



## TECHNICAL MEMORANDUM #4.3

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**Date:** September 21, 2010

Project #: 10213

**To:** Larry Conrad  
Clackamas County

**From:** Daniel Seeman, Marc Butorac, PE, PTOE, Shing Tsoi and Shaun Quayle, PE

**Project:** 172<sup>nd</sup>/190<sup>th</sup> Corridor Plan

**Subject:** Future 2035 No-Build Transportation Conditions Analysis

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This memorandum summarizes the key findings revealed from analysis of the 172<sup>nd</sup>/190<sup>th</sup> Corridor under future year 2035 “no-build” conditions. The purpose of conducting the no-build analysis is to determine the need for corridor improvements to meet forecast travel demand in the Project Study Area (PSA).

### **BACKGROUND ASSUMPTIONS**

The Statement of Work for the 172<sup>nd</sup>/190<sup>th</sup> Corridor Plan project requires that the 2035 forecast developed by Metro be used as the basis for the future no-build analysis. This forecast is to be assigned on Metro’s 2035 Regional Transportation Plan (RTP) financially constrained model network.

The Metro model is chosen for many reasons. Most importantly, it provides consistency with the updated 2035 RTP and all of the related assumptions for growth and planned transportation improvements in the region and the study area. Specifically, the 2035 RTP includes assumptions that are consistent with regional growth projections, as compared with local growth assumptions in Happy Valley’s Comprehensive Plan (TSP)<sup>1</sup>. Further, the Metro model assumes a level and type of growth in the Damascus area that is indicative of urban densities consistent with requirements by Metro (Damascus has yet to adopt a Comprehensive Plan, which leaves that geographical area in a state of flux and would default to Clackamas County for zoning and density, if no city Comprehensive Plan is adopted). Finally, the 2035 financially constrained Metro model represents a regionally agreed upon set of transportation improvements as being fundable and constructible by the planning horizon of year 2035.

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<sup>1</sup>This is according to discussions with staff of DKS, the consultant responsible for the Happy Valley travel demand model, who indicated that the City Comprehensive Plan assumes aggressive growth in Happy Valley for “buildout” levels in year 2035.

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## Modeling Capabilities and Constraints

Metro has prepared a subarea model using the 2035 RTP model as its basis, to support the 172<sup>nd</sup>/190<sup>th</sup> Corridor Plan project. This subarea model has certain capabilities and constraints that the Project Management Team (PMT) and Project Advisory Committee should be aware of moving forward into the concept development and screening process. The subarea model is capable of efficiently producing re-assignments of vehicle and truck volumes, based on proposed changes (reflecting concepts) to the roadway network in the PSA. A constraint of this methodology is that these re-assignments will only affect the routing of vehicle volumes (generally only within the PSA network) and will not affect the origin or destination of vehicle trips. Use of this methodology implicitly recognizes that, while a change in the vehicle network may prompt a traveler to alter his/her origin or destination choice, motorists will continue to make trips using the previously developed mode splits.

The subarea model provided by Metro includes a fixed trip matrix and network, without the ability to modify the trip generation or mode split model components. Any changes that may affect desired land use, transit services/facilities, mode choice, or origin/destination pairings would need to be conducted in the larger regional travel demand model by Metro.

## No-Build Roadway Network Assumptions

Specific information about the Metro 2035 RTP financially constrained model network is contained in Metro's 2035 *Regional Transportation Plan: Appendix 1.3, Modeling Assumptions*<sup>2</sup>. The Appendix describes the 2035 No-Build Roadway Network as comprising "the 2005 network plus any projects that have been completed (or committed for funding) as of 2009" and includes a list of those "completed" roadway projects used in the network. Projects from this list that are for the Oregon Department of Transportation (ODOT), the Counties of Clackamas and Multnomah, and the Cities of Damascus, Happy Valley, and Gresham are repeated in Table 4.3-1 (following page) along with an indication of whether each has direct, indirect, or no impact on travel demand on the 172<sup>nd</sup>/190<sup>th</sup> corridor.

As can be seen from Table 4.3-1, only one project (Sunnyside Road) has a direct impact and four other projects have indirect impacts on the PSA. The Sunnyside Road project has been recently completed, which included intersection enhancements at the SE 172<sup>nd</sup> Avenue/SE Sunnyside Road intersection and the widening of SE Sunnyside Road to a 5-lane urban cross-section west of the PSA. It is also important to note that the widening of SE 172<sup>nd</sup> Avenue, a project which opened between OR 212 and SE Sunnyside Road during the development of the 172<sup>nd</sup>/190<sup>th</sup> Corridor Project, is not among these "completed" projects (NOTE: This project widened SE 172<sup>nd</sup> Avenue from a rural, two-lane cross-section to an urban, five-lane cross section.). The 2035 No-Build Roadway Network was updated to include this "completed" project and all subsequent modeling will reflect the influence of this improvement on forecast travel demands.

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<sup>2</sup> Metro 2035 Regional Transportation Plan, Appendix 1.3, Modeling Assumptions, March 2010.

**Table 4.3-1 Metro 2035 RTP No-Build Roadway Network Projects**

Agency	Project Name	PSA Impact
<b>City of Gresham</b>	<b><i>Powell Boulevard: 174th to Eastman Parkway</i></b>	<b><i>Indirect</i></b>
<b>Clackamas County</b>	<b>SE Sunnyside Road</b>	<b>Direct</b>
<b>Clackamas County</b>	<b><i>W.Otty Road Extension</i></b>	<b><i>Indirect</i></b>
<b>Clackamas County</b>	<b><i>Summers Lane Extension – 122nd to 132nd only</i></b>	<b><i>Indirect</i></b>
<b>Clackamas County</b>	<b><i>Fuller Road pedestrian improvements</i></b>	<b><i>Indirect</i></b>
Clackamas County	Stafford/Rosemont intersection	None
Multnomah County	Rehabilitation of WRBs—on-going	None
Multnomah County	WRB Preservation/Painting—on-going	None
Multnomah County	Broadway and Burnside Bridges—Broadway painting partially completed and deck replacement. Burnside Bridge deck replacement.	None
Multnomah County	Morrison Bridge Bike/Ped Facility—funded, construction delayed until 2008	None
Multnomah County	Lovejoy sidewalk—presumably completed with Lovejoy Ramp replacement	None
Multnomah County	Burnside Bridge, Esplanade Ramp	None
Multnomah County	257th/Palmquist/US 26 Intersection	None
Multnomah County	223rd Ave. RR Crossing (south of Sandy Blvd)	None
Multnomah County	MKC Collector: Arata to Glisan	None
Multnomah County	207th Ave Connector	None
ODOT	I-5: Delta park to Lombard	None
ODOT	I-205 Aux. Lanes: I-5 to Stafford Road	None
ODOT	I-5 @ OR 217: Kruse Way	None

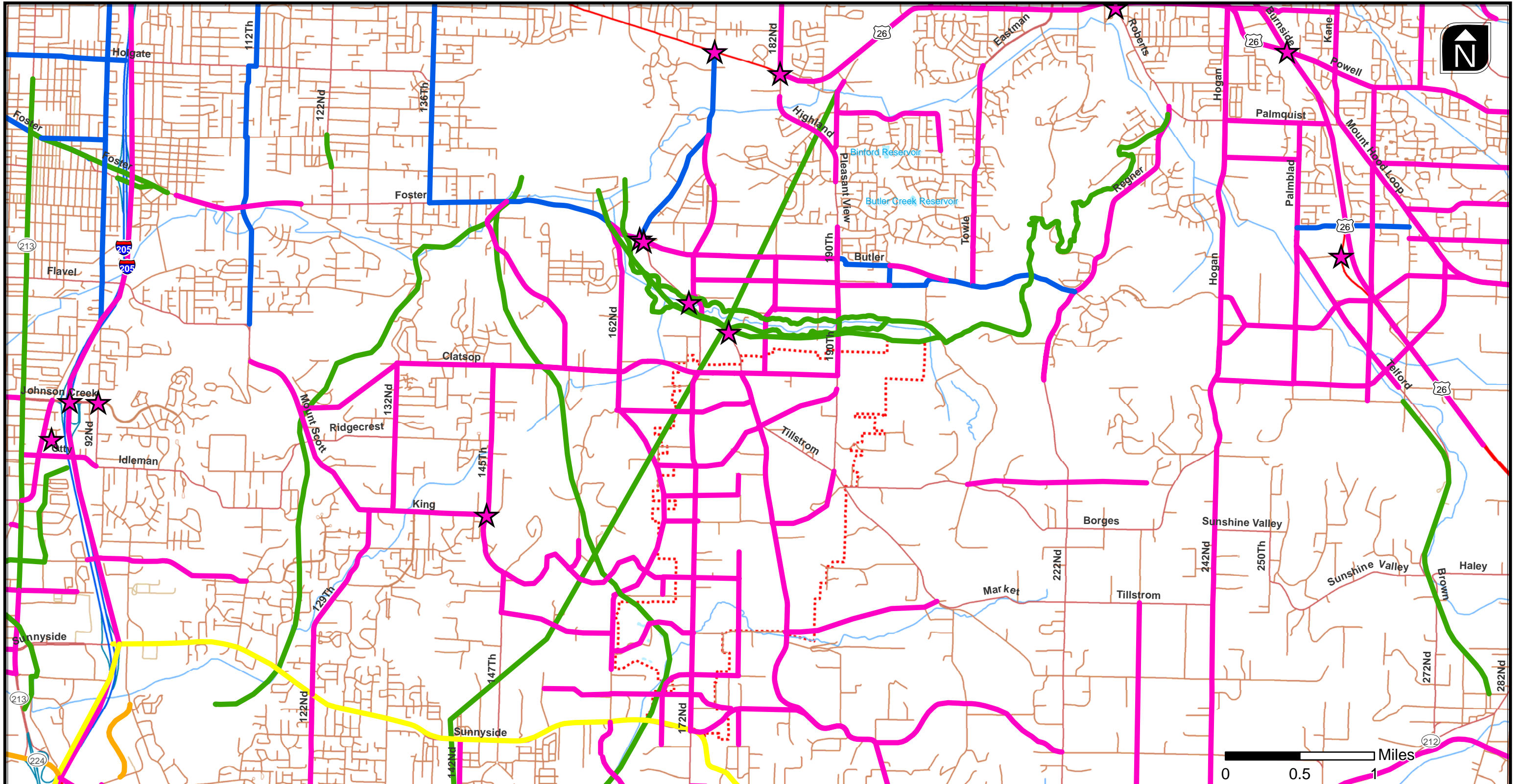
Note: **Bold** entries have direct impacts; ***Bold italicized*** entries have indirect impacts on the 172<sup>nd</sup>/190<sup>th</sup> corridor; and standard type entries have no impact.

Appendix 1.1, of Metro’s 2035 financially constrained RTP<sup>3</sup> lists approximately 700 improvement projects and programs contained in the RTP. It is important to know which projects are included in this network, particularly those that are expected to have a direct or indirect impact on travel demands within the 172<sup>nd</sup>/190<sup>th</sup> corridor. Several projects from the list that are located in or near the PSA are summarized in Table 4.3-2. Among them is the widening of SE 172<sup>nd</sup> Avenue to five lanes, from the SE Foster Road to SE Sunnyside Road, and a new roadway connection from SE 172<sup>nd</sup> Avenue to SE 190<sup>th</sup> Drive. This project, labeled as Metro Project ID 10033, represents the capacity and connectivity improvement concept being considered by the 172<sup>nd</sup>/190<sup>th</sup> Corridor Plan project. Thus, the Metro 2035 financially constrained RTP and associated subarea model represents a “build” forecast for the study corridor. Figure 4.3-1 shows the 2035 Metro RTP corridor investments in and near the PSA.








<sup>3</sup> Metro 2035 Regional Transportation Plan, Appendix 1.1, Project List, March 2010.

**Table 4.3-2 Metro 2035 Financially Constrained RTP, App. 1.1: Project List (Abbreviated)**

Metro Project ID	Project Name	Project Start Location	Project End Location	Description	Time Period
<b>Inside Project Study Area</b>					
10033	172 <sup>nd</sup> Avenue Improvements	Foster Rd./190 <sup>th</sup>	Sunnyside Road	Widen to five lanes including new bridge across. Construct connection to 190 <sup>th</sup> .	2008-2017
10038	242 <sup>nd</sup> Avenue	Multnomah County line	Hwy 212	Reconstruct 242nd and widen to three lanes. The Damascus/Boring Concept Plan identifies 242nd as a community bus transit classification.	2018-2025
10040	162nd Avenue Extension North	Hagen Rd.	Clatsop St.	Construct a new 3-lane roadway with traffic signals.	2018-2025
10041	162nd Avenue Extension South Phase 1	Rock Creek Blvd.	Goose Hollow Dr.	Construct a new 2 - 3 lane roadway with intersection improvements at Hwy-212/162nd on all 4 approaches. The second phase is Project #11346.	2008-2017
10074	New Connection	177th to 190th	Arterial #3	New arterial from the Rock Creek Blvd interchange. This portion within Damascus.	2018-2025
10076	SE Sunnyside Road East Extension	SE 172nd Avenue	SE 242nd Ave.	Extend Sunnyside Road east from 172nd Ave to 242nd Ave. Evaluate alignment options between Bohna Park Road and Tillstrom Road for the connection from Foster Road to 242nd Ave.	2018-2025
10138	Hwy 212 widening to 5 lane boulevard	Sunrise Unit 1 Terminus	East City Limits	Widen Highway 212 to a 5-lane boulevard section through Damascus.	2018-2025
10460	SE 174th N/S Improvements	Giese	174th/Jenne	Construction of new roadway that adds n/s capacity in vicinity of 174/Jenne. This facility will have two travel lanes in each direction (total 4 travel lanes), and a median/turn lane which will be primarily a median, with left turn pockets at the intersection of the New Road/Giese, and also New Road/McKinley.	2008-2017
10462	Butler Rd. Improvements	190 <sup>th</sup>	Towle Rd.	Improve Butler Rd. in new alignment to collector standards, at Towle intersection, add northbound and westbound turn pockets and signalize.	2008-2017
10463	Foster Rd. Extension (north)	Jenne	172nd	New north extension of Foster.	2008-2017
10464	Giese Rd. Extension	182 <sup>nd</sup>	172nd	New extension of Giese Rd. to Foster Road.	2018-2025
10465	172nd Avenue Improvements	Giese Rd.	Foster Rd.	Upgrade street to urban standards with sidewalks, bike lanes.	2018-2025
10466	172nd Avenue Improvements	Butler Rd.	Cheldelin Rd.	Upgrade street to urban standards with sidewalks, bike lanes, and add roundabout or traffic signal at 172nd/Foster.	2018-2025
10468	Giese Rd. Improvements	182nd Ave.	190th Ave.	Upgrade street to urban standards with sidewalks, bike lanes.	2018-2025
10469	Foster Rd. Bridge	Foster Rd.		Construct bridge crossing.	2018-2025




H:\PROJECTS\172nd Ave Sunnyside Rd Alter. Design\Future Conditions\Figure4\_4-1.mxd

	Intersection		Roadway
	Bicycle		Pedestrian
	Freight		Transit
			Core Study Area

## Regional Transportation Plan Programmed Improvements



172nd / 190th  
Corridor Plan



CLACKAMAS  
COUNTY

**Figure  
4.3-1**



**Table 4.3-2 Metro 2035 Financially Constrained RTP, App. 1.1: Project List (Abbreviated)  
Continued**

<b>Metro Project ID</b>	<b>Project Name</b>	<b>Project Start Location</b>	<b>Project End Location</b>	<b>Description</b>	<b>Time Period</b>
10470	Giese Rd. Extension Bridge	Giese Rd.		Construct bridge crossing.	2018-2025
10533	190th: 30th to So. Boundary of Pleasant Valley	30th	Southern boundary of Pleasant Valley	Improve existing road to major arterial standards, signalize 190th @ Giese, Butler, Richey, Cheldelin.	2008-2017
10534	Cheldelin: 172nd to 190th	172nd	190th	Improve existing road to minor arterial standards, signalize Cheldelin at 172nd, 182nd, and Foster.	2008-2017
10535	Clatsop: New extension	162nd	172nd	Extend Clatsop into Pleasant Valley, and construct bridge.	2008-2017
10537	Richey	182nd	190th	Improve to collector standards, and signalize 190th/Richey.	2008-2017
10538	Sager	162nd	Foster	Improve to collector standards, and signalize Sager @172nd.	2008-2017
10539	Foster South: new road	County Line	Sager	Build new road section to collector standards.	2008-2017
10540	162nd	Foster	So. boundary of Pleasant Valley	Improve 162nd to collector standards, add signal at Foster @ 162nd.	2008-2017
10541	182nd	Giese	Cheldelin	Improve 182nd to collector standards.	2008-2017
10543	172nd: Cheldelin south to Pleasant Valley boundary	Cheldelin	So. Boundary of Pleasant Valley	Improve 172nd Ave. to major arterial standards.	2008-2017
10860	Collector 72 (Knapp)	172nd	182nd	Build new road to green street collector standards.	2008-2017
10861	Collector 72 (Knapp)	182nd	190th	Build new road to green street collector standards.	2008-2017
10862	Community Street 72	190th	Binford Parkway	Build new road to green street community standards.	2008-2017
10869	Sunrise Project: Construct improvements in the Sunrise Corridor consistent with the supplemental EIS	I-205	122nd Ave./Hwy. 212/224	Construct improvements consistent with the supplemental Sunrise Corridor EIS, 2-lane mainline; new O'Xing of I-205 connecting 82nd Ave. and 82nd Dr.	2008-2017
10890	Sunrise Project: Acquire right-of-way: Webster Rd. to SE 172nd Ave	Webster Rd./Hwy. 224	172nd Ave./Hwy. 212	Acquire right-of-way: Webster Rd. to SE 172nd Ave. to accommodate six-through lane expressway, plus auxiliary lanes.	2008-2017
10894	Sunrise Hwy. PE: Webster Rd. to SE 172nd Ave	Webster Rd./Hwy. 224	172nd Ave./Hwy. 212	Preliminary engineering and EIS from Webster Rd. to SE 172nd.	2008-2017
11346	162nd Ave. Extension South Phase 2	157th Ave.	Rock Creek Blvd.	Construct a new 3 lane roadway with traffic signals and bridge over Rock Creek. The first phase is Project #10041.	2008-2017
11349	Hwy-212/224 improvements	82nd	98th	Construct 3rd WB lane on Hwy. 212/224	2008-2017

**Table 4.3-2 Metro 2035 Financially Constrained RTP, App. 1.1: Project List (Abbreviated)  
Continued**

Metro Project ID	Project Name	Project Start Location	Project End Location	Description	Time Period
<b>Outside Project Study Area</b>					
10215	Foster Rd., SE (136th - Jenne): Multi-modal Improvements	SE 136th	SE Jenne Rd.	Widen street to three lanes to provide two travel lanes, continuous turn lane, bike lanes, sidewalks, and drainage.	2008-2017
10431	Highland/190th Rd. Widening	200' south of SW 11th	Ending at the intersection of Pleasant View Dr./SE 190th and Butler	Reconstruct and widen street to five lanes with sidewalks and bike lanes. Widen and determine the appropriate cross-section for Highland Drive and Pleasant View Drive from Powell Boulevard to 190th Ave.	2008-2017
10498	181st (182nd) at Division/Powell Intersections	181st at Division		At Division: add second westbound left turn lane (TIF P1). At Powell, add northbound and southbound double left turn lanes (TIF P2 and TSP8). At Powell add SB and NB lanes.	2008-2017
10349	174th & Jenne Rd. , SE (Foster - Powell): Multi-model Improvements	SE Powell	SE Foster Rd	Roadway improvements to increase safety and capacity to accommodate increased residential roadway to 3 lanes and provide development. Widen bike lanes, sidewalks to provide better transportation links on this vital north/south link.	2018-2025
10857	Jenne/Foster	Intersection Jenne/Foster		Add second EB left turn lane. Requires widening of Jenne North.	2018-2025
10858	174 <sup>th</sup> /Powell	Intersection of 174 <sup>th</sup> /Powell		Improve intersection to 5 lane section.	2018-2025
10859	Pleasant View Dr., Powell Loop to Highland Drive	Powell Loop	Highland Drive	Widen roadway and construct curb and gutter, sidewalks, bike lanes and storm drainage.	2008-2017

## **No-Build Transit Network Assumptions**

Metro's 2035 Regional Transportation Plan: Appendix 1.3, *Modeling Assumptions*, also summarizes the transit network assumptions in the model. In recognition of the rural nature of this area, no transit network improvements have occurred in the PSA since 2005. The 2005 transit network "consists of current service and existing (2005) MAX lines and frequent service bus lines, as well as existing service for other transit districts like C-TRAN, SMART, CAT, SAM and SCTD."

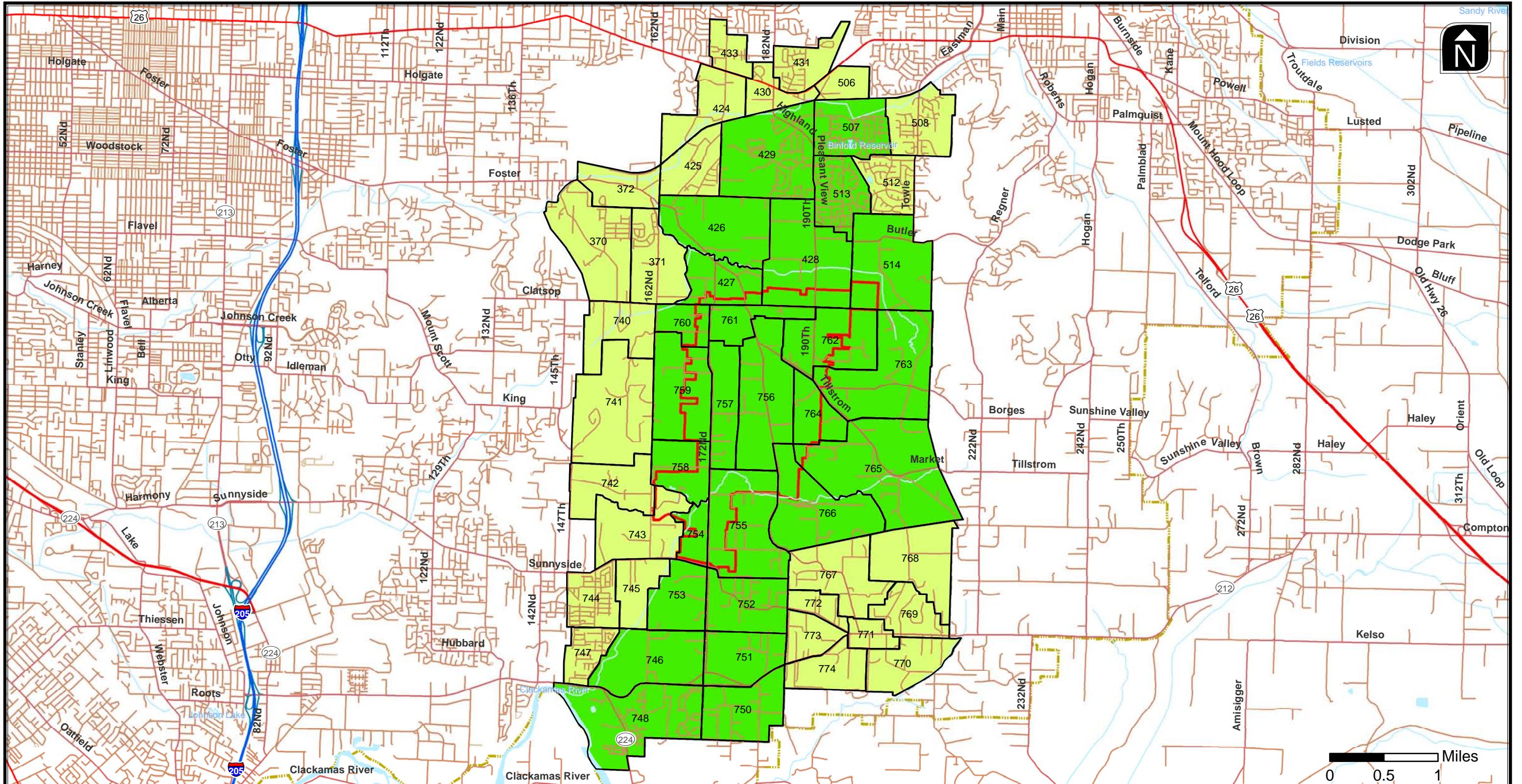
Relevant planned transit improvements included in the 2035 No-Build transit network are:

- Current service similar to 2009 headways and TriMet bus routes and MAX lines.
- The assumed C-TRAN transit network for the 2035 is similar to the current service of I-205 light rail (MAX Green line including downtown Portland transit mall)
- Streetcar extension to the South Waterfront District
- MAX Red Line extension to Merlo (158th)

## **2035 Growth Assumptions**

A description of the plans and policies governing growth and development in the area served by the 172<sup>nd</sup>/190<sup>th</sup> corridor is provided in Technical Memorandum #3.1. The Comprehensive Plans of Gresham, Happy Valley, and Damascus (if adopted) have the greatest impacts on this corridor, as each anticipates urbanization. Gresham anticipates creation of the Pleasant Valley Town Center, at the northern end of the corridor. Happy Valley and Damascus anticipate neighborhood residential development, commercial and retail development, and extensive industrial and other large-scale forms of employment along both sides of the corridor. The area is expected to become a net importer of workers to this sub-regional employment hub, self-sufficient in meeting the daily needs of neighborhoods and businesses in the area, and transit-supportive in its densities, organization, and mix of uses.

Table 4.3-3 summarizes the anticipated growth in households and jobs, within the PSA, over the next 25 years. The data is subdivided by agency with land use authority and assumes that Damascus will adopt a Comprehensive Plan with similar types and intensities of development as assumed in the Metro 2035 RTP. Figure 4.3-1 illustrates the area represented by the data. Note that only a portion of each City is contained within the PSA, and therefore, only a portion of each City's overall growth is captured in Figure 4.3-2.



- Core Study Area
- Primary Study Area TAZ
- Expanded Study Area TAZ
- Metro Urban Growth Boundary

## Project Area Transportation Analysis Zones



**Figure  
4.3-2**

**Table 4.3-3 Study Area Growth in Households and Jobs from 2005 to 2035**

PRIMARY STUDY AREA TAZs	EXISTING HH	FUTURE HH	GROWTH IN HH	EXISTING JOBS	FUTURE JOBS	GROWTH IN JOBS
426	215	1,291	1,076	30	1,331	1,301
427	82	309	227	144	255	111
428	232	2,407	2,175	35	351	316
429	686	794	108	85	325	240
507	858	894	36	52	60	8
513	568	547	(21)	51	60	9
514	163	337	174	14	20	6
746	34	47	13	38	6,633	6,595
748	572	1,246	674	12	48	36
750	156	539	383	17	42	25
751	113	320	207	30	428	398
752	124	758	634	32	151	119
753	83	447	364	16	49	33
754	15	111	96	3	34	31
755	120	2,079	1,959	43	111	68
756	53	633	580	20	64	44
757	48	763	715	12	27	15
758	44	540	496	8	13	5
759	47	1,079	1,032	8	120	112
760	44	304	260	52	320	268
761	126	440	314	5	25	20
762	67	465	398	25	34	9
763	52	660	608	13	18	5
764	22	229	207	17	24	7
765	161	1,488	1,327	30	57	27
766	75	1,131	1,056	13	22	9
<b>TOTAL</b>	<b>4,760</b>	<b>19,858</b>	<b>15,098</b>	<b>805</b>	<b>10,622</b>	<b>9,817</b>

Note: HH = households; TAZ = Transportation Analysis Zone

**Table 4.3-3 Study Area Growth in Households and Jobs from 2005 to 2035 (Continued)**

EXPANDED STUDY AREA TAZs	EXISTING HH	FUTURE HH	GROWTH IN HH	EXISTING JOBS	FUTURE JOBS	GROWTH IN JOBS
370	207	358	151	11	12	1
371	167	363	196	22	391	369
372	59	212	153	16	113	97
424	414	727	313	389	617	228
425	89	168	79	4	416	412
430	936	1053	117	483	883	400
431	284	350	66	83	139	56
433	257	289	32	188	294	106
506	706	891	185	90	687	597
508	81	116	35	81	91	10
512	501	484	(17)	52	60	8
740	114	384	270	0	0	0
741	22	1,020	998	0	0	0
742	56	161	105	16	19	3
743	84	1,049	965	38	170	132
744	445	560	115	438	600	162
745	50	907	857	21	37	16
747	277	345	68	54	109	55
767	132	1,213	1,081	13	34	21
768	39	1,012	973	0	0	0
769	97	615	518	67	118	51
770	112	923	811	16	54	38
771	9	372	363	348	1,243	895
772	29	489	460	40	150	110
773	53	707	654	130	633	503
774	49	780	731	27	119	92
<b>TOTAL</b>	<b>5,269</b>	<b>15,548</b>	<b>10,279</b>	<b>2,627</b>	<b>6,989</b>	<b>4,361</b>
<b>GRAND TOTAL</b>	<b>10,029</b>	<b>35,406</b>	<b>25,377</b>	<b>3,432</b>	<b>17,611</b>	<b>14,178</b>

Households in the PSA, defined as land directly served by the corridor, are forecast to grow by more than 300 percent between 2005 and 2035. Jobs in the same area are forecast to grow by more than 1,200 percent. Growth in the expanded study area, which includes additional land in Portland, Gresham, Damascus, Happy Valley, and the Pleasant Valley Town Center area, reveals an increase of approximately 200 percent in households and 170 percent in jobs.

### TRAVEL DEMAND MODEL AND PERIOD OF ANALYSIS

The Metro regional travel demand model is calibrated to provide forecasts of vehicular demands for several periods of the typical weekday. The regional model is selected for reasons stated earlier in this document, providing a single and consistent source of forecasting.

The period of concern in this study is the typical weekday p.m. peak in the year 2035. The weekday p.m. peak hour represents the time period during which the transportation system experiences the highest volumes. This period will continue to be the most critical as the planned land uses of industrial and other significant employment are realized. Thus, it is appropriate to maintain a focus on the weekday p.m. peak period for the future conditions analysis.

For consistency with the existing conditions analysis for the 172<sup>nd</sup>/190<sup>th</sup> Corridor Plan, the Metro p.m. 2-hour peak period will be **adjusted to reflect the single weekday p.m. peak hour**. A multiplicative factor of 0.52 will be applied to the weekday p.m. 2-hour peak to estimate the single weekday p.m. peak hour, which is consistent with factors recommended by Metro for past similar project analysis. This methodology acknowledges that, in the 2035 future, traffic during the two half-hour periods that represent the shoulders of the peak hour are approximately 92 percent of peak hour volumes.

## 2035 Subarea Model Modifications

The Metro financially constrained (FC) model serves as a base for the project study area (PSA), as mentioned previously. As defined in the project statement of work, the 2035 FC model was modified to represent a 2035 No-Build scenario within the PSA. To accomplish this, the following adjustments to the model were carried out to reestablish a No-Build network geometry within the PSA:

- SE 172<sup>nd</sup> Avenue was reduced from five lanes to the current 2-lane cross-section from SE Foster Road to SE Sunnyside Road.
- The SE 172<sup>nd</sup> Avenue to SE 190<sup>th</sup> Drive new east-west roadway was removed from the model to reflect existing conditions.
- The east-west connector between SE 172<sup>nd</sup> Avenue and SE Foster Road, north of Tillstrom Road, acting as an extension of Sager Road, was removed.

The result of these changes restored the future road network within the PSA to current conditions, thereby reflecting a “no-build” scenario.

It should be noted that projects adjacent to the PSA were left unchanged for the 2035 No-Build analysis, which include:

- The Clatsop-Cheldelin Road extension between SE 172<sup>nd</sup> Avenue and SE 190<sup>th</sup> Drive.
- The north-south roadway connector between SE Richey Road and the Clatsop-Cheldelin Road extension.
- SE 190<sup>th</sup> Drive capacity expansion to a 4/5-lane cross-section from the current 2-lane cross-section between the Clatsop Extension and SE Butler Road.
- SE Sunnyside Side Road extension between SE 172<sup>nd</sup> Avenue and SE 222<sup>nd</sup> Drive as a 5-lane urban cross-section roadway.
- SE 162<sup>nd</sup> Avenue extension between SE Sager Road and SE Hagen Road as a 4/5-lane cross-section roadway.
- SE Giese Road extension between SE 182<sup>nd</sup> Avenue and SE Foster Road as a new 2/3-lane cross-section roadway.

Appendix “A” contains 2035 model capacity plots for the base financially constrained model and the PSA no-build model.

### NCHRP 255 Model Volume Post Processing

The 2035 financially constrained (FC) model, altered in the project study area (PSA) to represent no-build roadway geometry provides an unrefined or post-processed model result. In order to validate and normalize the model results, a standard process based upon a methodology documented in the National Cooperative Highway Research Program (NCHRP) Special Report 255 was utilized. This process requires the following inputs: 1) observed existing turning movement volumes, 2) the existing year travel demand model turning movement volumes, and 3) the 2035 FC No-Build turning movement volumes in the PSA. Simply put, the relationship between the measured traffic volumes and the existing year travel demand model reflect the accuracy of the model calibration. That relationship is then applied to the 2035 model to normalize or adjust the model results as the average of: 1) ratio between the measured traffic volumes and the existing model count and (2) the arithmetic difference between the existing year and 2035 future models.

These resultant traffic volumes after the NCHRP 255 method are then further refined to allow for reasonable balancing between intersections to account for the coarseness of traffic volume loading in the regional travel demand model.

Appendix “B” contains the NCHRP 255 post-processing worksheets.

### 2035 PSA No-Build Intersection Analysis

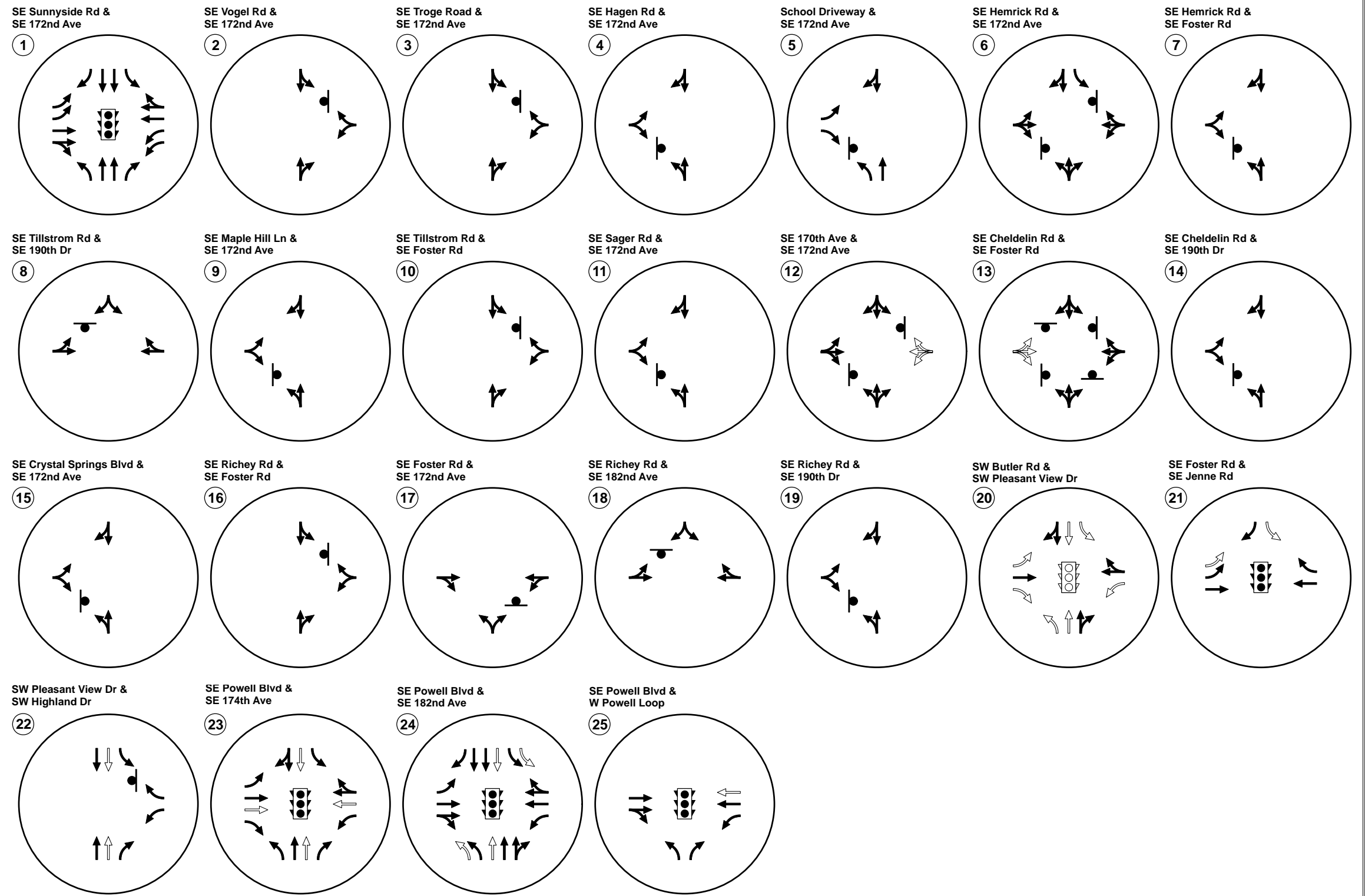
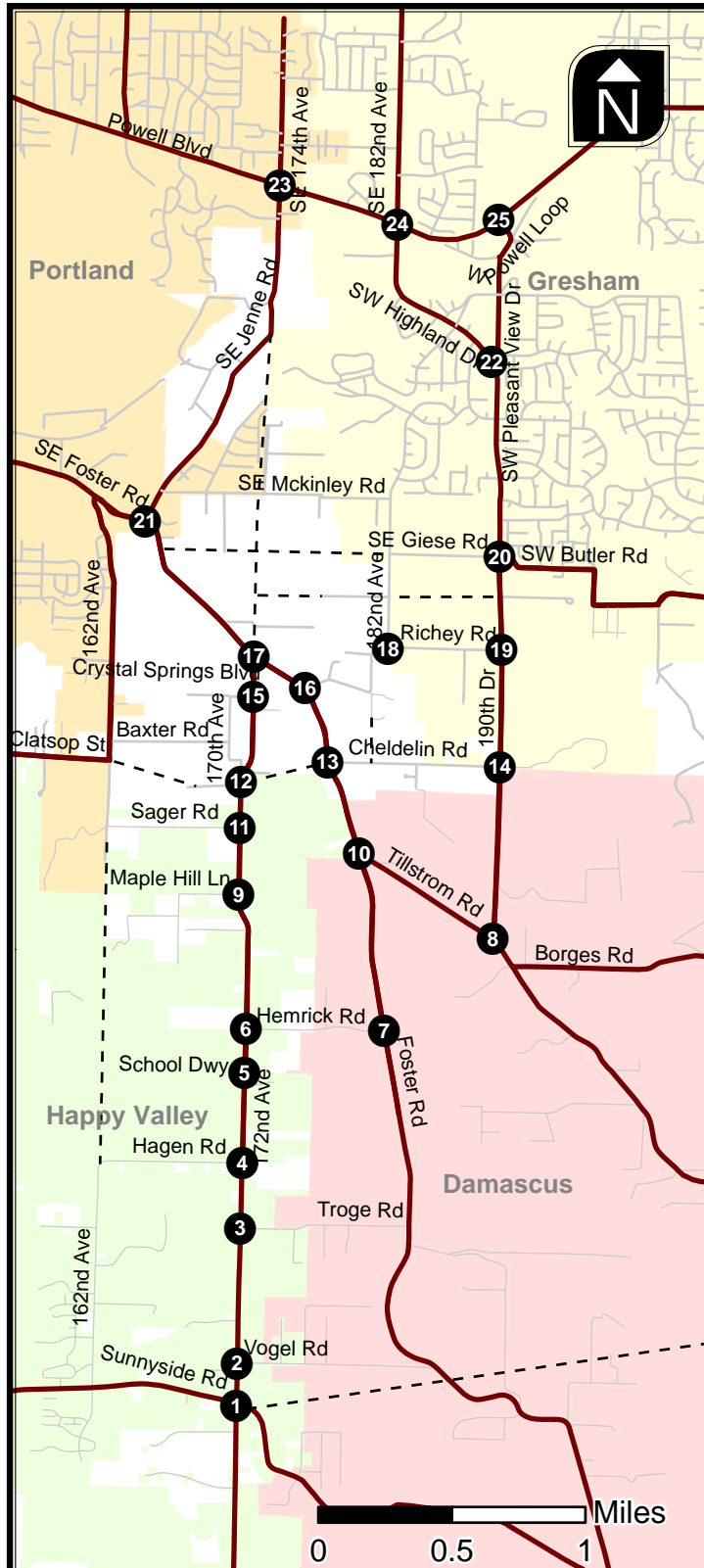
This analysis includes review of the 2035 traffic volumes under base or true No-Build geometry within the project study area (PSA). Metro’s financially constrained projects adjacent to the PSA are, however, included in this analysis. Potential mitigations in the PSA intersections were then reviewed to address operational deficiencies. The identified deficiencies are based on the intersection operational standards that were presented in detail in Technical Memorandum 4.1: Existing Transportation Conditions Analysis. These are shown in Table 4.3-4 and are assumed to apply for this 2035 No-Build PSA condition.

**Table 4.3-4 –Jurisdiction’ Peak Hour Intersection Operational Standards**

Jurisdiction <sup>1</sup>	Level of Service (Delay) Standard	Volume to Capacity Ratio Standard
Clackamas County	D or better	-
Metro / ODOT	-	0.99 (1 <sup>st</sup> and 2 <sup>nd</sup> hour)
City of Gresham	E or better	-
City of Happy Valley	D or better (signals); E or better (unsignalized)	-
City of Damascus	None established	-
City of Portland	D or better (signals); E or better (unsignalized)	-

1 – Operational standards are defined in the Cities’ TSP and County TSP and in the Oregon Highway Plan (1999).

Figure 4.3-3 shows the PSA 2035 No-Build lane configurations and traffic control, which are identical to the existing conditions. Figure 4.3-4 shows the 2035 post-processed PSA No-Build traffic volumes and operational results.



H:\profiles\10213 - 172nd Ave Sunnyside Rd Alter. Design\Future Conditions\2010 Nov Update\Figure4\_3-3\_2010 Nov.mxd

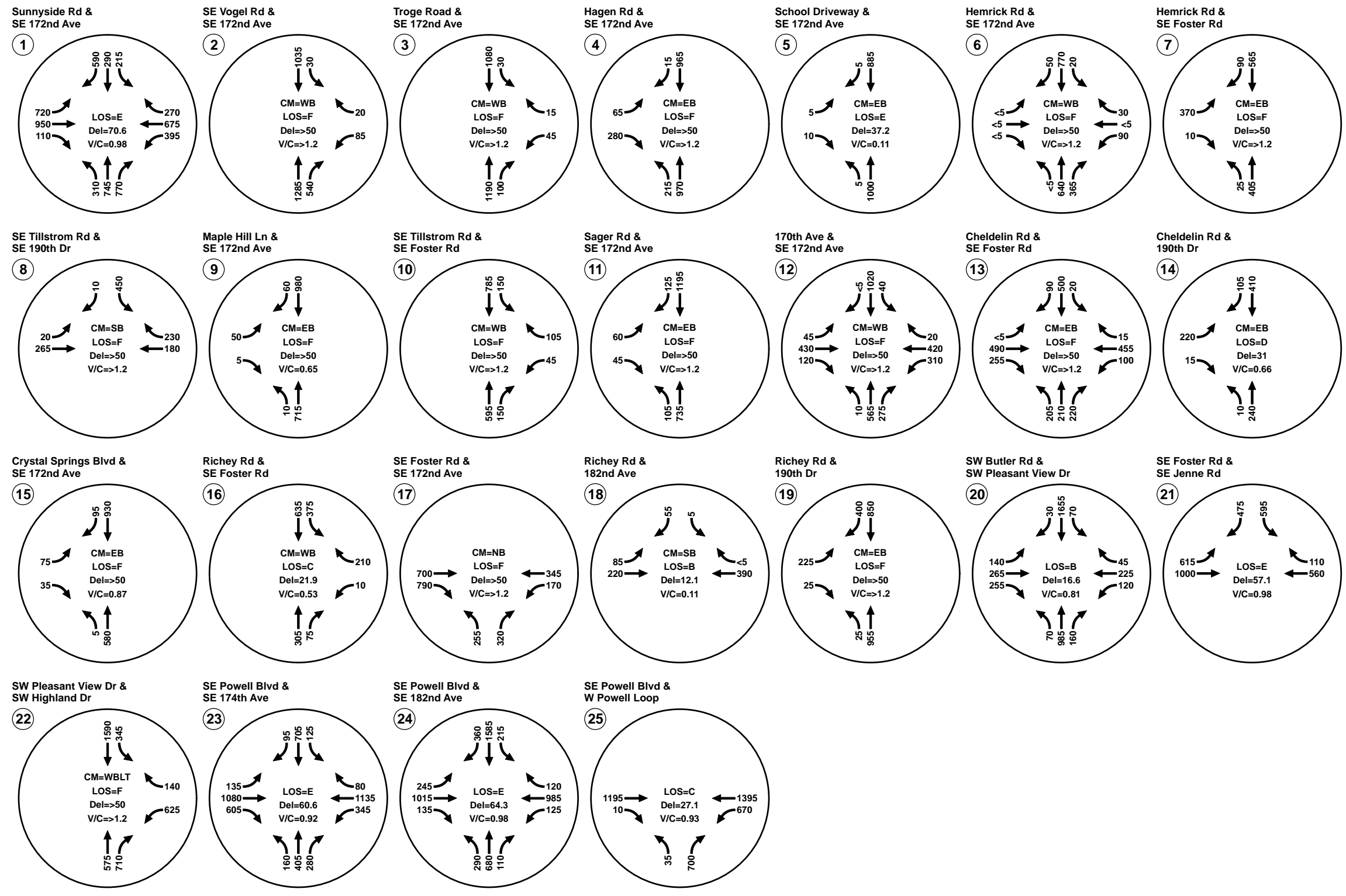
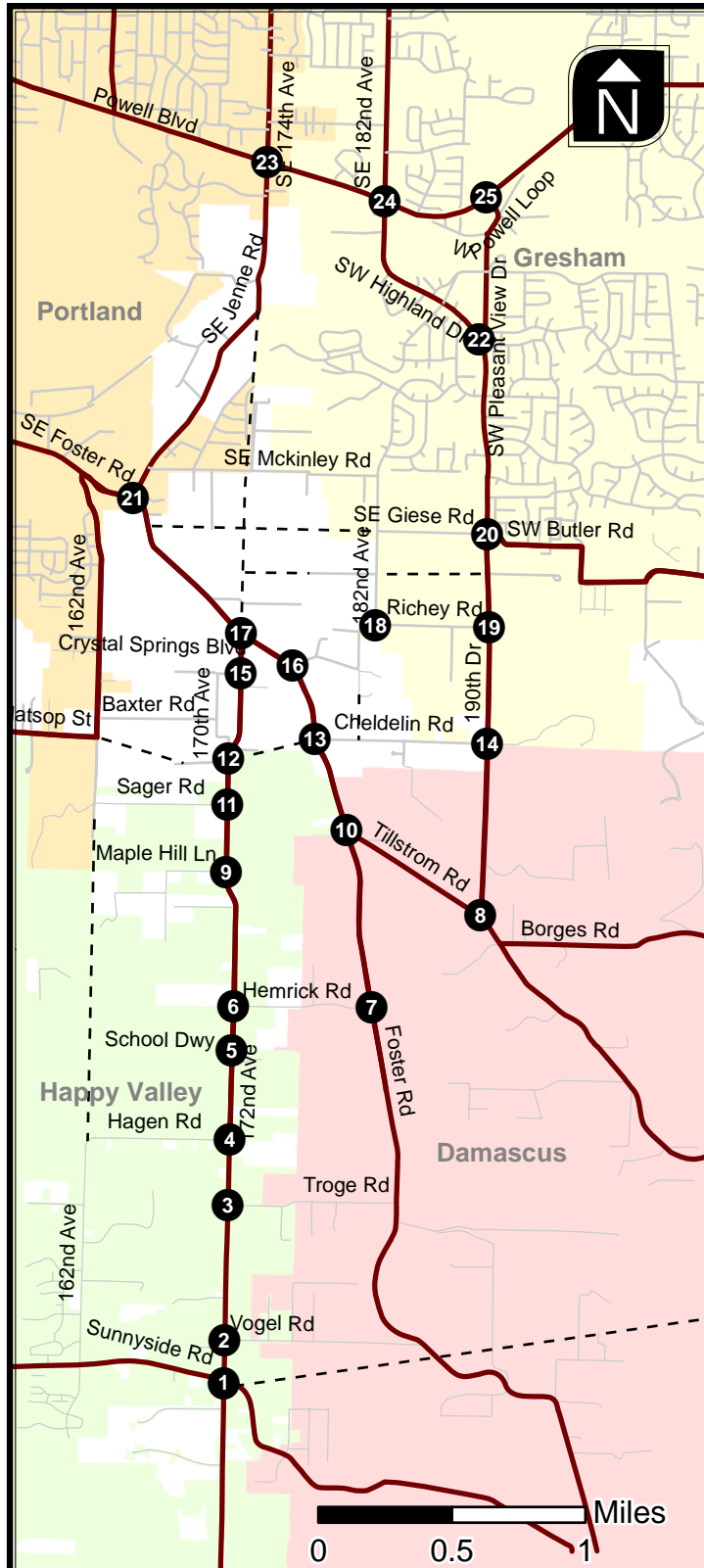
	Study Intersections		Traffic Signal		New Lane under FC Projects
	Arterial/Collector Streets		Stop Sign		
	Local Street		New Traffic Signal under FC Projects		
	2035 FC Project				

## 2035 PSA No-Build Lane Configurations & Traffic Control Devices

172nd / 190th  
Corridor Plan

CLACKAMAS  
COUNTY

Figure  
**4.3-3**



- Study Intersections
- Arterial/Collector Streets
- Local Street
- - - 2035 FC Project

CM = CRITICAL MOVEMENT (UNSIGNIALIZED)  
 LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNIALIZED)  
 Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNIALIZED)  
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

## 2035 PSA No-Build Weekday PM Peak Hour Traffic Conditions



Figure 4.3-4

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As shown in Figure 4.3-4, nearly every study area intersection within the PSA will not meet the applicable level of service and volume-to-capacity standards under the current traffic control and lane geometry. The only exceptions are the SE Richey Road/SE 182<sup>nd</sup> Avenue, SE 190<sup>th</sup> Drive/Cheldelin Road, and SE Foster Road/Richey Road intersections. Among the six study intersections outside the PSA, all, except the SE Foster Road/SE Jenne Road, SE Powell Road/SE 174<sup>th</sup> Avenue, and SW Pleasant View Drive/SW Highland Drive intersections, will meet the applicable level of service and volume-to-capacity standards under the future scenarios with all financially constrained projects in place.

The resultant poor traffic operations can be attributed to the 300+ percent increase in households and 1,200+ percent increase in jobs projected within the PSA. As a result, the current roadway infrastructure cannot support the projected increase in traffic demand in 2035 during the weekday p.m. peak hour. *Appendix "C" contains the 2035 No-Build PSA traffic operations worksheets for the weekday p.m. peak hour.*

### **Initial 2035 Intersection Operational Mitigation**

The vast majority of the failing intersections are currently unsignalized, two-way stop-controlled intersections. Thus, changes to intersection traffic control, such as signalization, and increased lane capacity were considered in this initial 2035 mitigation analysis to meet the applicable standards for each jurisdiction (as listed in Table 4.3-4). Each PSA intersection's mitigation is described below:

- SE 172<sup>nd</sup> Avenue/SE Sunnyside Road<sup>4</sup>:
  - Construct second northbound right-turn lane.
  - Construct exclusive westbound right-turn lane.
- SE 172<sup>nd</sup> Avenue / SE Vogel Road:
  - Construct center left-turn lane on SE 172<sup>nd</sup> Avenue.
  - Construct exclusive northbound right-turn lane.
  - Install roundabout or traffic signal.
- SE 172<sup>nd</sup> Avenue / SE Troge Road:
  - Construct center left-turn lane on SE 172<sup>nd</sup> Avenue.
  - Construct exclusive westbound left-turn lane.
- SE 172<sup>nd</sup> Avenue / SE Hagen Road:
  - Construct center left-turn lane on SE 172<sup>nd</sup> Avenue.
  - Construct exclusive eastbound left-turn lane on SE Hagen Road.
  - Construct additional southbound and northbound through lane on SE 172<sup>nd</sup> Avenue.

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<sup>4</sup> Modeling includes a five-leg intersection with four legs as currently configured and the fifth leg as the Sunnyside extension. Capacity analysis assumed this intersection as a four-leg, with the Sunnyside extension being combined with the existing Sunnyside on the east leg.

- Install roundabout or traffic signal <sup>5</sup>
- SE 172<sup>nd</sup> Avenue / Scouters Mountain School Driveway
  - Construct center left-turn lane on SE 172<sup>nd</sup> Avenue.
- SE 172<sup>nd</sup> Avenue / SE Hemrick Road:
  - Construct exclusive westbound left-turn lane on SE Hemrick Road.
  - Construct exclusive northbound right-turn lane on SE 172<sup>nd</sup> Avenue.
  - Install roundabout or traffic signal.
- SE Foster Road / SE Hemrick Road:
  - Construct center left-turn lane on SE Foster Road.
  - Construct exclusive eastbound left-turn lane on SE Hemrick Road.
  - Install roundabout or traffic signal.
- SE Tillstrom Road / SE 190<sup>th</sup> Drive
  - Construct center left-turn lane on SE Tillstrom Road .
  - Construct exclusive southbound left-turn lane on SE 190<sup>th</sup> Drive.
  - Install roundabout or traffic signal.
- SE Tillstrom Road / SE Foster Road
  - Construct center left-turn lane on SE Foster Road.
  - Install roundabout or traffic signal.
- SE 172<sup>nd</sup> Avenue / SE Sager Road
  - Construct center left-turn lane on SE 172<sup>nd</sup> Road.
  - Construct exclusive eastbound left-turn lane on SE Sager Road.
  - Construct additional southbound and northbound through lane on SE 172<sup>nd</sup> Avenue.
- SE Foster Road / SE Cheldelin Road
  - Construct center two-way left-turn lane on SE Foster Road.
  - Construct new eastbound Clatsop-Cheldelin Road approach as an exclusive left, through, and right-turn lanes.
  - Construct exclusive westbound left-turn lane on Cheldelin Road.
  - Install roundabout or traffic signal.
- SE 172<sup>nd</sup> Avenue / SE 170<sup>th</sup> Avenue
  - Construct northbound and southbound left-turn lane on SE 172<sup>nd</sup> Avenue.
  - Construct new westbound Clatsop-Cheldelin Road approach as an exclusive left, shared through-right-turn lanes.
  - Construct eastbound SE 170<sup>th</sup> Avenue approach as an exclusive left, through, and right-turn lanes.
  - Install roundabout or traffic signal.

---

<sup>5</sup> A roundabout treatment may have modified geometry requirements to meet adopted standards, signalized mitigation was assumed for simplicity of this initial analysis.

- Construct additional southbound and northbound through lane on SE 172<sup>nd</sup> Avenue.
- SE 172<sup>nd</sup> Avenue / SE Crystal Springs Boulevard
  - Construct center left-turn lane on SE 172<sup>nd</sup> Avenue.
  - Construct exclusive eastbound left -turn lane on SE Crystal Springs Boulevard.
- SE Foster Road / SE Richey Road
  - Construct center left-turn lane on SE Foster Road.
  - Construct exclusive westbound left -turn lane on SE Richey Road.
  - Install roundabout or traffic signal.
- SE 172<sup>nd</sup> Avenue / SE Foster Road
  - Construct center left-turn lane on SE Foster Road.
  - Construct exclusive northbound left -turn lane on SE 172<sup>nd</sup> Avenue.
  - Construct exclusive eastbound right-turn lane on SE Foster Road.
  - Install roundabout or traffic signal.
- SE 190<sup>th</sup> Drive / SE Richey Road
  - Construct center left-turn lane on SE 190<sup>th</sup> Drive.
  - Construct exclusive eastbound left-turn lane on SE Richey Road.
  - Construct exclusive southbound right-turn lane on SE 190<sup>th</sup> Drive.
  - Install roundabout or traffic signal.
- SE Foster Road / SE Jenne Road
  - Construct a second southbound left-turn lane on SE Jenne Road.
- SW Pleasant View Drive / SW Highland Drive
  - Install roundabout or traffic signal.
- SE Powell Boulevard / SE 174<sup>th</sup> Avenue
  - Construct a second westbound left-turn lane on SE Powell Boulevard.

The mitigated lane geometry and traffic control for each intersection are shown in Figure 4.3-5, and mitigated 2035 weekday p.m. peak hour traffic conditions are shown in Figure 4.3-6. For simplicity and consistency, a traffic signal (although a roundabout may also apply) was assumed at all intersections requiring enhanced traffic control, as shown in Figures 4.3-5 and 4.3-6.

As shown in these figures, the 2035 post-processed, projected traffic demand during the weekday p.m. peak hour would necessitate 12 new traffic signals or roundabouts and new exclusive turn lanes at virtually all study intersections. It should be noted that these improvements are not recommended; rather, these are mitigations that would be necessary to meet jurisdictional operational standards. The interaction of the additional traffic signals (or roundabouts) at these intersections has not been evaluated.

It should be noted that in many locations within the PSA, it appears a three-lane roadway cross-section may be sufficient to accommodate traffic demands. The two exceptions are on SE 172<sup>nd</sup> Avenue between SE 170<sup>th</sup> Avenue and SE Sager Road, and at the SE 172<sup>nd</sup> Avenue/SE Hagen Road intersection. Both of these sections of SE 172<sup>nd</sup> Avenue would require additional through lanes to meet current operational standards.

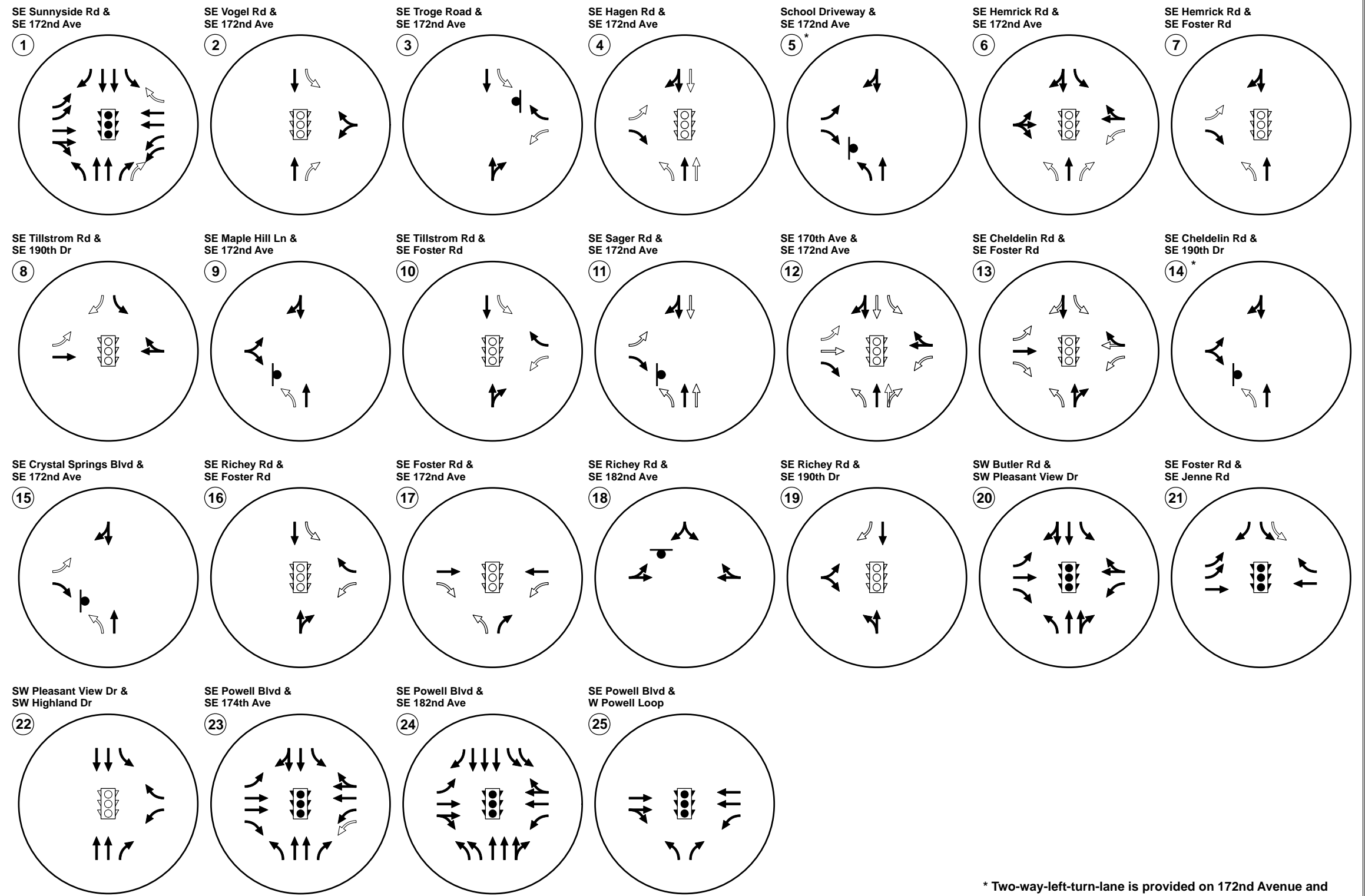
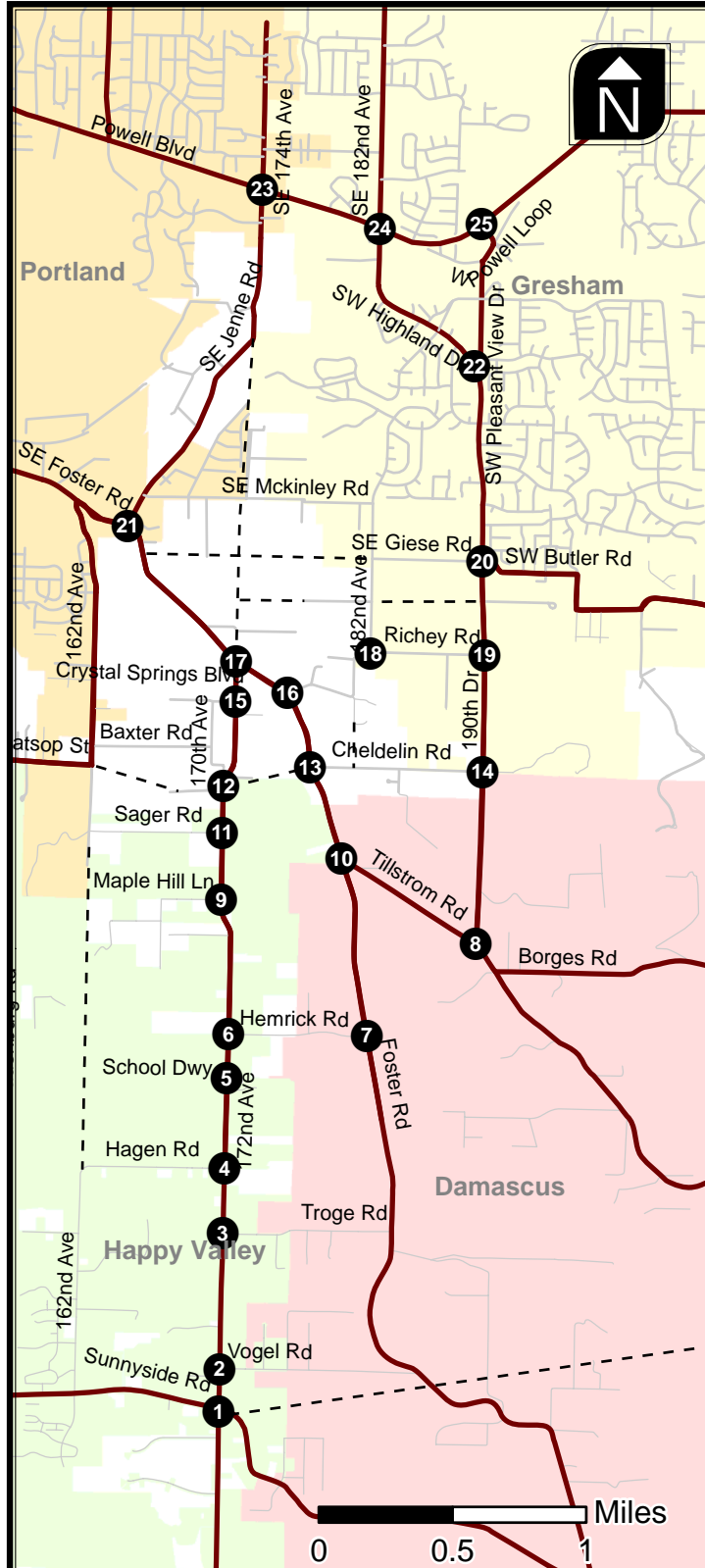
These mitigations have been identified to satisfy the most restrictive operational standards for the controlling jurisdiction(s), including:

- In Clackamas County, LOS D for all intersections
- In Happy Valley and Portland, LOS D for signalized intersections and LOS E for unsignalized intersections

It is important to note that many of these locations would require less mitigation using a less restrictive operational standard (i.e., LOS E).

This No-Build analysis will inform the next project steps of developing alternative roadway links and geometry for the SE 172<sup>nd</sup>/190<sup>th</sup> corridor and the PSA. *It should be noted that the initial mitigation analysis does not address other critical considerations, such as safety, land use compatibility, nor environmental impacts. These factors as well as many of the identified goals and objectives for the project may require substantially different mitigation solutions and/or alignments. As such, the mitigation information provided above is to provide context entering the concept development phase of the project.*

*Appendix "D" contains the 2035 No-Build PSA traffic operations worksheets for the weekday p.m. peak hour.*



\* Two-way-left-turn-lane is provided on 172nd Avenue and 190th Drive due to three lane cross-section widening

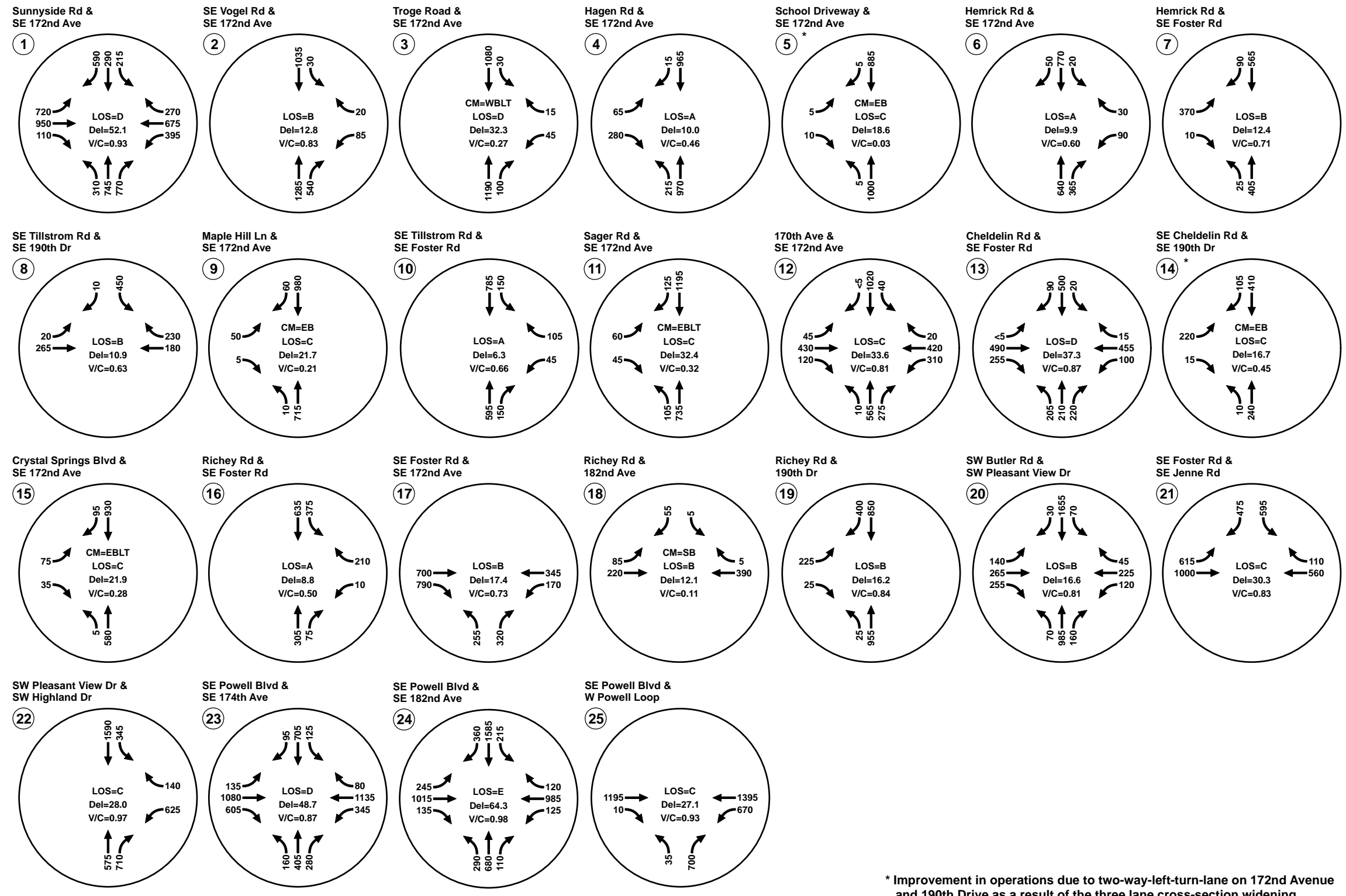
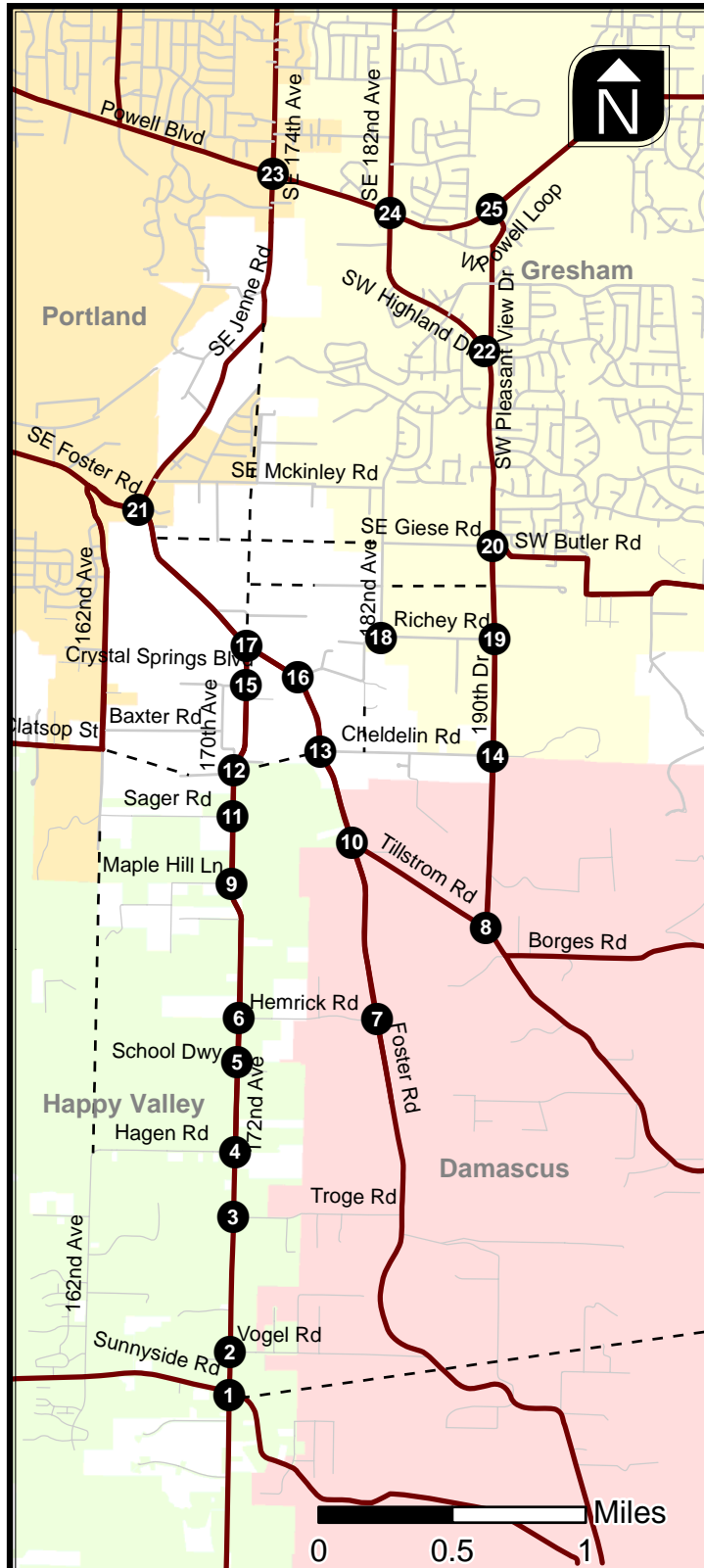
	Study Intersections		Traffic Signal		New Lane
	Arterial/Collector Streets		Stop Sign		
	Local Street		New Traffic Signal		
	2035 FC Project				

## 2035 PSA Mitigated Lane Configurations & Traffic Control Devices



Figure  
**4.3-5**

H:\profiles\10213 - 172nd Ave Sunnyside Rd Alter. Design\Future Conditions\2010 Nov Update\Figure4\_3-5\_2010 Nov.mxd



\* Improvement in operations due to two-way-left-turn-lane on 172nd Avenue and 190th Drive as a result of the three lane cross-section widening

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- Study Intersections
- Arterial/Collector Streets
- Local Street
- - - 2035 FC Project

CM = CRITICAL MOVEMENT (UNSIGNALIZED)  
 LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)  
 Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)  
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

## 2035 PSA Mitigated Weekday PM Peak Hour Traffic Conditions

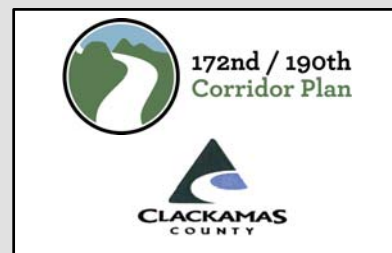


Figure  
**4.3-6**

## MODEL SENSITIVITY COMPARISON

A high-level comparison was conducted to gauge the relative differences in the available travel demand model-based analyses. Each model has a variety of roadway network modifications and land use assumptions within the study area that contribute to the difference in the projections.

The four models compared for the 2035 weekday PM peak hour time period are listed below:

**1) Metro Financially Constrained 172<sup>nd</sup>-190<sup>th</sup> Corridor Plan No-Build Scenario (shown in red)** – This model includes all of the Metro Financially Constrained (FC) projects, except (1) the 172<sup>nd</sup> to 190<sup>th</sup> connector roadway and (2) the capacity enhancement project (5-lane cross-section) to SE 172<sup>nd</sup> Avenue between SE Foster Road and SE Sunnyside Road.

**2) Metro Financially Constrained Model (shown in blue)** – This model includes all of the Metro FC projects. Both the 172<sup>nd</sup>-190<sup>th</sup> connector and the SE 172<sup>nd</sup> capacity enhancement project (5-lane cross-section) are included.

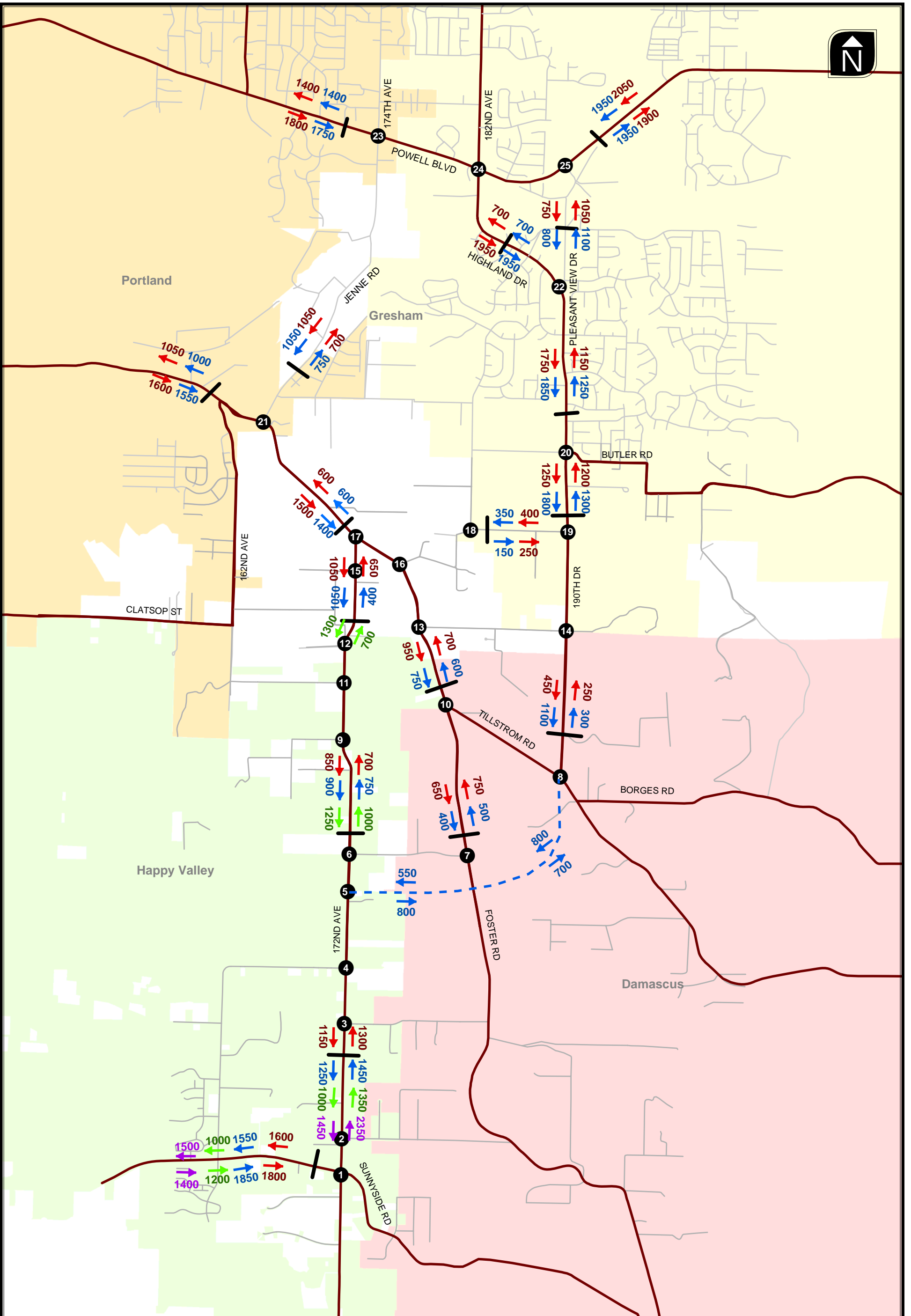
**3) Happy Valley Comprehensive Plan Map – 2035 Traffic Analysis (shown in green)** – This analysis was provided by the City’s traffic consultant and is reflective of the analysis to evaluate if the proposed future roadway network can accommodate the proposed zoning designation for the Happy Valley Comprehensive Plan. The key difference with this model is it’s inclusion of numerous new east-west connections into SE 172<sup>nd</sup> Avenue between SE Sunnyside Road and SE 170<sup>th</sup> Avenue.

**4) SE 172<sup>nd</sup>-South Improvement Project (shown in purple)** – An analysis of travel demand was conducted to develop transportation improvements for the section of SE 172<sup>nd</sup> between OR 212 and Sunnyside Road. This model assumed more aggressive land use assumptions in Happy Valley, particularly south of SE Sunnyside Road. This model also assumed an extension of Sunnyside Road from 172<sup>nd</sup> due east to SE 222<sup>nd</sup>, and disconnection of current Sunnyside Road alignment east of SE 172<sup>nd</sup> Avenue.

The following is a summary of the notable trends in this high-level comparison, as shown in Figure 4.3-7:

- The model have generally very similar weekday PM peak hour projections within the PSA;
- The 172<sup>nd</sup> South Improvement Project traffic model shows over 700 more two-way p.m. peak vehicles on 172<sup>nd</sup> north of Sunnyside Road (2,750 vs. 3,450 p.m. peak hour two-way volumes), as compared with the Metro FC 172<sup>nd</sup>-190<sup>th</sup> Corridor Plan No-Build model forecasts. This higher traffic volume is due to the following assumptions: 1) more aggressive future employment in Happy Valley [5,000 more jobs], and 2) Sunnyside extension from 172<sup>nd</sup> to 222<sup>nd</sup>.
- The new SE 172<sup>nd</sup>-190<sup>th</sup> connector as shown in the model carries volumes warranting a 2/3 lane cross-section (connects approximately between SE 172<sup>nd</sup>/Scouters Mountain School driveway and SE 190<sup>th</sup>/SE Tillstrom);

- Without the new 172<sup>nd</sup>-190<sup>th</sup> connector, SE Foster Road carries between 100-250 more vehicles in each direction; and,
- With the new 172<sup>nd</sup>-190<sup>th</sup> connector, SE 190<sup>th</sup> Drive carries approximately another 500 more vehicles in the southbound direction.
- Outside of the PSA, both the Metro FC and No-Build models show very similar traffic demand. This would indicate the lack of regional alternatives besides the Foster Road and 172<sup>nd</sup> corridors, which is also shown in the regional travel demand model's willingness to assign more volume than capacity along the 172<sup>nd</sup> corridor, without any geometric improvements (FSA no-build).



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- ← 2035 Volume Estimate (Metro FC but No-Build PSA)
- ← 2035 Volume Estimate (Metro FC Model)
- ← 2035 Volume Estimate (Happy Valley Comprehensive Plan)
- ← 2035 Volume Estimate (Clackamas Co. 172nd South Improvement Project)
- ← 2035 Volume Estimate (unlabeled)

### PM Peak Hour Traffic Volume Estimates 2035 Projection



**Figure  
4.3-7**

## SUMMARY

This 2035 No-Build transportation conditions analysis reviewed projected growth, modified the 2035 financially constrained model to represent the current roadway geometry within the PSA, developed post-processed year 2035 traffic demand for the weekday p.m. peak hour from the modified model, evaluated study intersection traffic operations under the 2035 weekday p.m. peak hour (under No-Build geometry), and then identified initial mitigation improvements required to meet applicable intersection operational standards from solely an operational perspective. *This information is meant solely to provide context entering the concept development phase of the project.*

The results of this analysis indicate:

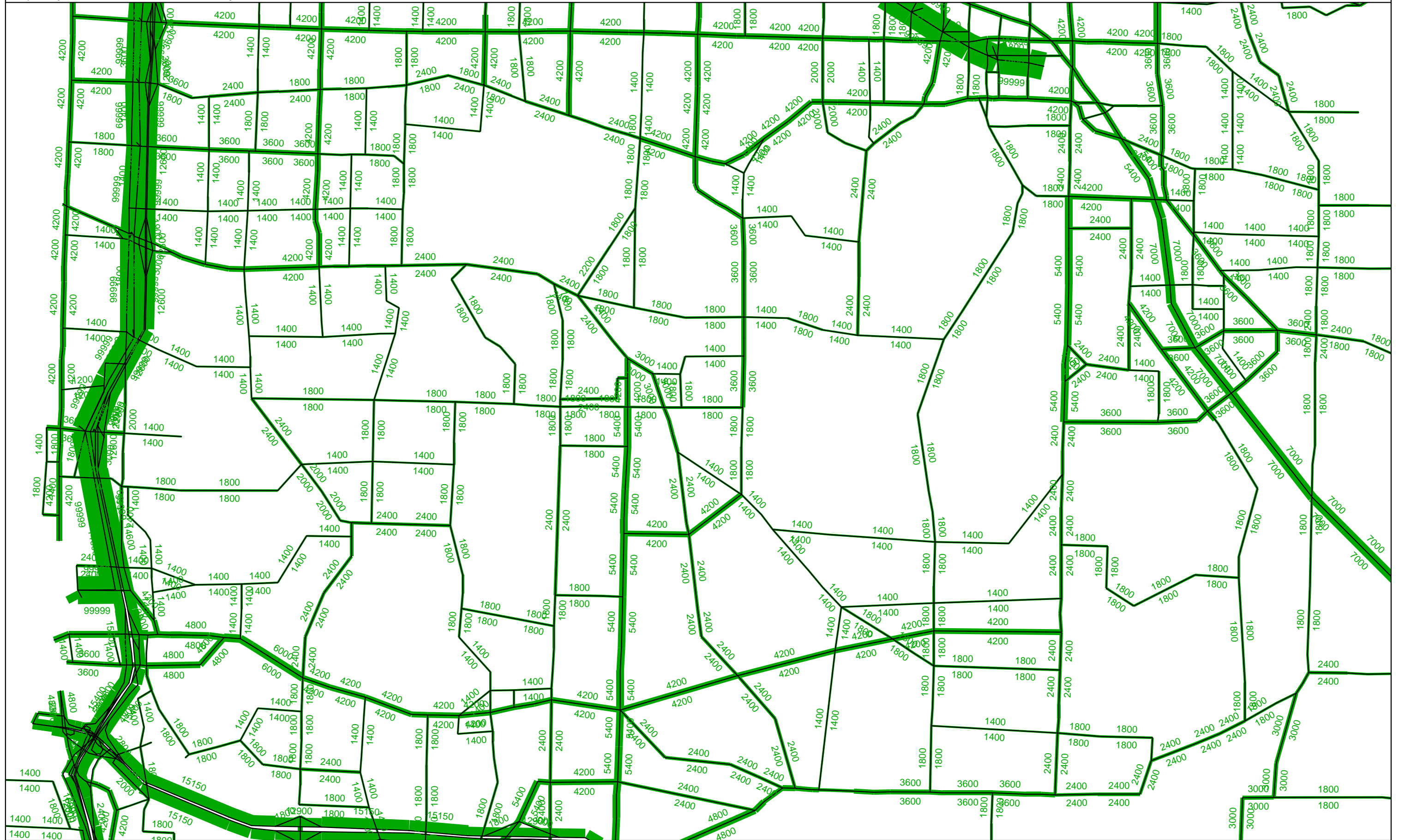
- Households in the primary study area, defined as land directly served by the corridor, are forecast to grow by more than 300 percent, between 2005 and 2035. Jobs in the same area are forecast to grow by more than 1,200 percent.
- Growth in the expanded study area, which includes additional lands in Portland, Gresham, Damascus, Happy Valley, and the Pleasant Valley Town Center area, is expected to increase approximately 200 percent in households and 170 percent in jobs.
- The 2035 financially constrained travel demand model was modified to create a PSA No-Build condition by:
  - Removing the SE 172<sup>nd</sup> Avenue-SE Foster Road new connector roadway north of Tillstrom Road;
  - Removing the SE 172<sup>nd</sup>-190<sup>th</sup> Avenue new connector roadway; and
  - Reducing the SE 172<sup>nd</sup> Avenue cross-section from five lanes to the current 2-lane cross-section
- All projects identified in the 2035 FC travel demand model outside the PSA were left in this No-Build analysis.
- Under year 2035 post-processed weekday p.m. peak hour traffic demand, the current or No-Build PSA intersections generally do not meet applicable intersection standards (as shown in Table 4.3-4). The only exceptions are:
  - SE Richey Road/SE 182<sup>nd</sup> Avenue,
  - SE 190<sup>th</sup> Drive/Cheldelin Road, and
  - SE Foster Road/Richey Road.
- Of the six study intersections outside PSA, three of them meet the applicable intersection standards (as shown in Table 4.3-4). The exceptions are:
  - SE Foster Road/SE Jenne Road,

- SE Powell Road/SE 174<sup>th</sup> Avenue, and
- SW Pleasant View Drive/SW Highland Drive.
- Initial mitigation solutions were identified for intersections not meeting applicable standards under the year 2035 conditions to provide context to the concept development phase of the project. The following is a general summary:
  - At the majority of study intersections, a three-lane major roadway cross-section is sufficient to accommodate year 2035 traffic demands. The two exceptions are SE 172<sup>nd</sup> Avenue between SE 170<sup>th</sup> Avenue and SE Sager Road, and SE 172<sup>nd</sup> Avenue at Hagen Road, both requiring new through lanes (five lane section).
  - 12 intersections will require a new form of intersection control, such as a roundabout or traffic signal (although a traffic signal was assumed for the purposes of this planning level analysis).
    - SE 172<sup>nd</sup> Avenue / SE Vogel Road
    - SE 172<sup>nd</sup> Avenue / SE Hagen Road
    - SE 172<sup>nd</sup> Avenue / SE Hemrick Road
    - SE Foster Road / SE Hemrick Road
    - SE 190<sup>th</sup> Drive / SE Tillstrom Road
    - SE Foster Road / SE Tillstrom Road
    - SE 172<sup>nd</sup> Avenue / SE 170<sup>th</sup> Avenue
    - SE Foster Road / SE Cheldelin Road
    - SE Foster Road / SE Richey Road
    - SE 172<sup>nd</sup> Avenue / SE Foster Road
    - SE 190<sup>th</sup> Drive / SE Richey Road
    - SW Pleasant View Drive / SW Highland Drive

This No-Build analysis will inform the next project steps of developing alternative roadway links and geometry for the SE 172<sup>nd</sup>/190<sup>th</sup> corridor and the PSA. *It should be noted that the initial mitigation analysis does not address other critical considerations, such as safety, land use compatibility, nor environmental impacts. These factors as well as many of the identified goals and objectives for the project may require substantially different mitigation solutions and/or alignments. As such, the mitigation information provided above is to provide context entering the concept development phase of the project.*

Appendix A – 2035  
VISUM Travel Demand  
Model Capacity Plots

Capacity Plot for Metro's Financially Constrained Model

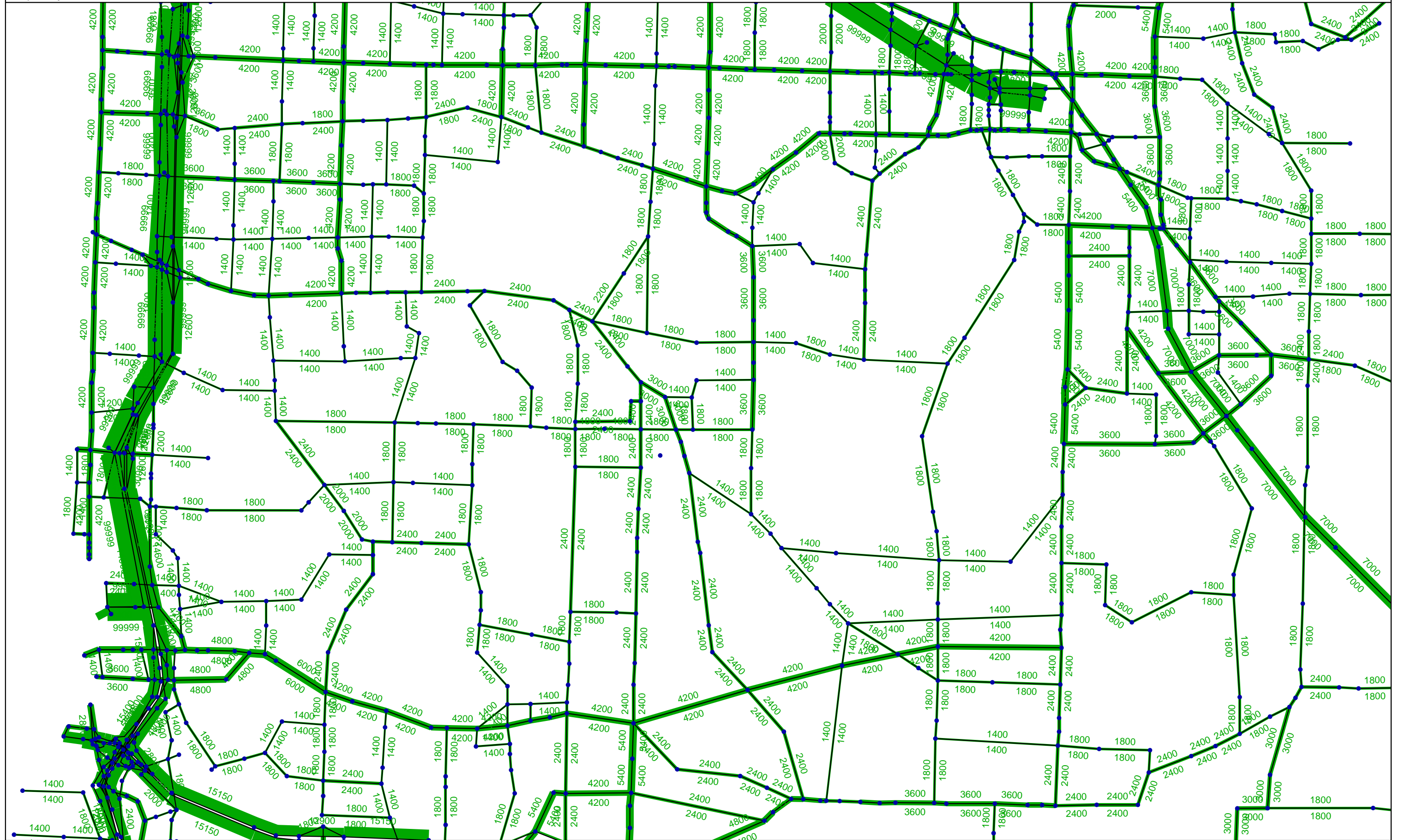


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Capacity Plot for PSA No-Build Model



Appendix B – NCHRP  
255 Post-Processing  
Traffic Volume  
Worksheets

2035 172nd Corridor Plan Volume Development - Study Intersections (PSA No-Build Model)

Growth Rate  2008 2005 2035

Peak 2 Hour to 1 Hour Conversion

Intersection	Movement	Existing Volume - 1 Hour	Existing Model Volume - 1 Hour	Future NB Model Volume - 1 Hour	Model:Existing	Ratio	Difference	Average	Growth Factor	Analysis Volume	Modified Analysis Volume
<b>172nd / Sunnyside</b>	<b>Total</b>	<b>1,591</b>	<b>1692</b>	<b>6,792</b>	<b>1.06</b>	<b>6,388</b>	<b>6,692</b>	<b>6,540</b>	<b>4.11</b>	<b>6,046</b>	<b>6,046</b>
PSA # 1	SBR	220	136	420	0.62	678	503	591	2.68	591	591
Metro Node ID 10361	SBT	86	249	552	2.89	191	389	290	3.37	290	290
	SBL	17	36	306	2.11	145	287	216	12.70	216	216
	WBR	12	9	234	0.78	300	237	268	22.36	268	268
	WBT	209	243	743	1.16	640	709	674	3.23	674	674
	WBL	5	9	510	1.77	289	506	397	79.48	397	397
	NBR	6	15	1095	2.43	451	1,086	769	128.09	769	769
	NBT	137	307	915	2.24	408	744	576	4.20	744	744
	NBL	91	29	250	0.32	780	311	311	3.42	311	311
	EBR	139	138	111	0.99	112	112	112	0.81	112	112
	EBT	258	381	1206	1.48	818	1,084	951	3.69	951	951
	EBL	411	140	451	0.34	1,321	722	1,022	2.49	722	722
<b>172nd / Vogel</b>	<b>Total</b>	<b>946</b>	<b>872</b>	<b>2,806</b>	<b>0.92</b>	<b>3,046</b>	<b>2,880</b>	<b>2,963</b>	<b>3.13</b>	<b>3,193</b>	<b>2,993</b>
PSA # 2	SBT	309	418	1251	1.35	924	1,142	1,033	3.34	1,033	1,033
Metro Node ID 24080	SBL	9	0	0	0.00	#DIV/0!	9	#DIV/0!	#DIV/0!	28	28
Zone Connector	WBR	7	0	0	0.00	#DIV/0!	7	#DIV/0!	#DIV/0!	22	22
	WBL	27	0	0	0.00	#DIV/0!	27	#DIV/0!	#DIV/0!	85	85
	NBR	173	0	0	0.00	#DIV/0!	173	#DIV/0!	#DIV/0!	542	542
	NBT	421	453	1555	1.08	1,444	1,523	1,483	3.52	1,483	1,283
<b>172nd / Troge</b>	<b>Total</b>	<b>761</b>	<b>846</b>	<b>2,252</b>	<b>1.11</b>	<b>2,027</b>	<b>2,167</b>	<b>2,097</b>	<b>2.76</b>	<b>2,160</b>	<b>2,460</b>
PSA # 3	SBT	289	411	1103	1.42	776	982	879	3.04	879	1,079
Metro Node ID 24074	SBL	11	0	0	0.00	#DIV/0!	11	#DIV/0!	#DIV/0!	30	30
Zone Connector	WBR	5	0	0	0.00	#DIV/0!	5	#DIV/0!	#DIV/0!	14	14
	WBL	17	0	0	0.00	#DIV/0!	17	#DIV/0!	#DIV/0!	47	47
	NBR	37	0	0	0.00	#DIV/0!	37	#DIV/0!	#DIV/0!	102	102
	NBT	402	435	1148	1.08	1,062	1,115	1,089	2.71	1,089	1,189
<b>172nd / Hagen</b>	<b>Total</b>	<b>792</b>	<b>1099</b>	<b>2,901</b>	<b>1.39</b>	<b>2,090</b>	<b>2,594</b>	<b>2,342</b>	<b>2.96</b>	<b>2,587</b>	<b>2,513</b>
PSA # 4	SBR	27	154	92	5.72	16	-36	16	0.59	16	16
Metro Node ID 13924	SBT	295	409	1188	1.39	857	1,074	965	3.27	965	965
	NBT	402	433	1021	1.08	948	990	969	2.41	969	969
	NBL	6	4	215	0.69	310	217	263	43.86	217	217
	EBR	8	5	279	0.65	429	282	355	44.40	355	282
	EBL	54	94	107	1.73	62	68	65	1.20	65	65
<b>172nd / School Access</b>	<b>Total</b>	<b>782</b>	<b>1090</b>	<b>2,407</b>	<b>1.39</b>	<b>1,727</b>	<b>2,099</b>	<b>1,913</b>	<b>2.45</b>	<b>1,919</b>	<b>1,919</b>
PSA # 5	SBR	3	0	0	0.00	#DIV/0!	3	#DIV/0!	#DIV/0!	7	7
Metro Node ID 30941	SBT	323	564	1280	1.75	733	1,039	886	2.74	886	886
Zone Connector	NBT	446	526	1127	1.18	955	1,047	1,001	2.25	1,001	1,001
	NBL	3	0	0	0.00	#DIV/0!	3	#DIV/0!	#DIV/0!	7	7
	EBR	4	0	0	0.00	#DIV/0!	4	#DIV/0!	#DIV/0!	10	10
	EBL	3	0	0	0.00	#DIV/0!	3	#DIV/0!	#DIV/0!	7	7
<b>172nd / Hemrick</b>	<b>Total</b>	<b>798</b>	<b>1078</b>	<b>2,190</b>	<b>1.35</b>	<b>1,621</b>	<b>1,910</b>	<b>1,765</b>	<b>2.21</b>	<b>1,925</b>	<b>1,975</b>
PSA # 6	SBR	1	0	0	0.00	#DIV/0!	1	#DIV/0!	#DIV/0!	2	52
Metro Node ID 50108	SBT	282	560	1212	1.98	611	934	772	2.74	772	772
Zone Connector	SBL	9	0	0	0.00	#DIV/0!	9	#DIV/0!	#DIV/0!	20	20
	WBR	14	0	0	0.00	#DIV/0!	14	#DIV/0!	#DIV/0!	31	31
	WBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	WBL	41	0	0	0.00	#DIV/0!	41	#DIV/0!	#DIV/0!	91	91
	NBR	166	0	0	0.00	#DIV/0!	166	#DIV/0!	#DIV/0!	367	367
	NBT	285	518	978	1.82	538	745	641	2.25	641	641
	NBL	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBR	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBL	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
<b>Foster / Hemrick</b>	<b>Total</b>	<b>612</b>	<b>607</b>	<b>1,332</b>	<b>0.99</b>	<b>1,344</b>	<b>1,337</b>	<b>1,340</b>	<b>2.19</b>	<b>1,464</b>	<b>1,464</b>
PSA # 7	SBR	42	0	0	0.00	#DIV/0!	42	#DIV/0!	#DIV/0!	92	92
Metro Node ID 24060	SBT	185	377	884	2.04	434	692	563	3.04	563	563
Zone Connector	NBT	201	230	448	1.14	392	419	406	2.02	406	406
	NBL	11	0	0	0.00	#DIV/0!	11	#DIV/0!	#DIV/0!	24	24
	EBR	5	0	0	0.00	#DIV/0!	5	#DIV/0!	#DIV/0!	11	11
	EBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBL	168	0	0	0.00	#DIV/0!	168	#DIV/0!	#DIV/0!	368	368
<b>190th / Tillstrom</b>	<b>Total</b>	<b>499</b>	<b>996</b>	<b>1,837</b>	<b>2.00</b>	<b>920</b>	<b>1,340</b>	<b>1,130</b>	<b>2.26</b>	<b>1,158</b>	<b>1,158</b>
PSA # 8	SBR	18	161	100	8.93	11	-43	11	0.62	11	11
Metro Node ID 14216	SBL	74	200	752	2.71	278	626	452	6.11	452	452
	WBR	66	111	317	1.69	188	272	230	3.49	230	230
	WBT	100	186	289	1.86	155	203	179	1.79	179	179
	EBT	197	232	305	1.18	258	269	264	1.34	264	264
	EBL	44	105	74	2.39	31	13	22	0.50	22	22
<b>172nd / Maple Lane</b>	<b>Total</b>	<b>609</b>	<b>1090</b>	<b>2,191</b>	<b>1.79</b>	<b>1,224</b>	<b>1,710</b>	<b>1,467</b>	<b>2.41</b>	<b>1,470</b>	<b>1,820</b>
PSA # 9	SBR	5	0	0	0.00	#DIV/0!	5	#DIV/0!	#DIV/0!	12	62
Metro Node ID 14219	SBT	295	571	1343	1.94	694	1,067	881	2.99	881	981
Zone Connector	NBT	303	519	848	1.71	495	632	563	1.86	563	713
	NBL	4	0	0	0.00	#DIV/0!	4	#DIV/0!	#DIV/0!	10	10
	EBR	2	0	0	0.00	#DIV/0!	2	#DIV/0!	#DIV/0!	5	5
	EBL	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	50
<b>Foster / Tillstrom</b>	<b>Total</b>	<b>838</b>	<b>1152</b>	<b>2,179</b>	<b>1.37</b>	<b>1,585</b>	<b>1,865</b>	<b>1,725</b>	<b>2.06</b>	<b>1,825</b>	<b>1,825</b>
PSA # 10	SBT	208	304	987	1.46	676	891	784	3.77	784	784
Metro Node ID 14220	SBL	148	261	264	1.76	150	151	150	1.02	150	150
	WBR	92	254	270	2.76	98	108	103	1.12	103	103
	WBL	29	93	118	3.21	37	54	45	1.56	45	45
	NBR	105	77	114	0.74	155	142	148	1.41	148	148
	NBT	256	163	425	0.64	669	519	594	2.32	594	594
<b>172nd / Sager</b>	<b>Total</b>	<b>607</b>	<b>746</b>	<b>3,015</b>	<b>1.23</b>	<b>2,455</b>	<b>2,877</b>	<b>2,666</b>	<b>4.39</b>	<b>2,621</b>	<b>2,271</b>
PSA # 11	SBR	3	1	125	0.17	720	127	127	42.43	127	127
Metro Node ID 45424	SBT	290	321	1589	1.11	1,436	1,558	1,497	5.16	1,497	1,197
	NBT	285	321	902	1.13	801	866	834	2.93	834	734
	NBL	18	9	98	0.49	199	107	153	8.50	107	107
	EBR	9	95	165	10.52	16	79	47	5.27	47	47
	EBL	2	0	137	0.00	#DIV/0!	139	#DIV/0!	#DIV/0!	9	59
<b>172nd / 170th</b>	<b>Total</b>	<b>589</b>	<b>1077</b>	<b>3,739</b>	<b>1.83</b>	<b>2,044</b>	<b>3,251</b>	<b>2,648</b>	<b>4.49</b>	<b>3,483</b>	<b>3,258</b>
PSA # 12	SBR	2	132	31	66.04	0	-99	0	0.23	0	0
Metro Node ID 11491	SBT	293	322	1188	1.10	1,079	1,158	1,119	3.82	1,119	1,019
	SBL			42	#DIV/0!	#DIV/0!	42	#DIV/0!	#DIV/0!	42	42
	WBR			18	#DIV/0!	#DIV/0!	18	#DIV/0!	#DIV/0!	18	18
	WBT			420	#DIV/0!	#DIV/0!	420	#DIV/0!	#DIV/0!	420	420
	WBL			311	#DIV/0!	#DIV/0!	311	#DIV/0!	#DIV/0!	311	311
	NBR			273	#DIV/0!	#DIV/0!	273	#DIV/0!	#DIV/0!	273	273
	NBT	283	321	755	1.13	666	717	691	2.44	691	566
	NBL	6	36	12	6.07	2	-18	2	0.33	12	12
	EBR	4	20	214	5.07	42	198	120	30.03	120	120
	EBT			431	#DIV/0!	#DIV/0!	431	#DIV/0!	#DIV/0!	431	431
	EBL	1	245	45	245.44	0	-199				

Intersection	Movement	Existing Volume - 1 Hour	Existing Model Volume - 1 Hour	Future NB Model Volume - 1 Hour	Model:Existing	Ratio	Difference	Average	Growth Factor	Analysis Volume	Modified Analysis Volume	
Foster / Cheldelin PSA # 13 Metro Node ID 45407 Zone Connector	Total	724	1023	2,267		1.41	1,604	1,968	1,786	2.47	2,469	2,469
	SBR		0	88	#DIV/0!	#DIV/0!	88	#DIV/0!	#DIV/0!	88	88	88
	SBT	315	565	802	1.79	447	552	500	1.59	500	500	500
	SBL	8	0	84	0.00	#DIV/0!	92	#DIV/0!	#DIV/0!	20	20	20
	WBR	6	0	11	0.00	#DIV/0!	17	#DIV/0!	#DIV/0!	15	15	15
	WBT		0	457	#DIV/0!	#DIV/0!	457	#DIV/0!	#DIV/0!	457	457	457
	WBL	40	0	376	0.00	#DIV/0!	416	#DIV/0!	#DIV/0!	99	99	99
	NBR	89	0	150	0.00	#DIV/0!	239	#DIV/0!	#DIV/0!	220	220	220
	NBT	266	458	387	1.72	225	195	210	0.79	210	210	210
	NBL		0	205	#DIV/0!	#DIV/0!	205	#DIV/0!	#DIV/0!	205	205	205
	EBR		0	253	#DIV/0!	#DIV/0!	253	#DIV/0!	#DIV/0!	253	253	253
	EBT		0	492	#DIV/0!	#DIV/0!	492	#DIV/0!	#DIV/0!	492	492	492
EBL		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0	0	
190th / Cheldelin PSA # 14 Metro Node ID 24300 Zone Connector	Total	368	554	1,178		1.51	782	992	887	2.41	1,001	1,001
	SBR	44	0	0	0.00	#DIV/0!	44	#DIV/0!	#DIV/0!	106	106	106
	SBT	105	352	822	3.35	245	575	410	3.91	410	410	410
	NBT	117	202	356	1.73	206	271	238	2.04	238	238	238
	NBL	4	0	0	0.00	#DIV/0!	4	#DIV/0!	#DIV/0!	10	10	10
	EBR	7	0	0	0.00	#DIV/0!	7	#DIV/0!	#DIV/0!	17	17	17
	EBL	91	0	0	0.00	#DIV/0!	91	#DIV/0!	#DIV/0!	219	219	219
172nd / Crystal Springs PSA # 15 Metro Node ID 15904	Total	619	1107	2,383		1.79	1,333	1,896	1,614	2.61	1,668	1,718
	SBR	23	44	139	1.92	73	118	95	4.15	95	95	95
	SBT	302	434	1174	1.44	817	1,042	930	3.08	930	930	930
	NBT	288	550	789	1.91	414	528	471	1.63	528	528	528
	NBL	0	16	29	#DIV/0!	0	12	6	#DIV/0!	6	6	6
	EBR	0	21	87	#DIV/0!	0	66	33	#DIV/0!	33	33	33
EBL	6	42	165	6.93	24	130	77	12.80	77	77	77	
Foster / Richey PSA # 16 Metro Node ID 11488	Total	1,086	1483	1,899		1.37	1,391	1,502	1,446	1.33	1,611	1,611
	SBT	319	501	886	1.57	564	704	634	1.99	634	634	634
	SBL	260	246	360	0.95	380	373	376	1.45	376	376	376
	WBR	203	161	166	0.79	210	208	209	1.03	209	209	209
	WBL	13	101	88	7.80	11	0	0	0.00	11	11	11
	NBR	57	156	0	2.74	0	-99	0	0.00	76	76	76
NBT	234	317	398	1.35	294	316	305	1.30	305	305	305	
172nd / Foster PSA # 17 Metro Node ID 11490	Total	1,316	1966	3,556		1.49	2,381	2,906	2,643	2.01	2,581	2,581
	WBT	279	342	414	1.23	338	351	345	1.24	345	345	345
	WBL	155	136	150	0.88	172	170	171	1.10	171	171	171
	NBR	156	192	372	1.23	301	335	318	2.04	318	318	318
	NBL	132	399	583	3.02	193	316	255	1.93	255	255	255
	EBR	173	342	1163	1.97	589	994	791	4.57	791	791	791
EBT	421	555	874	1.32	663	740	701	1.67	701	701	701	
182nd / Richey PSA # 18 Metro Node ID 45441 Node Only	Total	473	644	938		1.36	689	767	728	1.54	759	759
	SBR	35	0	0	0.00	#DIV/0!	35	#DIV/0!	#DIV/0!	54	54	54
	SBL	4	0	0	0.00	#DIV/0!	4	#DIV/0!	#DIV/0!	6	6	6
	WBR	2	0	0	0.00	#DIV/0!	2	#DIV/0!	#DIV/0!	3	3	3
	WBT	157	263	556	1.68	332	450	391	2.49	391	391	391
	EBT	221	381	382	1.72	222	222	222	1.00	222	222	222
EBL	54	0	0	0.00	#DIV/0!	54	#DIV/0!	#DIV/0!	83	83	83	
190th / Richey PSA # 19 Metro Node ID 11487	Total	756	1245	3,329		1.65	2,022	2,840	2,431	3.22	2,476	2,476
	SBR	164	263	556	1.60	346	457	402	2.45	402	402	402
	SBT	135	369	1416	2.73	518	1,182	850	6.30	850	850	850
	NBT	203	211	974	1.04	939	967	953	4.70	953	953	953
	NBL	7	0	0	0.00	#DIV/0!	7	#DIV/0!	#DIV/0!	23	23	23
	EBR	8	0	0	0.00	#DIV/0!	8	#DIV/0!	#DIV/0!	26	26	26
EBL	239	402	382	1.68	227	219	223	0.93	223	223	223	
Pleasant View Dr/Butler Dr PSA # 20 Metro Node ID	Total	1,043	#VALUE!	4,823	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	4,023	4,023
	SBR	30	#VALUE!	28	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	28	28
	SBT	276	405	2045	1.47	1,395	1,916	1,655	6.00	1,655	1,655	1,655
	SBL	50	33	50	0.66	77	68	72	1.45	72	72	72
	WBR	39	15	19	0.39	50	43	46	1.19	46	46	46
	WBT	41	#VALUE!	225	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	225	225	225
	WBL	31	268	430	8.66	50	192	121	3.90	121	121	121
	NBR	96	205	290	2.13	136	181	158	1.65	158	158	158
	NBT	348	358	1005	1.03	976	994	985	2.83	985	985	985
	NBL	0	0	72	#DIV/0!	#DIV/0!	72	#DIV/0!	#DIV/0!	72	72	72
	EBR	3	#VALUE!	256	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	256	256	256
	EBT	67	#VALUE!	264	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	264	264	264
EBL	62	#VALUE!	140	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	140	140	140	
Foster/Jenne PSA # 21 Metro Node ID	Total	1,892	2330	4,666		1.23	3,790	4,229	4,009	2.12	4,075	4,075
	SBR	353	349	471	0.99	476	475	475	1.35	475	475	475
	SB-to-NE		0	17	#DIV/0!	#DIV/0!	17	#DIV/0!	#DIV/0!	17	17	17
	SBL	175	409	973	2.34	417	739	578	3.30	578	578	578
	WBR	142	385	331	2.71	122	88	105	0.74	105	105	105
	WBT	255	352	393	1.38	284	296	290	1.14	290	290	290
	WB-to-NE		0	250	#DIV/0!	#DIV/0!	250	#DIV/0!	#DIV/0!	250	250	250
	SWR		0	7	#DIV/0!	#DIV/0!	7	#DIV/0!	#DIV/0!	7	7	7
	SWT		0	272	#DIV/0!	#DIV/0!	272	#DIV/0!	#DIV/0!	272	272	272
	SWL		0	470	#DIV/0!	#DIV/0!	470	#DIV/0!	#DIV/0!	470	470	470
	EB-to-NE		0	397	#DIV/0!	#DIV/0!	397	#DIV/0!	#DIV/0!	397	397	397
EBT	416	538	746	1.29	577	624	600	1.44	600	600	600	
EBL	551	296	340	0.54	631	594	613	1.11	613	613	613	
Highland/Pleasant View Dr PSA # 22 Metro Node ID	Total	1,305	1328	4,042		1.02	3,972	4,019	3,996	3.06	3,989	3,989
	SBR		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0	0
	SBT	451	312	1242	0.69	1,796	1,381	1,589	3.52	1,589	1,589	1,589
	SBL	129	183	437	1.41	309	384	346	2.69	346	346	346
	WBR	70	93	174	1.32	132	152	142	2.02	142	142	142
	WBT		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0	0
	WBL	123	287	992	2.33	426	829	627	5.10	627	627	627
	NBR	200	231	777	1.15	673	746	709	3.55	709	709	709
	NBT	332	224	420	0.67	623	528	576	1.73	576	576	576
	NBL		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0	0
	EBR		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0	0
EBT		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0	0	
EBL		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0	0	
Powell/174th PSA # 23 Metro Node ID	Total	2,760	2885	5,304		1.05	5,074	5,179	5,127	1.86	5,049	5,149
	SBR	78	10	27	0.13	213	95	95	1.22	95	95	95
	SBT	192	230	787	1.20	656	749	703	3.66	703	703	703
	SBL	74	16	66	0.22	303	124	124	1.67	124	124	124
	WBR	44	2	37	0.05	792	79	79	1.80	79	79	79
	WBT	594	551	973	0.93	1,049	1,016	1,033	1.74	1,033	1,033	1,133
	WBL	189	308	504	1.63	309	385	347	1.84	347	347	347
	NBR	296	358	342	1.21	283	280	281	0.95	281	281	281
	NBT	238	134	254	0.56	452	358	405	1.70	405	405	405
	NBL	107	173	239	1.61	148	174	161	1.50	161	161	161
	EBR	170	225	721	1.32	544	666	605	3.56	605	605	605
EBT	702	854	1269	1.22	1,044	1,117	1					

Intersection	Movement	Existing Volume - 1 Hour	Existing Model Volume - 1 Hour	Future NB Model Volume - 1 Hour	Model:Existing	Ratio	Difference	Average	Growth Factor	Analysis Volume	Modified Analysis Volume
<b>Powell/182nd</b>	<b>Total</b>	<b>3,492</b>	<b>3355</b>	<b>5,656</b>	<b>0.96</b>	<b>5,886</b>	<b>5,792</b>	<b>5,839</b>	<b>1.67</b>	<b>5,959</b>	<b>5,862</b>
PSA # 24	SBR	190	89	258	0.47	552	360	456	2.40	456	360
Metro Node ID	SBT	670	582	1433	0.87	1,648	1,520	1,584	2.36	1,584	1,584
	SBL	202	176	190	0.87	218	216	217	1.07	217	217
	WBR	114	94	97	0.82	118	118	118	1.04	118	118
	WBT	517	548	1030	1.06	972	999	985	1.91	985	985
	WBL	116	140	149	1.21	123	124	124	1.07	124	124
	NBR	55	120	196	2.18	90	131	110	2.01	110	110
	NBT	438	274	460	0.62	736	624	680	1.55	680	680
	NBL	202	105	166	0.52	321	263	292	1.45	292	292
	EBR	145	358	342	2.47	138	129	134	0.92	134	134
	EBT	648	854	1269	1.32	963	1,063	1,013	1.56	1,013	1,013
	EBL	195	16	66	0.08	799	245	245	1.26	245	245
<b>Powell/W Powell Loop</b>	<b>Total</b>	<b>2,131</b>	<b>1544</b>	<b>3,168</b>	<b>0.72</b>	<b>4,371</b>	<b>3,754</b>	<b>4,063</b>	<b>1.91</b>	<b>4,153</b>	<b>4,009</b>
PSA # 25	SBR		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
Metro Node ID	SBT		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
	SBL		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
	WBR		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
	WBT	784	624	1167	0.80	1,466	1,327	1,396	1.78	1,396	1,396
	WBL	214	131	588	0.61	960	671	815	3.81	815	671
	NBR	224	137	499	0.61	817	586	701	3.13	701	701
	NBT		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
	NBL	19	0	0	0.00	#DIV/0!	19	#DIV/0!	#DIV/0!	36	36
	EBR	6	0	0	0.00	#DIV/0!	6	#DIV/0!	#DIV/0!	11	11
	EBT	884	653	915	0.74	1,239	1,146	1,193	1.35	1,193	1,193
	EBL		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0

- Intersection growth rate negative due to bypass, so intersection growth rate from no build used to account to growth in side-street movements.
- Used 255 difference method, as the ratio method was unreasonable.
- Used 255 ratio method, as the difference method was unreasonable.
- Model shows negative growth for movement, intersection growth rate used instead.
- Movement is not in the model, intersection growth rate used instead.
- Movement closed in 2030 conditions.
- Movement growth factor too large, Intersection growth rate used instead
- Raw model volume used

2035 172nd Corridor Plan Volume Development - Study Intersections (Metro's Financially Constrained Model)

Growth Rate  2008 2005 2035 Peak 2 Hour to 1 Hour Conversion

Intersection	Movement	Existing Volume - 1 Hour	Existing Model Volume - 1 Hour	Future NB Model Volume - 1 Hour	Model:Existing	Ratio	Difference	Average	Growth Factor	Analysis Volume	Modified Analysis Volume
<b>172nd / Sunnyside</b>	<b>Total</b>	<b>1,591</b>	<b>1692</b>	<b>6,856</b>	<b>1.06</b>	<b>6,448</b>	<b>6,755</b>	<b>6,602</b>	<b>4.15</b>	<b>2,378</b>	<b>2,378</b>
PSA # 1	SBR	220	136	455	0.62	735	539	637	2.89	637	637
Metro Node ID 10361	SBT	86	249	669	2.89	232	507	369	4.29	369	369
	SBL	17	36	264	2.11	125	245	185	10.87	185	185
	WBR	12	9	173	0.78	222	176	199	16.58	199	199
	WBT	209	243	672	1.16	579	639	609	2.91	609	609
	WBL	5	9	488	1.77	276	484	380	75.98	380	380
	NBR	6	15	1015	2.43	418	1,006	712	118.73	712	712
	NBT	137	307	1074	2.24	479	904	691	5.05	691	691
	NBL	91	29	233	0.32	730	295	295	3.25	295	295
	EBR	139	138	100	0.99	101	102	101	0.73	101	101
	EBT	258	381	1110	1.48	752	987	870	3.37	870	870
	EBL	411	140	602	0.34	1,761	872	1,317	3.20	872	872
<b>172nd / Vogel</b>	<b>Total</b>	<b>946</b>	<b>872</b>	<b>3,170</b>	<b>0.92</b>	<b>3,441</b>	<b>3,244</b>	<b>3,343</b>	<b>3.53</b>	<b>3,620</b>	<b>3,120</b>
PSA # 2	SBT	309	418	1363	1.35	1,007	1,254	1,131	3.66	1,131	1,031
Metro Node ID 24080	SBL	9	0	0	0.00	#DIV/0!	9	#DIV/0!	#DIV/0!	32	32
Zone Connector	WBR	7	0	0	0.00	#DIV/0!	7	#DIV/0!	#DIV/0!	25	25
	WBL	27	0	0	0.00	#DIV/0!	27	#DIV/0!	#DIV/0!	95	95
	NBR	173	0	0	0.00	#DIV/0!	173	#DIV/0!	#DIV/0!	611	611
	NBT	421	453	1807	1.08	1,678	1,775	1,726	4.10	1,726	1,326
<b>172nd / Troge</b>	<b>Total</b>	<b>761</b>	<b>846</b>	<b>2,621</b>	<b>1.11</b>	<b>2,359</b>	<b>2,536</b>	<b>2,448</b>	<b>3.22</b>	<b>2,535</b>	<b>2,735</b>
PSA # 3	SBT	289	411	1218	1.42	857	1,096	976	3.38	976	1,176
Metro Node ID 24074	SBL	11	0	0	0.00	#DIV/0!	11	#DIV/0!	#DIV/0!	35	35
Zone Connector	WBR	5	0	0	0.00	#DIV/0!	5	#DIV/0!	#DIV/0!	16	16
	WBL	17	0	0	0.00	#DIV/0!	17	#DIV/0!	#DIV/0!	55	55
	NBR	37	0	0	0.00	#DIV/0!	37	#DIV/0!	#DIV/0!	119	119
	NBT	402	435	1403	1.08	1,297	1,370	1,334	3.32	1,334	1,334
<b>172nd / Hagen</b>	<b>Total</b>	<b>792</b>	<b>1099</b>	<b>3,387</b>	<b>1.39</b>	<b>2,440</b>	<b>3,079</b>	<b>2,760</b>	<b>3.48</b>	<b>2,952</b>	<b>2,952</b>
PSA # 4	SBR	27	154	225	5.72	39	98	69	2.54	69	69
Metro Node ID 13924	SBT	295	409	1291	1.39	931	1,177	1,054	3.57	1,054	1,054
	NBT	402	433	1370	1.08	1,273	1,339	1,306	3.25	1,306	1,306
	NBL	6	4	86	0.69	125	88	106	17.72	88	88
	EBR	8	5	265	0.65	407	267	337	42.17	337	337
	EBL	54	94	150	1.73	86	110	98	1.82	98	98
<b>172nd / School Access</b>	<b>Total</b>	<b>782</b>	<b>564</b>	<b>3,459</b>	<b>0.72</b>	<b>4,798</b>	<b>3,677</b>	<b>4,237</b>	<b>5.42</b>	<b>3,172</b>	<b>3,172</b>
PSA # 5	SBR	3	0	0	0.00	#DIV/0!	3	#DIV/0!	#DIV/0!	16	16
Metro Node ID 30941	SBT	323	564	1108	1.75	635	867	751	2.33	751	751
	SBL	0	0	272	#DIV/0!	#DIV/0!	272	#DIV/0!	#DIV/0!	272	272
	WBR	0	0	150	#DIV/0!	#DIV/0!	150	#DIV/0!	#DIV/0!	150	150
	WBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	WBL	0	0	408	#DIV/0!	#DIV/0!	408	#DIV/0!	#DIV/0!	408	408
	NBR	0	0	557	#DIV/0!	#DIV/0!	557	#DIV/0!	#DIV/0!	557	557
Zone Connector	NBT	446	0	962	0.00	#DIV/0!	1,408	#DIV/0!	#DIV/0!	962	962
	NBL	3	0	0	0.00	#DIV/0!	3	#DIV/0!	#DIV/0!	16	16
	EBR	4	0	0	0.00	#DIV/0!	4	#DIV/0!	#DIV/0!	22	22
	EBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBL	3	0	0	0.00	#DIV/0!	3	#DIV/0!	#DIV/0!	16	16
<b>172nd / Hemrick</b>	<b>Total</b>	<b>798</b>	<b>1078</b>	<b>2,245</b>	<b>1.35</b>	<b>1,662</b>	<b>1,965</b>	<b>1,814</b>	<b>2.27</b>	<b>2,075</b>	<b>2,125</b>
PSA # 6	SBR	1	0	0	0.00	#DIV/0!	1	#DIV/0!	#DIV/0!	2	52
Metro Node ID 50108	SBT	282	560	1305	1.98	658	1,027	842	2.99	842	842
Zone Connector	SBL	9	0	0	0.00	#DIV/0!	9	#DIV/0!	#DIV/0!	20	20
	WBR	14	0	0	0.00	#DIV/0!	14	#DIV/0!	#DIV/0!	32	32
	WBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	WBL	41	0	0	0.00	#DIV/0!	41	#DIV/0!	#DIV/0!	93	93
	NBR	166	0	0	0.00	#DIV/0!	166	#DIV/0!	#DIV/0!	377	377
	NBT	285	518	941	1.82	517	707	612	2.15	707	707
	NBL	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBR	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBL	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
<b>Foster / Hemrick</b>	<b>Total</b>	<b>612</b>	<b>607</b>	<b>875</b>	<b>0.99</b>	<b>883</b>	<b>880</b>	<b>881</b>	<b>1.44</b>	<b>927</b>	<b>927</b>
PSA # 7	SBR	42	0	0	0.00	#DIV/0!	42	#DIV/0!	#DIV/0!	60	60
Metro Node ID 24060	SBT	185	377	564	2.04	277	372	324	1.75	324	324
Zone Connector	NBT	201	230	311	1.14	272	283	278	1.38	278	278
	NBL	11	0	0	0.00	#DIV/0!	11	#DIV/0!	#DIV/0!	16	16
	EBR	5	0	0	0.00	#DIV/0!	5	#DIV/0!	#DIV/0!	7	7
	EBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBL	168	0	0	0.00	#DIV/0!	168	#DIV/0!	#DIV/0!	242	242
<b>190th / Tillstrom</b>	<b>Total</b>	<b>499</b>	<b>996</b>	<b>2,865</b>	<b>2.00</b>	<b>1,436</b>	<b>2,368</b>	<b>1,902</b>	<b>3.81</b>	<b>2,524</b>	<b>2,524</b>
PSA # 8	SBR	18	161	0	8.93	0	-143	0	0.00	0	0
Metro Node ID 14216	SBT	0	0	604	#DIV/0!	#DIV/0!	604	#DIV/0!	#DIV/0!	604	604
	SBL	74	200	580	2.71	214	454	334	4.51	454	454
	WBR	66	111	256	1.69	152	211	182	2.75	182	182
	WBT	100	186	242	1.86	130	156	143	1.43	143	143
	WBL	0	0	184	#DIV/0!	#DIV/0!	184	#DIV/0!	#DIV/0!	184	184
	NBR	0	0	174	#DIV/0!	#DIV/0!	174	#DIV/0!	#DIV/0!	174	174
	NBT	0	0	530	#DIV/0!	#DIV/0!	530	#DIV/0!	#DIV/0!	530	530
	NBL	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBR	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	EBT	197	232	295	1.18	250	259	255	1.29	255	255
	EBL	44	105	0	2.39	0	-61	0	0.00	0	0
<b>172nd / Maple Lane</b>	<b>Total</b>	<b>609</b>	<b>1090</b>	<b>2,177</b>	<b>1.79</b>	<b>1,216</b>	<b>1,696</b>	<b>1,456</b>	<b>2.39</b>	<b>1,511</b>	<b>1,761</b>
PSA # 9	SBR	5	0	0	0.00	#DIV/0!	5	#DIV/0!	#DIV/0!	12	62
Metro Node ID 14219	SBT	295	571	1400	1.94	724	1,124	924	3.13	924	974
Zone Connector	NBT	303	519	777	1.71	453	560	507	1.67	560	660
	NBL	4	0	0	0.00	#DIV/0!	4	#DIV/0!	#DIV/0!	10	10
	EBR	2	0	0	0.00	#DIV/0!	2	#DIV/0!	#DIV/0!	5	5
	EBL	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	50
<b>Foster / Tillstrom</b>	<b>Total</b>	<b>838</b>	<b>1152</b>	<b>1,632</b>	<b>1.37</b>	<b>1,188</b>	<b>1,318</b>	<b>1,253</b>	<b>1.50</b>	<b>1,352</b>	<b>1,352</b>
PSA # 10	SBT	208	304	739	1.46	506	644	575	2.76	575	575
Metro Node ID 14220	SBL	148	261	295	1.76	167	182	175	1.18	175	175
	WBR	92	254	242	2.76	87	80	84	0.91	84	84
	WBL	29	93	0	3.21	0	-64	0	0.00	0	0
	NBR	105	77	0	0.74	0	28	14	0.13	14	14
	NBT	256	163	356	0.64	560	449	505	1.97	505	505
<b>172nd / Sager</b>	<b>Total</b>	<b>607</b>	<b>746</b>	<b>2,878</b>	<b>1.23</b>	<b>2,343</b>	<b>2,740</b>	<b>2,541</b>	<b>4.19</b>	<b>2,616</b>	<b>2,266</b>
PSA # 11	SBR	3	1	74	0.17	426	76	76	25.44	76	76
Metro Node ID 45424	SBT	290	321	1617	1.11	1,461	1,586	1,524	5.25	1,524	1,224
	NBT	285	321	799	1.13	709	763	736	2.58	736	636
	NBL	18	9	116	0.49	237	126	181	10.08	126	126
	EBR	9	95	167	10.52	16	82	49	5.43	49	49
	EBL	2	0	105	0.00	#DIV/0!	107	#DIV/0!	#DIV/0!	105	155

Intersection	Movement	Existing Volume - 1 Hour	Existing Model Volume - 1 Hour	Future NB Model Volume - 1 Hour	Model:Existing	Ratio	Difference	Average	Growth Factor	Analysis Volume	Modified Analysis Volume
172nd / 170th PSA # 12 Metro Node ID 11491	<b>Total</b>	<b>589</b>	<b>1077</b>	<b>3,482</b>	<b>1.83</b>	<b>1,903</b>	<b>2,993</b>	<b>2,448</b>	<b>4.16</b>	<b>3,226</b>	<b>3,001</b>
	SBR	2	132	31	66.04	0	-99	0	0.24	0	0
	SBT	293	322	1210	1.10	1,100	1,181	1,140	3.89	1,140	1,040
	SBL			18	#DIV/0!	#DIV/0!	18	#DIV/0!	#DIV/0!	18	18
	WBR			15	#DIV/0!	#DIV/0!	15	#DIV/0!	#DIV/0!	15	15
	WBT			383	#DIV/0!	#DIV/0!	383	#DIV/0!	#DIV/0!	383	383
	WBL			238	#DIV/0!	#DIV/0!	238	#DIV/0!	#DIV/0!	238	238
	NBR			239	#DIV/0!	#DIV/0!	239	#DIV/0!	#DIV/0!	239	239
	NBT	283	321	527	1.13	465	489	477	1.69	477	352
	NBL	6	36	137	6.07	23	107	65	10.79	137	137
	EBR	4	20	242	5.07	48	226	137	34.15	137	137
	EBT			391	#DIV/0!	#DIV/0!	391	#DIV/0!	#DIV/0!	391	391
EBL	1	245	50	245.44	0	-195	0	0.20	50	50	
Foster / Cheldelin PSA # 13 Metro Node ID 45407 Zone Connector	<b>Total</b>	<b>724</b>	<b>1023</b>	<b>1,944</b>	<b>1.41</b>	<b>1,376</b>	<b>1,645</b>	<b>1,510</b>	<b>2.09</b>	<b>1,443</b>	<b>1,443</b>
	SBR			73	#DIV/0!	#DIV/0!	73	#DIV/0!	#DIV/0!	73	73
	SBT	315	565	734	1.79	409	484	447	1.42	447	447
	SBL	8	0	38	0.00	#DIV/0!	46	#DIV/0!	#DIV/0!	17	17
	WBR	6	0	12	0.00	#DIV/0!	18	#DIV/0!	#DIV/0!	13	13
	WBT			435	#DIV/0!	#DIV/0!	435	#DIV/0!	#DIV/0!	435	435
	WBL	40	0	234	0.00	#DIV/0!	274	#DIV/0!	#DIV/0!	83	83
	NBR	89	0	35	0.00	#DIV/0!	124	#DIV/0!	#DIV/0!	186	186
	NBT	266	458	454	1.72	264	263	264	0.99	264	264
	NBL			128	#DIV/0!	#DIV/0!	128	#DIV/0!	#DIV/0!	128	128
	EBR			221	#DIV/0!	#DIV/0!	221	#DIV/0!	#DIV/0!	221	221
	EBT			426	#DIV/0!	#DIV/0!	426	#DIV/0!	#DIV/0!	426	426
EBL			1	#DIV/0!	#DIV/0!	1	#DIV/0!	#DIV/0!	1	1	
190th / Cheldelin PSA # 14 Metro Node ID 45408	<b>Total</b>	<b>368</b>	<b>554</b>	<b>2,901</b>	<b>1.51</b>	<b>1,926</b>	<b>2,714</b>	<b>2,320</b>	<b>6.30</b>	<b>2,591</b>	<b>2,591</b>
	SBR	44	0	393	0.00	#DIV/0!	437	#DIV/0!	#DIV/0!	277	277
	SBT	105	352	1253	3.35	374	1,006	690	6.57	1,006	1,006
	SBL	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	WBL	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	WBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	WBR	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	NBR	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	NBT	117	202	749	1.73	433	664	549	4.69	664	664
	NBL	4	0	20	0.00	#DIV/0!	24	#DIV/0!	#DIV/0!	25	25
	EBR	7	0	55	0.00	#DIV/0!	62	#DIV/0!	#DIV/0!	44	44
	EBT	0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
EBL	91	0	431	0.00	#DIV/0!	522	#DIV/0!	#DIV/0!	574	574	
172nd / Crystal Springs PSA # 15 Metro Node ID 15904	<b>Total</b>	<b>619</b>	<b>1107</b>	<b>2,216</b>	<b>1.79</b>	<b>1,240</b>	<b>1,729</b>	<b>1,484</b>	<b>2.40</b>	<b>1,461</b>	<b>1,461</b>
	SBR	23	44	139	1.92	72	118	95	4.13	95	95
	SBT	302	434	1133	1.44	789	1,001	895	2.96	895	895
	NBT	288	550	562	1.91	294	300	297	1.03	300	300
	NBL	0	16	30	#DIV/0!	0	14	7	#DIV/0!	7	7
	EBR	0	21	127	#DIV/0!	0	106	53	#DIV/0!	53	53
EBL	6	42	226	6.93	33	190	111	18.55	111	111	
Foster / Richey PSA # 16 Metro Node ID 11488	<b>Total</b>	<b>1,086</b>	<b>1,483</b>	<b>1,755</b>	<b>1.37</b>	<b>1,285</b>	<b>1,358</b>	<b>1,322</b>	<b>1.22</b>	<b>1,613</b>	<b>1,613</b>
	SBT	319	501	773	1.57	492	590	541	1.70	541	541
	SBL	260	246	297	0.95	314	311	312	1.20	312	312
	WBR	203	161	145	0.79	182	186	184	0.91	184	184
	WBL	13	101	73	7.80	9	-16	9	0.72	9	9
	NBR	57	156	1	2.74	0	-98	0	0.00	201	201
NBT	234	317	467	1.35	345	384	365	1.56	365	365	
172nd / Foster PSA # 17 Metro Node ID 11490	<b>Total</b>	<b>1,316</b>	<b>1,966</b>	<b>3,339</b>	<b>1.49</b>	<b>2,236</b>	<b>2,690</b>	<b>2,463</b>	<b>1.87</b>	<b>2,403</b>	<b>2,403</b>
	WBT	279	342	491	1.23	400	428	414	1.48	414	414
	WBL	155	136	121	0.88	138	140	139	0.90	139	139
	NBR	156	192	280	1.23	227	244	236	1.51	236	236
	NBL	132	399	507	3.02	168	240	204	1.55	204	204
	EBR	173	342	1150	1.97	582	982	782	4.52	782	782
EBT	421	555	790	1.32	600	657	628	1.49	628	628	
182nd / Richey PSA # 18 Metro Node ID 45441 Node Only	<b>Total</b>	<b>473</b>	<b>644</b>	<b>800</b>	<b>1.36</b>	<b>587</b>	<b>628</b>	<b>608</b>	<b>1.29</b>	<b>625</b>	<b>625</b>
	SBR	35	0	0	0.00	#DIV/0!	35	#DIV/0!	#DIV/0!	45	45
	SBL	4	0	0	0.00	#DIV/0!	4	#DIV/0!	#DIV/0!	5	5
	WBR	2	0	0	0.00	#DIV/0!	2	#DIV/0!	#DIV/0!	3	3
	WBT	157	263	486	1.68	290	380	335	2.13	335	335
	EBT	221	381	314	1.72	182	154	168	0.76	168	168
EBL	54	0	0	0.00	#DIV/0!	54	#DIV/0!	#DIV/0!	69	69	
190th / Richey PSA # 19 Metro Node ID 11487	<b>Total</b>	<b>756</b>	<b>1,245</b>	<b>3,625</b>	<b>1.65</b>	<b>2,202</b>	<b>3,137</b>	<b>2,669</b>	<b>3.53</b>	<b>3,175</b>	<b>3,147</b>
	SBR	164	263	486	1.60	303	387	345	2.10	387	387
	SBT	135	369	1646	2.73	602	1,412	1,007	7.46	1,412	1,412
	NBT	203	211	1179	1.04	1,137	1,172	1,154	5.69	1,154	1,154
	NBL	7	0	0	0.00	#DIV/0!	7	#DIV/0!	#DIV/0!	25	25
	EBR	8	0	0	0.00	#DIV/0!	8	#DIV/0!	#DIV/0!	28	0
EBL	239	402	314	1.68	187	151	169	0.71	169	169	
Pleasant View Dr/Butler Dr PSA # 20 Metro Node ID	<b>Total</b>	<b>1,043</b>	<b>#VALUE!</b>	<b>4,935</b>	<b>#VALUE!</b>	<b>#VALUE!</b>	<b>#VALUE!</b>	<b>#VALUE!</b>	<b>#VALUE!</b>	<b>4,084</b>	<b>4,084</b>
	SBR	30	#VALUE!	15	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	15	15
	SBT	276	405	2154	1.47	1,469	2,025	1,747	6.33	1,747	1,747
	SBL	50	33	50	0.66	76	67	72	1.43	72	72
	WBR	39	15	20	0.39	51	44	47	1.22	47	47
	WBT	41	#VALUE!	135	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	135	135
	WBL	31	268	484	8.66	56	247	151	4.88	151	151
	NBR	96	205	321	2.13	150	212	181	1.89	181	181
	NBT	348	358	1125	1.03	1,093	1,115	1,104	3.17	1,104	1,104
	NBL	0	0	61	#DIV/0!	#DIV/0!	61	#DIV/0!	#DIV/0!	61	61
	EBR	3	#VALUE!	256	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	256	256
	EBT	67	#VALUE!	241	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	241	241
EBL	62	#VALUE!	74	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	74	74	
Foster/Jenne PSA # 21 Metro Node ID	<b>Total</b>	<b>1,892</b>	<b>2,330</b>	<b>4,457</b>	<b>1.23</b>	<b>3,620</b>	<b>4,020</b>	<b>3,820</b>	<b>2.02</b>	<b>3,871</b>	<b>3,871</b>
	SBR	353	349	476	0.99	481	480	481	1.36	481	481
	SB-to-NE		0	18	#DIV/0!	#DIV/0!	18	#DIV/0!	#DIV/0!	18	18
	SBL	175	409	943	2.34	404	709	556	3.18	556	556
	WBR	142	385	331	2.71	122	88	105	0.74	105	105
	WBT	255	352	440	1.38	319	343	331	1.30	331	331
	WB-to-NE		0	200	#DIV/0!	#DIV/0!	200	#DIV/0!	#DIV/0!	200	200
	SWR		0	6	#DIV/0!	#DIV/0!	6	#DIV/0!	#DIV/0!	6	6
	SWT		0	201	#DIV/0!	#DIV/0!	201	#DIV/0!	#DIV/0!	201	201
	SWL		0	424	#DIV/0!	#DIV/0!	424	#DIV/0!	#DIV/0!	424	424
	EB-to-NE		0	354	#DIV/0!	#DIV/0!	354	#DIV/0!	#DIV/0!	354	354
	EBT	416	538	724	1.29	560	602	581	1.40	581	581
EBL	551	296	341	0.54	633	595	614	1.11	614	614	
Highland/Pleasant View Dr PSA # 22 Metro Node ID	<b>Total</b>	<b>1,305</b>	<b>1,328</b>	<b>4,162</b>	<b>1.02</b>	<b>4,089</b>	<b>4,138</b>	<b>4,114</b>	<b>3.15</b>	<b>4,090</b>	<b>4,090</b>
	SBR		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	SBT	451	312	1268	0.69	1,833	1,407	1,620	3.59	1,620	1,620
	SBL	129	183	422	1.41	298	368	333	2.58	333	333
	WBR	70	93	165	1.32	125	142	133	1.91	133	133
	WBT		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0	0
	WBL	123	287	1058	2.33	454	895	674	5.48	674	674
	NBR	200	231	846	1.15	733	815	774	3.87	774	774
	NBT	332	224	402	0.67	598	511	554	1.67	554	554
	NBL		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0		

Intersection	Movement	Existing Volume - 1 Hour	Existing Model Volume - 1 Hour	Future NB Model Volume - 1 Hour	Model:Existing	Ratio	Difference	Average	Growth Factor	Analysis Volume	Modified Analysis Volume
<b>Powell/174th</b>	<b>Total</b>	<b>76</b>	<b>25</b>	<b>85</b>	<b>0.33</b>	<b>260</b>	<b>136</b>	<b>136</b>	<b>1.79</b>	<b>136</b>	<b>5,090</b>
PSA # 23	SBR	78	10	27	0.13	213	95	95	1.22	95	95
Metro Node ID	SBT	192	230	793	1.20	661	755	708	3.69	708	708
	SBL	74	16	59	0.22	270	117	117	1.58	117	117
	WBR	44	2	37	0.05	792	79	79	1.80	79	79
	WBT	594	551	982	0.93	1,059	1,025	1,042	1.75	1,042	1,142
	WBL	189	308	466	1.63	286	348	317	1.68	317	317
	NBR	296	358	327	1.21	270	265	267	0.90	267	267
	NBT	238	134	262	0.56	466	366	416	1.75	416	416
	NBL	107	173	251	1.61	156	186	171	1.59	171	171
	EBR	170	225	731	1.32	552	675	614	3.61	614	614
	EBT	702	854	1212	1.22	996	1,060	1,028	1.46	1,028	1,028
	EBL	76	25	85	0.33	260	136	136	1.79	136	136
<b>Powell/182nd</b>	<b>Total</b>	<b>3,492</b>	<b>3355</b>	<b>5,532</b>	<b>0.96</b>	<b>5,758</b>	<b>5,669</b>	<b>5,714</b>	<b>1.64</b>	<b>5,845</b>	<b>5,744</b>
PSA # 24	SBR	190	89	267	0.47	570	368	469	2.47	469	368
Metro Node ID	SBT	670	582	1447	0.87	1,665	1,535	1,600	2.39	1,600	1,600
	SBL	202	176	190	0.87	219	217	218	1.08	218	218
	WBR	114	94	89	0.82	108	109	109	0.95	109	109
	WBT	517	548	1008	1.06	951	977	964	1.86	964	964
	WBL	116	140	137	1.21	113	112	113	0.97	113	113
	NBR	55	120	197	2.18	90	132	111	2.02	111	111
	NBT	438	274	439	0.62	704	604	654	1.49	654	654
	NBL	202	105	161	0.52	312	259	285	1.41	285	285
	EBR	145	358	327	2.47	132	114	123	0.85	123	123
	EBT	648	854	1212	1.32	920	1,006	963	1.49	963	963
	EBL	195	16	59	0.08	711	238	238	1.22	238	238
<b>Powell/W Powell Loop</b>	<b>Total</b>	<b>2,131</b>	<b>1544</b>	<b>3,283</b>	<b>0.72</b>	<b>4,530</b>	<b>3,869</b>	<b>4,199</b>	<b>1.97</b>	<b>4,344</b>	<b>3,982</b>
PSA # 25	SBR		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
Metro Node ID	SBT		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
	SBL		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
	WBR		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
	WBT	784	624	1188	0.80	1,493	1,348	1,421	1.81	1,421	1,221
	WBL	214	131	642	0.61	1,049	725	887	4.14	887	725
	NBR	224	137	545	0.61	893	633	763	3.41	763	763
	NBT		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0
	NBL	19	0	0	0.00	#DIV/0!	19	#DIV/0!	#DIV/0!	69	69
	EBR	6	0	0	0.00	#DIV/0!	6	#DIV/0!	#DIV/0!	22	22
	EBT	884	653	907	0.74	1,228	1,138	1,183	1.34	1,183	1,183
	EBL		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!		0

- Intersection growth rate negative due to bypass, so intersection growth rate from no build used to account to growth in side-street movements.
- Used 255 difference method, as the ratio method was unreasonable.
- Used 255 ratio method, as the difference method was unreasonable.
- Model shows negative growth for movement, intersection growth rate used instead.
- Movement is not in the model, intersection growth rate used instead.
- Movement closed in 2030 conditions.
- Movement growth factor too large, Intersection growth rate used instead
- Raw model volume used

Appendix C – 2035 No-  
Build PM Peak Hour  
Intersection Operations  
Worksheets

# HCM Signalized Intersection Capacity Analysis

## 1: Sunnyside Rd & SE 172nd Ave

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↗		↖↗	↖↗		↖	↖↗	↖	↖	↖↗	↖
Volume (vph)	722	951	112	397	674	268	311	744	769	216	290	591
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0		4.5	5.0		4.5	5.0	5.0	4.5	5.0	5.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	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	1.00
Frt	1.00	0.98		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3467	3501		3502	3356		1787	3505	1578	1805	3574	1590
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3467	3501		3502	3356		1787	3505	1578	1805	3574	1590
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)	760	1001	118	418	709	282	327	783	809	227	305	622
RTOR Reduction (vph)	0	6	0	0	28	0	0	0	421	0	0	446
Lane Group Flow (vph)	760	1113	0	418	963	0	327	783	388	227	305	176
Confl. Peds. (#/hr)			2	2			2		1	1		2
Heavy Vehicles (%)	1%	1%	3%	0%	1%	8%	1%	3%	0%	0%	1%	0%
Turn Type	Prot			Prot			Prot		custom	Prot		custom
Protected Phases	5	2		1	6		7	4		3		8
Permitted Phases									2			6
Actuated Green, G (s)	31.5	54.4		19.1	42.0		26.5	35.9	54.4	20.0	29.4	42.0
Effective Green, g (s)	31.5	54.4		19.1	42.0		26.5	35.9	54.4	20.0	29.4	42.0
Actuated g/C Ratio	0.21	0.37		0.13	0.28		0.18	0.24	0.37	0.13	0.20	0.28
Clearance Time (s)	4.5	5.0		4.5	5.0		4.5	5.0	5.0	4.5	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	736	1283		451	950		319	848	578	243	708	450
v/s Ratio Prot	c0.22	0.32		0.12	c0.29		c0.18	c0.22		0.13	0.09	
v/s Ratio Perm									0.25			0.11
v/c Ratio	1.03	0.87		0.93	1.01		1.03	0.92	0.67	0.93	0.43	0.39
Uniform Delay, d1	58.5	43.7		64.0	53.2		61.0	54.9	39.5	63.5	52.2	42.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.8	6.4		25.0	32.6		57.0	15.4	3.1	39.8	0.4	0.6
Delay (s)	100.3	50.1		89.0	85.8		117.9	70.3	42.5	103.4	52.6	43.5
Level of Service	F	D		F	F		F	E	D	F	D	D
Approach Delay (s)		70.4			86.8			66.7			57.7	
Approach LOS		E			F			E			E	

### Intersection Summary

HCM Average Control Delay	70.6	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	148.4	Sum of lost time (s)	14.0
Intersection Capacity Utilization	101.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

# HCM Unsignalized Intersection Capacity Analysis

## 2: SE Vogel Rd & SE 172nd Ave

11/27/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	85	22	1283	542	28	1033
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	89	23	1351	571	29	1087
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			800			
pX, platoon unblocked	0.75	0.75			0.75	
vC, conflicting volume	2782	1636			1921	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	3220	1682			2065	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	74			86	
cM capacity (veh/h)	7	88			204	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	113	1921	1117
Volume Left	89	0	29
Volume Right	23	571	0
cSH	9	1700	204
Volume to Capacity	13.02	1.13	0.14
Queue Length 95th (ft)	Err	0	12
Control Delay (s)	Err	0.0	10.6
Lane LOS	F		B
Approach Delay (s)	Err	0.0	10.6
Approach LOS	F		

Intersection Summary			
Average Delay		361.2	
Intersection Capacity Utilization		113.2%	ICU Level of Service H
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 3: Troge Road & SE 172nd Ave

11/27/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	47	14	1189	102	30	1079
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	49	15	1252	107	32	1136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2504	1305			1359	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2504	1305			1359	
tC, single (s)	6.4	6.2			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.3	
p0 queue free %	0	93			93	
cM capacity (veh/h)	30	198			484	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	64	1359	1167
Volume Left	49	0	32
Volume Right	15	107	0
cSH	37	1700	484
Volume to Capacity	1.73	0.80	0.07
Queue Length 95th (ft)	172	0	5
Control Delay (s)	585.8	0.0	2.8
Lane LOS	F		A
Approach Delay (s)	585.8	0.0	2.8
Approach LOS	F		

Intersection Summary			
Average Delay		15.8	
Intersection Capacity Utilization		91.1%	ICU Level of Service
Analysis Period (min)		15	F

# HCM Unsignalized Intersection Capacity Analysis

## 4: Hagen Rd & SE 172nd Ave

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	65	282	217	969	965	16
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	68	297	228	1020	1016	17
Pedestrians	2					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2503	1026	1035			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2503	1026	1035			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	0	66			
cM capacity (veh/h)	21	287	678			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	365	1248	1033			
Volume Left	68	228	0			
Volume Right	297	0	17			
cSH	86	678	1700			
Volume to Capacity	4.26	0.34	0.61			
Queue Length 95th (ft)	Err	37	0			
Control Delay (s)	Err	11.3	0.0			
Lane LOS	F	B				
Approach Delay (s)	Err	11.3	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		1385.5				
Intersection Capacity Utilization		145.8%		ICU Level of Service		H
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 5: School Driveway & SE 172nd Ave

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	7	10	7	1001	886	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	7	11	7	1054	933	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)	6					
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2005	936	940			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2005	936	940			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	97	99			
cM capacity (veh/h)	66	324	737			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	18	7	1054	940		
Volume Left	7	7	0	0		
Volume Right	11	0	0	7		
cSH	159	737	1700	1700		
Volume to Capacity	0.11	0.01	0.62	0.55		
Queue Length 95th (ft)	9	1	0	0		
Control Delay (s)	37.2	9.9	0.0	0.0		
Lane LOS	E	A				
Approach Delay (s)	37.2	0.1		0.0		
Approach LOS	E					
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			62.7%	ICU Level of Service	B	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 6: Hemrick Rd & SE 172nd Ave

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔		↔	↔	↔
Volume (veh/h)	0	0	0	91	0	31	0	641	367	20	772	52
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	0	0	96	0	33	0	675	386	21	813	55
Pedestrians					2							
Lane Width (ft)					12.0							
Walking Speed (ft/s)					4.0							
Percent Blockage					0							
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1783	1945	840	1725	1779	870	867			1063		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1783	1945	840	1725	1779	870	867			1063		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	0	100	91	100			97		
cM capacity (veh/h)	57	63	368	69	80	353	785			662		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	0	128	1061	21	867
Volume Left	0	96	0	21	0
Volume Right	0	33	386	0	55
cSH	1700	86	785	662	1700
Volume to Capacity	0.00	1.49	0.00	0.03	0.51
Queue Length 95th (ft)	0	251	0	2	0
Control Delay (s)	0.0	355.1	0.0	10.6	0.0
Lane LOS	A	F		B	
Approach Delay (s)	0.0	355.1	0.0	0.3	
Approach LOS	A	F			

Intersection Summary		
Average Delay		22.1
Intersection Capacity Utilization	69.8%	ICU Level of Service C
Analysis Period (min)		15

# HCM Unsignalized Intersection Capacity Analysis

## 7: Hemrick Rd & SE Foster Rd

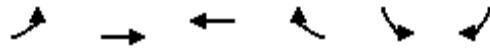
11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	368	11	24	406	563	92
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	387	12	25	427	593	97
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1119	641	689			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1119	641	689			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	98	97			
cM capacity (veh/h)	223	478	914			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	399	453	689			
Volume Left	387	25	0			
Volume Right	12	0	97			
cSH	227	914	1700			
Volume to Capacity	1.76	0.03	0.41			
Queue Length 95th (ft)	676	2	0			
Control Delay (s)	395.3	0.8	0.0			
Lane LOS	F	A				
Approach Delay (s)	395.3	0.8	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		102.6				
Intersection Capacity Utilization		68.7%		ICU Level of Service		C
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
 8: SE Tillstrom Rd & SE 190th Dr

11/27/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Volume (veh/h)	22	264	179	230	452	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	25	297	202	259	509	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			510			
pX, platoon unblocked						
vC, conflicting volume	461				678	331
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	461				678	331
tC, single (s)	4.1				6.4	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.4
p0 queue free %	98				0	98
cM capacity (veh/h)	1111				411	701

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	322	461	521
Volume Left	25	0	509
Volume Right	0	259	12
cSH	1111	1700	415
Volume to Capacity	0.02	0.27	1.26
Queue Length 95th (ft)	2	0	553
Control Delay (s)	0.8	0.0	161.6
Lane LOS	A		F
Approach Delay (s)	0.8	0.0	161.6
Approach LOS			F

Intersection Summary			
Average Delay		64.8	
Intersection Capacity Utilization		68.5%	ICU Level of Service C
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 9: Maple Hill Ln & SE 172nd Ave

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	50	5	10	713	981	62
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	53	5	11	751	1033	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1837	1065	1098			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1837	1065	1098			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	36	98	98			
cM capacity (veh/h)	83	273	643			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	58	761	1098			
Volume Left	53	11	0			
Volume Right	5	0	65			
cSH	88	643	1700			
Volume to Capacity	0.65	0.02	0.65			
Queue Length 95th (ft)	78	1	0			
Control Delay (s)	102.2	0.5	0.0			
Lane LOS	F	A				
Approach Delay (s)	102.2	0.5	0.0			
Approach LOS	F					
Intersection Summary						
Average Delay			3.3			
Intersection Capacity Utilization		65.4%		ICU Level of Service		C
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 10: SE Tillstrom Rd & SE Foster Rd

11/27/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	103	594	148	150	784
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	51	116	669	167	169	883
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1973	752			836	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1973	752			836	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	6	72			79	
cM capacity (veh/h)	54	408			802	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	167	836	1052
Volume Left	51	0	169
Volume Right	116	167	0
cSH	136	1700	802
Volume to Capacity	1.23	0.49	0.21
Queue Length 95th (ft)	252	0	20
Control Delay (s)	214.5	0.0	5.6
Lane LOS	F		A
Approach Delay (s)	214.5	0.0	5.6
Approach LOS	F		

Intersection Summary			
Average Delay		20.3	
Intersection Capacity Utilization		115.5%	ICU Level of Service
Analysis Period (min)		15	H

# HCM Unsignalized Intersection Capacity Analysis

## 11: Sager Rd & SE 172nd Ave

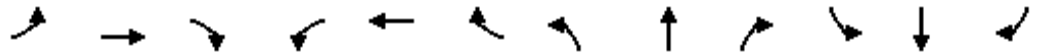
11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	59	47	107	734	1197	127
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	62	49	113	773	1260	134
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2325	1327	1394			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2325	1327	1394			
tC, single (s)	6.9	6.3	4.2			
tC, 2 stage (s)						
tF (s)	4.0	3.4	2.3			
p0 queue free %	0	73	76			
cM capacity (veh/h)	22	182	478			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	112	885	1394			
Volume Left	62	113	0			
Volume Right	49	0	134			
cSH	37	478	1700			
Volume to Capacity	3.05	0.24	0.82			
Queue Length 95th (ft)	Err	23	0			
Control Delay (s)	Err	7.5	0.0			
Lane LOS	F	A				
Approach Delay (s)	9999.0	7.5	0.0			
Approach LOS	F					
Intersection Summary						
Average Delay		469.5				
Intersection Capacity Utilization		131.4%		ICU Level of Service		H
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
 12: 170th Ave & SE 172nd Ave

11/27/2010



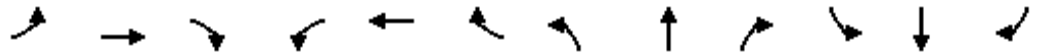
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	45	431	120	311	420	18	12	566	273	42	1019	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	47	454	126	327	442	19	13	596	287	44	1073	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2166	2069	1073	2279	1926	739	1073			883		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2166	2069	1073	2279	1926	739	1073			883		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.3			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.4			2.2		
p0 queue free %	0	0	53	0	0	95	98			94		
cM capacity (veh/h)	0	51	270	0	62	420	596			774		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	627	788	896	1117
Volume Left	47	327	13	44
Volume Right	126	19	287	0
cSH	0	0	596	774
Volume to Capacity	Err	Err	0.02	0.06
Queue Length 95th (ft)	Err	Err	2	5
Control Delay (s)	Err	Err	0.6	1.9
Lane LOS	F	F	A	A
Approach Delay (s)	Err	Err	0.6	1.9
Approach LOS	F	F		

Intersection Summary			
Average Delay		Err	
Intersection Capacity Utilization		160.7%	ICU Level of Service
Analysis Period (min)		15	H

HCM Unsignalized Intersection Capacity Analysis  
 13: Cheldelin Rd & SE Foster Rd

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	492	253	99	457	15	205	210	220	20	500	88
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	518	266	104	481	16	216	221	232	21	526	93

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	784	601	668	640
Volume Left (vph)	0	104	216	21
Volume Right (vph)	266	16	232	93
Hadj (s)	-0.20	0.02	-0.12	-0.03
Departure Headway (s)	9.4	9.6	9.4	9.5
Degree Utilization, x	2.04	1.60	1.75	1.69
Capacity (veh/h)	391	379	386	382
Control Delay (s)	497.7	306.1	372.3	346.9
Approach Delay (s)	497.7	306.1	372.3	346.9
Approach LOS	F	F	F	F

Intersection Summary			
Delay		388.0	
HCM Level of Service		F	
Intersection Capacity Utilization		153.7%	ICU Level of Service
Analysis Period (min)		15	H

# HCM Unsignalized Intersection Capacity Analysis

## 14: Cheldelin Rd & 190th Dr

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	219	17	10	238	410	106
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	231	18	11	251	432	112
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	759	487	543			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	759	487	543			
tC, single (s)	6.4	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	38	97	99			
cM capacity (veh/h)	369	557	1036			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	248	261	543			
Volume Left	231	11	0			
Volume Right	18	0	112			
cSH	378	1036	1700			
Volume to Capacity	0.66	0.01	0.32			
Queue Length 95th (ft)	112	1	0			
Control Delay (s)	31.0	0.4	0.0			
Lane LOS	D	A				
Approach Delay (s)	31.0	0.4	0.0			
Approach LOS	D					
Intersection Summary						
Average Delay			7.4			
Intersection Capacity Utilization		47.9%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 15: Crystal Springs Blvd & SE 172nd Ave

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	77	33	6	578	930	95
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	81	35	6	608	979	100
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1650	1029	1079			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1650	1029	1079			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	26	88	99			
cM capacity (veh/h)	109	286	654			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	116	615	1079			
Volume Left	81	6	0			
Volume Right	35	0	100			
cSH	134	654	1700			
Volume to Capacity	0.87	0.01	0.63			
Queue Length 95th (ft)	139	1	0			
Control Delay (s)	108.5	0.3	0.0			
Lane LOS	F	A				
Approach Delay (s)	108.5	0.3	0.0			
Approach LOS	F					
Intersection Summary						
Average Delay			7.0			
Intersection Capacity Utilization		67.7%		ICU Level of Service		C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 16: Richey Rd & SE Foster Rd

11/27/2010



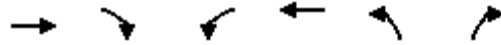
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	11	209	305	76	376	634
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	12	220	321	80	396	667
Pedestrians						1
Lane Width (ft)						12.0
Walking Speed (ft/s)						4.0
Percent Blockage						0
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1820	362			401	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1820	362			401	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	80	68			66	
cM capacity (veh/h)	57	682			1158	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	232	401	1063
Volume Left	12	0	396
Volume Right	220	80	0
cSH	440	1700	1158
Volume to Capacity	0.53	0.24	0.34
Queue Length 95th (ft)	75	0	38
Control Delay (s)	21.9	0.0	7.1
Lane LOS	C		A
Approach Delay (s)	21.9	0.0	7.1
Approach LOS	C		

Intersection Summary			
Average Delay		7.4	
Intersection Capacity Utilization		98.5%	ICU Level of Service F
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
 17: SE Foster Rd & SE 172nd Ave

11/27/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Volume (veh/h)	701	791	171	345	255	318
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	738	833	180	363	268	335
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1571		1877	1154
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1571		1877	1154
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			57		0	0
cM capacity (veh/h)			420		45	241

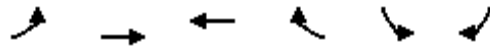
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	1571	543	603
Volume Left	0	180	268
Volume Right	833	0	335
cSH	1700	420	82
Volume to Capacity	0.92	0.43	7.37
Queue Length 95th (ft)	0	53	Err
Control Delay (s)	0.0	13.8	Err
Lane LOS		B	F
Approach Delay (s)	0.0	13.8	Err
Approach LOS			F

Intersection Summary			
Average Delay		2222.6	
Intersection Capacity Utilization		156.6%	ICU Level of Service H
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 18: Richey Rd & 182nd Ave

11/27/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Volume (veh/h)	83	222	391	3	6	54
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	87	234	412	3	6	57
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	415				822	413
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	415				822	413
tC, single (s)	4.1				6.6	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.7	3.3
p0 queue free %	92				98	91
cM capacity (veh/h)	1155				291	637

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	321	415	63
Volume Left	87	0	6
Volume Right	0	3	57
cSH	1155	1700	569
Volume to Capacity	0.08	0.24	0.11
Queue Length 95th (ft)	6	0	9
Control Delay (s)	2.8	0.0	12.1
Lane LOS	A		B
Approach Delay (s)	2.8	0.0	12.1
Approach LOS			B

Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization		50.7%	ICU Level of Service
Analysis Period (min)		15	A

# HCM Unsignalized Intersection Capacity Analysis

## 19: Richey Rd & 190th Dr

11/27/2010

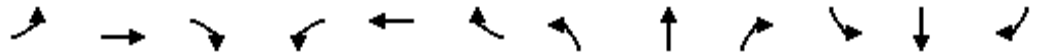


Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	223	26	23	953	850	402
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	235	27	24	1003	895	423
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2159	1107	1319			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2159	1107	1319			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	89	95			
cM capacity (veh/h)	50	258	530			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	262	1027	1318			
Volume Left	235	24	0			
Volume Right	27	0	423			
cSH	54	530	1700			
Volume to Capacity	4.81	0.05	0.78			
Queue Length 95th (ft)	Err	4	0			
Control Delay (s)	Err	1.6	0.0			
Lane LOS	F	A				
Approach Delay (s)	Err	1.6	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			1005.8			
Intersection Capacity Utilization			89.9%		ICU Level of Service	E
Analysis Period (min)			15			

# HCM Signalized Intersection Capacity Analysis

101: SE Powell Blvd & SE 174th Ave

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗	↘	↑↑		↘	↑↑	↗	↘	↑↑	
Volume (vph)	136	1081	605	347	1133	79	161	405	281	124	703	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	3.0	3.0	5.0		3.0	4.5	3.0	3.0	4.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frbp, ped/bikes	1.00	1.00	0.93	1.00	1.00		1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1687	3539	1486	1787	3441		1770	3505	1563	1787	3493	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1687	3539	1486	1787	3441		1770	3505	1563	1787	3493	
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)	143	1138	637	365	1193	83	169	426	296	131	740	100
RTOR Reduction (vph)	0	0	28	0	4	0	0	0	39	0	8	0
Lane Group Flow (vph)	143	1138	609	365	1272	0	169	426	257	131	832	0
Confl. Peds. (#/hr)	4		18	18		4	14		15	15		14
Confl. Bikes (#/hr)		3						1				2
Heavy Vehicles (%)	7%	2%	1%	1%	4%	0%	2%	3%	1%	1%	1%	1%
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Prot		
Protected Phases	5	2	3	1	6		3	8	1	7	4	
Permitted Phases			2					8				
Actuated Green, G (s)	14.9	50.9	63.9	28.0	64.0		13.0	31.1	59.1	14.5	32.6	
Effective Green, g (s)	14.9	50.9	63.9	28.0	64.0		13.0	31.1	59.1	14.5	32.6	
Actuated g/C Ratio	0.11	0.36	0.46	0.20	0.46		0.09	0.22	0.42	0.10	0.23	
Clearance Time (s)	3.0	5.0	3.0	3.0	5.0		3.0	4.5	3.0	3.0	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	180	1287	678	357	1573		164	779	660	185	813	
v/s Ratio Prot	0.08	0.32	c0.08	c0.20	0.37		c0.10	0.12	0.08	0.07	c0.24	
v/s Ratio Perm			0.33					0.09				
v/c Ratio	0.79	0.88	0.90	1.02	0.81		1.03	0.55	0.39	0.71	1.02	
Uniform Delay, d1	61.1	41.8	35.1	56.0	32.7		63.5	48.2	28.0	60.7	53.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	21.0	9.1	14.7	53.5	4.6		78.5	0.8	0.4	11.7	37.7	
Delay (s)	82.0	50.9	49.7	109.5	37.3		142.0	49.0	28.3	72.4	91.4	
Level of Service	F	D	D	F	D		F	D	C	E	F	
Approach Delay (s)		52.8			53.4			59.8			88.9	
Approach LOS		D			D			E			F	

## Intersection Summary

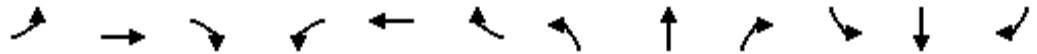
HCM Average Control Delay	60.6	HCM Level of Service	E
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	95.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 102: SE Powell Blvd & SE 182nd Ave

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗		↖	↖↗		↖↗	↖↗↘		↖↗	↖↗↘	↖
Volume (vph)	245	1013	134	124	985	118	292	680	110	217	1584	360
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0		3.0	5.0		3.0	5.0		3.0	5.0	3.0
Lane Util. Factor	1.00	0.95		1.00	0.95		0.97	0.91		0.97	0.91	1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3466		1787	3442		3467	5015		3467	5136	1542
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3466		1787	3442		3467	5015		3467	5136	1542
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)	258	1066	141	131	1037	124	307	716	116	228	1667	379
RTOR Reduction (vph)	0	8	0	0	8	0	0	18	0	0	0	5
Lane Group Flow (vph)	258	1199	0	131	1153	0	307	814	0	228	1667	374
Confl. Peds. (#/hr)	14		12	12		14	31		14	14		31
Confl. Bikes (#/hr)		2								2	1	
Heavy Vehicles (%)	2%	2%	2%	1%	3%	2%	1%	1%	0%	1%	1%	1%
Turn Type	Prot			Prot			Prot			Prot		pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases												4
Actuated Green, G (s)	18.0	47.0		10.0	39.0		11.0	39.8		12.2	41.0	59.0
Effective Green, g (s)	18.0	47.0		10.0	39.0		11.0	39.8		12.2	41.0	59.0
Actuated g/C Ratio	0.14	0.38		0.08	0.31		0.09	0.32		0.10	0.33	0.47
Clearance Time (s)	3.0	5.0		3.0	5.0		3.0	5.0		3.0	5.0	3.0
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)	255	1303		143	1074		305	1597		338	1685	728
v/s Ratio Prot	c0.15	0.35		0.07	c0.34		c0.09	0.16		0.07	c0.32	0.07
v/s Ratio Perm												0.17
v/c Ratio	1.01	0.92		0.92	1.07		1.01	0.51		0.67	0.99	0.51
Uniform Delay, d1	53.5	37.2		57.1	43.0		57.0	34.7		54.5	41.8	23.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	59.4	10.7		50.4	49.6		53.2	1.2		5.2	19.5	0.6
Delay (s)	112.9	47.9		107.5	92.6		110.2	35.8		59.7	61.3	23.6
Level of Service	F	D		F	F		F	D		E	E	C
Approach Delay (s)		59.3			94.1			55.9			54.9	
Approach LOS		E			F			E			D	

### Intersection Summary

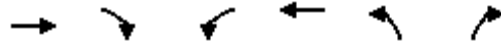
HCM Average Control Delay	64.3	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 103: SE Powell Blvd & W Powell Loop

11/27/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↙	↗
Volume (vph)	1193	11	671	1396	36	701
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		3.0	5.0	5.0	3.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frbp, ped/bikes	1.00		1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3534		1752	3539	1805	1566
Flt Permitted	1.00		0.10	1.00	0.95	1.00
Satd. Flow (perm)	3534		182	3539	1805	1566
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1256	12	706	1469	38	738
RTOR Reduction (vph)	1	0	0	0	0	3
Lane Group Flow (vph)	1267	0	706	1469	38	735
Confl. Peds. (#/hr)		2	2			
Confl. Bikes (#/hr)				1		1
Heavy Vehicles (%)	2%	0%	3%	2%	0%	3%
Turn Type			D.P+P		pm+ov	
Protected Phases	2		1	6	8	1
Permitted Phases			2			8
Actuated Green, G (s)	40.6		85.9	88.9	4.9	50.2
Effective Green, g (s)	40.6		85.9	88.9	4.9	50.2
Actuated g/C Ratio	0.39		0.83	0.86	0.05	0.48
Clearance Time (s)	5.0		3.0	5.0	5.0	3.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1382		836	3031	85	757
v/s Ratio Prot	c0.36		0.37	0.42	0.02	c0.42
v/s Ratio Perm			0.33			0.05
v/c Ratio	0.92		0.84	0.48	0.45	0.97
Uniform Delay, d1	30.0		21.8	1.8	48.1	26.1
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	9.8		7.8	0.1	3.7	25.7
Delay (s)	39.8		29.6	2.0	51.8	51.8
Level of Service	D		C	A	D	D
Approach Delay (s)	39.8			10.9	51.8	
Approach LOS	D			B	D	

### Intersection Summary

HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	103.8	Sum of lost time (s)	11.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 104: SW Pleasant View Dr & SW Highland Dr

11/27/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	627	142	576	709	346	1589
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	660	149	606	746	364	1673
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2171	303			1353	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2171	303			1353	
tC, single (s)	6.8	7.0			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	78			29	
cM capacity (veh/h)	11	687			510	

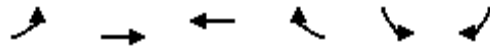
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	660	149	303	303	746	364	836	836
Volume Left	660	0	0	0	0	364	0	0
Volume Right	0	149	0	0	746	0	0	0
cSH	11	687	1700	1700	1700	510	1700	1700
Volume to Capacity	57.93	0.22	0.18	0.18	0.44	0.71	0.49	0.49
Queue Length 95th (ft)	Err	21	0	0	0	143	0	0
Control Delay (s)	Err	11.7	0.0	0.0	0.0	27.8	0.0	0.0
Lane LOS	F	B					D	
Approach Delay (s)	8154.8		0.0			5.0		
Approach LOS	F							

Intersection Summary			
Average Delay		1574.5	
Intersection Capacity Utilization		85.3%	ICU Level of Service E
Analysis Period (min)		15	

# HCM Signalized Intersection Capacity Analysis

## 105: SE Foster Rd & SE Jenne Rd

11/27/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	613	998	562	112	595	475
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0	5.0	5.0	3.0
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1863	1881	1599	1787	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1863	1881	1599	1787	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	645	1051	592	118	626	500
RTOR Reduction (vph)	0	0	0	3	0	55
Lane Group Flow (vph)	645	1051	592	115	626	445
Heavy Vehicles (%)	2%	2%	1%	1%	1%	2%
Turn Type	Prot			pm+ov		pm+ov
Protected Phases	5	2	6	4	4	5
Permitted Phases				6		4
Actuated Green, G (s)	27.0	80.0	50.0	100.0	50.0	77.0
Effective Green, g (s)	27.0	80.0	50.0	100.0	50.0	77.0
Actuated g/C Ratio	0.19	0.57	0.36	0.71	0.36	0.55
Clearance Time (s)	3.0	5.0	5.0	5.0	5.0	3.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	662	1065	672	1199	638	871
v/s Ratio Prot	0.19	c0.56	0.31	0.03	c0.35	0.10
v/s Ratio Perm				0.04		0.18
v/c Ratio	0.97	0.99	0.88	0.10	0.98	0.51
Uniform Delay, d1	56.2	29.5	42.2	6.1	44.5	19.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	28.4	24.2	12.9	0.0	30.8	0.5
Delay (s)	84.6	53.6	55.1	6.2	75.3	20.2
Level of Service	F	D	E	A	E	C
Approach Delay (s)		65.4	47.0		50.8	
Approach LOS		E	D		D	

### Intersection Summary

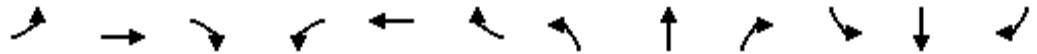
HCM Average Control Delay	57.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 106: SW Butler Rd & SW Pleasant View Dr

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	264	256	121	225	46	72	985	158	72	1655	28
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	1.00	1.00	1.00	1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1900	1615	1805	1822		1805	3505		1805	3564	
Flt Permitted	0.37	1.00	1.00	0.39	1.00		0.08	1.00		0.18	1.00	
Satd. Flow (perm)	698	1900	1615	734	1822		147	3505		348	3564	
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)	147	278	269	127	237	48	76	1037	166	76	1742	29
RTOR Reduction (vph)	0	0	23	0	8	0	0	15	0	0	1	0
Lane Group Flow (vph)	147	278	246	127	277	0	76	1188	0	76	1770	0
Heavy Vehicles (%)	2%	0%	0%	0%	2%	0%	0%	1%	0%	0%	1%	3%
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)	20.1	20.1	20.1	20.1	20.1		51.7	51.7		51.7	51.7	
Effective Green, g (s)	20.1	20.1	20.1	20.1	20.1		51.7	51.7		51.7	51.7	
Actuated g/C Ratio	0.25	0.25	0.25	0.25	0.25		0.65	0.65		0.65	0.65	
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)	176	479	407	185	459		95	2271		225	2309	
v/s Ratio Prot		0.15			0.15			0.34			0.50	
v/s Ratio Perm	c0.21		0.15	0.17			c0.52			0.22		
v/c Ratio	0.84	0.58	0.60	0.69	0.60		0.80	0.52		0.34	0.77	
Uniform Delay, d1	28.3	26.2	26.3	27.0	26.3		10.3	7.5		6.3	9.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	27.5	1.8	2.5	10.1	2.2		36.6	0.2		0.9	1.6	
Delay (s)	55.8	27.9	28.9	37.1	28.6		46.9	7.7		7.2	11.4	
Level of Service	E	C	C	D	C		D	A		A	B	
Approach Delay (s)		34.2			31.2			10.0			11.2	
Approach LOS		C			C			B			B	

### Intersection Summary

HCM Average Control Delay	16.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	79.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		
























c Critical Lane Group

Appendix D - 2035  
Mitigated PM Peak Hour  
Intersection Operations  
Worksheets

# HCM Signalized Intersection Capacity Analysis

## 1: Sunnyside Rd & SE 172nd Ave

11/27/2010

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	722	951	112	397	674	268	311	744	769	216	290	591	
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.5	5.0		4.5	5.0	4.5	4.0	5.0	4.5	4.5	5.0	4.5	
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	0.88	1.00	0.95	1.00	
Frbp, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3467	3501		3502	3574	1495	1786	3505	2802	1805	3574	1602	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.50	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3467	3501		3502	3574	1495	944	3505	2802	1805	3574	1602	
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)	760	1001	118	418	709	282	327	783	809	227	305	622	
RTOR Reduction (vph)	0	7	0	0	0	10	0	0	46	0	0	47	
Lane Group Flow (vph)	760	1112	0	418	709	272	327	783	763	227	305	575	
Confl. Peds. (#/hr)			2	2			2		1	1		2	
Heavy Vehicles (%)	1%	1%	3%	0%	1%	8%	1%	3%	0%	0%	1%	0%	
Turn Type	Prot			Prot		pm+ov	D.P+P		pm+ov	Prot		pm+ov	
Protected Phases	5	2		1	6	3	7	4	1	3	8	5	
Permitted Phases						6	8		4			8	
Actuated Green, G (s)	26.0	38.0		15.5	27.5	43.0	45.9	29.9	45.4	15.5	31.1	57.1	
Effective Green, g (s)	26.0	38.0		15.5	27.5	43.0	45.9	29.9	45.4	15.5	31.1	57.1	
Actuated g/C Ratio	0.22	0.32		0.13	0.23	0.36	0.39	0.25	0.39	0.13	0.26	0.48	
Clearance Time (s)	4.5	5.0		4.5	5.0	4.5	4.0	5.0	4.5	4.5	5.0	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	765	1128		460	834	545	473	889	1079	237	943	776	
v/s Ratio Prot	c0.22	c0.32		0.12	0.20	0.07	0.09	c0.22	0.09	c0.13	0.09	0.16	
v/s Ratio Perm						0.12	0.18		0.18			0.20	
v/c Ratio	0.99	0.99		0.91	0.85	0.50	0.69	0.88	0.71	0.96	0.32	0.74	
Uniform Delay, d1	45.9	39.7		50.5	43.2	29.1	27.3	42.3	30.6	50.9	34.9	24.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	30.7	23.1		21.5	8.3	0.7	4.3	10.2	2.1	46.2	0.2	3.8	
Delay (s)	76.6	62.8		72.0	51.5	29.8	31.6	52.4	32.8	97.1	35.1	28.3	
Level of Service	E	E		E	D	C	C	D	C	F	D	C	
Approach Delay (s)		68.4			53.2			40.6			43.6		
Approach LOS		E			D			D			D		
<b>Intersection Summary</b>													
HCM Average Control Delay			52.1									HCM Level of Service	D
HCM Volume to Capacity ratio			0.93										
Actuated Cycle Length (s)			117.9									Sum of lost time (s)	14.0
Intersection Capacity Utilization			89.8%									ICU Level of Service	E
Analysis Period (min)			15										
c	Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 2: SE Vogel Rd & SE 172nd Ave

11/27/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T	T	T	T
Volume (vph)	85	22	1283	542	28	1033
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.97		1.00	0.85	1.00	1.00
Flt Protected	0.96		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1777		1863	1615	1805	1863
Flt Permitted	0.96		1.00	1.00	0.06	1.00
Satd. Flow (perm)	1777		1863	1615	118	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	89	23	1351	571	29	1087
RTOR Reduction (vph)	11	0	0	0	0	0
Lane Group Flow (vph)	101	0	1351	571	29	1087
Heavy Vehicles (%)	0%	0%	2%	0%	0%	2%
Turn Type			pm+ov		Perm	
Protected Phases	8		2	8		6
Permitted Phases				2		6
Actuated Green, G (s)	11.2		64.2	75.4	64.2	64.2
Effective Green, g (s)	11.2		64.2	75.4	64.2	64.2
Actuated g/C Ratio	0.13		0.77	0.90	0.77	0.77
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	239		1434	1615	91	1434
v/s Ratio Prot	0.06		c0.73	c0.05		0.58
v/s Ratio Perm				0.31	0.24	
v/c Ratio	0.42		0.94	0.35	0.32	0.76
Uniform Delay, d1	33.1		8.0	0.6	2.9	5.3
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2		12.5	0.1	2.0	2.3
Delay (s)	34.3		20.5	0.7	5.0	7.7
Level of Service	C		C	A	A	A
Approach Delay (s)	34.3		14.6			7.6
Approach LOS	C		B			A

### Intersection Summary

HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	83.4	Sum of lost time (s)	4.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 3: Troge Road & SE 172nd Ave

11/27/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	47	14	1189	102	30	1079
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	49	15	1252	107	32	1136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL		TWLTL	
Median storage veh			2		2	
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2504	1305			1359	
vC1, stage 1 conf vol	1305					
vC2, stage 2 conf vol	1199					
vCu, unblocked vol	2504	1305			1359	
tC, single (s)	6.4	6.2			4.2	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.3	
p0 queue free %	73	93			93	
cM capacity (veh/h)	181	198			484	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	49	15	1359	32	1136
Volume Left	49	0	0	32	0
Volume Right	0	15	107	0	0
cSH	181	198	1700	484	1700
Volume to Capacity	0.27	0.07	0.80	0.07	0.67
Queue Length 95th (ft)	27	6	0	5	0
Control Delay (s)	32.3	24.7	0.0	13.0	0.0
Lane LOS	D	C		B	
Approach Delay (s)	30.5		0.0	0.4	
Approach LOS	D				

Intersection Summary					
Average Delay			0.9		
Intersection Capacity Utilization			78.8%	ICU Level of Service	D
Analysis Period (min)			15		

# HCM Signalized Intersection Capacity Analysis

## 4: Hagen Rd & SE 172nd Ave

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	65	282	217	969	965	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1805	1615	1805	3539	3530	
Flt Permitted	0.95	1.00	0.20	1.00	1.00	
Satd. Flow (perm)	1805	1615	379	3539	3530	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	297	228	1020	1016	17
RTOR Reduction (vph)	0	261	0	0	1	0
Lane Group Flow (vph)	68	36	228	1020	1032	0
Confl. Peds. (#/hr)			2			2
Heavy Vehicles (%)	0%	0%	0%	2%	2%	0%
Turn Type		Perm	pm+pt			
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	8.6	8.6	53.4	53.4	40.9	
Effective Green, g (s)	8.6	8.6	53.4	53.4	40.9	
Actuated g/C Ratio	0.12	0.12	0.76	0.76	0.58	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	222	198	462	2700	2063	
v/s Ratio Prot	c0.04		c0.06	0.29	0.29	
v/s Ratio Perm		0.02	c0.32			
v/c Ratio	0.31	0.18	0.49	0.38	0.50	
Uniform Delay, d1	28.0	27.6	4.2	2.8	8.5	
Progression Factor	1.00	1.00	1.00	1.00	1.24	
Incremental Delay, d2	0.8	0.5	0.8	0.4	0.8	
Delay (s)	28.8	28.0	5.1	3.2	11.3	
Level of Service	C	C	A	A	B	
Approach Delay (s)	28.1			3.5	11.3	
Approach LOS	C			A	B	

### Intersection Summary

HCM Average Control Delay	10.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

# HCM Unsignalized Intersection Capacity Analysis

## 5: School Driveway & SE 172nd Ave

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	7	10	7	1001	886	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	7	11	7	1054	933	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)	6					
Median type				TWLTL	TWLTL	
Median storage (veh)				2	2	
Upstream signal (ft)	590					
pX, platoon unblocked	0.74	0.74	0.74			
vC, conflicting volume	2005	936	940			
vC1, stage 1 conf vol	936					
vC2, stage 2 conf vol	1068					
vCu, unblocked vol	2178	743	748			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	97	99			
cM capacity (veh/h)	234	312	648			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	18	7	1054	940
Volume Left	7	7	0	0
Volume Right	11	0	0	7
cSH	530	648	1700	1700
Volume to Capacity	0.03	0.01	0.62	0.55
Queue Length 95th (ft)	3	1	0	0
Control Delay (s)	18.6	10.6	0.0	0.0
Lane LOS	C	B		
Approach Delay (s)	18.6	0.1		0.0
Approach LOS	C			

Intersection Summary			
Average Delay		0.2	
Intersection Capacity Utilization		62.7%	ICU Level of Service B
Analysis Period (min)		15	

# HCM Signalized Intersection Capacity Analysis

## 6: Hemrick Rd & SE 172nd Ave

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↖	↗		↖	↗	↖	↗	↖	↗
Volume (vph)	0	0	0	91	0	31	0	641	367	20	772	52
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	
Frbp, ped/bikes				1.00	1.00			1.00	0.98	1.00	1.00	
Flpb, ped/bikes				1.00	1.00			1.00	1.00	1.00	1.00	
Fr <sub>t</sub>				1.00	0.85			1.00	0.85	1.00	0.99	
Fl <sub>t</sub> Protected				0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1805	1615			1881	1560	1803	1847	
Fl <sub>t</sub> Permitted				0.76	1.00			1.00	1.00	0.36	1.00	
Satd. Flow (perm)				1439	1615			1881	1560	685	1847	
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	0	0	96	0	33	0	675	386	21	813	55
RTOR Reduction (vph)	0	0	0	0	29	0	0	0	93	0	2	0
Lane Group Flow (vph)	0	0	0	96	4	0	0	675	293	21	866	0
Confl. Peds. (#/hr)									2	2		
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%	2%	0%
Turn Type	Perm			Perm			Perm			Perm	Perm	
Protected Phases		4			8			2				6
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)				8.9	8.9			53.1	53.1	53.1	53.1	
Effective Green, g (s)				8.9	8.9			53.1	53.1	53.1	53.1	
Actuated g/C Ratio				0.13	0.13			0.76	0.76	0.76	0.76	
Clearance Time (s)				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	
Lane Grp Cap (vph)				183	205			1427	1183	520	1401	
v/s Ratio Prot					0.00			0.36			c0.47	
v/s Ratio Perm				c0.07					0.19	0.03		
v/c Ratio				0.52	0.02			0.47	0.25	0.04	0.62	
Uniform Delay, d <sub>1</sub>				28.6	26.7			3.2	2.5	2.1	3.8	
Progression Factor				1.00	1.00			2.09	6.38	1.00	1.00	
Incremental Delay, d <sub>2</sub>				2.7	0.0			1.1	0.5	0.1	2.1	
Delay (s)				31.3	26.8			7.7	16.5	2.3	5.9	
Level of Service				C	C			A	B	A	A	
Approach Delay (s)		0.0			30.1			10.9			5.8	
Approach LOS		A			C			B			A	

### Intersection Summary

HCM Average Control Delay	9.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

# HCM Signalized Intersection Capacity Analysis

## 7: Hemrick Rd & SE Foster Rd

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	368	11	24	406	563	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1787	1615	1805	1881	1817	
Flt Permitted	0.95	1.00	0.21	1.00	1.00	
Satd. Flow (perm)	1787	1615	407	1881	1817	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	387	12	25	427	593	97
RTOR Reduction (vph)	0	8	0	0	9	0
Lane Group Flow (vph)	387	4	25	427	681	0
Heavy Vehicles (%)	1%	0%	0%	1%	3%	0%
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	15.6	15.6	22.8	22.8	22.8	
Effective Green, g (s)	15.6	15.6	22.8	22.8	22.8	
Actuated g/C Ratio	0.34	0.34	0.49	0.49	0.49	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	601	543	200	924	893	
v/s Ratio Prot	c0.22			0.23	c0.37	
v/s Ratio Perm		0.00	0.06			
v/c Ratio	0.64	0.01	0.12	0.46	0.76	
Uniform Delay, d1	13.0	10.2	6.4	7.8	9.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.4	0.0	0.3	0.4	3.9	
Delay (s)	15.4	10.3	6.7	8.1	13.5	
Level of Service	B	B	A	A	B	
Approach Delay (s)	15.3			8.1	13.5	
Approach LOS	B			A	B	

### Intersection Summary

HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	46.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 8: SE Tillstrom Rd & SE 190th Dr

11/27/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	22	264	179	230	452	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.92		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1881	1726		1805	1524
Flt Permitted	0.33	1.00	1.00		0.95	1.00
Satd. Flow (perm)	630	1881	1726		1805	1524
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	107%	107%	107%	107%	107%	107%
Adj. Flow (vph)	25	297	202	259	509	12
RTOR Reduction (vph)	0	0	80	0	0	7
Lane Group Flow (vph)	25	297	381	0	509	5
Confl. Bikes (#/hr)			2			
Heavy Vehicles (%)	0%	1%	4%	0%	0%	6%
Turn Type	Perm					Perm
Protected Phases		6	2		4	
Permitted Phases	6					4
Actuated Green, G (s)	13.9	13.9	13.9		17.1	17.1
Effective Green, g (s)	13.9	13.9	13.9		17.1	17.1
Actuated g/C Ratio	0.36	0.36	0.36		0.44	0.44
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	225	670	615		791	668
v/s Ratio Prot		0.16	c0.22		c0.28	
v/s Ratio Perm	0.04					0.00
v/c Ratio	0.11	0.44	0.62		0.64	0.01
Uniform Delay, d1	8.4	9.6	10.4		8.6	6.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.5	1.9		1.8	0.0
Delay (s)	8.6	10.1	12.2		10.4	6.2
Level of Service	A	B	B		B	A
Approach Delay (s)		10.0	12.2		10.3	
Approach LOS		A	B		B	
<b>Intersection Summary</b>						
HCM Average Control Delay			10.9		HCM Level of Service	B
HCM Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			39.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			58.6%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
 9: Maple Hill Ln & SE 172nd Ave

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	50	5	10	713	981	62
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	53	5	11	751	1033	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				TWLTL	TWLTL	
Median storage veh				2	2	
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1837	1065	1098			
vC1, stage 1 conf vol	1065					
vC2, stage 2 conf vol	772					
vCu, unblocked vol	1837	1065	1098			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	81	98	98			
cM capacity (veh/h)	273	273	643			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	58	11	751	1098
Volume Left	53	11	0	0
Volume Right	5	0	0	65
cSH	273	643	1700	1700
Volume to Capacity	0.21	0.02	0.44	0.65
Queue Length 95th (ft)	20	1	0	0
Control Delay (s)	21.7	10.7	0.0	0.0
Lane LOS	C	B		
Approach Delay (s)	21.7	0.1		0.0
Approach LOS	C			

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		65.4%	ICU Level of Service C
Analysis Period (min)		15	

# HCM Signalized Intersection Capacity Analysis

## 10: SE Tillstrom Rd & SE Foster Rd

11/27/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↶	↶	↷		↶	↷
Volume (vph)	45	103	594	148	150	784
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	0.98	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.97		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1532	1834		1787	1863
Flt Permitted	0.95	1.00	1.00		0.27	1.00
Satd. Flow (perm)	1752	1532	1834		507	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	107%	107%	107%	107%	107%	107%
Adj. Flow (vph)	51	116	669	167	169	883
RTOR Reduction (vph)	0	102	8	0	0	0
Lane Group Flow (vph)	51	14	828	0	169	883
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	3%	3%	1%	0%	1%	2%
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	5.8	5.8	34.3		34.3	34.3
Effective Green, g (s)	5.8	5.8	34.3		34.3	34.3
Actuated g/C Ratio	0.12	0.12	0.71		0.71	0.71
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	211	185	1308		362	1329
v/s Ratio Prot	c0.03		0.45			c0.47
v/s Ratio Perm		0.01			0.33	
v/c Ratio	0.24	0.08	0.63		0.47	0.66
Uniform Delay, d1	19.2	18.8	3.6		3.0	3.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.6	0.2	1.0		1.0	1.3
Delay (s)	19.8	18.9	4.6		3.9	5.0
Level of Service	B	B	A		A	A
Approach Delay (s)	19.2		4.6			4.9
Approach LOS	B		A			A

Intersection Summary			
HCM Average Control Delay		5.9	HCM Level of Service A
HCM Volume to Capacity ratio		0.60	
Actuated Cycle Length (s)		48.1	Sum of lost time (s) 8.0
Intersection Capacity Utilization		65.3%	ICU Level of Service C
Analysis Period (min)		15	

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 11: Sager Rd & SE 172nd Ave

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	59	47	107	734	1197	127
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	62	49	113	773	1260	134
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				TWLTL	TWLTL	
Median storage (veh)				2	2	
Upstream signal (ft)					1153	
pX, platoon unblocked	0.73	0.73	0.73			
vC, conflicting volume	1938	697	1394			
vC1, stage 1 conf vol	1327					
vC2, stage 2 conf vol	612					
vCu, unblocked vol	1546	0	800			
tC, single (s)	7.8	7.1	4.2			
tC, 2 stage (s)	6.8					
tF (s)	4.0	3.4	2.3			
p0 queue free %	68	94	81			
cM capacity (veh/h)	192	771	579			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	62	49	113	386	386	840	554
Volume Left	62	0	113	0	0	0	0
Volume Right	0	49	0	0	0	0	134
cSH	192	771	579	1700	1700	1700	1700
Volume to Capacity	0.32	0.06	0.19	0.23	0.23	0.49	0.33
Queue Length 95th (ft)	33	5	18	0	0	0	0
Control Delay (s)	32.4	10.0	12.7	0.0	0.0	0.0	0.0
Lane LOS	D	A	B				
Approach Delay (s)	22.5		1.6		0.0		
Approach LOS	C						

Intersection Summary			
Average Delay		1.6	
Intersection Capacity Utilization	56.4%		ICU Level of Service B
Analysis Period (min)	15		

# HCM Signalized Intersection Capacity Analysis

## 12: 170th Ave & SE 172nd Ave

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	431	120	311	420	18	12	566	273	42	1019	0
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	1.00	1.00	1.00	1.00	1.00		1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1900	1615	1805	1888		1543	3411		1805	3539	
Flt Permitted	0.42	1.00	1.00	0.14	1.00		0.11	1.00		0.14	1.00	
Satd. Flow (perm)	798	1900	1615	268	1888		181	3411		262	3539	
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)	47	454	126	327	442	19	13	596	287	44	1073	0
RTOR Reduction (vph)	0	0	74	0	1	0	0	49	0	0	0	0
Lane Group Flow (vph)	47	454	52	327	460	0	13	834	0	44	1073	0
Confl. Bikes (#/hr)								1				
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	1%	0%	0%	2%	50%
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)	35.9	30.5	30.5	52.2	42.8		38.1	35.8		41.5	37.5	
Effective Green, g (s)	35.9	30.5	30.5	52.2	42.8		38.1	35.8		41.5	37.5	
Actuated g/C Ratio	0.35	0.29	0.29	0.50	0.41		0.37	0.34		0.40	0.36	
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)	328	557	474	396	777		96	1174		164	1276	
v/s Ratio Prot	0.01	0.24		c0.14	0.24		0.00	0.24		c0.01	c0.30	
v/s Ratio Perm	0.04		0.03	c0.27			0.05			0.10		
v/c Ratio	0.14	0.82	0.11	0.83	0.59		0.14	0.71		0.27	0.84	
Uniform Delay, d1	23.0	34.1	26.8	24.0	23.8		24.1	29.6		21.6	30.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	9.0	0.1	13.1	1.2		0.6	2.1		0.9	5.2	
Delay (s)	23.2	43.1	26.9	37.1	25.0		24.7	31.7		22.5	35.7	
Level of Service	C	D	C	D	C		C	C		C	D	
Approach Delay (s)		38.3			30.0			31.6			35.2	
Approach LOS		D			C			C			D	

### Intersection Summary

HCM Average Control Delay	33.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	104.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

# HCM Signalized Intersection Capacity Analysis

## 13: Cheldelin Rd & SE Foster Rd

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	492	253	99	457	15	205	210	220	20	500	88
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	1.00		1.00	1.00		1.00	1.00	
Frbp, ped/bikes		1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.98	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1900	1615	1805	1891		1805	1720		1612	1811	
Flt Permitted		1.00	1.00	0.11	1.00		0.11	1.00		0.42	1.00	
Satd. Flow (perm)		1900	1615	203	1891		204	1720		705	1811	
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	518	266	104	481	16	216	221	232	21	526	93
RTOR Reduction (vph)	0	0	139	0	1	0	0	29	0	0	5	0
Lane Group Flow (vph)	0	518	127	104	496	0	216	424	0	21	614	0
Confl. Bikes (#/hr)								1				
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	2%	2%	12%	3%	0%
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		33.5	33.5	45.2	45.2		59.0	52.4		46.4	43.8	
Effective Green, g (s)		33.5	33.5	45.2	45.2		59.0	52.4		46.4	43.8	
Actuated g/C Ratio		0.30	0.30	0.40	0.40		0.53	0.47		0.41	0.39	
Clearance Time (s)		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	
Lane Grp Cap (vph)		567	482	192	762		267	803		313	707	
v/s Ratio Prot		c0.27		0.04	c0.26		c0.08	0.25		0.00	c0.34	
v/s Ratio Perm			0.08	0.18			0.34			0.03		
v/c Ratio		0.91	0.26	0.54	0.65		0.81	0.53		0.07	0.87	
Uniform Delay, d1		38.0	30.0	26.1	27.1		23.5	21.2		19.8	31.5	
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		19.2	0.3	3.1	2.0		16.3	0.6		0.1	11.0	
Delay (s)		57.2	30.3	29.2	29.1		39.8	21.8		19.9	42.5	
Level of Service		E	C	C	C		D	C		B	D	
Approach Delay (s)		48.0			29.1			27.6			41.7	
Approach LOS		D			C			C			D	

### Intersection Summary

HCM Average Control Delay	37.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	112.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

# HCM Unsignalized Intersection Capacity Analysis

## 14: Cheldelin Rd & 190th Dr

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	219	17	10	238	410	106
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	231	18	11	251	432	112
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL	TWLTL		
Median storage veh			2	2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	759	487	543			
vC1, stage 1 conf vol	487					
vC2, stage 2 conf vol	272					
vCu, unblocked vol	759	487	543			
tC, single (s)	6.4	6.3	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.4	2.2			
p0 queue free %	58	97	99			
cM capacity (veh/h)	554	557	1036			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	248	11	251	543
Volume Left	231	11	0	0
Volume Right	18	0	0	112
cSH	555	1036	1700	1700
Volume to Capacity	0.45	0.01	0.15	0.32
Queue Length 95th (ft)	57	1	0	0
Control Delay (s)	16.7	8.5	0.0	0.0
Lane LOS	C	A		
Approach Delay (s)	16.7	0.3		0.0
Approach LOS	C			

Intersection Summary			
Average Delay		4.0	
Intersection Capacity Utilization		47.9%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
 15: Crystal Springs Blvd & SE 172nd Ave

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	77	33	6	578	930	95
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	81	35	6	608	979	100
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				TWLTL	TWLTL	
Median storage veh				2	2	
Upstream signal (ft)				1273	807	
pX, platoon unblocked	0.73					
vC, conflicting volume	1650	1029	1079			
vC1, stage 1 conf vol	1029					
vC2, stage 2 conf vol	621					
vCu, unblocked vol	1704	1029	1079			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	72	88	99			
cM capacity (veh/h)	293	286	654			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	81	35	6	608	1079
Volume Left	81	0	6	0	0
Volume Right	0	35	0	0	100
cSH	293	286	654	1700	1700
Volume to Capacity	0.28	0.12	0.01	0.36	0.63
Queue Length 95th (ft)	28	10	1	0	0
Control Delay (s)	21.9	19.3	10.6	0.0	0.0
Lane LOS	C	C	B		
Approach Delay (s)	21.1		0.1		0.0
Approach LOS	C				

Intersection Summary					
Average Delay			1.4		
Intersection Capacity Utilization		65.6%		ICU Level of Service	C
Analysis Period (min)		15			

# HCM Signalized Intersection Capacity Analysis

## 16: Richey Rd & SE Foster Rd

11/27/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	11	209	305	76	376	634
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	0.98	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.97		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1550	1820		1770	1863
Flt Permitted	0.95	1.00	1.00		0.30	1.00
Satd. Flow (perm)	1805	1550	1820		563	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	12	220	321	80	396	667
RTOR Reduction (vph)	0	186	11	0	0	0
Lane Group Flow (vph)	12	34	390	0	396	667
Confl. Peds. (#/hr)		1				
Confl. Bikes (#/hr)			1			
Heavy Vehicles (%)	0%	2%	2%	0%	2%	2%
Turn Type		Perm			pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8			6	
Actuated Green, G (s)	7.1	7.1	16.1		30.8	30.8
Effective Green, g (s)	7.1	7.1	16.1		30.8	30.8
Actuated g/C Ratio	0.15	0.15	0.35		0.67	0.67
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	279	240	638		659	1250
v/s Ratio Prot	0.01		0.21		c0.14	0.36
v/s Ratio Perm		c0.02			c0.26	
v/c Ratio	0.04	0.14	0.61		0.60	0.53
Uniform Delay, d1	16.5	16.8	12.3		4.5	3.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.3	1.7		1.5	0.4
Delay (s)	16.6	17.0	14.1		6.1	4.3
Level of Service	B	B	B		A	A
Approach Delay (s)	17.0		14.1			5.0
Approach LOS	B		B			A

### Intersection Summary

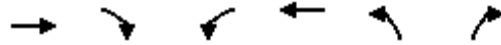
HCM Average Control Delay	8.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	45.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 17: SE Foster Rd & SE 172nd Ave

11/27/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (vph)	701	791	171	345	255	318
Ideal Flow (vphpl)	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
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1845	1583	1770	1863	1770	1599
Flt Permitted	1.00	1.00	0.13	1.00	0.95	1.00
Satd. Flow (perm)	1845	1583	249	1863	1770	1599
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	738	833	180	363	268	335
RTOR Reduction (vph)	0	398	0	0	0	235
Lane Group Flow (vph)	738	435	180	363	268	100
Confl. Bikes (#/hr)				1	1	
Heavy Vehicles (%)	3%	2%	2%	2%	2%	1%
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		3	8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	35.6	35.6	47.7	47.7	17.1	17.1
Effective Green, g (s)	35.6	35.6	47.7	47.7	17.1	17.1
Actuated g/C Ratio	0.49	0.49	0.66	0.66	0.23	0.23
Clearance Time (s)	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
Lane Grp Cap (vph)	902	774	332	1221	416	376
v/s Ratio Prot	c0.40		c0.06	0.19	c0.15	
v/s Ratio Perm		0.28	0.29			0.06
v/c Ratio	0.82	0.56	0.54	0.30	0.64	0.27
Uniform Delay, d1	15.8	13.1	10.9	5.4	25.1	22.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.8	0.9	1.8	0.1	3.4	0.4
Delay (s)	21.7	14.1	12.8	5.5	28.5	23.1
Level of Service	C	B	B	A	C	C
Approach Delay (s)	17.6			7.9	25.5	
Approach LOS	B			A	C	

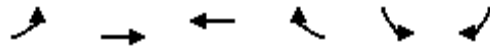
### Intersection Summary

HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	72.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

# HCM Unsignalized Intersection Capacity Analysis

## 18: Richey Rd & 182nd Ave

11/27/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	83	222	391	3	6	54
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	87	234	412	3	6	57
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	415				822	413
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	415				822	413
tC, single (s)	4.1				6.6	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.7	3.3
p0 queue free %	92				98	91
cM capacity (veh/h)	1155				291	637

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	321	415	63
Volume Left	87	0	6
Volume Right	0	3	57
cSH	1155	1700	569
Volume to Capacity	0.08	0.24	0.11
Queue Length 95th (ft)	6	0	9
Control Delay (s)	2.8	0.0	12.1
Lane LOS	A		B
Approach Delay (s)	2.8	0.0	12.1
Approach LOS			B

Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization		50.7%	ICU Level of Service
Analysis Period (min)		15	A

# HCM Signalized Intersection Capacity Analysis

## 19: Richey Rd & 190th Dr

11/27/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	223	26	23	953	850	402
Ideal Flow (vphpl)	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
Frbp, ped/bikes	1.00			1.00	1.00	0.98
Flpb, ped/bikes	1.00			1.00	1.00	1.00
Frt	0.99			1.00	1.00	0.85
Flt Protected	0.96			1.00	1.00	1.00
Satd. Flow (prot)	1762			1879	1863	1565
Flt Permitted	0.96			0.97	1.00	1.00
Satd. Flow (perm)	1762			1820	1863	1565
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	235	27	24	1003	895	423
RTOR Reduction (vph)	9	0	0	0	0	168
Lane Group Flow (vph)	253	0	0	1027	895	255
Confl. Peds. (#/hr)			1			1
Heavy Vehicles (%)	2%	0%	0%	1%	2%	1%
Turn Type			Perm			Perm
Protected Phases	4			2	6	
Permitted Phases			2			6
Actuated Green, G (s)	12.4			30.9	30.9	30.9
Effective Green, g (s)	12.4			30.9	30.9	30.9
Actuated g/C Ratio	0.24			0.60	0.60	0.60
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	3.0			3.0	3.0	3.0
Lane Grp Cap (vph)	426			1096	1122	943
v/s Ratio Prot	c0.14				0.48	
v/s Ratio Perm				c0.56		0.16
v/c Ratio	0.59			0.94	0.80	0.27
Uniform Delay, d1	17.2			9.3	7.8	4.8
Progression Factor	1.00			1.00	1.00	1.00
Incremental Delay, d2	2.2			14.4	4.0	0.2
Delay (s)	19.4			23.7	11.8	5.0
Level of Service	B			C	B	A
Approach Delay (s)	19.4			23.7	9.6	
Approach LOS	B			C	A	

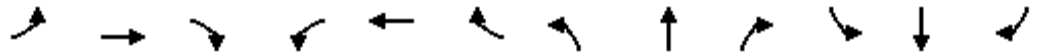
### Intersection Summary

HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	51.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	89.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

# HCM Signalized Intersection Capacity Analysis

## 101: SE Powell Blvd & SE 174th Ave

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	136	1081	605	347	1133	79	161	405	281	124	703	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	3.0	3.0	5.0		3.0	4.5	3.0	3.0	4.5	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.94	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1687	3539	1504	3467	3441		1770	3505	1556	1787	3495	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1687	3539	1504	3467	3441		1770	3505	1556	1787	3495	
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)	143	1138	637	365	1193	83	169	426	296	131	740	100
RTOR Reduction (vph)	0	0	7	0	4	0	0	0	57	0	9	0
Lane Group Flow (vph)	143	1138	630	365	1272	0	169	426	239	131	831	0
Confl. Peds. (#/hr)	4		18	18		4	14		15	15		14
Confl. Bikes (#/hr)		3						1				2
Heavy Vehicles (%)	7%	2%	1%	1%	4%	0%	2%	3%	1%	1%	1%	1%
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Prot		
Protected Phases	5	2	3	1	6		3	8	1	7	4	
Permitted Phases			2					8				
Actuated Green, G (s)	11.0	46.0	60.6	13.0	48.0		14.6	30.9	43.9	13.2	29.5	
Effective Green, g (s)	11.0	46.0	60.6	13.0	48.0		14.6	30.9	43.9	13.2	29.5	
Actuated g/C Ratio	0.09	0.39	0.51	0.11	0.40		0.12	0.26	0.37	0.11	0.25	
Clearance Time (s)	3.0	5.0	3.0	3.0	5.0		3.0	4.5	3.0	3.0	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	156	1373	768	380	1393		218	913	576	199	869	
v/s Ratio Prot	0.08	0.32	c0.10	c0.11	c0.37		0.10	0.12	0.05	0.07	c0.24	
v/s Ratio Perm			0.32					0.11				
v/c Ratio	0.92	0.83	0.82	0.96	0.91		0.78	0.47	0.41	0.66	0.96	
Uniform Delay, d1	53.3	32.7	24.4	52.5	33.3		50.4	36.9	27.8	50.5	43.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	47.8	5.9	7.0	35.8	10.7		15.7	0.4	0.5	7.6	20.4	
Delay (s)	101.1	38.6	31.4	88.3	44.0		66.1	37.3	28.3	58.2	64.4	
Level of Service	F	D	C	F	D		E	D	C	E	E	
Approach Delay (s)		40.9			53.9			39.8			63.5	
Approach LOS		D			D			D			E	

### Intersection Summary

HCM Average Control Delay	48.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	118.6	Sum of lost time (s)	10.5
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 102: SE Powell Blvd & SE 182nd Ave

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗		↖	↖↗		↖↗	↖↗↘		↖↗	↖↗↘	↖
Volume (vph)	245	1013	134	124	985	118	292	680	110	217	1584	360
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0		3.0	5.0		3.0	5.0		3.0	5.0	3.0
Lane Util. Factor	1.00	0.95		1.00	0.95		0.97	0.91		0.97	0.91	1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3466		1787	3442		3467	5015		3467	5136	1542
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3466		1787	3442		3467	5015		3467	5136	1542
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)	258	1066	141	131	1037	124	307	716	116	228	1667	379
RTOR Reduction (vph)	0	8	0	0	8	0	0	18	0	0	0	5
Lane Group Flow (vph)	258	1199	0	131	1153	0	307	814	0	228	1667	374
Confl. Peds. (#/hr)	14		12	12		14	31		14	14		31
Confl. Bikes (#/hr)		2								2	1	
Heavy Vehicles (%)	2%	2%	2%	1%	3%	2%	1%	1%	0%	1%	1%	1%
Turn Type	Prot			Prot			Prot			Prot		pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases												4
Actuated Green, G (s)	18.0	47.0		10.0	39.0		11.0	39.8		12.2	41.0	59.0
Effective Green, g (s)	18.0	47.0		10.0	39.0		11.0	39.8		12.2	41.0	59.0
Actuated g/C Ratio	0.14	0.38		0.08	0.31		0.09	0.32		0.10	0.33	0.47
Clearance Time (s)	3.0	5.0		3.0	5.0		3.0	5.0		3.0	5.0	3.0
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)	255	1303		143	1074		305	1597		338	1685	728
v/s Ratio Prot	c0.15	0.35		0.07	c0.34		c0.09	0.16		0.07	c0.32	0.07
v/s Ratio Perm												0.17
v/c Ratio	1.01	0.92		0.92	1.07		1.01	0.51		0.67	0.99	0.51
Uniform Delay, d1	53.5	37.2		57.1	43.0		57.0	34.7		54.5	41.8	23.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	59.4	10.7		50.4	49.6		53.2	1.2		5.2	19.5	0.6
Delay (s)	112.9	47.9		107.5	92.6		110.2	35.8		59.7	61.3	23.6
Level of Service	F	D		F	F		F	D		E	E	C
Approach Delay (s)		59.3			94.1			55.9			54.9	
Approach LOS		E			F			E			D	

### Intersection Summary

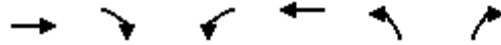
HCM Average Control Delay	64.3	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 103: SE Powell Blvd & W Powell Loop

11/27/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↵	↑↑	↵	↵
Volume (vph)	1193	11	671	1396	36	701
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		3.0	5.0	5.0	3.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frbp, ped/bikes	1.00		1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3534		1752	3539	1805	1566
Flt Permitted	1.00		0.10	1.00	0.95	1.00
Satd. Flow (perm)	3534		182	3539	1805	1566
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1256	12	706	1469	38	738
RTOR Reduction (vph)	1	0	0	0	0	3
Lane Group Flow (vph)	1267	0	706	1469	38	735
Confl. Peds. (#/hr)		2	2			
Confl. Bikes (#/hr)				1		1
Heavy Vehicles (%)	2%	0%	3%	2%	0%	3%
Turn Type			D.P+P		pm+ov	
Protected Phases	2		1	6	8	1
Permitted Phases			2			8
Actuated Green, G (s)	40.6		85.9	88.9	4.9	50.2
Effective Green, g (s)	40.6		85.9	88.9	4.9	50.2
Actuated g/C Ratio	0.39		0.83	0.86	0.05	0.48
Clearance Time (s)	5.0		3.0	5.0	5.0	3.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1382		836	3031	85	757
v/s Ratio Prot	c0.36		0.37	0.42	0.02	c0.42
v/s Ratio Perm			0.33			0.05
v/c Ratio	0.92		0.84	0.48	0.45	0.97
Uniform Delay, d1	30.0		21.8	1.8	48.1	26.1
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	9.8		7.8	0.1	3.7	25.7
Delay (s)	39.8		29.6	2.0	51.8	51.8
Level of Service	D		C	A	D	D
Approach Delay (s)	39.8			10.9	51.8	
Approach LOS	D			B	D	

### Intersection Summary

HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	103.8	Sum of lost time (s)	11.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 104: SW Pleasant View Dr & SW Highland Dr

11/27/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	627	142	576	709	346	1589
Ideal Flow (vphpl)	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	0.95	1.00	1.00	0.95
Frbp, ped/bikes	1.00	1.00	1.00	0.98	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1553	3574	1551	1787	3574
Flt Permitted	0.95	1.00	1.00	1.00	0.38	1.00
Satd. Flow (perm)	1770	1553	3574	1551	715	3574
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	660	149	606	746	364	1673
RTOR Reduction (vph)	0	94	0	343	0	0
Lane Group Flow (vph)	660	55	606	403	364	1673
Confl. Bikes (#/hr)				1		
Heavy Vehicles (%)	2%	4%	1%	2%	1%	1%
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Actuated Green, G (s)	33.0	33.0	48.1	48.1	48.1	48.1
Effective Green, g (s)	33.0	33.0	48.1	48.1	48.1	48.1
Actuated g/C Ratio	0.37	0.37	0.54	0.54	0.54	0.54
Clearance Time (s)	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
Lane Grp Cap (vph)	656	575	1929	837	386	1929
v/s Ratio Prot	c0.37		0.17			0.47
v/s Ratio Perm		0.04		0.26	c0.51	
v/c Ratio	1.01	0.10	0.31	0.48	0.94	0.87
Uniform Delay, d1	28.0	18.3	11.4	12.7	19.2	17.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	36.6	0.1	0.1	0.4	31.4	4.4
Delay (s)	64.7	18.4	11.5	13.2	50.6	22.1
Level of Service	E	B	B	B	D	C
Approach Delay (s)	56.2		12.4			27.2
Approach LOS	E		B			C

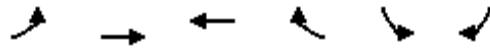
Intersection Summary

HCM Average Control Delay	28.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	89.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

# HCM Signalized Intersection Capacity Analysis

## 105: SE Foster Rd & SE Jenne Rd

11/27/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	613	998	562	112	595	475
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97	1.00	1.00	1.00	0.97	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1863	1881	1599	3467	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1863	1881	1599	3467	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	645	1051	592	118	626	500
RTOR Reduction (vph)	0	0	0	11	0	377
Lane Group Flow (vph)	645	1051	592	107	626	123
Heavy Vehicles (%)	2%	2%	1%	1%	1%	2%
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	23.6	63.9	37.3	61.3	24.0	24.0
Effective Green, g (s)	23.6	63.9	37.3	61.3	24.0	24.0
Actuated g/C Ratio	0.24	0.65	0.38	0.63	0.25	0.25
Clearance Time (s)	3.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	828	1216	717	1083	850	388
v/s Ratio Prot	0.19	c0.56	0.31	0.02	c0.18	
v/s Ratio Perm				0.04		0.08
v/c Ratio	0.78	0.86	0.83	0.10	0.74	0.32
Uniform Delay, d1	34.7	13.5	27.4	7.3	34.0	30.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	6.6	7.7	0.0	3.3	0.5
Delay (s)	39.4	20.1	35.1	7.3	37.4	30.7
Level of Service	D	C	D	A	D	C
Approach Delay (s)		27.5	30.5		34.4	
Approach LOS		C	C		C	

### Intersection Summary

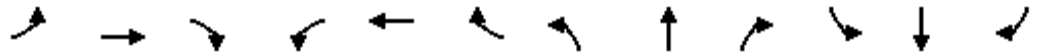
HCM Average Control Delay	30.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	97.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 106: SW Butler Rd & SW Pleasant View Dr

11/27/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	264	256	121	225	46	72	985	158	72	1655	28
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	1.00	1.00	1.00	1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1900	1615	1805	1822		1805	3505		1805	3564	
Flt Permitted	0.37	1.00	1.00	0.39	1.00		0.08	1.00		0.18	1.00	
Satd. Flow (perm)	698	1900	1615	734	1822		147	3505		348	3564	
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)	147	278	269	127	237	48	76	1037	166	76	1742	29
RTOR Reduction (vph)	0	0	23	0	8	0	0	15	0	0	1	0
Lane Group Flow (vph)	147	278	246	127	277	0	76	1188	0	76	1770	0
Heavy Vehicles (%)	2%	0%	0%	0%	2%	0%	0%	1%	0%	0%	1%	3%
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)	20.1	20.1	20.1	20.1	20.1		51.7	51.7		51.7	51.7	
Effective Green, g (s)	20.1	20.1	20.1	20.1	20.1		51.7	51.7		51.7	51.7	
Actuated g/C Ratio	0.25	0.25	0.25	0.25	0.25		0.65	0.65		0.65	0.65	
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)	176	479	407	185	459		95	2271		225	2309	
v/s Ratio Prot		0.15			0.15			0.34			0.50	
v/s Ratio Perm	c0.21		0.15	0.17			c0.52			0.22		
v/c Ratio	0.84	0.58	0.60	0.69	0.60		0.80	0.52		0.34	0.77	
Uniform Delay, d1	28.3	26.2	26.3	27.0	26.3		10.3	7.5		6.3	9.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	27.5	1.8	2.5	10.1	2.2		36.6	0.2		0.9	1.6	
Delay (s)	55.8	27.9	28.9	37.1	28.6		46.9	7.7		7.2	11.4	
Level of Service	E	C	C	D	C		D	A		A	B	
Approach Delay (s)		34.2			31.2			10.0			11.2	
Approach LOS		C			C			B			B	

### Intersection Summary

HCM Average Control Delay	16.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	79.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group