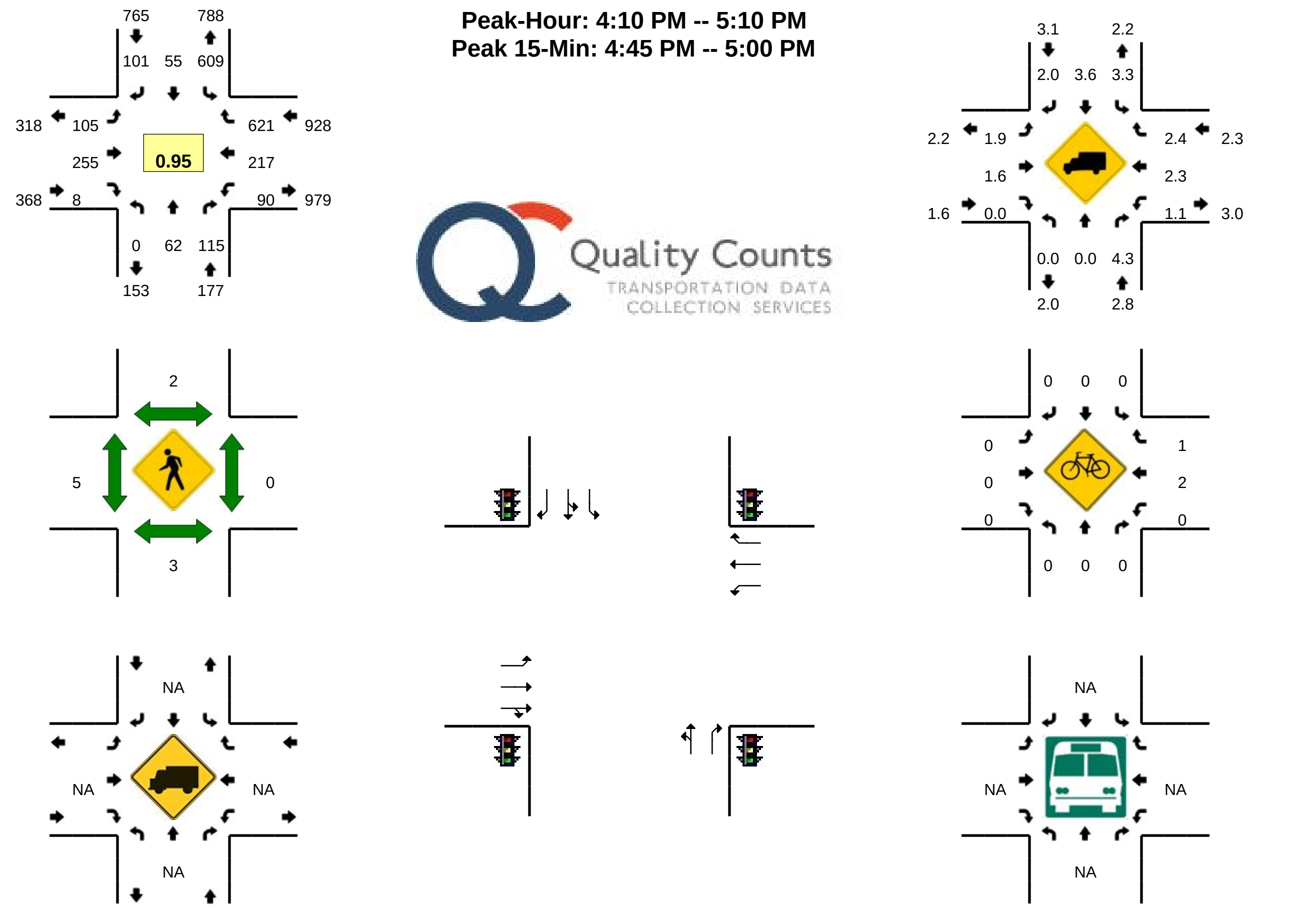
Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	60	1144	76	0	24	1696	104	4	88	64	88	0	56	36	56	0	3496
Heavy Trucks	0	24	4		0	52	0		0	0	0		0	4	0		84
Pedestrians		4				0				12				8			24
Bicycles	0	0	0		0	0	0		0	0	0		0	1	0		1
Railroad																	
Stopped Buses																	

Comments:

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

LOCATION: Oatfield Rd -- 82nd Dr | **QC JOB #:** 13837110
CITY/STATE: Gladstone, OR | **DATE:** Wed, Jun 08 2016

Peak-Hour: 4:10 PM -- 5:10 PM
Peak 15-Min: 4:45 PM -- 5:00 PM



5-Min Count Period Beginning At	Oatfield Rd (Northbound) Left	Thru	Right	U	Oatfield Rd (Southbound) Left	Thru	Right	U	82nd Dr (Eastbound) Left	Thru	Right	U	82nd Dr (Westbound) Left	Thru	Right	U	Total	Hourly Totals
4:00 PM	0	4	18	0	54	6	7	0	9	14	0	0	9	19	40	0	180	
4:05 PM	1	4	8	0	34	3	6	0	6	21	0	0	10	18	57	0	168	
4:10 PM	0	6	8	0	67	2	7	0	15	17	1	0	4	17	39	0	183	
4:15 PM	0	3	6	0	69	7	9	0	3	23	1	0	8	18	52	0	199	
4:20 PM	0	6	8	0	45	2	6	0	12	19	0	0	5	22	44	0	169	
4:25 PM	0	8	10	0	49	0	11	0	7	11	0	0	9	16	56	0	177	
4:30 PM	0	3	6	0	45	7	6	0	10	30	2	0	8	18	52	0	187	
4:35 PM	0	6	9	0	49	8	8	0	5	19	1	0	8	26	44	0	183	
4:40 PM	0	3	10	0	38	4	8	0	8	23	0	0	10	19	73	0	196	
4:45 PM	0	5	12	0	61	4	7	0	10	19	1	0	9	14	52	0	194	
4:50 PM	0	5	11	0	47	3	15	0	9	16	2	0	13	14	48	0	183	
4:55 PM	0	7	12	0	57	8	4	0	8	21	0	0	6	19	68	0	210	2229
5:00 PM	0	8	12	0	39	5	14	0	11	25	0	0	2	22	39	0	177	2226
5:05 PM	0	2	11	0	43	5	6	0	7	32	0	0	8	12	54	0	180	2238
5:10 PM	1	8	11	0	47	3	5	0	10	24	0	0	11	21	32	0	173	2228
5:15 PM	1	6	13	0	53	4	6	0	8	27	0	0	4	14	48	0	184	2213
5:20 PM	0	3	9	0	43	7	12	0	9	25	0	0	5	13	55	0	181	2225
5:25 PM	0	5	5	0	48	2	10	0	10	14	0	0	5	31	54	1	185	2233
5:30 PM	0	4	8	0	57	5	4	0	8	21	2	0	12	15	43	0	179	2225
5:35 PM	0	8	7	0	56	6	12	0	7	17	0	0	9	17	44	0	183	2225
5:40 PM	0	4	12	0	50	2	8	0	9	11	0	0	4	17	44	0	161	2190
5:45 PM	0	4	8	0	50	3	5	0	12	15	1	0	9	21	38	0	166	2162
5:50 PM	0	5	10	0	45	4	7	0	11	11	0	0	3	18	48	0	162	2141
5:55 PM	1	8	8	0	35	5	4	0	7	12	0	0	12	25	38	0	155	2086

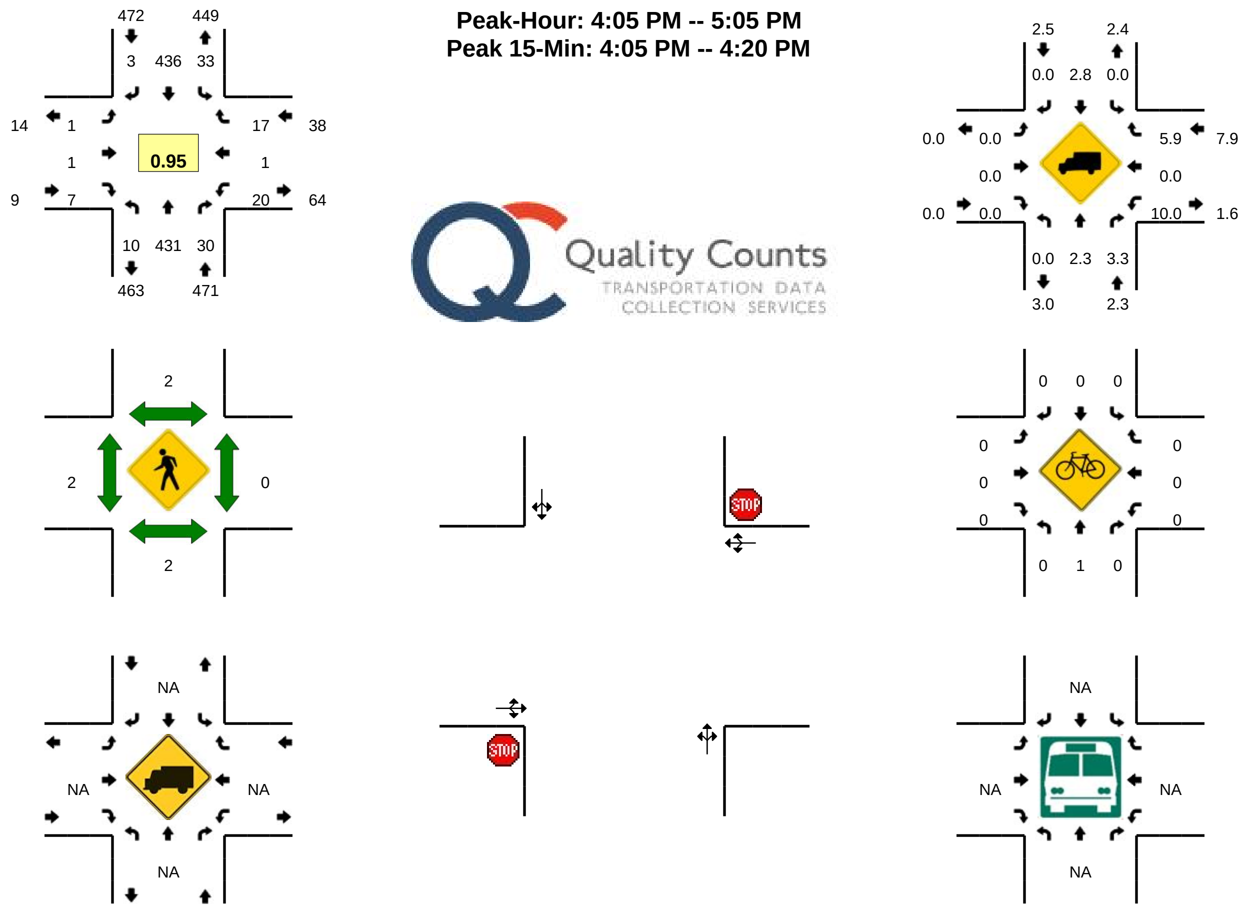
Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	0	68	140	0	660	60	104	0	108	224	12	0	112	188	672	0	2348
Heavy Trucks	0	0	4		16	0	0		4	4	0		0	4	24		56
Pedestrians		4				0				0				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Type of peak hour being reported: Intersection Peak — Method for determining peak hour: Total Entering Volume

LOCATION: Oatfield Rd -- Collins Crest St/Ridgegate Dr — **QC JOB #:** 13837112
CITY/STATE: Gladstone, OR — **DATE:** Wed, Jun 08 2016

Peak-Hour: 4:05 PM -- 5:05 PM
Peak 15-Min: 4:05 PM -- 4:20 PM



5-Min Count Period Beginning At	Oatfield Rd (Northbound) Left	Thru	Right	U	Oatfield Rd (Southbound) Left	Thru	Right	U	Collins Crest St/Ridgegate Dr (Eastbound) Left	Thru	Right	U	Collins Crest St/Ridgegate Dr (Westbound) Left	Thru	Right	U	Total	Hourly Totals
4:00 PM	0	34	1	0	1	32	1	0	0	0	0	0	0	0	2	0	71	
4:05 PM	1	42	7	0	4	45	0	0	0	0	1	0	1	0	2	0	103	
4:10 PM	0	28	4	0	1	41	0	0	1	0	0	0	3	0	0	0	78	
4:15 PM	2	34	1	0	2	38	1	0	0	0	0	0	1	0	0	0	79	
4:20 PM	1	39	2	0	1	31	1	0	0	0	0	0	0	0	2	0	77	
4:25 PM	1	39	2	0	4	40	1	0	0	0	1	0	0	0	2	0	90	
4:30 PM	0	39	1	0	5	25	0	0	0	0	0	0	2	0	2	0	74	
4:35 PM	1	28	1	0	5	33	0	0	0	0	1	0	2	1	2	0	74	
4:40 PM	1	43	3	0	4	37	0	0	0	0	1	0	5	0	1	0	95	
4:45 PM	2	35	3	0	4	38	0	0	0	0	1	0	1	0	3	0	87	
4:50 PM	1	27	2	0	0	40	0	0	0	0	0	0	0	0	2	0	72	
4:55 PM	0	39	2	0	0	37	0	0	0	1	1	0	3	0	0	0	83	983
5:00 PM	0	38	2	0	3	31	0	0	0	0	1	0	2	0	1	0	78	990
5:05 PM	2	41	1	0	4	27	0	0	0	0	0	0	1	1	2	0	79	966
5:10 PM	2	26	1	0	1	31	3	0	0	0	1	0	0	0	2	0	67	955
5:15 PM	1	40	3	0	2	40	2	0	1	1	0	0	2	0	2	0	94	970
5:20 PM	2	26	4	0	4	34	2	0	1	0	3	0	0	0	1	0	77	970
5:25 PM	0	28	0	0	4	41	1	0	1	0	1	0	4	0	1	0	81	961
5:30 PM	1	31	1	0	7	40	0	0	0	0	0	0	5	0	1	0	86	973
5:35 PM	2	28	2	0	2	20	0	0	1	0	0	0	0	0	4	0	59	958
5:40 PM	2	35	3	0	4	43	1	0	1	0	2	0	2	0	3	0	96	959
5:45 PM	0	22	2	0	3	24	2	0	0	0	3	0	3	0	1	0	60	932
5:50 PM	0	38	3	0	1	24	0	0	0	0	1	0	1	0	6	0	74	934
5:55 PM	1	33	3	0	1	35	0	0	0	0	2	0	2	0	1	0	78	929

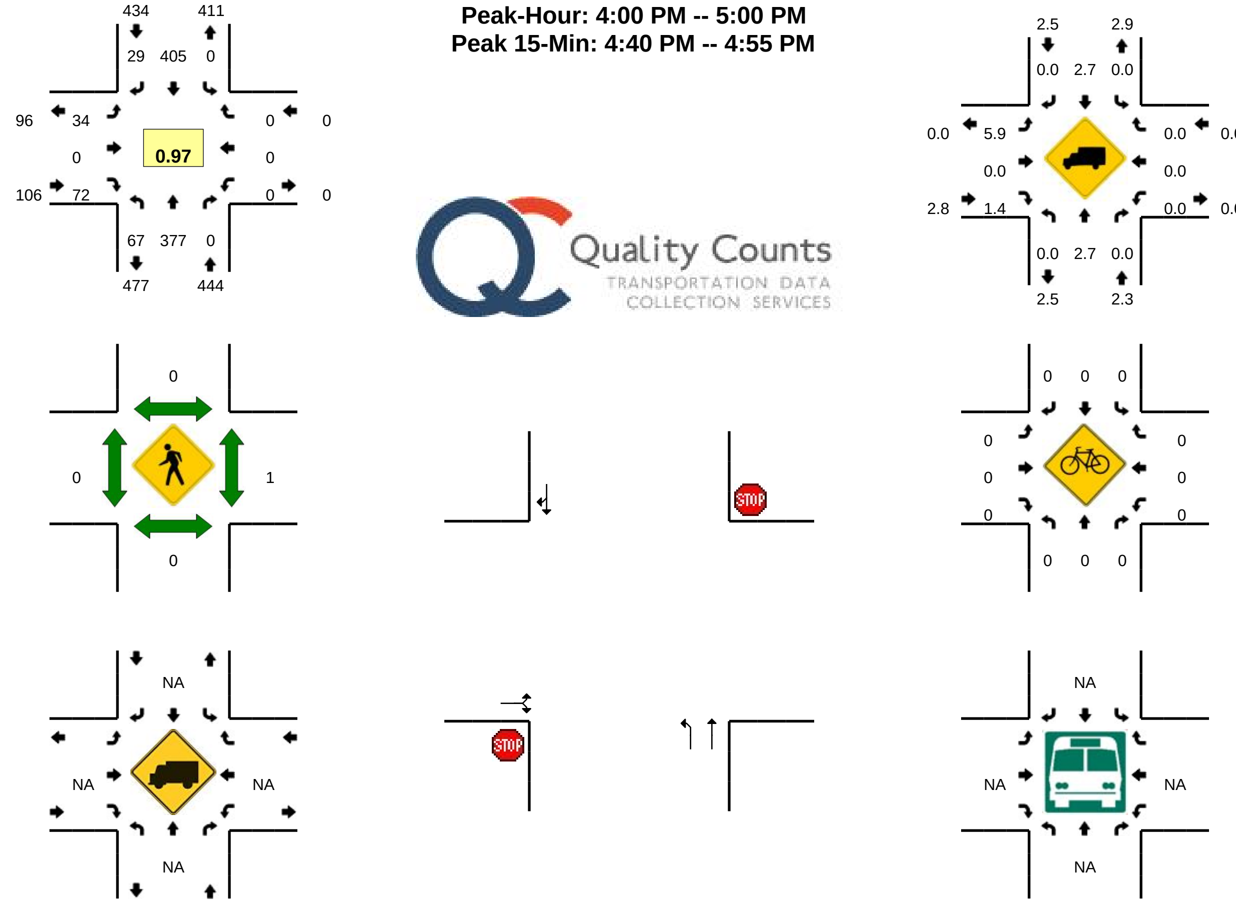
Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	12	416	48	0	28	496	4	0	4	0	4	0	20	0	8	0	1040
Heavy Trucks	0	4	0		0	16	0		0	0	0		0	0	0		20
Pedestrians		4				0				4				0			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

LOCATION: Oatfield Rd -- Glen Echo Ave | **QC JOB #:** 13837114
CITY/STATE: Clackamas, OR | **DATE:** Wed, Jun 08 2016

Peak-Hour: 4:00 PM -- 5:00 PM
Peak 15-Min: 4:40 PM -- 4:55 PM



5-Min Count Period Beginning At	Oatfield Rd (Northbound) Left	Thru	Right	U	Oatfield Rd (Southbound) Left	Thru	Right	U	Glen Echo Ave (Eastbound) Left	Thru	Right	U	Glen Echo Ave (Westbound) Left	Thru	Right	U	Total	Hourly Totals
4:00 PM	5	29	0	0	0	36	3	0	4	0	7	0	0	0	0	0	84	
4:05 PM	8	33	0	0	0	36	5	0	3	0	6	0	0	0	0	0	91	
4:10 PM	1	31	0	0	0	40	1	0	2	0	2	0	0	0	0	0	77	
4:15 PM	3	31	0	0	0	40	1	0	4	0	5	0	0	0	0	0	84	
4:20 PM	4	33	0	0	0	29	4	0	4	0	7	0	0	0	0	0	81	
4:25 PM	5	39	0	0	0	32	0	0	2	0	8	0	0	0	0	0	86	
4:30 PM	10	31	0	0	0	22	4	0	3	0	9	0	0	0	0	0	79	
4:35 PM	7	24	0	0	0	33	0	0	2	0	4	0	0	0	0	0	70	
4:40 PM	7	35	0	0	0	36	1	0	3	0	9	0	0	0	0	0	91	
4:45 PM	5	31	0	0	0	35	6	0	3	0	3	0	0	0	0	0	83	
4:50 PM	7	25	0	0	0	35	3	0	1	0	9	0	0	0	0	0	80	
4:55 PM	5	35	0	0	0	31	1	0	3	0	3	0	0	0	0	0	78	984
5:00 PM	6	31	0	0	0	30	3	0	1	0	3	0	0	0	0	0	74	974
5:05 PM	10	31	0	0	0	24	6	0	4	0	6	0	0	0	0	0	81	964
5:10 PM	10	20	0	0	0	33	2	0	4	0	4	0	0	0	0	0	73	960
5:15 PM	5	33	0	0	0	39	3	0	2	0	5	0	0	0	0	0	87	963
5:20 PM	4	25	0	0	0	36	5	0	1	0	1	0	0	0	0	0	72	954
5:25 PM	9	23	0	0	0	40	7	0	1	0	10	0	0	0	0	0	90	958
5:30 PM	2	29	0	0	0	38	3	0	4	0	8	0	0	0	0	0	84	963
5:35 PM	9	20	0	0	0	22	1	0	3	0	3	0	0	0	0	0	58	951
5:40 PM	9	35	0	0	0	38	2	0	0	0	9	0	0	0	0	0	93	953
5:45 PM	4	19	0	0	0	23	3	0	1	0	5	0	0	0	0	0	55	925
5:50 PM	10	32	0	0	0	25	4	0	0	0	0	0	0	0	0	0	71	916
5:55 PM	4	29	0	0	0	30	2	0	3	0	5	0	0	0	0	0	73	911

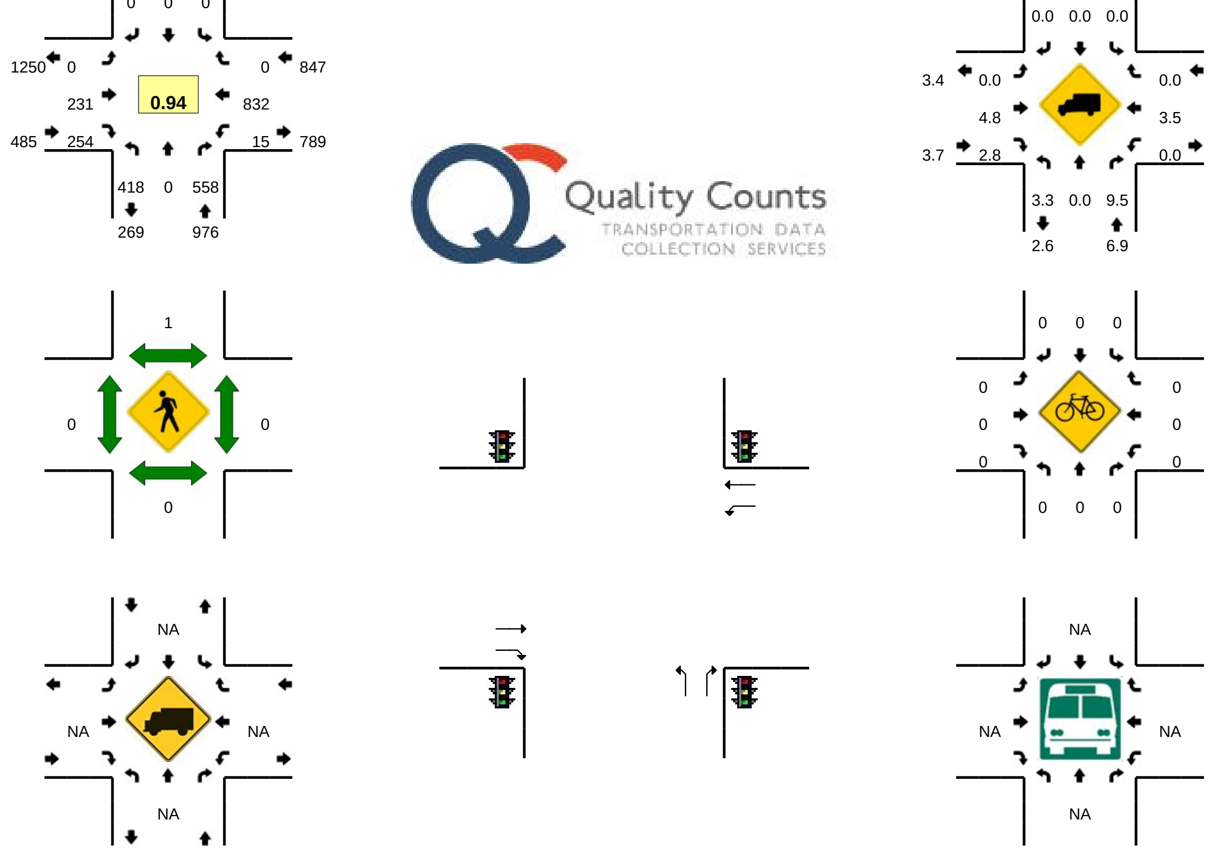
Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	76	364	0	0	0	424	40	0	28	0	84	0	0	0	0	0	1016
Heavy Trucks	0	16	0		0	12	0		0	0	0		0	0	0		28
Pedestrians		0				0				0				4			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

LOCATION: I-205 NB Ramps -- 82nd Dr | **QC JOB #:** 13837116
CITY/STATE: Clackamas, OR | **DATE:** Wed, Jun 08 2016

Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 4:30 PM -- 4:45 PM



5-Min Count Period Beginning At	I-205 NB Ramps (Northbound)				I-205 NB Ramps (Southbound)				82nd Dr (Eastbound)				82nd Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	35	0	40	0	0	0	0	0	0	21	23	0	1	63	0	0	183	
4:05 PM	47	0	56	0	0	0	0	0	0	17	18	0	3	67	0	0	208	
4:10 PM	30	0	42	0	0	0	0	0	0	10	25	0	3	76	0	0	186	
4:15 PM	31	0	49	0	0	0	0	0	0	16	20	0	3	71	0	0	190	
4:20 PM	30	0	54	0	0	0	0	0	0	22	19	0	4	53	0	0	182	
4:25 PM	45	0	49	0	0	0	0	0	0	14	10	0	3	68	0	0	189	
4:30 PM	35	0	56	0	0	0	0	0	0	25	22	0	1	77	0	0	216	
4:35 PM	31	0	38	0	0	0	0	0	0	18	18	0	0	70	0	0	175	
4:40 PM	46	0	63	0	0	0	0	0	0	19	21	0	1	71	0	0	221	
4:45 PM	35	0	32	0	0	0	0	0	0	21	21	0	0	66	0	0	175	
4:50 PM	38	0	40	0	0	0	0	0	0	22	17	0	2	57	0	0	176	
4:55 PM	39	0	49	0	0	0	0	0	0	14	19	0	2	64	0	0	187	2288
5:00 PM	25	0	40	0	0	0	0	0	0	19	22	0	1	70	0	0	177	2282
5:05 PM	36	0	60	0	0	0	0	0	0	14	21	0	1	66	0	0	198	2272
5:10 PM	29	0	52	0	0	0	0	0	0	23	22	0	0	76	0	0	202	2288
5:15 PM	33	0	43	0	0	0	0	0	0	20	28	0	1	72	0	0	197	2295
5:20 PM	31	0	40	0	0	0	0	0	0	18	24	0	2	72	0	0	187	2300
5:25 PM	40	0	45	0	0	0	0	0	0	18	19	0	4	71	0	0	197	2308
5:30 PM	30	0	40	0	0	0	0	0	0	10	13	0	0	76	0	0	169	2261
5:35 PM	31	0	54	0	0	0	0	0	0	15	21	0	1	60	0	0	182	2268
5:40 PM	25	0	44	0	0	0	0	0	0	19	18	0	1	53	0	0	160	2207
5:45 PM	29	0	50	0	0	0	0	0	0	8	26	0	2	54	0	0	169	2201
5:50 PM	32	0	44	0	0	0	0	0	0	12	19	0	1	57	0	0	165	2190
5:55 PM	34	0	48	0	0	0	0	0	0	14	18	0	2	39	0	0	155	2158

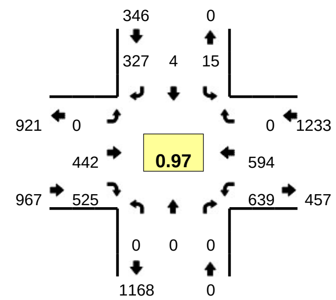
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	448	0	628	0	0	0	0	0	0	248	244	0	8	872	0	0	2448
Heavy Trucks	16	0	84		0	0	0		0	16	20		0	40	0		176
Pedestrians		0				4				0				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

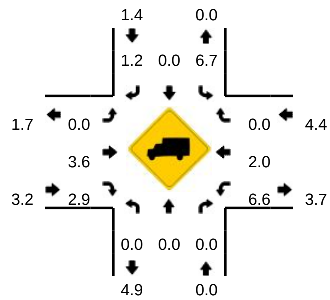
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

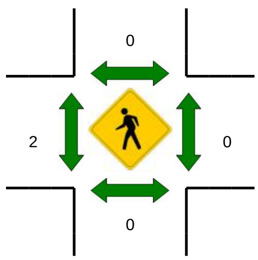
LOCATION: I-205 SB Ramps -- 82nd Dr | **QC JOB #:** 13837118

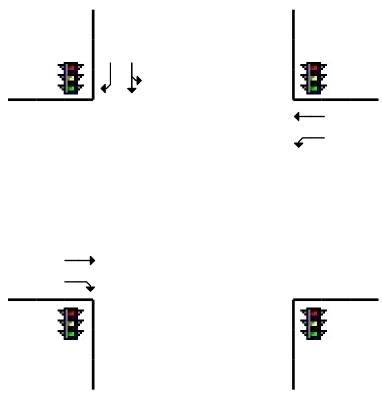
CITY/STATE: Clackamas, OR | **DATE:** Wed, Jun 08 2016

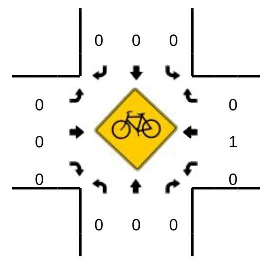


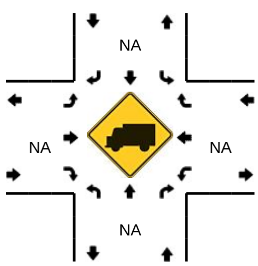
Peak-Hour: 4:00 PM -- 5:00 PM
Peak 15-Min: 4:40 PM -- 4:55 PM

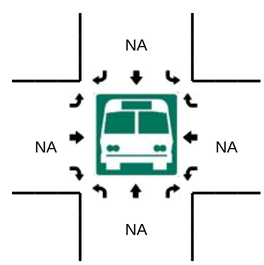












5-Min Count Period Beginning At	I-205 SB Ramps (Northbound)				I-205 SB Ramps (Southbound)				82nd Dr (Eastbound)				82nd Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	3	0	28	0	0	41	47	0	45	45	0	0	209	
4:05 PM	0	0	0	0	0	0	25	0	0	37	43	0	58	59	0	0	222	
4:10 PM	0	0	0	0	4	0	20	0	0	31	56	0	57	46	0	0	214	
4:15 PM	0	0	0	0	0	1	29	0	0	36	52	0	53	49	0	0	220	
4:20 PM	0	0	0	0	1	1	31	0	0	40	44	0	52	37	0	0	206	
4:25 PM	0	0	0	0	0	0	30	0	0	28	42	0	57	50	0	0	207	
4:30 PM	0	0	0	0	3	0	24	0	0	43	27	0	64	53	0	0	214	
4:35 PM	0	0	0	0	1	0	26	0	0	35	44	0	56	36	0	0	198	
4:40 PM	0	0	0	0	0	2	33	0	0	38	42	0	54	64	0	0	233	
4:45 PM	0	0	0	0	1	0	25	0	0	42	49	0	56	51	0	0	224	
4:50 PM	0	0	0	0	1	0	31	0	0	38	40	0	40	52	0	0	202	
4:55 PM	0	0	0	0	1	0	25	0	0	33	39	0	47	52	0	0	197	2546
5:00 PM	0	0	0	0	1	0	20	0	0	40	44	0	45	48	0	0	198	2535
5:05 PM	0	0	0	0	1	0	19	0	0	34	44	0	60	47	0	0	205	2518
5:10 PM	0	0	0	0	2	0	23	0	0	43	47	0	61	42	0	0	218	2522
5:15 PM	0	0	0	0	2	0	18	0	0	46	47	0	51	44	0	0	208	2510
5:20 PM	0	0	0	0	0	0	24	0	0	43	43	0	56	47	0	0	213	2517
5:25 PM	0	0	0	0	3	0	24	0	0	34	42	0	57	60	0	0	220	2530
5:30 PM	0	0	0	0	0	0	24	0	0	22	51	0	61	47	0	0	205	2521
5:35 PM	0	0	0	0	1	0	24	0	0	35	46	0	46	48	0	0	200	2523
5:40 PM	0	0	0	0	1	0	24	0	0	36	42	0	38	45	0	0	186	2476
5:45 PM	0	0	0	0	2	0	20	0	0	32	40	0	39	44	0	0	177	2429
5:50 PM	0	0	0	0	1	0	28	0	0	30	30	0	42	47	0	0	178	2405
5:55 PM	0	0	0	0	2	0	36	0	0	29	36	0	34	38	0	0	175	2383

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	8	8	356	0	0	472	524	0	600	668	0	0	2636
Heavy Trucks	0	0	0		0	0	0		0	32	8		32	12	0		84
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments: