

CHAPTER XII- TRANSIT SIGNAL PRIORITY

To effectively compete with SOV options, transit services need to maintain a predictable schedule and perform at an overall operating speed that compares reasonably with general traffic. Extended travel times and schedule delays can become a deterrent for attracting new riders to transit as well as influence some existing riders away from transit.

With regard to supporting speed and reliability goals for transit service, Transit Signal Priority (TSP) can provide a relatively low-cost capital improvement option in some service corridors. The goal of TSP is to provide transit vehicles with an advantage when crossing traffic signal controlled intersections. It achieves this by providing a system that detects transit vehicles in traffic (by receiving a “call” from the vehicle) and communicates with traffic signals to conditionally provide more “green light time” for these vehicles.

The City of Bellevue recognizes the potential role of TSP in supporting transit. Within the Comprehensive Plan, TSP is identified as an important additional element in the City’s transit environment. Partnerships with transit providers and, where appropriate, developers are the City’s key strategies for TSP development:

Policy TR-13

Require new development to incorporate physical features designed to promote use of alternatives to single-occupant vehicles, such as:

- Preferential parking for carpools and vanpools;
- Special loading and unloading facilities for carpools and vanpools;
- Transit facilities, including comfortable bus stops and waiting areas, adequate turning room, and where appropriate, signal preemption and queue-jump lanes; and
- Bicycle parking and related facilities.

Policy TR-53

Work with the transit providers to create, maintain, and enhance a system of supportive facilities and systems such as transit centers, passenger shelters, park-and-ride lots, bus queue by-pass lanes, bus signal priorities, pedestrian and bicycle facilities, pricing, and incentive programs. [Amended Ord. 5058]

TSP System Applications

The concept of TSP has been in existence since the 1960s. In the late seventies, extensive experiments were conducted in the U.S. to test various methods of minimizing bus delays at intersections. Because of advances in technology and increases in traffic congestion, a number of TSP demonstration programs and projects have been launched in the U.S. in recent years.

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Although it is similar in concept to emergency vehicle preemption treatments, it is important to recognize that, unlike emergency vehicle preemption, TSP tends not to be designed to favor transit vehicles at all times. Emergency vehicle preemption is an abrupt response that alters the normal operating cycle of a traffic signal. Ultimately, priority is given to the emergency vehicle unconditionally once a priority call is received by the signal. As such, emergency vehicle preemption may result in omitting signal phases.

With TSP, the priority for transit is generally designed to be conditional (e.g., is this particular bus entitled to priority?). Depending on the technology employed, any variety of conditions may be applied for granting priority. Some of the potential conditions include:

- **Schedule adherence:** Only buses that are “late enough” are granted priority.
- **Time interval since last activation:** Minimum intervals between priority activations may be used to limit the impact on other traffic.
- **Bus occupancy:** Higher occupancy buses may be given higher priority.

Also, the actual priority response tends to be managed within the normal signal operation cycle. Typical signal responses to a priority call include:

- **Green Extension:** green time is increased to allow predictable travel times, if timing can accommodate the additional time.
- **Red Truncation:** red time is shortened when the prioritized vehicle is predicted to arrive at the intersection during a red phase.
- **Phase suppression:** a low demand non-priority phase may be omitted from the normal phase sequence to hasten return to green for the priority vehicle. Phase suppression is not possible with the existing City of Bellevue signal system.

In most cases, TSP may “borrow” some green time from other non-coordinated signal phases, but it does not have to preclude any signal change. Further, signal response can be designed to provide compensation of green time to phases that were truncated, if desired. The impact on general traffic by TSP is not as disruptive, or as noticeable, as emergency vehicle priority.

Overview of Selected TSP Projects

The use of TSP in the U.S. continues to grow. As evidenced by the discussion of some projects below in Table XII-1, a variety of benefits can be derived from TSP for transit operations.

**Table XII-1
Select Transit Signal Priority Applications**

Location	Year Documented	Application	Reported Benefits
Los Angeles, CA	2001	Two corridors	7 percent reduction in travel time associated with lower signal delay
Cermak Road, IL	1994	Corridor wide (22)	Travel time reduction of 12 to 23 percent
Bremerton, WA	1994	Corridor wide application	Travel time reduction averaged 10 percent
Portland, OR	1993	4 signals on corridor of 8 signals	Travel time reduction of 5 to 8 percent
MD 2 Anne Arundel County, MD	1993	Corridor wide (14)	Travel time reduction of 13 to 18 percent

- **Los Angeles, CA:** TSP consisted of extending green time or truncating change time, as necessary, at signals where priority was activated. This TSP program was coupled with limited bus stops to achieve an overall reduction of 28 to 33 percent in traffic signal delay and a 7 percent reduction in overall travel time.
- **Cermak Road, IL:** This application consisted of passive priority (i.e., no special queue jump or other phases were used for the bus). This system reduced transit travel times by 12 to 23 percent. By not utilizing preemption, the impact on automotive traffic was minimal.
- **Bremerton, WA:** TSP was implemented on all major transit routes within the city. Studies of the system identified bus travel time reductions of up to 10 percent. However, because the Bremerton system used active priority that was similar to controller preemption logic, i.e., the traffic controller loses coordination and cycle lengths are adjusted to extend the bus phase, a measurable increase in cross street vehicle delay occurred. Recent enhancements to the controller logic have made the operation less disruptive to general traffic while retaining its effectiveness for bus travel time.
- **Portland, Oregon:** Conducted operational studies on four different corridors where TSP was implemented. The TSP system increased green time or truncated red time as needed. The result was a reduced travel time of 5 to 8 percent and an insignificant impact on general traffic. TSP continues to be expanded in Portland.

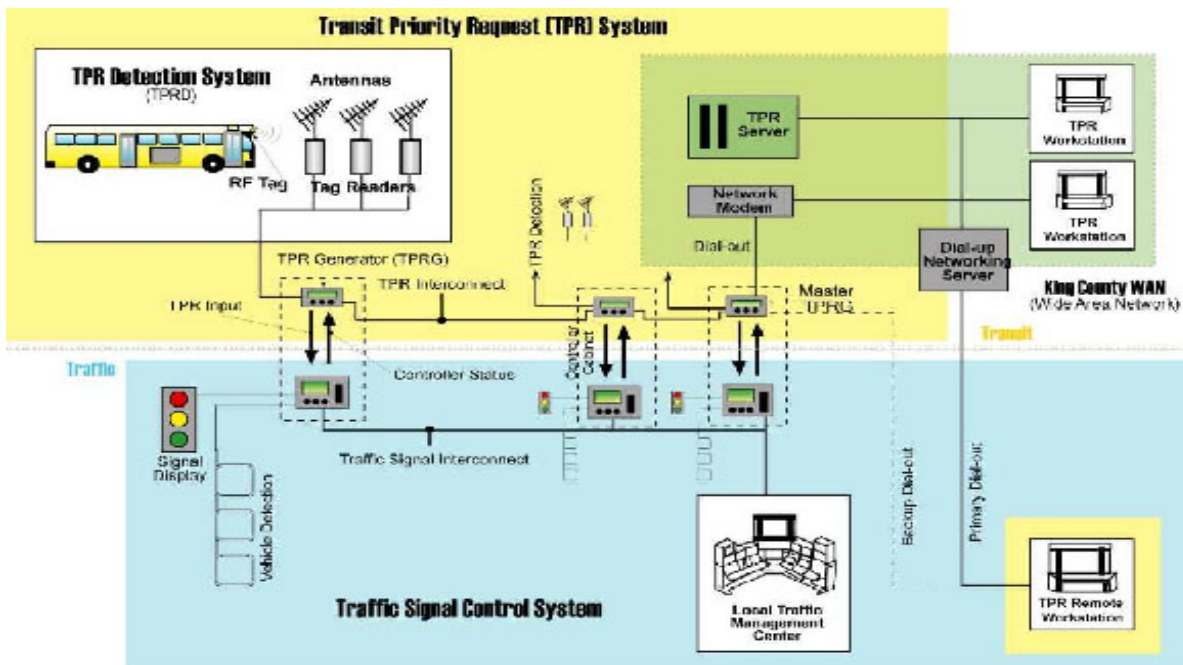
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- **Anne Arundel County, MD:** TSP was implemented on Maryland State Highway Route 2. Bus preemption was the strategy employed. This included green-time extension as well as queue jumps at certain intersections. Although travel time improvements were significant for both transit, 13 to 18 percent reduction in travel time, and general traffic traveling in the same direction, 4 to 5 percent travel time reduction, other traffic traveling in the corridor experienced an increase in travel times.

Local TSP Experience

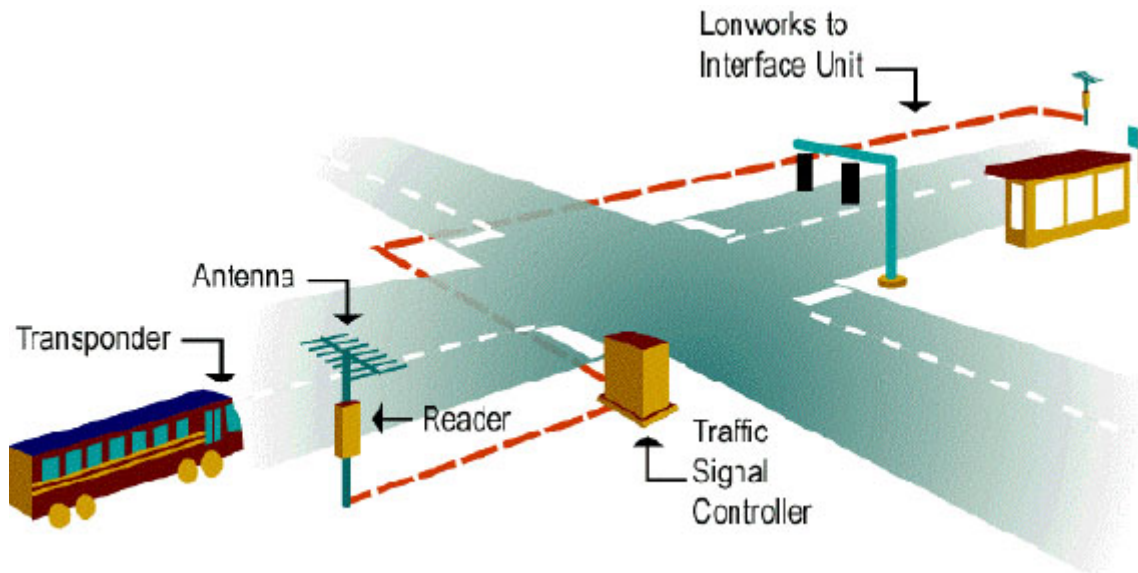
With regard to local applications of TSP, in the spring of 2000, King County implemented TSP at five intersections along Rainier Avenue in Seattle. The King County Metro (Metro) TSP on-street equipment includes an antenna, call-reader, and the existing traffic signal controller. Figures XII-1 and XII-2 show how the TSP system operates as implemented along Rainier Avenue in Seattle.

Figure XII-1¹
King County Transit Signal Priority System



¹ King County Metro web site (<http://transit.metrokc.gov/prog/tsp/tsp-strategy.html>) October 7, 2002

Figure XII-2
Schematic of King County Metro System Transit Signal Priority Study²



It is important to note that the Rainier Avenue system was designed with non-transit vehicles in mind. In addition to improving schedule adherence and travel time, a primary goal of the project was to avoid any delay to other traffic or disrupt the flow of traffic. To achieve this, transit vehicle calls for priority did result in extended green-time for priority buses and shortened red displays for such buses; but signals were not able to skip phases or break coordination to respond to priority calls. The City of Seattle, in conjunction with Metro, developed the implementation requirements for the system, summarized as follows:

- Traffic signals shall extend their green interval for approaching priority vehicles.
- Traffic signals shall shorten red displays for approaching priority vehicles.
- Traffic signals shall not shorten any minimum or clearance intervals.
- Traffic signals shall not skip any phases.
- Traffic signals shall not break coordination.

TSP reduced the number of times buses had to stop at intersections by 43% and decreased the average delay experienced by buses at intersections by 34%. Further, no side street cycle failures occurred. Thus, the reduction in green time for side streets had a minimal impact on travel time for those vehicles, less than 4 seconds per vehicle.

² King County Metro Website (<http://transit.metrokc.gov/prog/tsp/tp-schematic.html>), October 7, 2002

Considerations and Criteria for TSP in Bellevue

A variety of lessons and critical information have been learned from TSP applications to date. Ultimately, TSP can extract benefits from the signal system to provide transit operations with better reliability and travel times by reducing signal-related stops and average transit signal delay. In turn, this could also result in less transit-related congestion and increased attractiveness of transit as a mode option.

As evidenced by the experience of the Rainier Avenue program, local transit officials recognize “green time” as a resource. Further, newer technology has provided better tools to support the needs of both transit and general traffic. However, TSP use still needs to be balanced with local policy direction and the needs of other users—general traffic, pedestrians, cyclists, commercial traffic, emergency vehicles, etc. TSP needs to be able to assist transit vehicles without excess delay to non-transit vehicles. As such, TSP may not be appropriate in every transit corridor or at every intersection.

The City of Bellevue is well positioned to implement TSP treatments on its street network. Bellevue has recently updated its central traffic signal computer system and controllers, and Bellevue has developed TSP software for its signal computer system. Further, most Bellevue intersections are interconnected and can be controlled by the central signal system. The centralized traffic signal control software can facilitate the implementation of TSP anywhere in the system—individual controller software does not need to be revised. Upon identifying a TSP location, TSP would require installation of detectors and request generators as well as development of an appropriate timing plan.

At present, King County and the City are working concurrently to install a pilot TSP project at two locations: NE 8th Street/148th Avenue NE and NE 8th Street/156th Avenue NE. These TSP locations should be operational in December 2002. This initial application will provide an opportunity to document the impacts of TSP on transit speed and reliability as well as its impact on non-transit traffic. Further, this application should help the City develop decision and design criteria that can be applied to evaluating future TSP projects in Bellevue.

In the interim, some basic criteria for considering TSP can be outlined based on a review of TSP literature and case studies:

Intersection Considerations

- **How heavy is the volume of traffic at the intersection being considered? At other intersections in the corridor?** TSP is not effective at saturated intersections. Further, a single heavily saturated intersection in a TSP corridor may reduce the overall effectiveness of the treatment.
- **How congested are the cross streets?** In general, TSP implementation in areas with heavily congested cross streets can be problematic. In these situations, traffic disruptions caused by the priority response may not be able to resolve before the next priority call response.

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- **Is the intersection in a coordinated corridor?** The Bellevue traffic control system coordinates green-time in several arterial corridors throughout the city. Minor streets on coordinated corridors and left-turn movements have a greater ability to successfully accommodate TSP.

The benefits of TSP in areas of high congestion are limited and the impact on non-transit traffic is more pronounced. Conversely, if traffic is very light or free flowing, the benefit of TSP may be limited. Ultimately, **TSP has the most potential for providing benefits in areas with medium congestion and, in such situations, impacts on non-transit traffic can be minimized.**

Transit Service Considerations

Given a set of potential TSP intersections that have been screened based on overall traffic volumes, the second step in prioritizing projects can be based on the number of buses through the intersection.

- **What is the level of bus traffic?** Clearly, TSP will provide the most benefit in areas with a significant amount of bus traffic. Lightly traveled bus corridors may still benefit from TSP, if the corridor has some level of congestion that is creating delays. However, given a set of potential TSP intersections, those supporting more bus traffic should be prioritized over less transit traffic.

Suggested TSP Evaluation Process

Given the combined role of intersection and transit service characteristics in determining the potential for TSP at any given intersections, a suggested evaluation process has been designed that examines traffic delay, the amount of bus traffic, and signal coordination patterns. The evaluation process should be completed at each intersection approach at Bellevue's 160 intersections with bus volumes. The process, outlined below, assigns points based on these characteristics. The final ranking of intersections will correlate with the total points scored: high scoring intersections are a higher priority than low scoring intersections.

Step 1: assign points based on p.m. peak intersection level of service

Level of service (LOS) refers to the degree of congestion on a road or intersection. It is a measure of vehicle operating speed, travel time, travel delay, and driving comfort. Level of service is generally described by a letter scale ranging from A to F. For signalized intersections, LOS A represents free-flow conditions (motorists experience little or not delay) and LOS F represents forced-flow conditions (motorists experience delays in excess of 80 seconds per vehicle). LOS can be summarized for an intersection as well as for each intersection approach.

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The combined impact of approach and intersection level of service will influence the effectiveness of a TSP treatment. Table XII-2 outlines a suggested scoring matrix for intersections based on the combined traffic volume characteristics.

**Table XII-2
Point Scale for Intersection Characteristics**

Intersection LOS	Approach LOS					
	A	B	C	D	E	F
A	0	3	6	5	4	4
B	3	4	5	4	3	3
C	6	5	4	3	2	2
D	5	4	3	2	1	1
E	4	3	2	1	0	0
F	4	3	2	1	0	0

For any given intersection, both the intersection and approach LOS need to be determined. Based on the relationship of intersection and approach LOS, a score is assigned. The assigned score relates to the potential for TSP at the intersection. For instance, intersections with high delays for both the intersection and approach (LOS E or F) receive a score of zero, as these types of intersections are not ideal for TSP applications. Conversely, an intersection with medium approach delays (LOS C) and low intersection delays (LOS A) receives six points.

Step 2: assign points based on coordination characteristics during peak hours

The next step is to assign points to the intersection based on its existing signal coordination characteristics. TSP on through movements is more effective in non-coordinated corridors than coordinated corridors. In coordinated corridors, the through movement already receives the majority of excess green-time, so green time extensions are less likely to be as effective. A suggested scoring matrix based on coordination type is found in Table XII-3.

**Table XII-3
Point Scale for Coordination Characteristics**

Transit Network	Points
Non-Coordinated Arterial	2
Coordinated Arterial	0

To complete this step, the intersection should be referenced on the signal coordination map produced by the City of Bellevue Traffic Operations Group.

Upon completing the first two steps, transit service considerations (level of bus service) should be examined to determine a final score for peak hour characteristics.

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Step 3: assign points based on the level of bus service

Clearly, TSP will provide the most benefit in areas with a significant amount of bus traffic. Lightly traveled bus corridors may still benefit from TSP, if the corridor has some level of congestion that is creating delays. However, given a set of potential TSP intersections, those supporting more bus traffic should be prioritized over those with less transit traffic. The determination and scoring for this criterion reflect the City of Bellevue's Arterial Transit Priority Network definitions. Those definitions are based upon the number of buses that are projected to operate on each roadway.

Table XII-4 shows the suggested scoring for each intersection, which depends on whether the intersection is located on a transit principal corridor, transit minor corridor, or transit local access. Corridors with higher bus traffic receive a higher score.

**Table XII-4
Point Scale for Level of Bus Service**

	Definition	Points
Transit Principal Corridor	51+ daily one-way trips and/or Sound Transit	4
Transit Minor Corridor	21-50 daily one-way trips	2
Transit Local Access	1-20 daily one-way trips	1

Step 4: combine list of intersection scores and prioritize intersections for potential TSP treatment

The final step is to sum the scores for the intersection LOS characteristics, coordination characteristics, and bus service levels into one list. Using the combined list, determine the highest-ranking intersections. Again, the score received should correlate with the TSP potential for the intersection (high scoring intersections are a higher priority than low scoring intersections).

Exceptions to this analysis are to be expected. This scoring process is designed to provide a model for consideration and prioritization of TSP implementation; it is not designed to subjugate all case specific issues.

Recommendations

The suggested evaluation criteria were applied to each one of Bellevue's 160 signalized intersections and the associated 461 approach movements at these intersections with bus volumes. Each intersection was assigned a final score and ranked based on the final score. Intersections that scored more than seven or more points out of a possible twelve points should be considered for TSP improvements. Table XII-5 lists every analyzed intersection, its individual score for each criterion, as well as the assigned ranking.

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Based on the analysis, 169 individual approach movements at 82 intersections within the City of Bellevue have scores of 8 points or above and are appropriate for TSP purposes (Figure XII-3).

The cost of implementing TSP at an intersection increases with the number of individual approaches undertaken at the intersection in question. King County Metro presently uses the following cost estimates for a given intersection with between 1 and 4 approaches: 1 approach = \$25,000 per intersection; 2 approaches = \$35,000 per intersection; 3 approaches = \$50,000 per intersection; and, 4 approaches = \$75,000 per intersection. Given these numbers, the following cost estimates would apply to the intersections identified in this study:

25 intersections with 1 approach @ \$25,000/intersection	=	\$625,000
32 intersections with 2 approaches @ 35,000/intersection	=	\$1,120,000
23 intersections with 3 approaches @ \$50,000/intersection	=	\$1,150,000
2 intersections with 4 approaches @ \$75,000/intersection	=	\$150,000

Based on this analysis, installing TSP at all 82 locations and 169 approaches would require approximately \$3,045,000.

Conclusions

The intersections recommended for TSP treatment are an initial list of likely TSP candidates. The specific approaches determined to be TSP candidates may or may not prove to be feasible once a more refined analysis is conducted. During the planning and pre-design phases, various implementation issues could result in not pursuing these TSP installations, including:

- Measured actual delay associated with the recommended transit movement are not high enough to warrant investment
- Agreement between the City and Transit Agency(ies) cannot be reached as related to operations and maintenance
- Ability to affect timing changes as seen as necessary to warrant investment, may be an issue at closely spaced or tightly coordinated intersections
- Ability to move bus zones to far side will impact TSP effectiveness
- Changes in transit routing that change the underlying assumptions

Other intersections not listed in Figure XII-3 may prove to be TSP candidates due to:

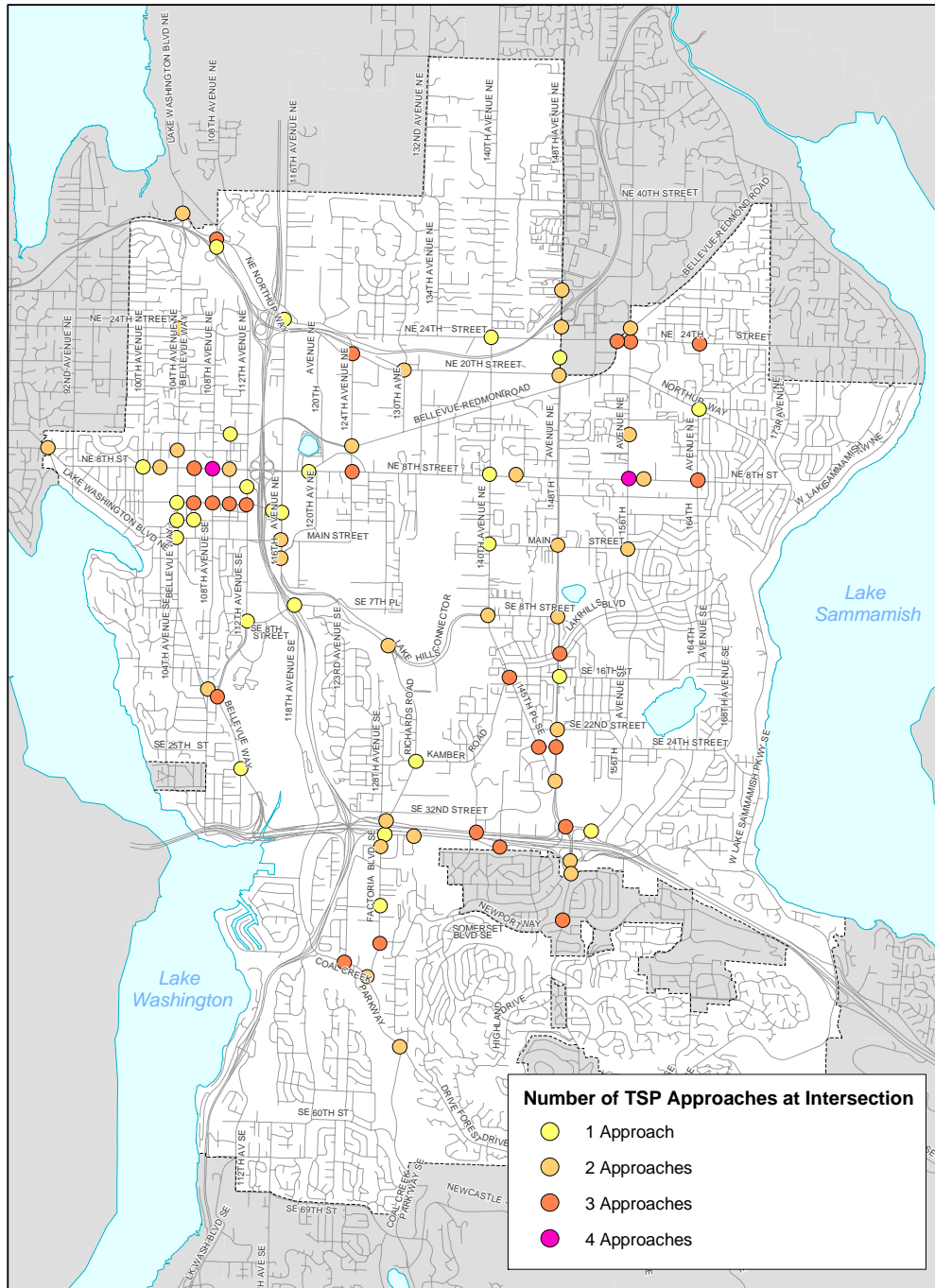
- Opportunities to incorporate TSP in new signal improvement projects
- Changes in transit routing that change the underlying assumptions
- TSP supports a Bus Rapid Transit or route based priority corridor

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Although TSP has existed on a conceptual level for decades, implementation is still not widespread and local experience is just beginning to develop. Outcomes to date suggest that TSP is an effective method for decreasing transit travel times and reducing schedule delays at a relatively modest cost: under \$80,000 cost per intersection. However, a primary concern is ensuring that TSP provides transit vehicles with an advantage without significant negative impact on the travel of non-transit vehicles.

The pending TSP implementation in Bellevue as well as continued experience at other King County TSP projects will provide more information that can be used to develop assessment criteria for future projects. In the interim, the decision criteria outlined above best reflect available data from TSP applications across the country and the existing literature on the subject. Regardless, for any TSP application, city and transit agency staff need work in concert to develop control strategies that are appropriate for the given conditions.

Figure XII-3
Intersections Recommended for TSP Treatment



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**Table XII-5
TSP Intersection Prioritization Results**

Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
Bel Way & Northup	41	74NB	5	4	2	11
NE 24th & 156th	71	61WB	5	4	2	11
Northup & 124th	73	88WB	5	4	2	11
NE 10th St & Bel Way	156	6WB	5	4	2	11
NE 10th St & Bel Way	281	6EB	5	4	2	11
SR 520 WB On & 108th	315	302SB	5	4	2	11
SE 36th & 142nd Place SE	396	171SB	5	4	2	11
NE 8th & 102nd	418	4SB	5	4	2	11
520 Ramp & 148th	451	279NB	5	4	2	11
Kamber Rd & 145th Pl	510	45NB	5	4	2	11
Newport wy & Allen Rd	596	104EB	5	4	2	11
108th & Bel Way		13NWB	6	4	0	10
156th & Bel red	42	60NB	6	4	0	10
NE 8th & Old Bel-Red	99	33WB	6	4	0	10
NE 24th & 156th	198	61EB	6	4	0	10
NE 8th & 124th	227	35EB	6	4	0	10
3600 Block & Factoria	523	285NB	6	4	0	10
NE 10th & Lk Washington	15	93SEB	4	4	2	10
Bel Way & Northup		74NWB	4	4	2	10
NE 10th & Lk Washington	47	93NWB	4	4	2	10
City Hall & SE 1st	48	131NB	4	4	2	10
Richard Rd & Lk Hills Conn		134NWB	4	4	2	10
Bel Way & 112th	53	14NB	4	4	2	10
SE 38th & 148th	57	174NB	4	4	2	10
NE 8th & 124th	100	35WB	4	4	2	10
NE 8th & Mall	106	299WB	4	4	2	10
BCC & 145th Pl	129	54WB	4	4	2	10
Eastgate Way & 139th Ave SE	136	272WB	4	4	2	10
Newport Way & 148th	145	133WB	4	4	2	10
Newport Way & Factoria	148	202WB	4	4	2	10
124th &	149	284WB	4	4	2	10
NE 24th & 164th	199	75EB	4	4	2	10
Northup & 130th	202	68EB	4	4	2	10
NE 8th & Mall	233	299EB	4	4	2	10
NE 8th & 164th	234	87EB	4	4	2	10
BCC & 145th Pl	254	54EB	4	4	2	10
SE 24th St & 148th	255	55EB	4	4	2	10
SE 36th & 132nd	263	291EB	4	4	2	10
SE 36th & 142nd Place SE	266	171EB	4	4	2	10
520 Ramp & 148th	320	279SB	4	4	2	10

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Table XII-5 (continued)						
TSP Intersection Prioritization Results						
Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
NE 8th & 156th	359	63SB	4	4	2	10
Eastgate Way & 139th Ave SE	390	272SB	4	4	2	10
Newport Way & 148th	400	133SB	4	4	2	10
NE 4th St & 106th	431	17SB	4	4	2	10
NE 8th & 156th	490	63NB	4	4	2	10
Newport Way & Factoria	531	202NB	4	4	2	10
NE 8th & 106th	549	16NB	4	4	2	10
NE 8th & 110th	551	27NB	4	4	2	10
Coal Creek & Factoria	581	203SB	4	4	2	10
Coal Creek & Factoria	583	203EB	4	4	2	10
Lk Hills Conn & 140th	592	43NB	4	4	2	10
Lk Hills Conn & 140th	593	43EB	4	4	2	10
City Hall & SE 1st	29	131SB	5	4	0	9
108th & Bel Way		13SEB	5	4	0	9
Bel Way & 112th		14SEB	5	4	0	9
Lk Hill Blvd & 148th	51	51NB	5	4	0	9
I-90 WB On & Richard Rd	55	105NB	5	4	0	9
NE 4th St & NB Ramp	109	225WB	5	4	0	9
NE 8th & 108th	166	21WB	5	4	0	9
NE 4th St & 106th	176	17WB	5	4	0	9
NE 4th St & 110th	177	159WB	5	4	0	9
NE 4th St & 108th	300	22EB	5	4	0	9
Main St & 148th	367	50SB	5	4	0	9
3600 Block & Factoria	395	285SB	5	4	0	9
Main St. & 116th	496	73NB	5	4	0	9
SE 8th & 148th	504	65NB	5	4	0	9
NE 4th St & Bel Way	558	8NB	5	4	0	9
I-90 WB On & Richard Rd	8	105WB	3	4	2	9
112th & Bel Way	21	108NWB	3	4	2	9
156th & Bel_red	27	60SB	3	4	2	9
Bel Way & 112th	34	14SB	3	4	2	9
SE 38th & 148th	38	174SB	3	4	2	9
Richard Rd & Lk Hills Conn		134SEB	3	4	2	9
Coal Creek & Forest Drive	59	98SEB	5	2	2	9
Coal Creek & Forest Drive		98NWB	5	2	2	9
NE 24th & 164th	72	75WB	5	2	2	9
NE 8th & 156th	105	63WB	3	4	2	9
SE 8th & I-405 NB On	118	219WB	6	1	2	9
SE 36th & 132nd	138	291WB	3	4	2	9
Northup & 108th Ave NE	188	78EB	3	4	2	9
Northup & 116th	192	114EB	5	2	2	9

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Table XII-5 (continued)
TSP Intersection Prioritization Results

Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
Eastgate Way & 139th Ave SE	261	272EB	3	4	2	9
SE 41st & Factoria	269	282EB	3	4	2	9
124th &	274	284EB	5	2	2	9
NE 6th & 112th	296	107EB	3	4	2	9
NE 29th & 148th	317	188SB	3	4	2	9
Bel-Red Rd & 124th	348	34SB	3	4	2	9
Main St & 156th	368	83SB	3	4	2	9
Kamber Rd & 145th Pl	381	45SB	3	4	2	9
BCC & 145th Pl	383	54SB	3	4	2	9
Eastgate Way & 148th	389	101SB	3	4	2	9
124th &	404	284SB	5	2	2	9
NE 8th & 106th	420	16SB	3	4	2	9
NE 8th & 108th	421	21SB	3	4	2	9
NE 8th & 110th	422	27SB	3	4	2	9
NE 4th St & 108th	430	22SB	3	4	2	9
NE 4th St & 110th	432	159SB	3	4	2	9
Northup & 108th Ave NE	445	78NB	3	4	2	9
NE 29th & 148th	448	188NB	3	4	2	9
Northup & 124th	457	88NB	3	4	2	9
Main St & 156th	499	83NB	3	4	2	9
SE 8th & 112th	506	89NB	3	4	2	9
SE 28th & 148th	516	57NB	3	4	2	9
NE 12th St & 110th	537	162NB	3	4	2	9
NE 8th & 108th	550	21NB	3	4	2	9
NE 24th & Bel_red		59WB	4	4	0	8
NE 24th & Bel_red		59NB	4	4	0	8
Lk Hill Blvd & 148th	32	51SB	4	4	0	8
Northup & 130th	75	68WB	4	4	0	8
NE 8th & 143rd	103	46WB	4	4	0	8
NE 8th & 106th	165	16WB	4	4	0	8
NE 4th St & 112th	178	72WB	4	4	0	8
NE 8th & 143rd	230	46EB	4	4	0	8
NE 8th & 156th	232	63EB	4	4	0	8
NE 4th St & 116th	237	139EB	4	4	0	8
NE 8th & 102nd	288	4EB	4	4	0	8
NE 8th & 108th	291	21EB	4	4	0	8
NE 4th St & 106th	301	17EB	4	4	0	8
NE 4th St & 110th	302	159EB	4	4	0	8
NE 4th St & 112th	303	72EB	4	4	0	8
NE 13th & 156th	346	70SB	4	4	0	8
SE 24th St & 148th	384	55SB	4	4	0	8

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Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
SE 28th & 148th	387	57SB	4	4	0	8
Newport Way & Factoria	403	202SB	4	4	0	8
NE 24th & 156th	455	61NB	4	4	0	8
NE 22nd & 148th	458	268NB	4	4	0	8
NE 13th & 156th	477	70NB	4	4	0	8
Main St & 148th	498	50NB	4	4	0	8
SE 16th & 148th	509	52NB	4	4	0	8
SE 24th St & 148th	513	55NB	4	4	0	8
I-90 Off & Richard Rd	520	204NB	4	4	0	8
NE 4th St & 112th	562	72NB	4	4	0	8
NE 24th & Bel_red	13	59EB	4	2	2	8
Lk Hill Blvd & 148th	19	51SWB	2	4	2	8
Eastgate Way & 156th	23	86EB	2	4	2	8
NE 8th & 164th	107	87WB	4	2	2	8
Main St & 140th	112	42WB	5	1	2	8
Kamber Rd & 145th Pl	127	45WB	5	1	2	8
SE 22nd & 148th	128	53WB	5	1	2	8
SE 36th & 142nd Place SE	141	171WB	4	2	2	8
NE 2nd & Bel Way	179	31WB	6	0	2	8
Northup & 124th	200	88EB	4	2	2	8
Northup & 148th	206	47EB	2	4	2	8
NE 8th & 140th	229	41EB	2	4	2	8
Main St. & 116th	238	73EB	5	1	2	8
SE 8th & 148th	246	65EB	5	1	2	8
SE 22nd & 148th	253	53EB	5	1	2	8
Eastgate Way & 148th	260	101EB	2	4	2	8
Newport Way & 148th	270	133EB	5	1	2	8
NE 8th & 100th Ave	286	3EB	2	4	2	8
Northup & 108th Ave NE	314	78SB	2	4	2	8
NE 24th & Bel Way	321	69SB	4	2	2	8
NE 24th & 140th	322	64SB	4	2	2	8
Northup & 148th	332	47SB	2	4	2	8
Northup & 164th	340	76SB	4	2	2	8
I-90 Ramp & 148th	397	227SB	2	4	2	8
NE 2nd & 106th	434	18SB	4	2	2	8
NE 24th & Bel Way	452	69NB	4	2	2	8
NE 24th & 164th	456	75NB	4	2	2	8
Bel-Red Rd & 124th	479	34NB	5	1	2	8
NE 8th & 124th	485	35NB	5	1	2	8
NE 8th & 164th	492	87NB	4	2	2	8
SE 26th & Richard Rd	514	82NB	4	2	2	8

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Table XII-5 (continued)						
TSP Intersection Prioritization Results						
Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
Eastgate Way & 148th	518	101NB	2	4	2	8
I-90 Ramp & 148th	525	227NB	2	4	2	8
NE 4th St & 108th	559	22NB	4	2	2	8
Main St. & Bel Way	568	9NB	2	4	2	8
Newport wy & Allen Rd	594	104SW	4	2	2	8
Newport Wy & Somerset	598	99WB	5	1	2	8
Northup & NE 24th	1	118NWB	5	2	0	7
Northup & Bel-Red	3	58WB	3	4	0	7
Northup & Bel-Red	14	58EB	5	2	0	7
NE 24th & Bel_red	44	59SWB	5	2	0	7
NE 8th & 100th Ave	161	3WB	3	4	0	7
NE 8th & 110th	167	27WB	3	4	0	7
NE 4th St & Bel Way	174	8WB	3	4	0	7
NE 4th St & 108th	175	22WB	3	4	0	7
Bel-Red Rd & 124th	221	34EB	5	2	0	7
NE 8th & 120th		233WB	3	4	0	7
NE 8th & Old Bel-Red	226	33EB	3	4	0	7
NE 4th St & NB Ramp	236	225EB	3	4	0	7
NE 8th & 110th	292	27EB	3	4	0	7
NE 24th & 156th	324	61SB	3	4	0	7
NE 22nd & 148th	327	268SB	3	4	0	7
SE 8th & 148th	375	65SB	3	4	0	7
SE 16th & 148th	380	52SB	3	4	0	7
I-90 Off & Richard Rd	391	204SB	3	4	0	7
SE 38th & Factoria	398	222SB	3	4	0	7
SE 41st & Factoria	399	282SB	3	4	0	7
NE 4th St & Bel Way	429	8SB	3	4	0	7
NE 4th St & 112th	433	72SB	3	4	0	7
Main St. & Bel Way	440	9SB	3	4	0	7
NE 24th & 140th	453	64NB	5	2	0	7
Bel-Red Rd & 148th	468	48NB	3	4	0	7
NE 15th & 156th	473	66NB	3	4	0	7
NE 4th St & 116th	495	139NB	5	2	0	7
SE 27th & 148th	515	56NB	3	4	0	7
SE 38th & Factoria	526	222NB	3	4	0	7
Bel Way & Northup	26	74SB	3	2	2	7
Eastgate Way & 161st Ave SE		92SWB	3	2	2	7
Northup & 120th	43	117NWB	3	2	2	7
SE 26th & Richard Rd	131	82WB	4	1	2	7
Eastgate Way & 148th	135	101WB	1	4	2	7
I-90 Off & Richard Rd	137	204WB	1	4	2	7

CAPITAL ELEMENT

Table XII-5 (continued)						
TSP Intersection Prioritization Results						
Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
Lk Washington Blvd & 100th A	182	1WB	4	1	2	7
NE 8th & 116th	225	30EB	1	4	2	7
SE 10th & Bel Way	247	12EB	3	2	2	7
SE 26th & Richard Rd	256	82EB	4	1	2	7
NE 4th St & Bel Way	299	8EB	4	1	2	7
Northup & 116th E	319	116SB	4	1	2	7
NE 8th & 164th	361	87SB	4	1	2	7
NE 4th St & 116th	364	139SB	4	1	2	7
NE 8th & 100th Ave	416	3SB	1	4	2	7
Lk Washington Blvd & 100th A	438	1SB	4	1	2	7
Main St. & 108th	442	24SB	3	2	2	7
SR 520 WB On & 108th	446	302NB	4	1	2	7
Northup & 116th	449	114NB	3	2	2	7
Northup & 148th	463	47NB	1	4	2	7
Northup & 164th	471	76NB	4	1	2	7
Coal Creek & Factoria	533	203NB	3	2	2	7
NE 4th St & 106th	560	17NB	3	2	2	7
Main St. & 112th	572	36NB	1	4	2	7
NE 2nd & 106th	575	18EB	3	2	2	7
Northup & 164th	584	76WB	3	2	2	7
SE 8th & I-405 SB Off	587	226WB	4	1	2	7
SE 8th & Lk Hills Conn	589	71NB	1	4	2	7
Newport Wy & Somerset	599	99NB	4	1	2	7
Northup & 120th	12	117EB	4	2	0	6
SE 32nd & Richard Rd	22	85NEB	4	2	0	6
156th & Bel_red		60NEB	4	2	0	6
Northup & 116th	65	114WB	4	2	0	6
Bel-Red Rd & 130th	91	37WB	4	2	0	6
Bel-Red Rd & 124th	94	34WB	4	2	0	6
NE 8th & 140th	102	41WB	2	4	0	6
NE 8th & 102nd	163	4WB	4	2	0	6
Bel-Red Rd & 130th	218	37EB	4	2	0	6
NE 8th & 120th	224	233EB	2	4	0	6
NE 8th & 106th	290	16EB	4	2	0	6
Main St. & 116th	365	73SB	4	2	0	6
Main St & 140th	366	42SB	4	2	0	6
Lk Hills Conn & 140th	374	43SB	4	2	0	6
NE 8th & 148th	489	49NB	2	4	0	6
Main St & 140th	497	42NB	4	2	0	6
112th & Bel Way	6	108WB	0	4	2	6
NE 8th & 405 OFF	10	26WB	0	4	2	6

CAPITAL ELEMENT

Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
Eastgate Way & 161st Ave SE		92NEB	3	1	2	6
108th & Bel Way	33	13SB	2	2	2	6
112th & Bel Way	36	108SB	0	4	2	6
SE 32nd & Richard Rd	37	85SB	2	2	2	6
108th & Bel Way	52	13NB	2	2	2	6
Kamber Rd & 139th Ave SE	54	280SWB	3	1	2	6
Eastgate Way & 156th	56	86NWB	2	2	2	6
NE 24th & 148th	70	81WB	0	4	2	6
NE 8th & 92nd Ave	96	94WB	0	4	2	6
NE 8th & 133rd Ped Crossing	101	288WB	0	4	2	6
Lk Hills Conn & 140th	120	43WB	3	1	2	6
NE 10th St & 102nd	155	129WB	0	4	2	6
NE 10th St & 106th	157	154WB	0	4	2	6
NE 10th St & 108th	158	190WB	0	4	2	6
NE 6th & 108th	170	126WB	0	4	2	6
NE 6th & 112th	171	107WB	0	4	2	6
Metro Base & 124th	208	95EB	0	4	2	6
NE 8th & 92nd Ave	223	94EB	0	4	2	6
NE 8th & 133rd Ped Crossing	228	288EB	0	4	2	6
SE 8th & 121st	243	106EB	3	1	2	6
SE 8th & I-405 NB On	244	219EB	3	1	2	6
SE 16th & 148th	251	52EB	3	1	2	6
Kamber Rd & 145th Pl	252	45EB	3	1	2	6
NE 10th St & 102nd	280	129EB	0	4	2	6
NE 10th St & 106th	282	154EB	0	4	2	6
NE 10th St & 108th	283	190EB	0	4	2	6
NE 10th St & 110th	285	235EB	0	4	2	6
NE 24th & 148th	323	81SB	0	4	2	6
Metro Base & 124th	334	95SB	0	4	2	6
NE 8th & 124th	354	35SB	3	1	2	6
SE 8th & 112th	377	89SB	0	4	2	6
Lk Hill Blvd & 145th Pl SE	378	44SB	0	4	2	6
SE 26th & Richard Rd	385	82SB	3	1	2	6
NE 12th St & Bel Way	405	5SB	2	2	2	6
NE 10th St & 110th	415	235SB	0	4	2	6
NE 6th & 106th	424	179SB	0	4	2	6
NE 6th & 108th	425	126SB	0	4	2	6
Metro Base & 124th	465	95NB	0	4	2	6
Lk Hill Blvd & 145th Pl SE	507	44NB	0	4	2	6
Newport Way & 148th	528	133NB	3	1	2	6
NE 10th St & 102nd	539	129NB	0	4	2	6

CAPITAL ELEMENT

Table XII-5 (continued)
TSP Intersection Prioritization Results

Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
NE 10th St & 106th	541	154NB	0	4	2	6
NE 10th St & 108th	542	190NB	0	4	2	6
NE 10th St & 110th	544	235NB	0	4	2	6
NE 6th & 106th	553	179NB	0	4	2	6
NE 6th & 108th	554	126NB	0	4	2	6
NE 4th St & 110th	561	159NB	4	0	2	6
SE 8th & I-405 SB Off	586	226EB	3	1	2	6
SE 8th & 121st	588	106NB	3	1	2	6
SE 8th & Lk Hills Conn	590	71SB	0	4	2	6
Newport wy & Allen Rd	595	104WB	3	1	2	6
Newport Wy & Somerset	597	99EB	3	1	2	6
I-90 WB On & Richard Rd		105SWB	3	2	0	5
Northup & NE 24th	11	118EB	3	2	0	5
Northup & Bel-Red		58NB	3	2	0	5
Bel-Red Rd & 120th	28	32SEB	3	2	0	5
Northup & Bel-Red	45	58SWB	4	1	0	5
NE 8th & 405 OFF	60	26NB	1	4	0	5
Northup & 116th E	66	116WB	3	2	0	5
Northup & 140th	78	39WB	1	4	0	5
NE 8th & 148th	104	49WB	1	4	0	5
NE 12th St & 108th	152	20WB	3	2	0	5
NE 8th & Bel Way	164	7WB	3	2	0	5
Northup & 116th E	193	116EB	3	2	0	5
NE 8th & 148th	231	49EB	1	4	0	5
NE 12th St & 108th	277	20EB	3	2	0	5
NE 12th St & Bel Way		5WB	3	2	0	5
NE 10th St & Bel Way	411	6SB	3	2	0	5
Northup & 156th	464	62NB	1	4	0	5
NE 12th St & Bel Way	534	5NB	3	2	0	5
NE 10th St & Bel Way	540	6NB	3	2	0	5
NE 8th & Bel Way	548	7NB	3	2	0	5
SE 38th & 148th	9	174WB	2	1	2	5
Northup & 108th Ave NE	61	78WB	1	2	2	5
NE 24th & 140th	196	64EB	2	1	2	5
Main St & 148th	240	50EB	2	1	2	5
Main St. & Bel Way	309	9EB	2	1	2	5
Bel-Red Rd & 116th	341	29SB	1	2	2	5
NE 12th St & 112th	409	25SB	2	1	2	5
Main St. & 110th	443	157SB	3	0	2	5
Bel-Red Rd & 116th	472	29NB	1	2	2	5
NE 2nd & 106th	574	18WB	3	0	2	5

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Table XII-5 (continued)
TSP Intersection Prioritization Results

Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
Northup & 164th	585	76EB	3	0	2	5
SE 8th & Lk Hills Conn	591	71EB	1	2	2	5
NE 8th & 405 OFF	25	26EB	0	4	0	4
Wolverine Way & Bel Way	30	10SB	0	4	0	4
Wolverine Way & Bel Way	49	10NB	0	4	0	4
Northup & 132nd	76	252WB	0	4	0	4
Northup & 136th Pl	77	185WB	0	4	0	4
Bel-Red Rd & 140th	86	40WB	2	2	0	4
NE 8th & 116th	98	30WB	0	4	0	4
NE 4th St & SB Ramp	108	224WB	0	4	0	4
NE 8th & 101st	162	303WB	0	4	0	4
Northup & 132nd	203	252EB	0	4	0	4
Northup & 136th Pl	204	185EB	0	4	0	4
Northup & 140th	205	39EB	0	4	0	4
Northup & 156th	207	62EB	0	4	0	4
Bel-Red Rd & 140th	213	40EB	2	2	0	4
NE 4th St & SB Ramp	235	224EB	0	4	0	4
NE 12th St & 112th	279	25EB	2	2	0	4
NE 8th & 101st	287	303EB	0	4	0	4
NE 8th & Bel Way	289	7EB	2	2	0	4
Northup & 156th	333	62SB	0	4	0	4
Bel-Red Rd & 148th	337	48SB	0	4	0	4
Bel-Red Rd & 140th	339	40SB	2	2	0	4
NE 15th & 156th	342	66SB	0	4	0	4
NE 10th & 156th	349	67SB	0	4	0	4
NE 8th & 140th	356	41SB	2	2	0	4
NE 8th & 148th	358	49SB	0	4	0	4
LK Trail & 148th	369	304SB	0	4	0	4
SE 8th & Bel Way	372	11SB	0	4	0	4
SE 10th & Bel Way	376	12SB	0	4	0	4
SE 16th & Bel Way	379	135SB	0	4	0	4
SE 22nd & 148th	382	53SB	0	4	0	4
SE 27th & 148th	386	56SB	0	4	0	4
NH School & Factoria	401	301SB	0	4	0	4
NE 6th & 112th	426	107SB	0	4	0	4
NE 2nd & Bel Way	435	31SB	0	4	0	4
Main St. & 112th	444	36SB	0	4	0	4
NE 24th & 148th	454	81NB	0	4	0	4
NE 10th & 156th	480	67NB	0	4	0	4
LK Trail & 148th	500	304NB	0	4	0	4
SE 10th & Bel Way	505	12NB	0	4	0	4

CAPITAL ELEMENT

Table XII-5 (continued)						
TSP Intersection Prioritization Results						
Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
SE 16th & Bel Way	508	135NB	0	4	0	4
SE 22nd & 148th	511	53NB	0	4	0	4
SE 41st & Factoria	527	282NB	0	4	0	4
NH School & Factoria	529	301NB	0	4	0	4
NE 6th & Bel Way	552	28NB	0	4	0	4
NE 6th & 112th	555	107NB	0	4	0	4
NE 2nd & Bel Way	563	31NB	0	4	0	4
SE 38th & 148th		174SEB	1	1	2	4
Eastgate Way & 161st Ave SE	24	92EB	0	2	2	4
Lake Washington & I405 off	39	221SB	1	1	2	4
Lake Washington & I405 off	58	221NB	1	1	2	4
SE 8th & Lk Hills Conn	116	71WB	0	2	2	4
SE 8th & 121st	117	106WB	0	2	2	4
Eastgate Way & 158th	139	90WB	0	2	2	4
Eastgate Way & 158th	264	90EB	0	2	2	4
SE 38th & Factoria	268	222EB	1	1	2	4
NE 6th & 106th	294	179EB	0	2	2	4
NE 30th & Bel Way	316	136SB	0	2	2	4
NE 17th & Bel Way	335	137SB	0	2	2	4
NE 10th & 116th	347	180SB	0	2	2	4
NE 8th & 116th	352	30SB	0	2	2	4
SE 30th & Richard Rd	388	132SB	0	2	2	4
NE 10th St & 106th	412	154SB	0	2	2	4
NE 2nd & 108th	436	23SB	0	2	2	4
NE 30th & Bel Way	447	136NB	0	2	2	4
NE 17th & Bel Way	466	137NB	0	2	2	4
NE 10th & 116th	478	180NB	0	2	2	4
NE 8th & 116th	483	30NB	1	1	2	4
SE 30th & Richard Rd	517	132NB	0	2	2	4
NE 12th St & 106th	535	15NB	0	2	2	4
NE 2nd & 108th	564	23NB	0	2	2	4
Main St. & 108th	570	24NB	0	2	2	4
Eastgate Way & 160th	578	91EB	0	2	2	4
Eastgate Way & 160th	579	91WB	0	2	2	4
Northup & 148th	79	47WB	1	2	0	3
NE 12th St & 112th	154	25WB	1	2	0	3
Main St. & Bel Way	184	9WB	2	1	0	3
Bel-Red Rd & 116th	214	29EB	1	2	0	3
NE 8th & Bel Way	419	7SB	1	2	0	3
Bel-Red Rd & 140th	470	40NB	1	2	0	3
NE 8th & 140th	487	41NB	1	2	0	3

CAPITAL ELEMENT

Table XII-5 (continued)
TSP Intersection Prioritization Results

Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
NE 12th St & 112th	538	25NB	2	1	0	3
Bel-Red Rd & 120th	580	32WB	1	2	0	3
SE 8th &	5	102WB	0	1	2	3
SE 8th &	18	102EB	0	1	2	3
Kamber Rd & 139th Ave SE	20	280EB	0	1	2	3
Eastgate Way & 161st Ave SE		92NWB	0	1	2	3
Northup & 156th	80	62WB	1	0	2	3
SE 8th & 112th	123	89WB	0	1	2	3
SE 38th & Factoria	143	222WB	1	0	2	3
NE 10th St & 110th	160	235WB	0	1	2	3
NE 4th St & 100th Ave	172	96WB	0	1	2	3
NE 4th St & 102nd	173	145WB	0	1	2	3
Main St. & 102nd	183	2WB	0	1	2	3
NE 10th St & 112th	284	234EB	0	1	2	3
NE 4th St & 102nd	298	145EB	0	1	2	3
Main St. & 102nd	308	2EB	0	1	2	3
Sunset Elementary & W. Lake	402	311SB	0	1	2	3
Sunset Elementary & W. Lake	530	311NB	0	1	2	3
NE 4th St & 100th Ave	556	96NB	0	1	2	3
Main St. & 112th	576	36WB	0	1	2	3
Bel-Red Rd & 148th	84	48WB	0	2	0	2
Bel-Red Rd &	85	308WB	0	2	0	2
Bel-Red Rd & 116th	87	29WB	0	2	0	2
Bel-Red Rd & 134TH	89	175WB	0	2	0	2
Bel-Red Rd & 132nd	90	38WB	0	2	0	2
NE 12th St & 106th	151	15WB	0	2	0	2
NE 12th St & 110th	153	162WB	0	2	0	2
Bel-Red Rd & 148th	211	48EB	0	2	0	2
Bel-Red Rd &	212	308EB	0	2	0	2
Bel-Red Rd & 134TH	216	175EB	0	2	0	2
Bel-Red Rd & 132nd	217	38EB	0	2	0	2
NE 12th St & 110th	278	162EB	0	2	0	2
Main St. & 112th	313	36EB	1	1	0	2
Northup & 140th	331	39SB	0	2	0	2
Evergreen & 140th	336	270SB	0	2	0	2
NE 6th & Bel Way	423	28SB	0	2	0	2
Northup & 140th	462	39NB	0	2	0	2
Evergreen & 140th	467	270NB	0	2	0	2
SE 8th & Bel Way	502	11NB	0	2	0	2
NE 12th St & 106th		15EB	0	2	0	2
NE 2nd & 108th	180	23WB	0	0	2	2

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Table XII-5 (continued)
TSP Intersection Prioritization Results

Intersection	TSPID	ID2	LOS	TPN	Cord art	Final score
NE 2nd & 108th	305	23EB	0	0	2	2
NE 2nd & 110th	306	158EB	0	0	2	2
NE 2nd & 110th	437	158SB	0	0	2	2
NE 2nd & 110th	565	158NB	0	0	2	2
Main St. & 106th	185	19WB	0	1	0	1
Main St. & 108th	186	24WB	0	1	0	1
Main St. & 110th	187	157WB	0	1	0	1
Main St. & 106th	310	19EB	0	1	0	1
Main St. & 108th	311	24EB	0	1	0	1
Main St. & 110th	312	157EB	0	1	0	1
NE 10th St & 112th	414	234SB	0	1	0	1