

**Exhibit 3.11**  
**Level of Service at SR 169 Intersections**  
 (2004 – 2030)

Milepost	Intersection	PM Peak Hour LOS <sup>1</sup>	
		2004	2030
<b>Enumclaw Segment</b>			
0.00	Griffin Avenue (SIG)	A	B
<b>Rural / Agricultural Segment</b>			
1.67	SE 416th Street (UNSIG)	D	A <sup>3</sup>
2.67	SE 400th Street (SIG)	B	D
3.52	Enumclaw - Franklin Road (UNSIG)	B	D
6.02	SE Green Valley Road (UNSIG)	C	<b>F<sup>2</sup></b>
<b>Black Diamond Segment</b>			
7.63	Lawson Street (UNSIG)	B	<b>F</b>
7.69	Baker Street (UNSIG)	C	<b>F</b>
8.25	Roberts Drive (UNSIG)	D	<b>F</b>
8.28	Black Diamond - Ravensdale Road (UNSIG)	<b>F</b>	<b>F</b>
<b>Maple Valley Segment</b>			
11.44	SR 516 -- Kent-Kangley Road (SIG)	<b>E</b>	<b>E<sup>4</sup></b>
13.53	SE 240th Street (SIG)	C	<b>B<sup>5</sup></b>
13.86	Witte Road SE (SIG)	D	D
14.04	SE Wax Road (SIG)	C	<b>E</b>
14.17	SE 231st Street (SIG)	C	D
<b>Cedar River Segment</b>			
15.07	SE 216th Way (SIG)	C	<b>F</b>
17.68	Cedar Grove Road (SIG)	B	D
<b>Renton Segment</b>			
19.22	Jones Rd. / 196th Avenue SE (SIG)	B	D
22.08	152nd Avenue SE (SIG)	A	C
22.32	149th Avenue SE (SIG)	C	<b>A<sup>6</sup></b>
22.99	140th Way SE (SIG)	D	<b>F</b>
25.18	I-405 Northbound Off-Ramp to Eastbound SR 169 (UNSIG)	<b>F</b>	<b>A<sup>7</sup></b>
25.26	I-405 Southbound On-Ramp -- Sunset Boulevard (SIG)	D	<b>F</b>

**NOTE:** SIG = Signalized; UNSIG = Unsignalized

*Improvements in LOS between 2004 and 2030 are the result of funded improvements noted in Chapter 2, section 18 in Exhibit 2.22 starting on page 2-44.*

<sup>1</sup> Level of service

<sup>2</sup> Intersection LOSs that do not meet (or will not meet) the LOS D standard are displayed in bold.

<sup>3</sup> 2005 Legislature provided funding to improve the intersection and reduce the risk of collisions.

<sup>4</sup> City of Maple Valley started intersection improvement in August of 2006. The city will widen the roadway to add lanes and turn pockets, install a new signal at SE 264<sup>th</sup> Street; and build new bike lanes, sidewalks, curbs and gutters. Expected completion date is December 2007.

<sup>5</sup> WSDOT Freight Corridor Improvement Project, which includes an over-crossing at SE 240th Street; an extension of SE 240th Street underneath SR 18 to Wax Road; add southbound travel lane, bike lane, and additional SB turning lane.

<sup>6</sup> King County relocated Elliott Bridge from 149<sup>th</sup> Avenue SE to 152<sup>nd</sup> Avenue SE/154<sup>th</sup> Place SE intersection (Sept. 2005).

<sup>7</sup> SR 169 / I-405 Phase I – relocate Cedar River Park entrance away from I-405. Phase II – widen SR 169 from new Cedar River Park entrance to I-405, HOV queue jump at I-405 northbound ramp, NB I-405 right turn lane onto EB SR 169.

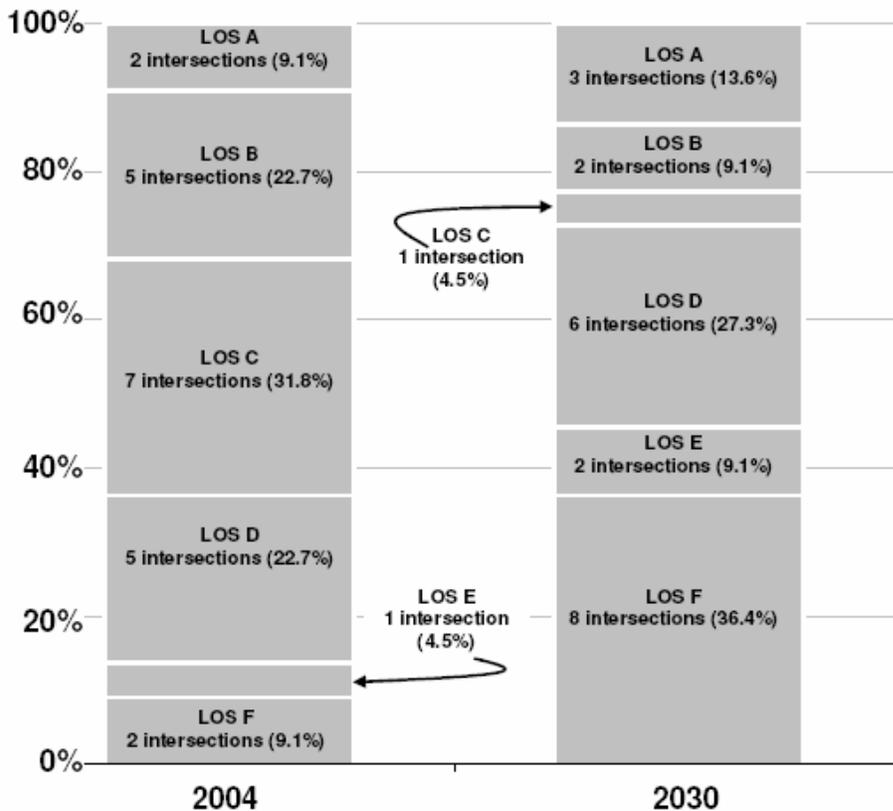
## 9 What are the projected (2030) SR 169 intersection LOS?

By 2030, the projected growth in traffic volumes and the accompanied delays along the corridor are estimated to push more intersections beyond their current capacity. While only three of the twenty-two intersections failed to meet the LOS D standard in 2004, by 2030 a total of ten intersections are projected to be worse than the level of service standard for the PM peak hour. As displayed in Exhibit 3.11 (previous page) and Exhibit 3.12 (below), between 2004 and 2030 there will be a drop in the level of service at most of the intersections on the corridor.

- In 2004 19 intersections (86.4%) were designated as LOS D or better.
- By 2030 12 intersections (54.5%) are estimated to rate at LOS D or better, with of 6 those right at LOS D.

Exhibit 3.12

### Projected Changes in SR 169 Intersection Level of Service 2004 to 2030



**Is Level of Service measured the same at signalized and unsignalized intersections?**

By design a signalized intersection and an unsignalized intersection operate differently. A signalized intersection will stop through traffic to allow the side street traffic to cross or access the main highway. At an unsignalized two-way stop controlled intersection, through traffic is not stopped and cross traffic is required to wait for a gap in mainline traffic in order to cross or merge onto the main highway.

At the same time, a signalized intersection may allow cross traffic a shorter delay than an unsignalized intersection. Because of these differences, the measured level of service at signalized and unsignalized intersections are a bit different.

Exhibit 3.13 below displays the different levels of service for signalized and unsignalized intersections as set out in the Highway Capacity Manual 2000. Each level of service is based on an increasing level of vehicle delay through the intersection.

**Exhibit 3.13**

**Intersection Level of Service and Vehicle Delay**

(Signalized and Unsignalized)

Level of Service	Seconds of Vehicle Delay	
	Signalized Intersections	Unsignalized Intersections
A	0 – 10	0 – 10
B	11 – 20	11 – 15
C	21 – 35	16 – 25
D	36 – 55	26 – 35
E	56 – 80	36 – 50
F	> 80	> 50

Source: Highway Capacity Manual 2000

Typically, LOS for signalized intersections is based on the average delay for the whole intersection. At the same time unsignalized intersection LOS is based on the average delay for the worst approach. But for comparison purposes in this document average vehicle delay and LOS was used for both signalized and unsignalized intersections. The delay differences

between a signalized and an unsignalized intersection begin to be more evident as the levels of service changes from LOS A toward LOS F.

**What are the projected (2030) SR 169 UNSIGNALIZED intersection levels of service?**

Exhibits 3.14 through 3.19 (starting on page 3-19) show the calculated LOS for key intersections in each corridor study segment. A number of intersections degrade to a PM peak hour LOS F by 2030. The majority of the 2030 LOS F intersections are unsignalized. These LOS F intersections are all located in succession, one after the other, in the Rural / Agricultural and Black Diamond segments:

- SE Green Valley Road,
- Lawson Street,
- Baker Street,
- Roberts Drive,
- Ravensdale Road

These LOS F intersections are expected to experience high enough traffic volumes along SR 169 during the peak hour that there will be few gaps for the vehicles along the minor streets to turn onto or cross SR 169. This will substantially increase the delay along the side streets, negatively affecting the LOS of the intersections.

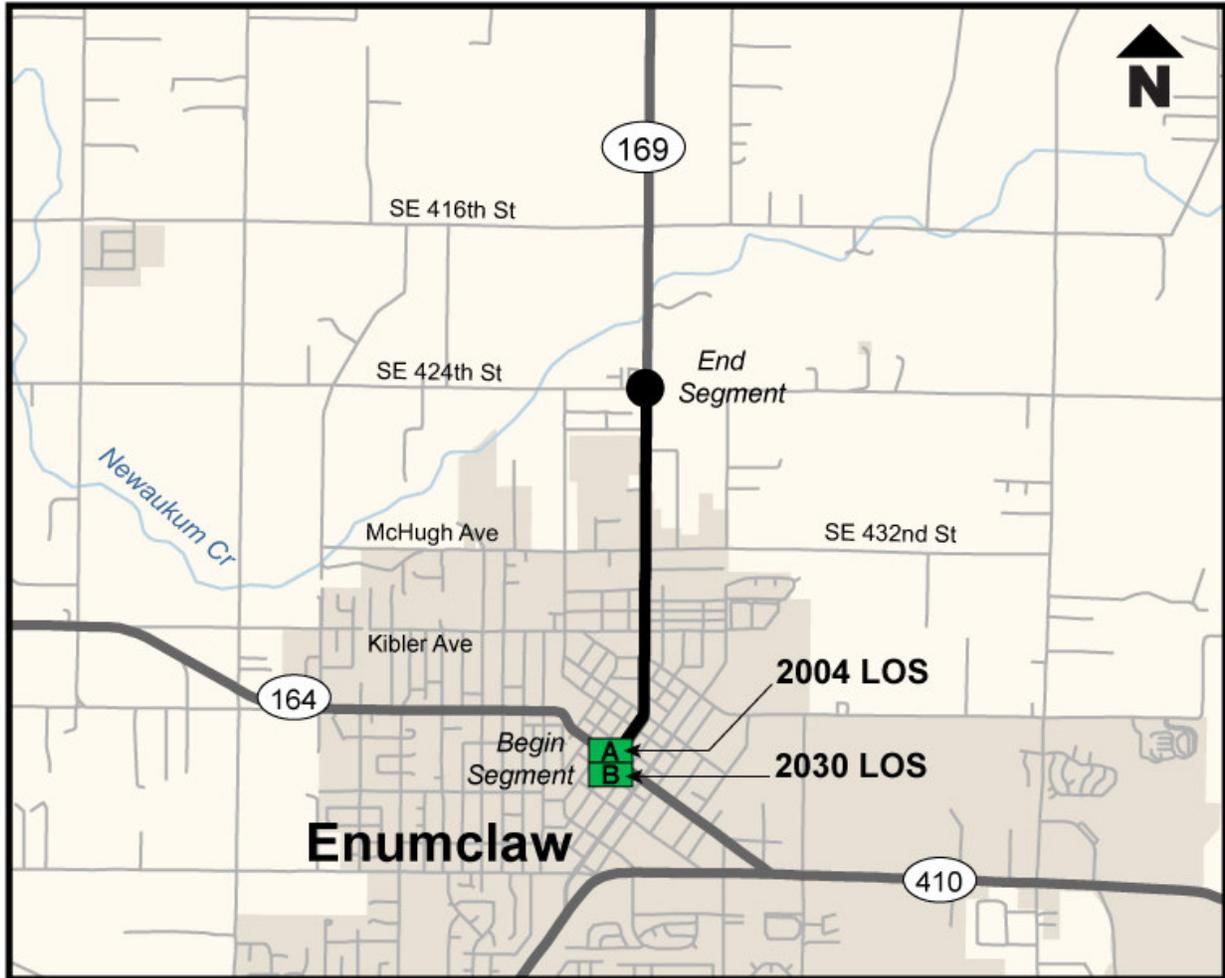
**What are the projected (2030) SR 169 SIGNALIZED intersection levels of service?**

Most of the north end of the SR 169 corridor contains signalized intersections. Three of these signalized intersections degrade to a PM peak hour LOS F by 2030. One 2030 LOS F intersection is located at the very busy SR 169 / I-405 Southbound On-Ramp interchange.

The other two 2030 LOS F intersections (SE 216th Way and 140th Way) are estimated to experience much the same delay issues as the unsignalized intersections mentioned above. Through traffic on SR 169 will be so heavy that it will get the majority of the “green time” from the traffic signals, resulting in significant delay on the minor streets. Even though the

minor street delay will be worse at these two intersections, the intersection approaches on SR 169 itself will also be at LOS F due to the significant increase in traffic volumes between 2004 and 2030.

**Exhibit 3.14**  
**Enumclaw Segment – Existing and Future PM Peak Hour Intersection LOS**

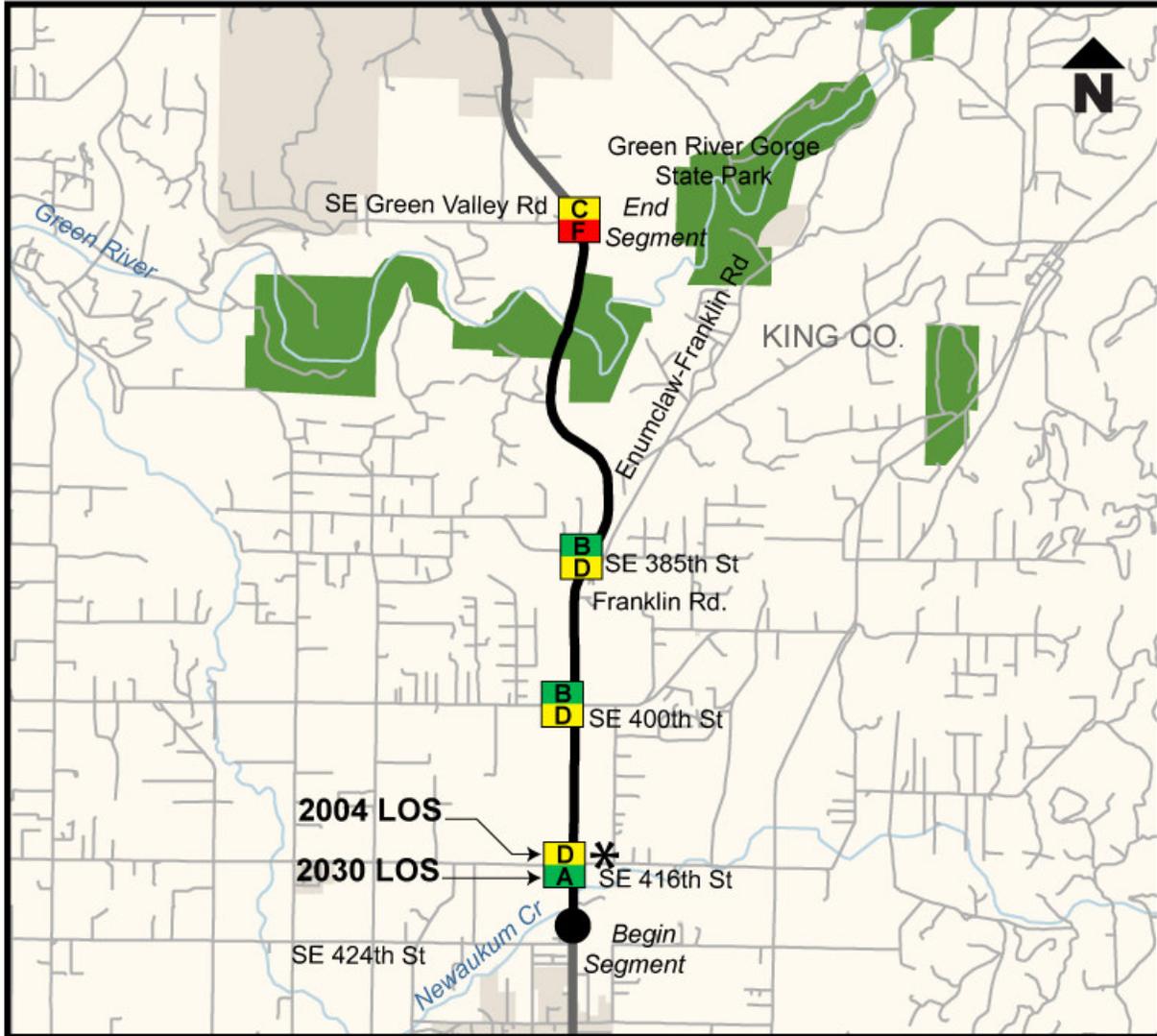


PM Peak Hour LOS is shown for 2004 (existing) and 2030 (future) traffic conditions.

**Levels of Service – A through F**

- |          |          |  |          |          |  |
|----------|----------|--|----------|----------|--|
| <b>A</b> | <b>B</b> | LOS A and B better than state standard | <b>C</b> | <b>D</b> | LOS C better than state standard<br>LOS D state standard |
| <b>E</b> | <b>F</b> | LOS E and F worse than state standard  |          |          |  |

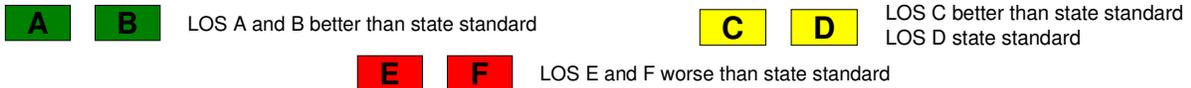
**Exhibit 3.15**  
**Rural / Agricultural Segment – Existing and Future PM Peak Hour Intersection LOS**



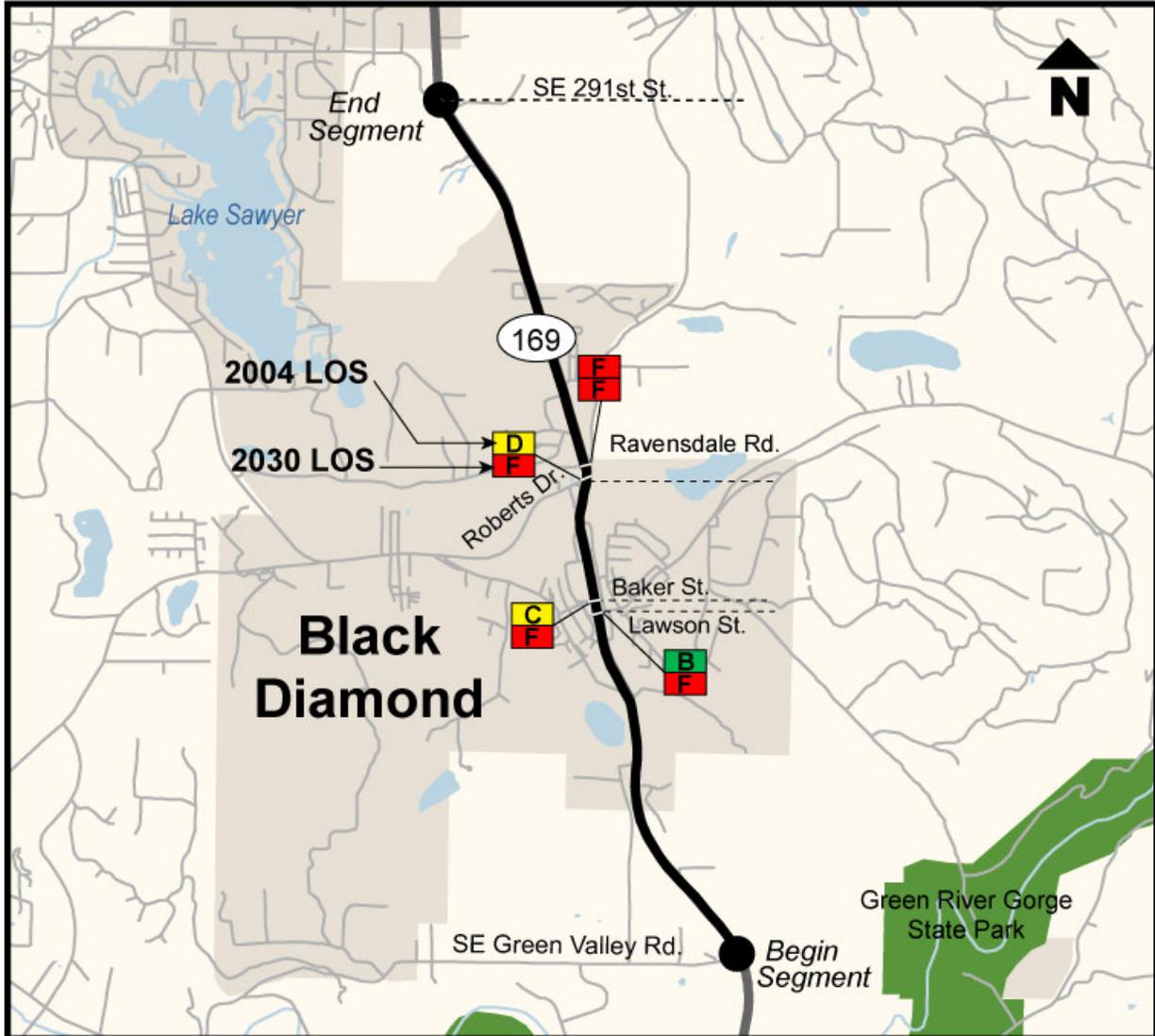
PM Peak Hour LOS is shown for 2004 (existing) and 2030 (future) traffic conditions.

\* Indicates an area where LOS is expected to improve between 2004 and the 2030 due to already funded improvements

**Levels of Service – A through F**



**Exhibit 3.16  
Black Diamond Segment – Existing and Future PM Peak Hour Intersection LOS**

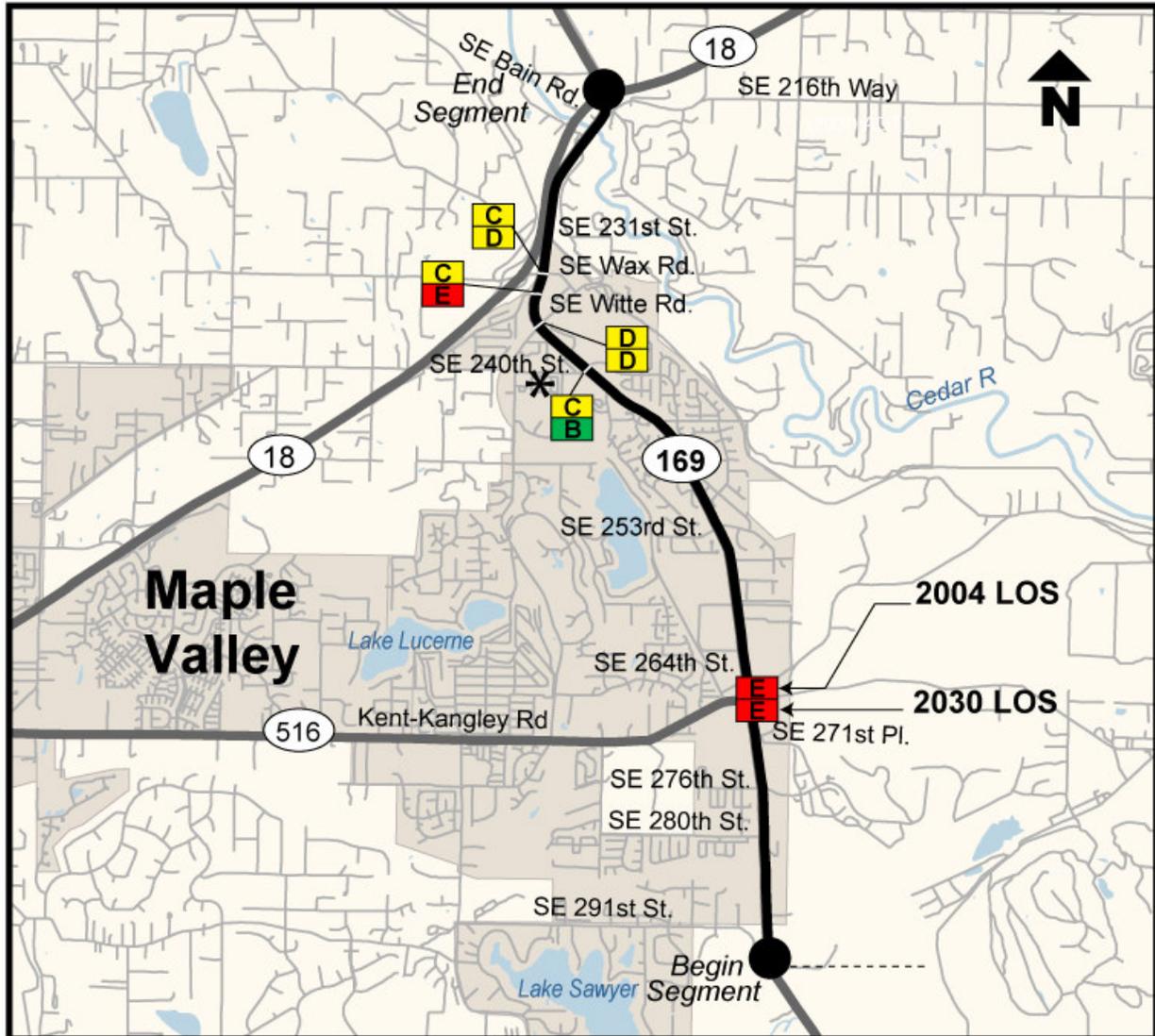


PM Peak Hour LOS is shown for 2004 (existing) and 2030 (future) traffic conditions.

**Levels of Service – A through F**

- |          |          |  |          |          |  |
|----------|----------|--|----------|----------|--|
| <b>A</b> | <b>B</b> | LOS A and B better than state standard | <b>C</b> | <b>D</b> | LOS C better than state standard<br>LOS D state standard |
| <b>E</b> | <b>F</b> | LOS E and F worse than state standard  |          |          |  |

**Exhibit 3.17  
Maple Valley Segment – Existing and Future PM Peak Hour Intersection LOS**



PM Peak Hour LOS is shown for 2004 (existing) and 2030 (future) traffic conditions.

\* Indicates an area where LOS is expected to improve between 2004 and the 2030 due to already funded improvements

**Levels of Service – A through F**

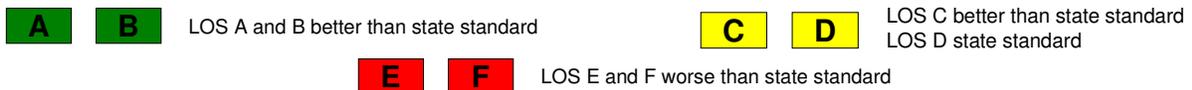
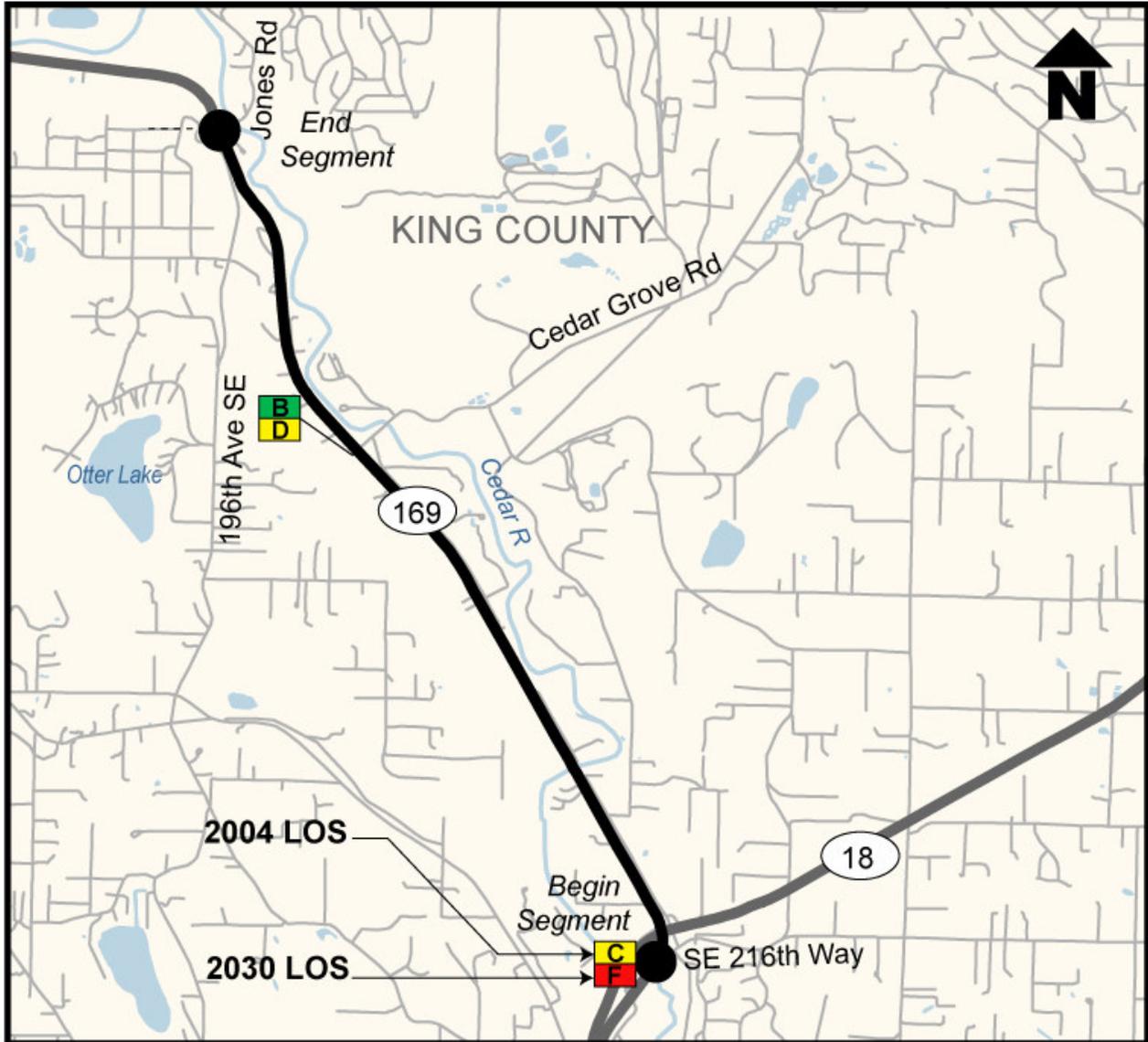


Exhibit 3.18  
Cedar River Segment – Existing and Future PM Peak Hour Intersection LOS

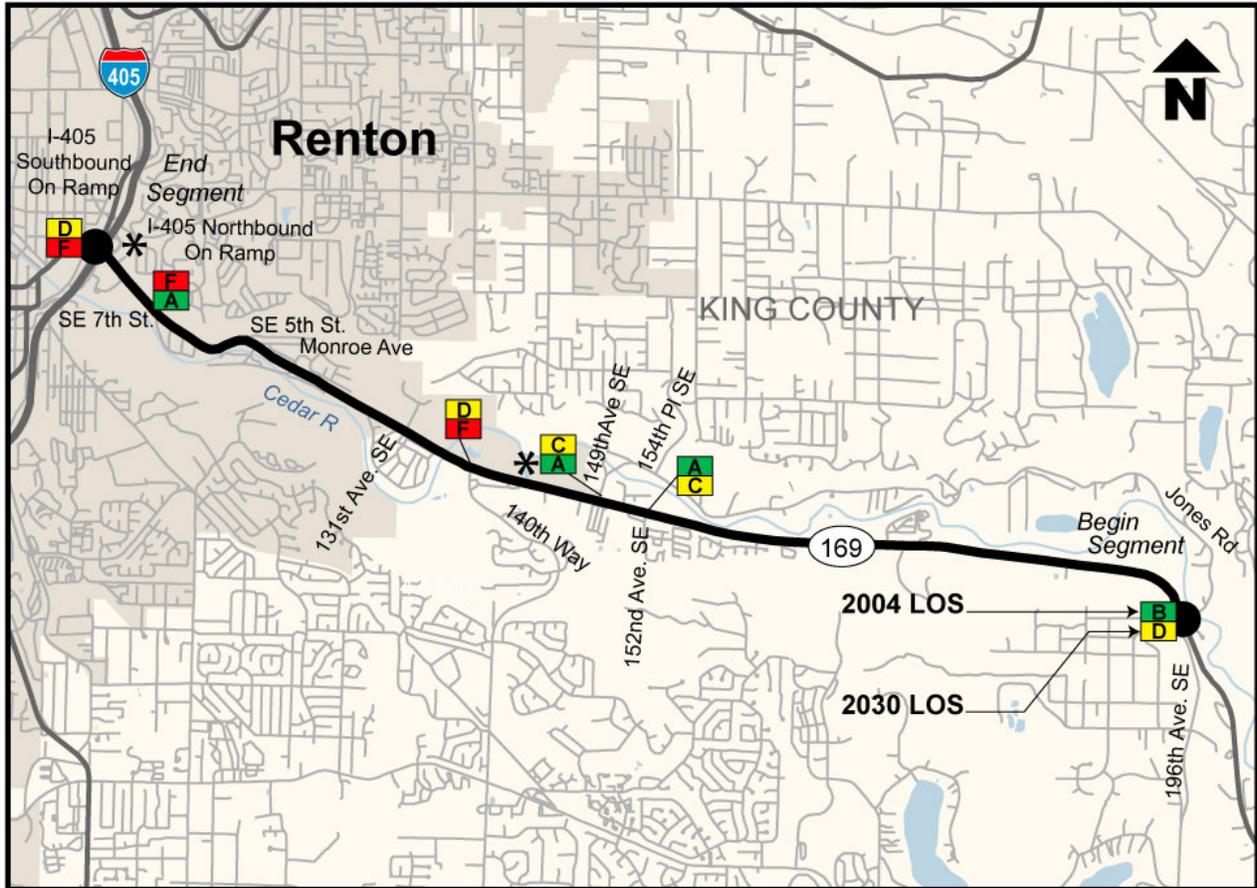


PM Peak Hour LOS is shown for 2004 (existing) and 2030 (future) traffic conditions.

Levels of Service – A through F

- |          |          |  |          |          |  |
|----------|----------|--|----------|----------|--|
| <b>A</b> | <b>B</b> | LOS A and B better than state standard | <b>C</b> | <b>D</b> | LOS C better than state standard<br>LOS D state standard |
| <b>E</b> | <b>F</b> | LOS E and F worse than state standard  |          |          |  |

**Exhibit 3.19  
Renton Segment – Existing and Future PM Peak Hour Intersection LOS**



PM Peak Hour LOS is shown for 2004 (existing) and 2030 (future) traffic conditions.

\* Indicates an area where LOS is expected to improve between 2004 and the 2030 due to already funded improvements

**Levels of Service – A through F**

<b>A</b>	<b>B</b>	LOS A and B better than state standard	<b>C</b>	<b>D</b>	LOS C better than state standard LOS D state standard
<b>E</b>	<b>F</b>	LOS E and F worse than state standard			

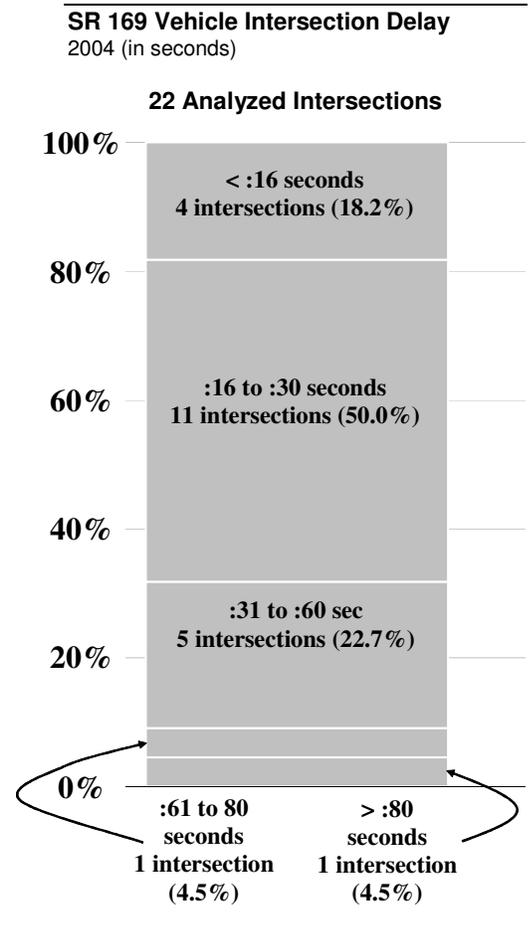
Intersection Vehicle Delay

**10 What is the current SR 169 intersection vehicle delay?**

All of the 22 analyzed intersections on SR 169 currently experience some PM peak hour delay, although significant delay is not wide spread. Presently, three intersections are operating at LOSs worse than the LOS D standard.<sup>4</sup> See Exhibit 3.20 on page 3-27 for vehicle delay at each of the 22 analyzed intersections.

The measured delay at all the analyzed intersections is displayed in the figure on the right and provides the following:

- Most of the intersections (15 intersections – 68%) experience less than 31 seconds of vehicle wait time.
- More intersections (11 – 50%) experience between 16 and 30 seconds of delay than any other level of delay.
- Almost all of the intersections (20 – 90.9%) are experiencing less than 61 seconds delay.



<sup>4</sup> As discussed above (Exhibit 3.13, page 3-17), signalized and unsignalized intersections are designed differently and delay can be different depending on the minor street cross traffic. The LOS D standard for the 8 unsignalized intersections is between 26 and 35 seconds, while the LOS D standard for the 14 signalized intersections is 36 to 55 seconds.

Current Delay at Unsignalized Intersections<sup>5</sup>

Of the 8 unsignalized intersections measured along the corridor all but one are located in the southern, more rural portion of the corridor.<sup>6</sup> As seen in the figure to the right, only two intersections experienced a delay worse than the standard of LOS D (26-35 seconds):

- Black Diamond / Ravensdale Road;
- I-405 Northbound Off-Ramp to Eastbound SR 169.

Four of the remaining six unsignalized intersections operated at delays between 13 and 20 seconds (LOS B and LOS C).

Current Delay at Signalized Intersections<sup>5</sup>

Of the 14 signalized intersections measured along the corridor none experienced a delay over 60 seconds. As seen in the figure to the right, only 1 intersection (SR 516 – Kent-Kangley Road – 60 seconds) showed a delay worse than the LOS D standard for signalized intersections (36 to 55 seconds).

Half of the signalized intersections experienced a delay between 16 and 30 seconds. Six of those (43%) experienced a delay of less than 30 seconds.

Current SR 169 PM Peak Hour Single Trip Delay

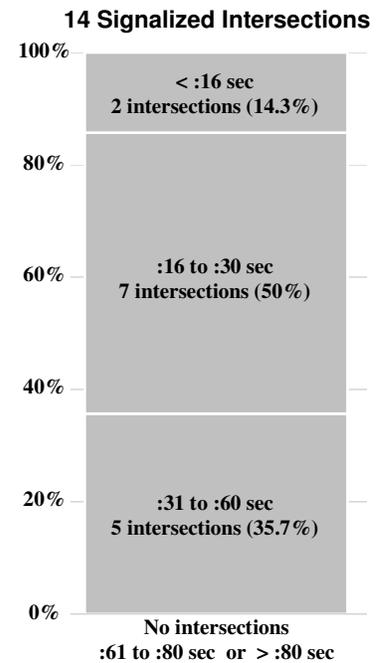
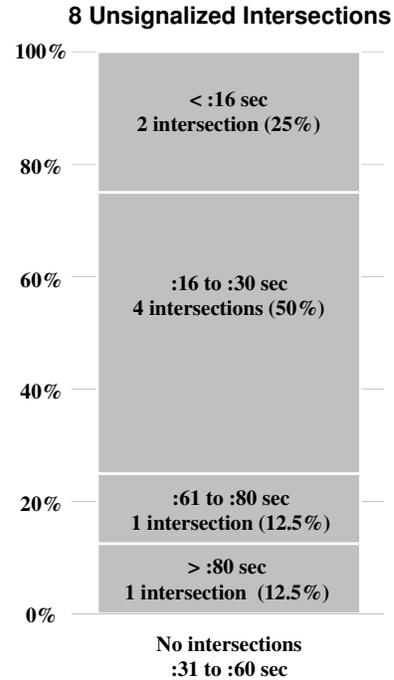
One PM Peak Hour Trip – One Vehicle in 2004:

One PM peak hour complete trip along SR 169 in 2004 would total 11.2 minutes of delay for an individual vehicle.

One PM Peak Hour Trip – All Vehicles in 2004:

Add up all of the vehicles making the same single PM peak hour trip 2004 and then multiply that by the 11.2 minutes of each individual vehicle delay. The total would be about 460 hours of vehicle delay per day.<sup>7</sup>

**SR 169 Vehicle Intersection Delay**  
2004 (in seconds)



22 total analyzed intersections

<sup>5</sup> Existing condition intersection delay was measured in December of 2004.

<sup>6</sup> The one unsignalized intersection not in the rural area is the I-405 off ramp to Eastbound SR 169. As a part of the I-405 improvement project, this intersection will be converted from an I-405 off-ramp and intersection to an I-405 off-ramp with an unrestricted right-turn onto a new eastbound right lane on SR 169, thus eliminating the “intersection” from the 2030 intersection analysis later in this chapter.

<sup>7</sup> Source: 2004 SR 169 WSDOT Traffic Counts

(672 PM peak hour seconds of intersection delay) X (45,780 pm peak hour vehicles) = 1,701,615 seconds of delay; or 27,876 minutes of delay; or 464.60 hours of delay.