City of Enumclaw

SR 410 Corridor Study

transpoGROUP

City of Enumclaw

SR 410 CORRIDOR STUDY

(Enumclaw Segment MP 22.46 to MP 25.82)

Project No. 0714 – STPUS-0410(048)

Prepared for:
City of Enumclaw

June 2010

Prepared by:

transpoGROUP

In association with:

AHBL

11730 118th Avenue NE, Suite 600
Kirkland, WA 98034-7120
Phone: 425-821-3665
Fax: 425-825-8434
www.transpogroup.com

06395.00

Table of Contents

Figures

Tables

Appendices

Introduction

State Route (SR) 410 is an important corridor providing the primary connection between the City of Enumclaw and Pierce County communities to the south, while also being a National Scenic Byways Corridor allowing access to Mt. Rainier National Park, the Mt. Baker-Snoqualmie National Forest, Crystal Mountain Ski Area, and Yakima to the east. The corridor is one of five highways within the State providing a west-east connection across the Cascade Mountain range. However both Chinook Pass and Cayuse Pass are seasonally closed in the winter, typically November to May or June.

The corridor study, led by the City of Enumclaw and partially funded with a Federal Surface Transportation Program – Small (STPUS) grant from the Puget Sound Regional Council (PSRC), has been prepared to identify future needs along the SR 410 corridor. It provides a menu of improvement concepts along the corridor meant to guide investments in improvements to infrastructure as future funding becomes available or as new development takes place. No funding has been secured to complete the improvements identified in the study (as of January 2010).

What is the purpose and need for the corridor study?

The corridor study will identify both intersection and roadway improvements within the City of Enumclaw and its urban growth area (UGA) to increase safety, alleviate future traffic congestion predicted along the corridor, enhance local circulation and access patterns, and expand existing non-motorized facilities in a manner consistent with the City's Comprehensive Plan.

The City of Enumclaw is planning for a substantial increase in commercial and residential development in the years ahead now that the over ten-year old sanitary sewer connection and associated building moratorium has been lifted with the 2009 completion of the wastewater treatment plant expansion. A significant amount of the City's growth is forecasted for the eastern end of the SR 410 corridor. Several developments are in the planning or development stages, while others await permits to be issued.

Future development along the SR 410 corridor is expected to include agricultural, residential, and commercial development which will contribute to the City's identity and local economy. This local development growth, coupled with increased regional travel along SR 410, has created a need to identify future improvement concepts for the corridor and the City's overall vision and priorities for implementing them.

The purpose for the corridor study is to:

- Develop concepts to improve safety and alleviate future traffic congestion predicted along the corridor. The intersection with SR 164 will fall below adopted level of service standards with increased development anticipated on the east side of the City. Other intersections along the corridor, which are predominantly unsignalized, will also fall below standards in the future. Poor operations will also likely decrease overall safety. The corridor study reviews intersection control, operations, and safety along the entire length of the corridor and identifies the appropriate levels of access and traffic control.
- The City is planning to upgrade surrounding local arterial and collector streets and extend Dickson Avenue to create additional local circulation and transportation connectivity options, consistent with the City's 2004 Comprehensive Plan. The changes to existing travel patterns which are anticipated to result from new local connections have been considered as potential alternatives to additional capacity improvements along SR 410. The corridor study provides the justification for corridor improvements, while also considering the impacts of improvements along the City's local street system.
- Enhance and provide new access to public and private properties both for existing and future development. Many drivers stop along the corridor to shop, run errands, and support other business and living needs. With additional growth planned along the corridor, the needs for

residents and regional travelers to visit local businesses will continue to grow. The corridor study evaluates how access to existing businesses and future development can be enhanced, or even facilitated, by corridor improvements that benefit all users. Access and circulation improvements along the corridor will significantly benefit the people living and doing business within the Enumclaw community.

With the lifting of the development moratorium and subsequent planned future development, it is an opportune time to define improvements along the corridor before development occurs. The corridor study provides a "menu" of improvements the City could consider at such time funding is available or new development occurs to implement the identified improvements.

How was the corridor study prepared?

The corridor study built off the City's adopted 2004 Comprehensive Plan, which identified the study as a high priority project. The land use plan was used to prepare estimates of travel demand in Year 2030 to identify concepts to address safety, congestion, mobility, and promote the use of alternative modes of travel. The City and consultant team worked with Washington State Department of Transportation (WSDOT) staff to identify issues and develop feasible concepts for consideration. This study's preliminary concepts were presented to the Enumclaw City Council to obtain their direction and identify locations that should be prioritized higher than others. The draft concepts were then presented to the general public and surrounding businesses during a public open house meeting to obtain their input and feedback. The input from the public, businesses, WSDOT, and City Council were then used to prepare a final menu of improvement concepts illustrated within this corridor study.

How is the corridor study organized?

The corridor study comprises the following chapters:

1. **Assessment of Existing Corridor Conditions** describes the existing infrastructure along the corridor and how it currently operates.
2. **Assessment of Future Corridor Needs** describes the future impacts of land use growth on the corridor and the corridor improvements needed to address existing issues and future growth.
3. **Description of the Improvement Concepts** presents the various concepts and design characteristics that will address the identified impacts and support the long-term vision of the City.
4. **Environmental Considerations** identifies potential environmental constraints and necessary permits to consider if the improvement concepts are implemented.

Additional background data is included as part of the Appendix material.

What is the study area?

The study area focuses on the SR 410 corridor between 244th Avenue SE to the south/west and 288th Avenue SE to the north/east. The extents of the identified study area are shown in Figure 1.

Corridor Segments

The corridor was divided into three segments based on how the characteristics of the SR 410 corridor change within the study area. The resulting corridor segments are shown in Figure 2. The extents of each segment are as follows:

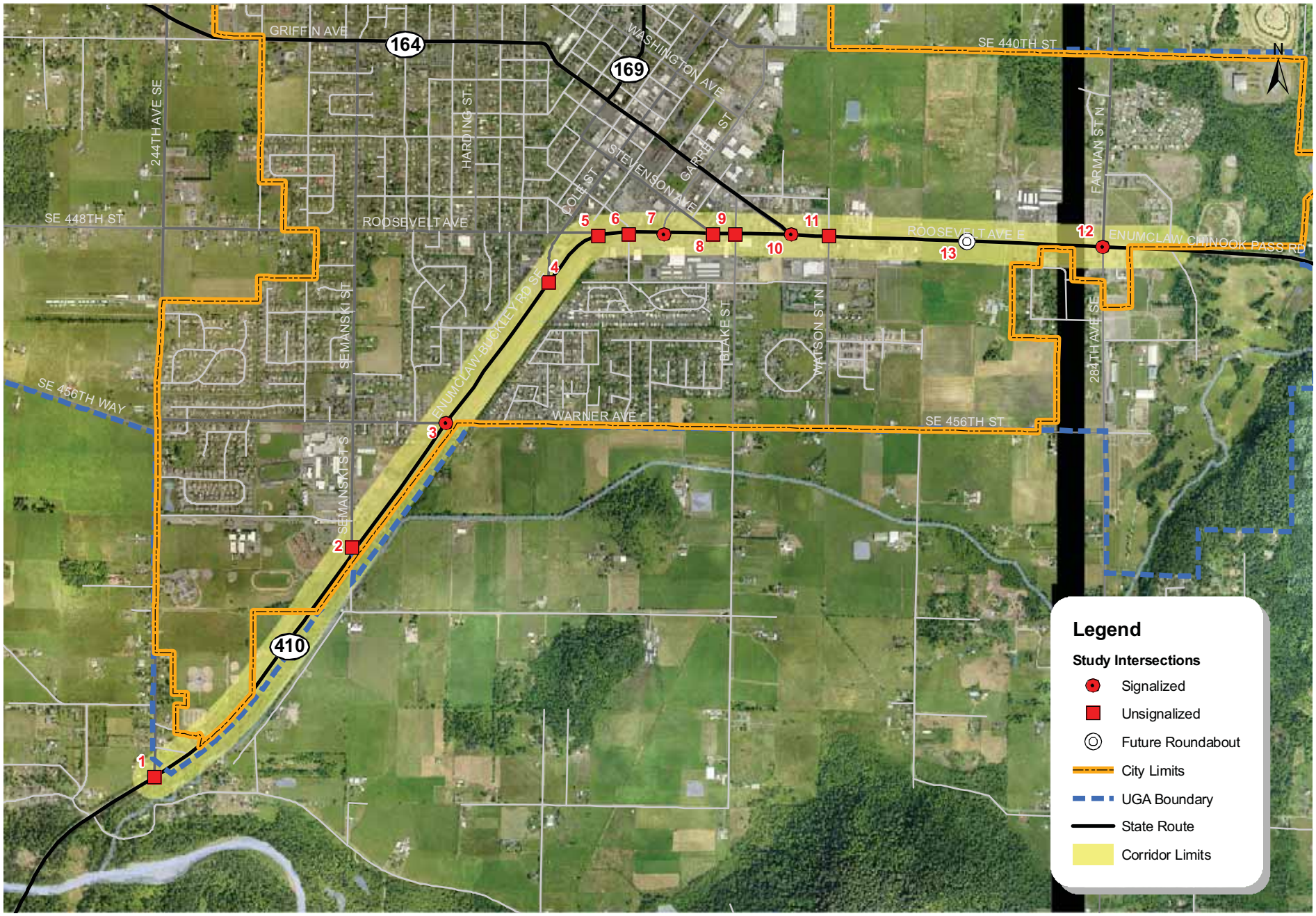
- Segment 1 (West): MP 22.46 to MP 24.05
- Segment 2 (Central): MP 24.05 to MP 25.12
- Segment 3 (East): MP 25.12 to MP 25.82

Segment 1 represents a section of the SR 410 corridor with few driveways or intersections and is bordered to the east by the Foothills Trail. Segment 2 includes the more urban portion of the study area, with closely spaced intersections, including numerous commercial business driveways. Segment 3 includes the segment to the east where a majority of the future commercial and residential development will likely occur.

Study Intersections

A total of 12 existing intersections were evaluated as part of the corridor study. An additional "13th" intersection was included as part of the future analysis. This additional intersection represents the location of where Suntop Boulevard N is anticipated to intersect SR 410. It is located just east of Watson Street N.

1.	Milepost 22.48	244th Avenue SE	(stop-controlled)
2.	Milepost 23.28	Semanski St S (252nd Ave SE)	(stop-controlled)
3.	Milepost 23.68	Warner Avenue (SE 456th St)	(signalized)
4.	Milepost 24.14	Cole Street	(stop-controlled)
5.	Milepost 24.32	Roosevelt Avenue	(stop-controlled)
6.	Milepost 24.40	Monroe Ave/Mountain Villa Dr	(stop-controlled)
7.	Milepost 24.50	Garrett Street	(signalized)
8.	Milepost 24.63	Stevenson Avenue	(stop-controlled)
9.	Milepost 24.68	Blake Street	(stop-controlled)
10.	Milepost 24.82	Griffin Avenue (SR 164)	(signalized)
11.	Milepost 24.92	Watson Street N	(stop-controlled)
12.	Milepost 25.64	Farman St N (284th Ave SE)	(signalized)
13.	Milepost 25.29	Suntop Boulevard N	(proposed round-about)



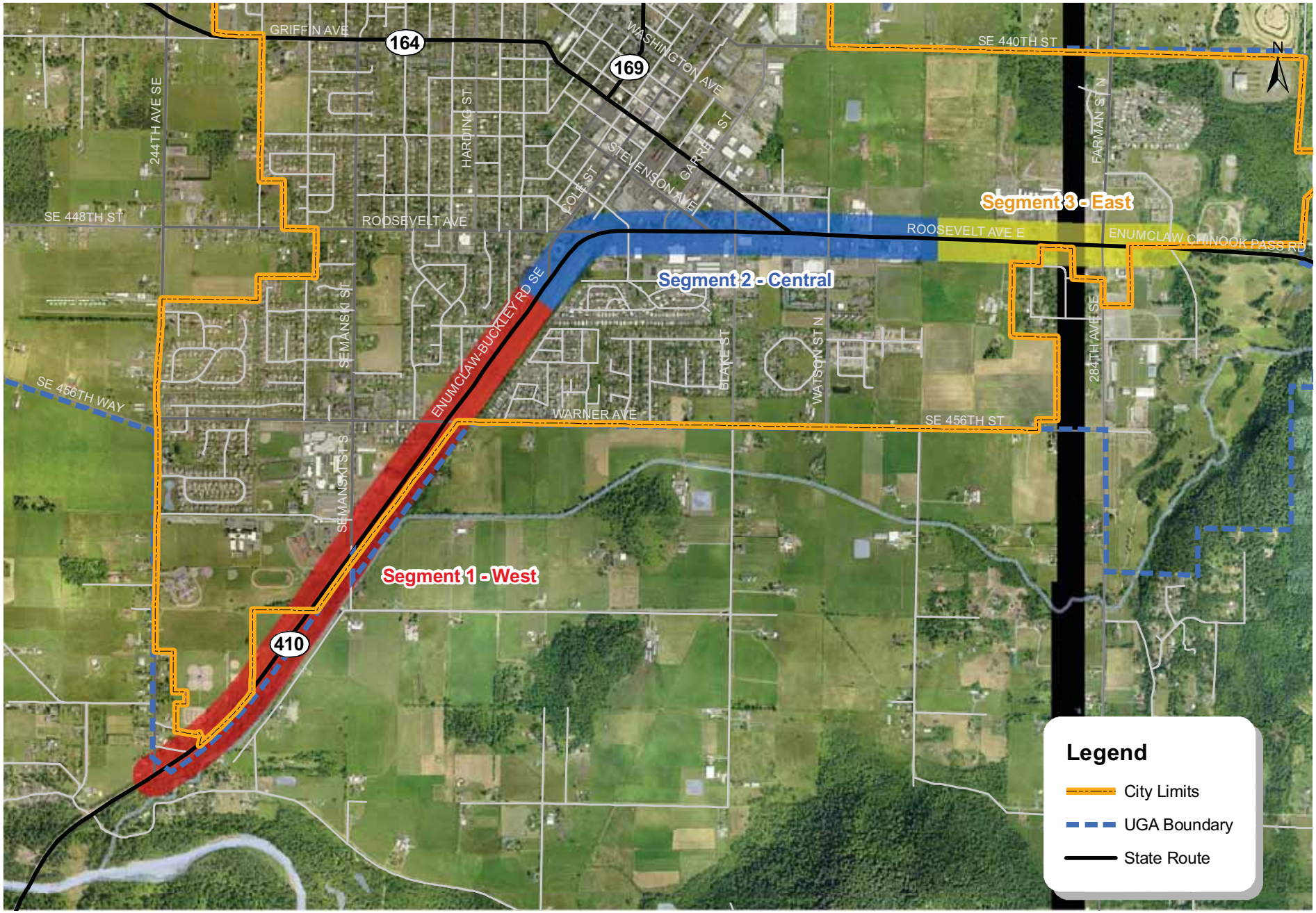
Study Area

SR 410 Corridor Study

M:\06\06395 SR 410 Corridor Study\GIS\MXD\FIG1_StudyArea

FIGURE
1

transpoGROUP



Corridor Segments

FIGURE
2

SR 410 Corridor Study

M:\06\06395 SR 410 Corridor Study\GIS\MXD\FIG2_CorridorSegments.mxd

transpoGROUP

Assessment of Existing Corridor Conditions

The assessment of existing corridor conditions provides an evaluation of current traffic operations and intersection and roadway levels of service (LOS) along the SR 410 corridor between 244th Avenue SE to the west and 288th Avenue SE (Enumclaw golf course access road) to the east. The analysis also summarizes recent collision data along the corridor, and existing non-motorized and transit facilities.

The results of the existing conditions analysis assist in identifying future needs along the 4-mile corridor and development of improvement alternatives to address those needs.

What is the corridor's functional classification?

Within the study area, WSDOT classifies SR 410 as an Urban Minor Arterial. An urban minor arterial provides connectivity between cities and major destinations as well as principal arterials and freeways. SR 410 extends from Yakima in central Washington through Enumclaw. At Enumclaw it turns southwest through the Cities of Buckley, Bonney Lake, and Sumner where it terminates at the junction with SR 167. WSDOT has not designated SR 410 as a Highway of Statewide Significance (HSS), however the Puget Sound Regional Council (PSRC) has designated SR 410 as a Highway of Regional Significance. SR 410 east of Enumclaw is a designated National Scenic Byways Corridor. The posted speed limit along all three segments of the corridor within Enumclaw is 40 mph.

What is the corridor access classification?

WSDOT has jurisdiction over SR 410 and the highway is considered a Managed Access Highway with rules governing the frequency and types of access that can be granted. Specific rules governing Managed Access Highways were created in 1991 and roadway accesses granted before 1991 were grandfathered in so that the new rules only apply when redevelopment occurs. Managed access highways in unincorporated areas require a state-issued access permit. However, pursuant to Washington State Law (WAC 468-50-010) and Enumclaw Municipal Code (EMC 12.28.010) the City of Enumclaw is the permitting authority for managed access routes within their boundaries.

There are five Managed Access classifications in WSDOT's system with Class 1 allowing for the least amount of access and greatest mobility and Class 5 allowing for the most access with potentially less mobility. Table 1 lists the access classifications of sections of SR 410 as defined by WSDOT. A copy of the Washington Highway Classification Description Table is included as a attachment to this memorandum. Access management regulates proposed street connections and property access driveways to the state route.

Table 1. Managed Access Sections on SR 410[1]

Access Management Section	WSDOT Access Classification
244th Ave SE to City limits (MPs 22.46 to 25.71)[2]	Class 4
City limits to 288th Ave SE (MPs 25.71 to 25.82)[2]	Class 1

1. Access granted before 1991 is grandfathered in and management techniques only apply to new development or redevelopment.
2. The City limit was adjusted to approximately milepost 26.17 by City ordinance 2304 (2006), 2,789 feet to the east of Farman Street N.

The majority of SR 410 within the study area is a Class 4 Managed Access Highway. A small segment to the east of the existing city limit is Class 1. On Class 4 roadways, access is allowed every 250 feet with one access per contiguous parcel under the same ownership, except with justification. The Class 1 access is much more restrictive with accesses spaced a minimum of 1,320 feet apart. This is reflective of the roadway entering unincorporated King County with a speed limit of 55 mph. These access classifications must be kept in mind when determining future improvements, access management opportunities, and new traffic control.

What are the traffic volumes in the study area?

Traffic volume data in the study area were collected for intersections and roadway segments for the weekday PM peak hour. In addition, weekday AM peak hour traffic counts were collected at the following three intersections:

- 244th Avenue SE (stop-controlled)
- Garrett Street (signalized)
- SR 164 (signalized)

These three intersections were chosen based on their operations during the weekday PM peak hour. These intersections also handle some of the highest total entering volumes of the study intersections, and/or link the SR 410 corridor with another major arterial. While the corridor study is focused on improvements necessary to handle the PM peak hour traffic volumes, these intersections would likely be the only locations along the corridor where AM peak hour travel could impact the preferred design option.

In addition to the weekday AM and PM peak traffic count data, average daily traffic (ADT) volumes were also collected along SR 410. This additional data provides information related to the profile of hourly traffic volumes outside of the peak hours, and identified the relationship between the weekday AM and PM peak hour traffic volumes to daily traffic volumes along the corridor. Typically, weekday AM peak hour traffic represents approximately six percent of ADT, while approximately ten percent of ADT occurs during the weekday PM peak hour.

Data Collection

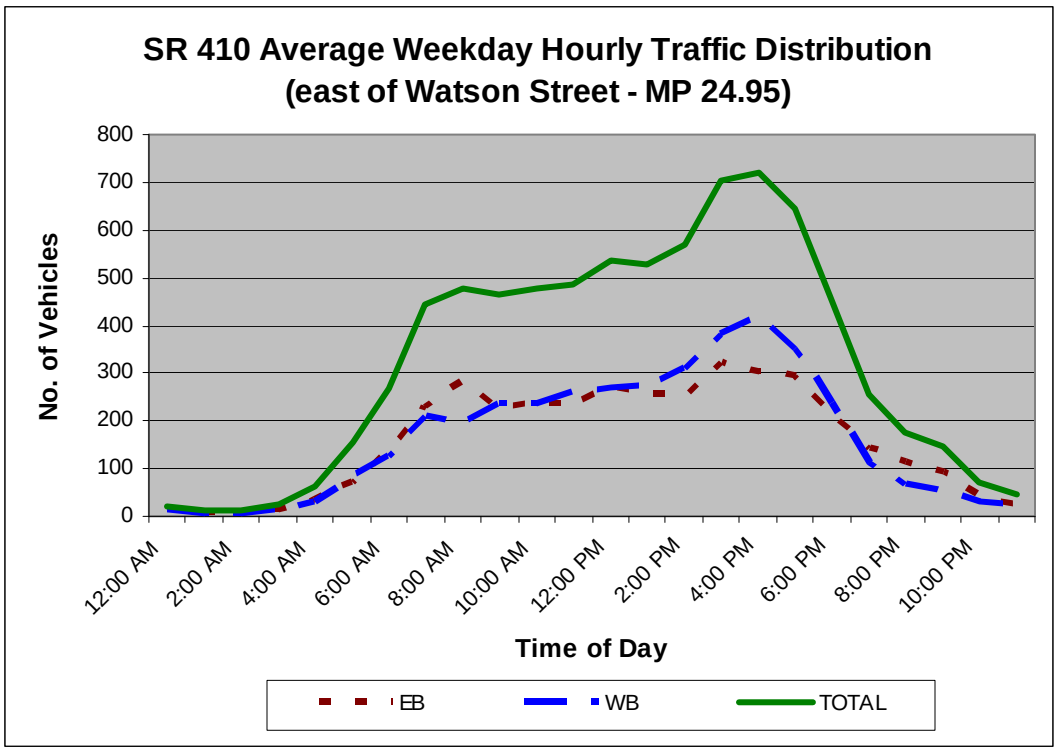
All traffic counts were conducted during the winter months of December 2003 and January 2009. This represents a time period that includes ski area traffic to/from Crystal Mountain Resort. It should be noted that to the north of the City of Enumclaw, SR 169 was closed during January 2009 for bridge repairs. This could have resulted in changes in travel patterns at study intersections relative to the count data collected during December 2003. The two sets of data were compared, and adjusted as appropriate. Therefore, it is not anticipated that the closure of SR 169 impacted the findings of this analysis.

Existing weekday PM peak hour traffic count data from 2003 was assembled from the Enumclaw Comprehensive Plan. Additional data from several study intersections were collected in January 2009 and compared to the previous counts to determine if new data at all the intersections were needed. The comparison showed that traffic volumes between 2003 and 2009 were generally consistent, with only marginal variability and differences. As such, 2009 counts were used, if available, and 2003 counts were used at the remaining study intersections.

Daily Traffic Volumes

Weekday average daily traffic (ADT) volume data were collected along SR 410 to the east of the intersection with Watson Street N. The data was collected in January 2009. Along this section of roadway the weekday average daily traffic is approximately 7,700 vehicles; 3,800 in the eastbound direction and 3,900 in the westbound direction, per day. These volumes are generally consistent with 2007 average annual daily traffic (AADT) data published by WSDOT in the *2007 Annual Traffic Report*. Figure 5 provides a graph showing the hourly distribution of traffic along the corridor. It shows that the corridor is most highly traveled during the weekday PM peak period, with the majority of traffic travelling in the westbound direction. During the weekday AM peak period the peak direction is reversed to eastbound.

Figure 3. Average Weekday Distribution of Traffic



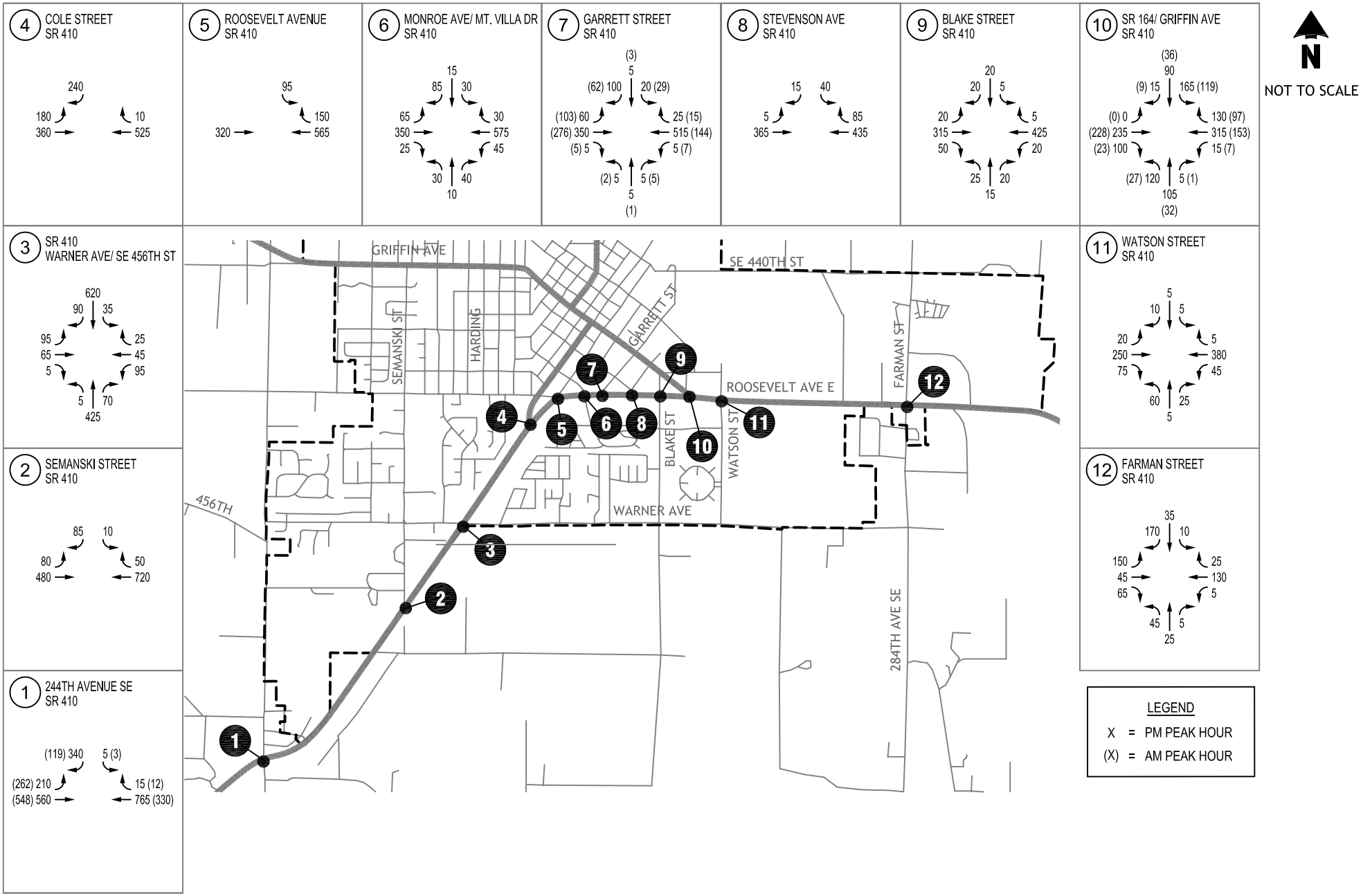
ADT volumes at other locations along the corridor were estimated by multiplying the weekday PM peak hour roadway volumes by a factor of ten, consistent with the count data. To the northeast of 244th Avenue SE, the ADT along SR 410 is approximately 13,500 vehicles, and to the northeast of Cole Street the ADT is approximately 8,900 vehicles. The ADT volumes at these locations are also generally consistent with the 2007 volumes published by WSDOT.

Peak Hour Traffic Volumes

The weekday AM and PM peak hour intersection turning movement volumes are illustrated in Figure 4, and the weekday PM peak hour roadway segment volumes are shown on Figure 5. Along corridor Segment 1, the PM peak hour volumes are approximately 1,100 vehicles westbound and 770 vehicles eastbound west of 244th Avenue SE. Once the corridor enters the City, the volumes drop to approximately 780 vehicles westbound and 570 vehicles eastbound. Near Segment 2, through the commercial area, the volumes drop further, to roughly 550 vehicles westbound and 380 eastbound. Finally, along Segment 3, to the east of Farman Street N (284th Avenue SE), the volumes are at their lowest, with 160 vehicles westbound and 60 vehicles eastbound. The roadway volumes on other arterials intersecting the study corridor range from approximately 100 to 300 vehicles in each direction.

During the weekday AM peak hour, traffic volumes along Segment 1 are approximately 450 vehicles westbound and 810 eastbound. Along Segment 2, through the commercial area, the volumes decrease to approximately 210 vehicles westbound and 390 eastbound. To the east, in the vicinity of the transition between Segment 2 and Segment 3, the westbound volumes slightly increase to 230 vehicles while the eastbound volumes drop to 260 vehicles. No weekday AM peak hour counts were collected within Segment 3 at the very east end of the corridor.

The notable observations from the review of the peak hour traffic volumes include:



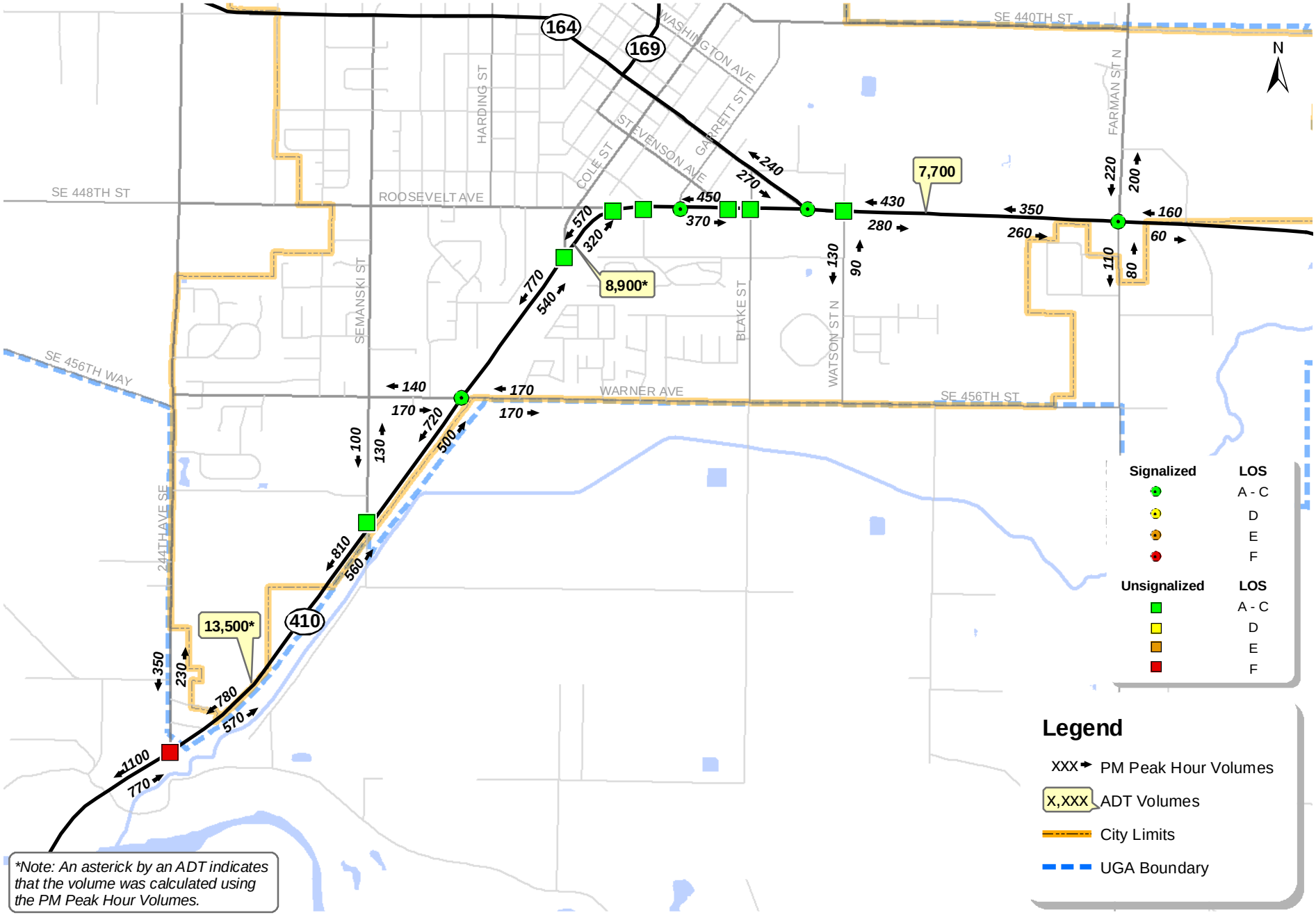
2009 Peak Hour Turning Movements

FIGURE 4

SR 410 Corridor Study

M:\06\06395 SR 410 Corridor Study\6.0 Graphics\CAD\Graphic02 <C> robertm 12/10/09 11:05

transpoGROUP



2009 Levels of Service & Traffic Volumes

FIGURE **5**

SR 410 Corridor Study

M:\06\06395 SR 410 Corridor Study\GIS\MXD\FIG4_LOSandVolumes.mxd

transpoGROUP

- During the weekday AM peak hour the peak travel direction is in the eastbound direction; this is likely attributable to traffic traveling to Crystal Mountain ski area and Mount Rainier National Park.

- During the weekday PM peak hour the peak travel direction is westbound; this reverse in direction is likely due to traffic heading away from Crystal Mountain ski area as well as other travelers heading into Pierce County.

Peak hour traffic volumes help identify travel patterns and are also used for LOS analysis at key intersections.

How do the study area intersections operate today?

An intersection level of service (LOS) model was developed to evaluate the major intersections along the corridor highlighted in Figure 4. The results of the LOS analysis provide a baseline against which the traffic forecasts and improvement alternatives can be compared. The existing intersection operations for the weekday AM and PM peak hours are discussed below.

Intersection Level of Service Methodology

The operational characteristics of an intersection are determined by calculating the intersection's LOS. The intersection as a whole and its individual turning movements can be described alphabetically with a LOS range of A through F. LOS A indicates free-flow traffic and LOS F indicates extreme congestion, such as "stop and go traffic" and long vehicle delays. LOS is measured in average control delay per vehicle and is reported for the intersection as a whole at signalized intersections and for the approach or turning movement that experiences the most delay at unsignalized intersections. Control delay is defined as the combination of initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Appendix A details the intersection LOS methodology.

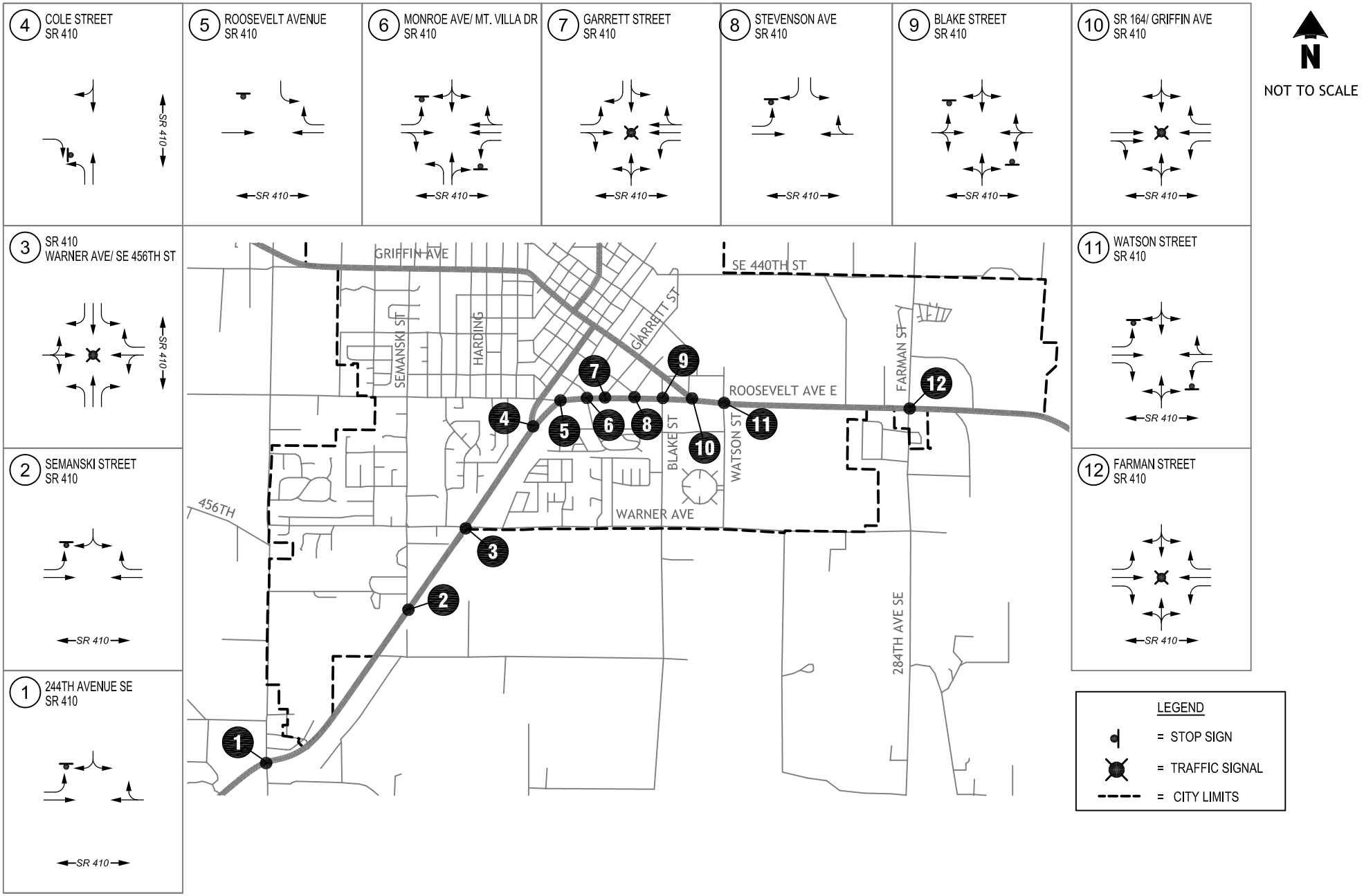
Jurisdictions have LOS standards for roadways in accordance with the Growth Management Act (GMA). The City of Enumclaw has set a standard of LOS D for signalized intersections and LOS E for unsignalized intersections, as stated in the 2004 Comprehensive Plan. The LOS D standard for signalized intersections is consistent with the LOS D standard set by PSRC and WSDOT for SR 410, which is a regionally significant state highway. For roadways in unincorporated areas surrounding the City, King County has set an LOS E standard.

Existing LOS, delays, and volume-to-capacity (V/C) ratios were calculated at the study intersections based on methods contained in the *Highway Capacity Manual 2000* (HCM). The Synchro 7 software package was used for these calculations.

Existing Intersection Level of Service

This section summarizes intersection levels of service within the study area. With the exception of the intersection with 244th Avenue SE, which currently operates at LOS F during the weekday PM peak hour, the study intersections along SR 410 have low delays; all experience average delays of less than thirty seconds and operate above the LOS D standard for signalized locations. The three intersections analyzed in the weekday AM peak hour have lower average delays than during the weekday PM peak hour, and operate at least one level of service grade better at all locations. Table 2 summarizes the LOS results at the study intersections.

For the LOS analysis, existing traffic volumes were rounded to the nearest five vehicles because weekday volumes fluctuate day-to-day. Figure 5 and Table 2 illustrate the LOS at each study intersection and Figure 6 shows the lane geometry and traffic control at each intersection.



Existing (2009) Intersection Channelization & Traffic Control

FIGURE 6

SR 410 Corridor Study

M:\06\06395 SR 410 Corridor Study\6.0 Graphics\CAD\Graphic02 <B> robertm 12/10/09 11:10

transpoGROUP

Table 2. Existing (2009) Weekday Peak Hour Level of Service

ID	Intersection	2009 Existing LOS[1]	Delay[2]	V/C[3] or WM[4]
	Weekday PM Peak Hour			
1	SR 410/ 244th Avenue SE	F	90.9	SB
2	SR 410/ Semanski Street S/252nd Avenue SE	C	20.7	SB
3	SR 410/ Warner Avenue (SE 456th St)	C	20.3	0.65
4	SR 410/ Cole Street	C	18.0	SB
5	SR 410/ Roosevelt Avenue	B	14.0	SB
6	SR 410/ Mountain Villa Dr/Monroe Avenue	C	16.0	NBL
7	SR 410/ Garrett Street	B	10.6	0.37
8	SR 410/ Stevenson Avenue	B	11.8	SB
9	SR 410/ Blake Street	C	19.7	NB
10	SR 410/ Griffin Avenue (SR 164)	C	22.5	0.60
11	SR 410/ Watson Street N	B	13.5	NB
12	SR 410/ Farman Street N (284th Avenue SE)	B	12.8	0.26
	Weekday AM Peak Hour			
1	SR 410/ 244th Avenue SE	C	15.1	SB
7	SR 410/ Garrett Street	A	9.6	0.33
10	SR 410/ Griffin Avenue (SR 164)	B	13.7	0.37

1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

As shown in Table 2, the only intersection operating below LOS D during the weekday PM peak hour is the intersection with 244th Avenue SE. The poor intersection operations at this location are due to the 244th Avenue SE approach being stop-controlled, combined with high traffic volumes along SR 410. Therefore vehicles making the southbound to eastbound left-turn turn are delayed trying to find a gap in traffic to safely turn onto the highway. In addition, the southbound approach has only a single shared lane for left- and right-turning vehicles. Vehicles making the southbound to westbound right-turn movement can either be delayed by the left turning vehicles waiting for gaps in traffic or must also wait for gaps in traffic to turn right. None of the intersections analyzed during the AM peak hour operate below the LOS D standard.

How does the highway corridor operate today?

An operational analysis of the SR 410 corridor was conducted using PM peak hour volumes to serve as a baseline against which alternatives can be measured and compared. Corridor segments 1, 2, and 3 were analyzed separately, to recognize each segment has different roadway characteristics. The following sections describe the methodology used to calculate the LOS for the corridor segments and the results of the analysis.

Highway Level of Service Methodology

Highway LOS was determined in accordance with the *Highway Capacity Manual* 2000 (HCM) methodology using the Synchro 7™ software package. Factors influencing highway LOS include traffic volumes, design speed of the highway, delay at signalized intersections, and directional distribution of traffic.

Traffic operations for highway segments are described alphabetically with a range of LOS similar to the intersection LOS, with LOS A indicating free-flowing traffic and LOS F indicating extreme congestion and

long vehicle delays. Highway LOS, or otherwise referred to as urban arterial LOS by the HCM, is measured using an average vehicle speed which accounts for delays caused by signalized intersections.

Existing Highway Level of Service

Table 3 contains the highway LOS results and average speed per vehicle for the study segments along SR 410. The posted speed limit along SR 410 within the study area is 40 mph.

Table 3. Existing (2009) Highway Level of Service

Segment	MP (limits)	Direction	LOS[1]	PM Peak Hour Average Speed[2]
Segment 1 – West	22.46 – 24.29	Eastbound	B	34.1
		Westbound	B	31.8
Segment 2 – Central	24.29 – 25.12	Eastbound	B	29.4
		Westbound	C	26.6
Segment 3 – East	25.12 – 25.82	Eastbound	B	32.4
		Westbound	B	30.3

1. LOS = Level of Service
2. Average speed is in miles per hour and accounts for delays at signalized intersections.

All highway segments operate at LOS B, except for the westbound direction of Segment 2 which operates at LOS C. All of the segments meet the WSDOT LOS D standard.

How does the corridor "system" operate today?

The highway level of service methodology only evaluates movement along the SR 410 corridor, or "throughput," and does not consider the operations of the minor streets. Within the study area, a majority of the traffic along the corridor uses only a segment of the corridor since it also serves as the City's 'main street." Completing just a "throughput" operations analysis is not reflective of how the corridor serves the residents or businesses of the City. Therefore, system wide PM peak hour operations were evaluated to provide an understanding of the delay to all vehicles to and from SR 410 (i.e., the major street and minor street delays). This calculation provides an understanding of the total hours of delay for the system during the PM peak hour.

System wide delay was calculated based on the movement delay and traffic volumes for the study intersections provided by Synchro 7.0. The system wide delay represents the delay (in seconds per vehicle) multiplied by the number of vehicles for the particular movement divided by the number of seconds per hour to provide a total hours of delay. Similar to corridor operations, segments 1, 2, and 3 were analyzed separately, to recognize that each segment has different roadway characteristics. In addition, the total hours of delay was also calculated for the entire study area. Table 4 provides a summary of the existing system operations.

Table 4. Existing (2009) PM Peak Hour System Operations

Segment	MP (limits)	Total Hours of Delay[1]
Segment 1 – West	22.46 – 24.29	19.0
Segment 2 – Central	24.29 – 25.12	15.9
Segment 3 – East	25.12 – 25.82	2.5
Total	**22.46 – 25.82**	**37.4**

3. The delay (in seconds per vehicle) multiplied by the number of vehicles for each particular movement divided by the number of seconds per hour to provide a total hours of delay.

As shown in the table, the highest system delays are along segments 1 and 2 corresponding to the locations where traffic volumes are highest. Very few system delays are present along Segment 3.

What is the collision history along the corridor?

Collision data for the corridor was provided by WSDOT and reviewed to identify if a high rate of collisions have occurred or if collision patterns exist, indicating a safety issue. The review of collisions includes both intersection locations and roadway segments. Data for the most recent complete five years (2003 to 2007) were obtained.

Table 5 summarizes collisions at the study intersections. The average number of collisions per year and common accident types are shown, as well as accidents per Million Entering Vehicles (MEV). One accident per MEV is a common threshold used to identify intersections where possible safety issues are present. Since intersections vary in the total number of entering traffic, the collision rate per MEV assists in identifying if a location has a high rate of collisions.

Table 5. Intersection Collision History[1] (2003 to 2007)

Intersection	MP	Average Collisions per Year	Daily Total Entering Vehicles	Collisions per MEV	Collision Type (Majority)
244th Avenue SE	22.46	2.8	19,000	0.40	Rear-end
Semanski Street S/252nd Ave SE	23.28	1.4	14,300	0.27	Angle
Warner Avenue (SE 456th St)	23.68	3.8	15,800	0.66	Rear-end
Cole Street	24.14	1.4	13,100	0.29	Rear-end
Roosevelt Avenue	24.29	1.2	11,300	0.29	Angle
Monroe Avenue/Mtn. Villa Drive	24.40	4.8	13,600	0.97	Angle
Garrett Street	24.50	2.2	10,900	0.55	Turn
Blake Street	24.68	1.4	9,400	0.41	Angle
Griffin Avenue (SR 164)	24.82	1.2	12,900	0.25	Angle
Watson Street N	**24.92**	**5.2**	**8,700**	**1.64**	**Angle**
Farman Street (284th Ave SE)	25.64	2.0	7,200	0.76	Turn

BOLD: Indicates a location of concern.
1. Source: WSDOT

Angle collisions were the predominant collision type at a majority of the intersections. All but one of these intersections was unsignalized. At these locations the main cause was side street traffic not yielding to vehicles on SR 410. The intersection with SR 164 was the only signalized intersection where the majority of collisions were angle. The high number of angle collisions at this location was likely the result of permitted left-turn phasing on the westbound approach and left-turning vehicles not yielding to on-coming eastbound traffic. Rear-end and turn (both left and right turns) collisions were the next most common collision type. The rear-end collisions were likely caused by driver error (such as speeding or following too closely).

The intersection of SR 410/Watson Street N is the only location with a collision rate above 1.0 MEV. This is likely the result of the intersection being stop-controlled on the minor approach, the close proximity of several driveways, and vehicles turning onto SR 410 having to cross three or four lanes of traffic. In addition, the collision rate at the Monroe Avenue/Mountain Villa Drive intersection with SR 410 is approaching 1.0. Again, this is likely the result of the side-street approaches being stop-controlled, and the proximity to the Roosevelt Avenue and Garrett Street intersections.

Collisions which were not identified as being related to the intersections along the corridor were summarized by corridor segment and are shown in Table 6. The average number of collisions per year and associated collision rates were used to identify segments with potential safety issues. Collisions along highway segments are typically evaluated in terms of collisions per million vehicle miles (MVM) traveled. Currently there are no universally accepted guidelines for identifying hazards based only on accident rates; however, WSDOT publishes average accident rates by roadway classification for comparison purposes. WSDOT highway classifications for SR 410 were obtained from the 2007 WSDOT

State Highway Log. For an urban minor arterial classification, which SR 410 is classified as, the average statewide collision rate is 3.32 collisions per MVM, according to WSDOT's *2007 Washington State Collisions Data Summary*. Table 6 shows the results of this comparison.

Table 6. Roadway Collision History[1] (2003 to 2007)

Intersection	MP (limits)	WSDOT Functional Class[2]	Average Collisions per Year	Average Daily Vehicles	Collisions per MVM	Segment Rate vs. Average[3]	Collision Type (Majority)
Segment 1 West	22.46 – 24.29	Urban Minor Arterial	5.2	12,800	0.72	Below	Rear-end
Segment 2 Central	24.29 – 25.12	Urban Minor Arterial	3.2	10,200	0.77	Below	Rear-end
Segment 3 East	25.12 – 25.82	Urban Minor Arterial	1.6	7,750	1.09	Below	Rear-end

1. Source: WSDOT
2. Functional Classification from WSDOT State Highway Log (2007).
3. Rate of comparison was 3.32 collisions per MVM, taken from WSDOT's *2007 Washington State Collision Data Summary.*

As shown, none of the segments are above the average rate listed by WSDOT for similar roadway segments. The majority of collisions reported along all three roadway segments were rear-end collisions. Most of the rear-end collisions are likely attributable to driver error (such as speeding or following too closely).

What non-motorized facilities exist along the corridor?

Non-motorized facilities along SR 410 consist of sidewalks, wide shoulders, and the Enumclaw portion of the Foothills Trail. Sidewalks are located intermittently along the corridor, mainly in Segment 2, through the established commercial area, with some located in Segment 3 in the vicinity of Farman Street N. Elsewhere, shoulders are typically 8 feet wide on both sides of the roadway, with some variation between 6 feet and 10 feet. The Foothills Trail currently runs alongside SR 410 on the east side from Garrett Street to 252nd Avenue SE (Semanski Street S), with a future King County sponsored trail extension southward to Mud Mountain Road. It is a paved shared-use path, with a trailhead and parking area located 200 feet east of the Warner Avenue/SR 410 intersection. King County Parks has an extension of this trail budgeted in their Capital Improvement Plan. This extension will run from the current terminus at 252nd Avenue SE (Semanski Street S) to just north of Mud Mountain Road. Construction is scheduled to begin in 2011. All of these facilities are shown in Figure 7.

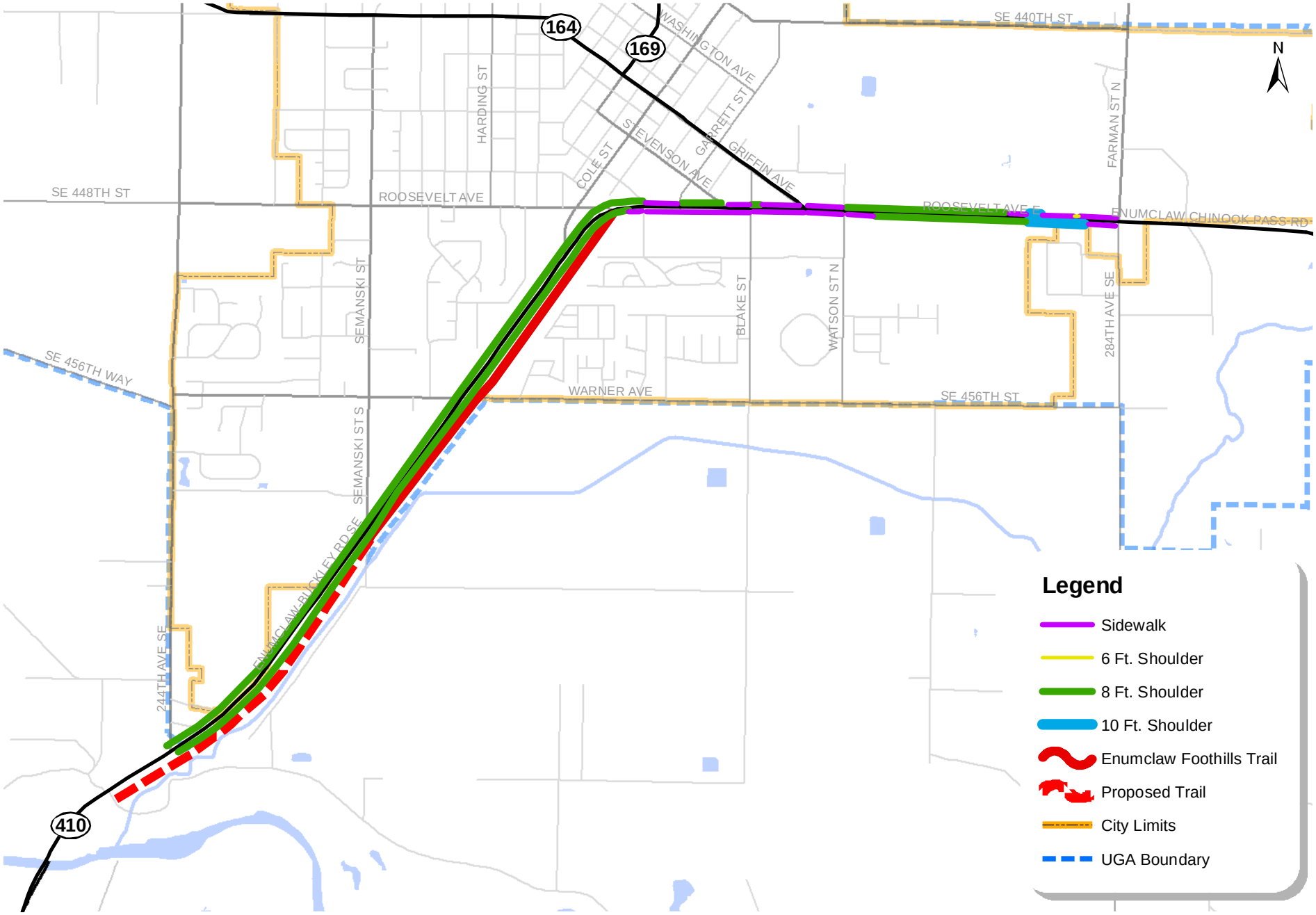
In addition to sidewalks and trails, SR 410 is designated as a bicycle route in the King County *Bicycling Guidemap* (2006). Bicycles are able to share the roadway with other vehicles and wide shoulders provide additional pavement for bicyclists. However there are no designated bicycle lanes along SR 410 in the study area.

What transit facilities and services are provided?

Transit facilities along SR 410 are operated by King County Metro Transit. Only two routes operate along SR 410, neither of which have a transit stop located directly along SR 410. However stops are located just north of the corridor: one northwest of the SR 410/Griffin Avenue (SR 164) intersection and another northwest of the SR 410/Monroe Avenue intersection. The transit routes which serve these stops are numbers 912 and 186:

Route 912

Metro Route 912 provides service between Covington and Enumclaw via southern Maple Valley and Black Diamond during weekdays. The route terminates in Enumclaw at the Enumclaw Pool (420 Semanski Street S). Hours of operation are from approximately 9:00am to 3:30pm with headways of approximately 90 minutes.



Existing Non Motorized Facilities

FIGURE 7

SR 410 Corridor Study

M:\06\06395 SR 410 Corridor Study\GIS\MXD\FIG6_NonMotorized.mxd

transpoGROUP

Route 186

Metro Route 186 serves Auburn and Enumclaw on weekdays and Saturday. The terminus in Auburn is at the Auburn Rail Station. Hours of operation are from 5:00am to 7:30pm on weekdays and 10:00am to 6:30pm on Saturday. Headways on Saturday are roughly 90 minutes, with weekday headways of 30 minutes during the peak commute periods, and 90 minutes off-peak. Route 186 was formally renumbered from Route 915, effective June 14th, 2010.

King County Metro Transit (Bus) service has historically been revised or adjusted to meet ridership demand and budgetary constraints, and future hours of service for the two routes are subject to revision in the future. These revisions can occur due to seasonal issues as well.

What are the key findings from the existing corridor assessment?

Below is a brief summary of 2009 existing conditions along the SR 410 corridor:

- Weekday average daily traffic volumes along the corridor range from approximately 13,500 vehicles per day in Segment 1, to 7,700 vehicles per day at the east end of Segment 2. During the weekday AM peak hour, traffic volumes in the eastbound travel direction are highest, while during the weekday PM peak hour westbound traffic volumes are highest. Overall, traffic volumes within the study area are highest during the weekday PM peak hour.

- With the exception of the intersection with 244th Avenue SE, which operates at LOS F during the weekday PM peak hour, all study intersections currently operate at LOS D or better, meeting the applicable WSDOT and City LOS standards. All corridor segments currently operate at LOS C or better.

- Watson Street N is the only intersection with a collision-per-MEV rate greater than 1.0. In addition, the collision rate at the Monroe Avenue/Mountain Villa Drive intersection is approaching 1.0. All three study corridor segments have a collision-per-MVM rate below the WSDOT average for a similar facility (urban minor arterial).

- Pedestrian facilities generally consist of intermittent sidewalks in Segments 2 and 3, and the 10-foot wide asphalt shared-use Foothills Trail in Segment 1. Shoulders approximately 8-feet wide are mostly present along the entire length of Segments 1 and 3, and along the majority of Segment 2, and provide some separation of bicyclists from vehicles.

- Two transit routes currently operate along the SR 410 corridor within the study area. However, no transit stops are located directly on the corridor.

- Seasonal variability of traffic volumes along the corridor is attributed to the winter closure of SR 410 at Cayuse Pass/Chinook Pass, thereby making winter snow-related recreation the main trip generator in the November to May season. During the June to October summer season, trips are mainly generated by through trips to Yakima, White Pass (SR 123), as well as primary tourist and recreational access to Mount Baker/Snoqualmie National Forest and Mount Rainier National Park. However, commercial trucking activity is prohibited within Mount Rainer National Park on SR 410.

- All segments have some degree of channelization improvements in the form of left turn lanes, right turn lanes or two-way left turn lanes. Raised curbing provides some degree of access management control at certain intersections. One right-in/right-out access driveway to a retail shopping center exists west of Garrett Street.

Assessment of Future Corridor Needs

The goal of the needs assessment is to provide an understanding of future transportation improvements that are needed along SR 410 to serve future travel demand for all modes of transportation. The needs analysis focuses on the future roadway, intersection, non-motorized, and transit needs identified through the use of travel forecasts generated for the corridor. The need for future improvements is based on the results of the existing conditions, future travel forecasts, and the desire to meet acceptable LOS thresholds set by the City and WSDOT. The City must balance the local residents and business community's desire for easy access to and from the corridor against corridor throughput delay. Improvements made in the short-term (less than 6 years) may reflect a partial implementation of those ultimately needed as traffic volumes eventually increase with local and regional growth.

The chapter describes the development of travel forecasts as well as the implication of these forecasts on all modes of travel within the study area.

How were the travel forecasts developed?

Traffic volume forecasts for baseline 2030 conditions were developed using the same methodology used to develop the forecasts published in the City of Enumclaw Comprehensive Plan (June 2005). The City was divided into Transportation Analysis Zones (TAZ) that typically represent major trip generators such as a residential neighborhood, a commercial/retail development, or an employment center. Based on the existing and future (2023) land uses located in each of these zones, the anticipated growth in trip generation for each zone was estimated and assigned to the street system. The trip assignment for each zone was then added to existing (2003) traffic volumes, to generate 2023 forecast volumes.

In order to develop traffic volume forecasts for 2030, the same methodology was used. Land use growth between 2023 and 2030 was assumed to continue to occur at the same rate as was estimated for 2003 to 2023. Based on the resulting land use growth between 2009 and 2030, the trip generation for each zone was estimated and assigned to the street system. The assignment of growth trips for each zone was then added to existing traffic counts to provide 2030 forecast volumes.

In addition, growth in through trips was also accounted for as part of the forecasts, using the same methodology as outlined above. The growth in through trips between 2003 and 2023 developed for the Comprehensive Plan was extrapolated to forecast the additional growth anticipated to occur between 2023 and 2030. The resulting trips were added to the existing 2009 traffic counts. Appendix E describes the forecasting process in more detail.

Suntop Farms Planned Unit Development (PUD)

Suntop Farms PUD is a proposed residential and commercial development located to the east of downtown Enumclaw, south of SR 410. The proposed development represents a significant portion of the anticipated growth occurring in one of the identified TAZs. A Traffic Impact Analysis (TIA) has been prepared for the Suntop Farms PUD to identify project impacts, and includes a detailed assignment of project trips. To account for traffic generated by Suntop Farms PUD in the 2030 forecasts, the specific assignment of traffic documented in the TIA was included. However, the trip generation for the TAZ in which Suntop Farms PUD is located was reduced by a corresponding amount to ensure that the trips were not double counted.

Corridor Capacity Constraints

The resulting 2030 traffic volumes forecasts were then compared to the capacity of the SR 410 corridor, to ensure that the resulting forecasts are reasonable given the constraints of the roadway system. Based on information provided by City of Enumclaw and WSDOT staff, it is unlikely that capacity improvements would be implemented along SR 410 to the west of 244th Avenue SE. The future capacity of this segment of SR 410 depends on widening the bridge over the White River and through Buckley. Such extensive

improvements are not identified in the state, regional, or local agency long-term plans; therefore the highway is anticipated to remain unchanged from existing conditions south of 244th Avenue SE. The 2030 weekday PM peak hour traffic volume forecasts in the westbound direction would exceed the available roadway capacity assuming no widening. Therefore, the forecast volumes were reduced to ensure that the roadway would not operate above capacity. It is assumed that under this scenario, more trips would be internalized within the City of Enumclaw, fewer trips would be generated, and trips would use alternate routes.

The SR 410 bridge across the Pierce/King County line at the White River is the only crossing serving the Enumclaw Plateau. In fact, the closest crossing to the west of Enumclaw is R Street SE in the City of Auburn, some 10 miles to the west. This concentrates traffic between north Pierce County and the Enumclaw Plateau on the SR 410 two-lane bridge crossing at White River. This crossing is a major local transportation constraint that has historically affected and continues to affect commuters.

What are the expected traffic volumes along the corridor?

The baseline 2030 forecast traffic volumes for the weekday PM peak hour are shown in both Figures 8 and 9. Figure 8 highlights the 2030 intersection turning movements and compares them against existing 2009 data. Future daily traffic volumes along the corridor are anticipated to be between 13,000 and 21,500 vehicles per day along SR 410 within the study area. This represents an approximately two percent per year increase in daily traffic volumes along the corridor. PM peak hour traffic volumes would range from approximately 1,450 to 200 vehicles per direction with an approximately one percent per year increase in peak hour traffic volumes. Future congestion, primarily along Segment 1 would cause traffic volumes to spread beyond the peak hour. The highest volumes are estimated to continue to occur along Segment 1, with large volumes also located east of the SR 164 intersection along Segment 2.

How were the future transportation needs assessed?

Intersection, roadway, safety, non-motorized, and transit needs were evaluated along the corridor consistent with the methodology used to evaluate the existing conditions. Intersection and roadway needs were evaluated based on anticipated vehicle delays, safety, and access issues along SR 410. Non-motorized and transit needs were assessed based on completing key missing connections and from comments provided by the public, City staff, and WSDOT. Improvements completed early in the 20-year planning horizon should strive to balance the community's desire for access to, from and across SR 410 with corridor throughput. As traffic volumes increase over time, the need for more aggressive access management control may affect this balance.

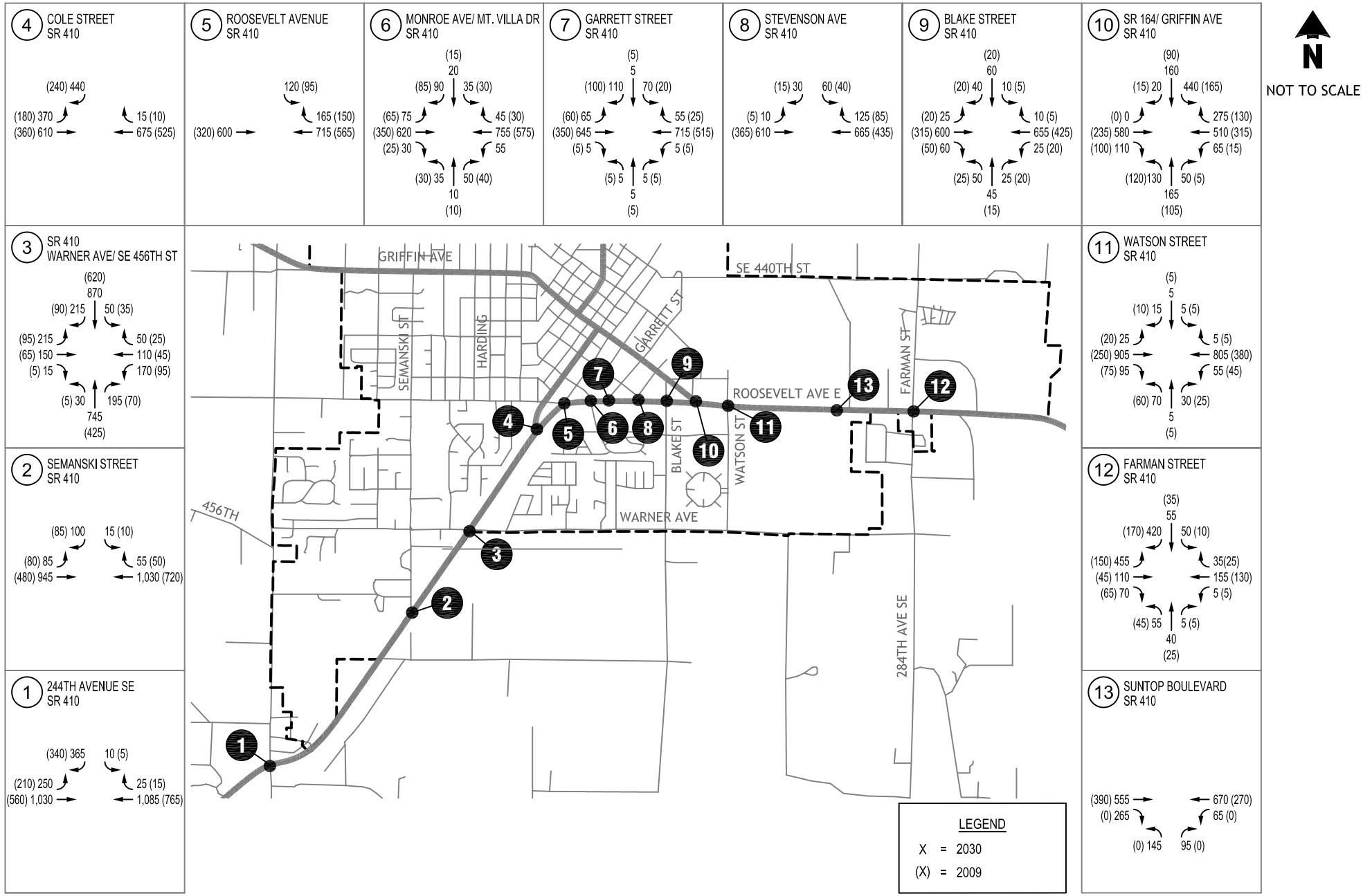
What are the forecasted intersection needs?

The same intersection level of service (LOS) model that was used for existing conditions was also used to evaluate future baseline conditions for the study intersections along the corridor. The results of the LOS analysis are compared to existing conditions for comparative purposes.

Baseline 2030 Intersection Level of Service

This section summarizes future baseline intersection levels of service within the study area. Many of the study intersections are forecast to operate below the WSDOT standard of LOS D. As is to be expected, all of the intersections are forecast to experience longer delays in the future. Table 1 summarizes the LOS results at the study intersections.

For the LOS analysis, the baseline forecast traffic volumes were rounded to the nearest five vehicles as weekday volumes fluctuate day-to-day. Figure 9 and Table 7 illustrate the LOS at each study intersection.



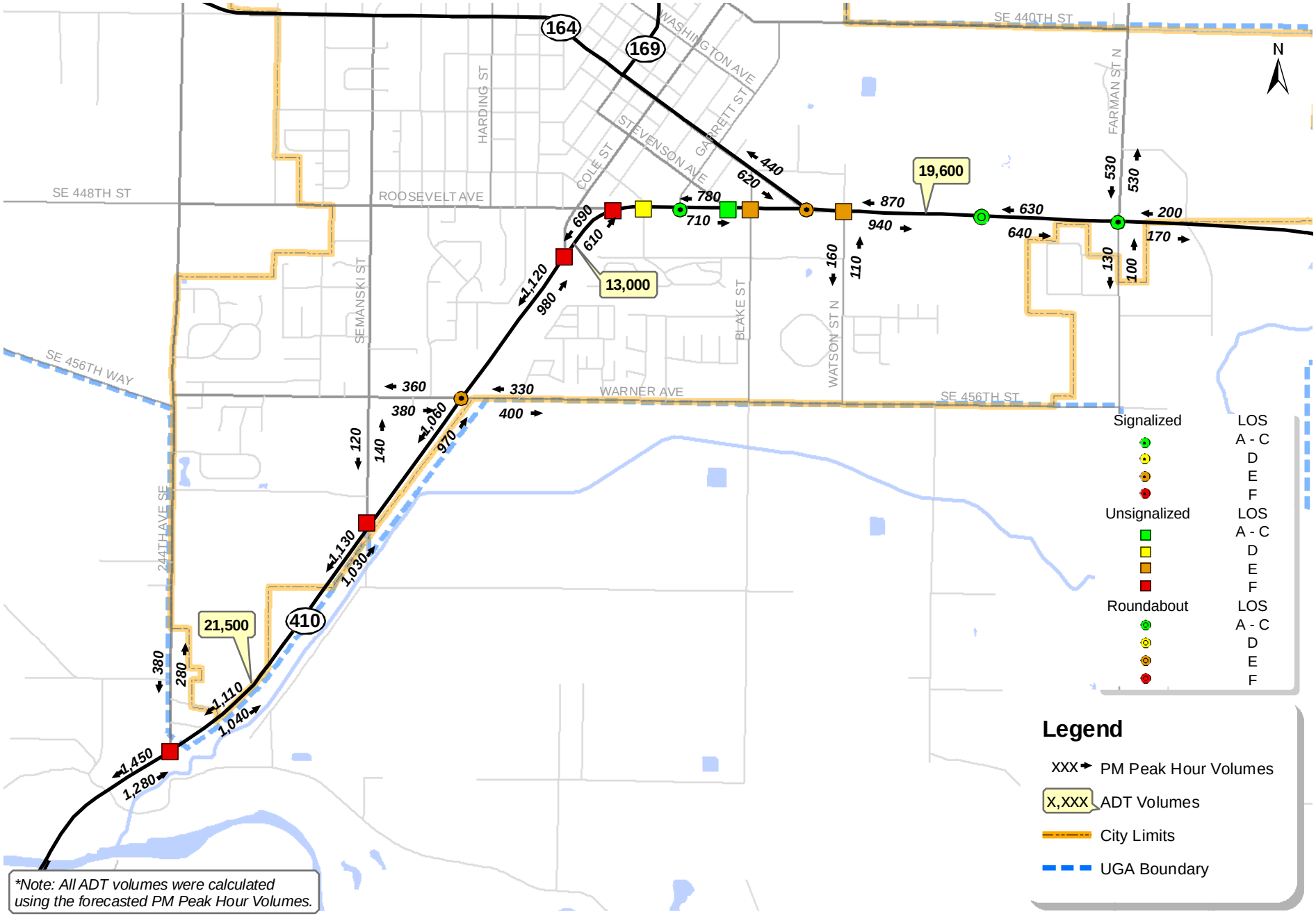
Baseline 2030 PM Peak Hour Turning Movements

FIGURE **8**

SR 410 Corridor Study

M:\06\06395 SR 410 Corridor Study\6.0 Graphics\CAD\Graphic02 <D> robertm 12/10/09 14:35

transpoGROUP



Baseline 2030 PM Peak Hour Levels of Service & Traffic Volumes

FIGURE 9

SR 410 Corridor Study

M:\06\06395 SR 410 Corridor Study\GIS\MXD\FIG7_FutureLOSandVolumes.mxd

transpoGROUP

Table 7. Existing (2009) and Baseline (2030) Intersection Level of Service

ID	Intersection	2009 Existing			2030 Future Baseline		
		LOS[1]	Delay[2]	V/C[3] or WM[4]	LOS	Delay	V/C or WM
	Weekday PM Peak Hour						
1	SR 410/ 244th Avenue SE	**F**	**90.9**	**SB**	**F**	**>200**	**SB**
2	SR 410/ Semanski Street S/252nd Avenue SE	C	20.7	SB	**F**	**97**	**SB**
3	SR 410/ Warner Avenue (SE 456th St)	C	20.3	0.65	**E**	**74**	**1.02**
4	SR 410/ Cole Street	C	18.0	SB	**F**	**102**	**SB**
5	SR 410/ Roosevelt Avenue	B	14.0	SB	**F**	**112**	**SB**
6	SR 410/ Mountain Villa Dr/Monroe Avenue	C	16.0	NBL	D	26	SB
7	SR 410/ Garrett Street	B	10.6	0.37	B	12	0.60
8	SR 410/ Stevenson Avenue	B	11.8	SB	C	15	SB
9	SR 410/ Blake Street	C	19.7	NB	**E**	**46**	**NB**
10	SR 410/ Griffin Avenue (SR 164)	C	22.5	0.60	**E**	**61**	**0.98**
11	SR 410/ Watson Street N	B	13.5	NB	**E**	**44**	**NB**
12	SR 410/ Farman Street N (284th Ave SE)	B	12.8	0.26	C	21	0.79
13	SR 410/ Suntop Boulevard N	-	-	-	A	8	-

Source: Transpo Group, 2009.
BOLD indicates locations operating below LOS standard.
1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

As shown in Table 7, eight of the thirteen (62%) study intersections along SR 410 are forecast to operate below the WSDOT standard of LOS D by the year 2030. The majority of those below standard are unsignalized intersections. The high traffic volumes travelling along the SR 410 corridor make turns from the minor street approaches difficult as there are few acceptable gaps in traffic on the main line to allow for safe turns.

Future Intersection Needs

Traffic signals, round-abouts, and additional turn lanes all are options to improve safety and mobility along the corridor. Several of the intersections along SR 410 will require some form of traffic control improvement with the forecast traffic growth as left-turns to and from the highway will become more and more difficult thereby dramatically increasing delays and reducing safety. However access management and circulation improvements may reduce the number of intersections for which traffic control upgrades will be necessary.

Each individual intersection has been analyzed using the intersection operations model. Specific improvement project recommendations are presented in the next chapter based on the needs assessment. It is important when addressing the transportation challenges in a particular community to understand the needs and visions of those who live and work in the area and will depend on the improvements to address their daily transportation needs.

Intersection improvements will need to be made at key intersections to compliment the access management improvements and circulation roads. By making targeted intersection improvements on access controlled corridors, traffic is encouraged to funnel to key locations that are designed to accommodate the demand while reducing the amount of traffic conflict points and the need for uncontrolled locations elsewhere, thus reducing delays at the remaining intersections.

Round-abouts provide traffic control at intersections in lieu of signalization when appropriate. Round-abouts could be strategically placed at the ingress and egress routes to Segment 2 to act as “gateways.”

Round-abouts can be designed to help motorists recognize the transition from rural to urban environments in an attempt to increase awareness that more vehicular and non-motorized traffic conflicts can be expected. Round-abouts may even have two lanes to accommodate higher traffic volumes and separate left-turns from through movements, but taper back into one lane several hundred feet after the round-about.

Round-abouts can have additional landscaping or other features which provide a welcoming atmosphere for visitors. Slip lanes can be provided to serve higher right-turning volumes, especially at locations such as Cole Street, Suntop Blvd N or 244th Avenue SE where more right-of-way is available and less pedestrian traffic is present.

What are the forecast roadway operations and needs?

In addition to the intersection LOS analysis, an operational analysis of SR 410 roadway operations was conducted based on the 2030 weekday PM peak hour forecasts. Corridor Segments 1, 2, and 3 were analyzed separately to capture the different roadway characteristics associated with each segment. The same methodology was used as in existing conditions for consistency. The following summarizes the results of the analysis.

2030 Roadway Level of Service

Table 8 summarizes the highway LOS results and average speed per vehicle for the study segments along SR 410 for 2030 baseline conditions. For comparison purposes, the 2009 existing roadway LOS results are also presented.

Table 8. Existing (2009) and Baseline (2030) Highway Level of Service

			2009 PM Peak Hour		2030 PM Peak Hour	
Segment	**MP (limits)**	**Direction**	**LOS[1]**	**Average Speed[2]**	**LOS**	**Average Speed[2]**
Segment 1 West	22.46 – 24.29	Eastbound	B	34.1	C	27.4
		Westbound	B	31.8	D	21.6
Segment 2 Central	24.29 – 25.12	Eastbound	B	29.4	B	29.8
		Westbound	C	26.6	C	26.3
Segment 3 East	25.12 – 25.82	Eastbound	B	32.4	C	27.8
		Westbound	B	30.3	C	24.8

1. LOS = Level of Service
2. Average speed is in miles per hour and accounts for delays at signalized intersections.

All highway segments are anticipated to continue to operate at LOS D or better, which meets the WSDOT LOS D standard. However the highway LOS analysis only accounts for delays encountered at signals. It does not account for delays experienced by side street traffic or the numerous driveways that are along the corridor. So while the highway LOS may show acceptable operations, vehicle queuing and congestion is expected at several intersections and along several segments of the corridor.

Future Roadway Needs

Although capacity could be added along the entire segment of SR 410 through the addition of new travel lanes, the expansion of the highway would be costly and would not fit into the character of the surrounding land uses in Segments 1 and 3. In addition, a corridor of signalized intersections is not likely the best long-term solution. However a combination of various corridor improvements is likely the best option for improving safety and mobility along the corridor, while also supporting additional growth within the City. Alternatives to adding through lane capacity and numerous signalized intersections along Segments 1 and 3 include: the addition of right and left-turn pockets or turn lanes at key intersections; the construction of auxiliary lanes such as left-turn refuge/merge lanes; the construction of gateway round-abouts or landscaped medians at entrances to the City to demonstrate the transition from a rural to an

urban environment; and well planned access management techniques coupled with improved side street and alternate route circulation strategies.

Below is a description of types of improvements that could be considered along the corridor.

Strategic Capacity Investments
The significant amount of driveways, unsignalized intersections, and possible access management treatments, make Segment 2 an ideal candidate for widening to 5 lanes. Much of Segment 2 has already been designed with the assumption it will be five lanes at a future date. Curbs and sidewalks have already been set-back, and parts of Segment 2 are 4 lanes today. A 5-lane segment fits the urban character of the segment and will require minimal investment in infrastructure. It will address poor intersection operations and significant queuing issues in the future, and likely alleviate the need for additional traffic control.

Turn Lanes
Right and left-turn pockets or turn lanes allow vehicles who are accessing side streets to slow down and make a maneuver without having to slow other vehicles behind them. On a roadway that is at or near capacity, any slight disturbance in traffic flow can cause a chain reaction that ripples down the corridor and causes traffic flow to break down. Right and left-turn pockets may be effective at most of the major intersections along Segments 1 and 3.

Left-turn merge/refuge lanes are a viable option at intersections where side street traffic is fairly low but where there are sufficient gaps in main line traffic to allow for safe and efficient left-turns. Low side street traffic volumes might make extensive traffic control measures like signals or round-abouts less cost effective because they would be underutilized when considering the construction and maintenance costs of such facilities and not fit within the character of the corridor.

The left-turn refuge/merge lanes allow motorists the ability to break the left-turn movement up into two steps thereby reducing the need to find gaps in traffic from both directions and allowing the motorists to focus on gaps in one direction at a time. The left-turn refuge/merge lanes allow motorists to focus on crossing the travel lane of vehicles going in the opposite direction first and then have sufficient space to accelerate to prevailing highway speeds in order to merge with vehicles traveling in the same direction. Left-turn merge/refuge lanes might work well at intersections such as 244th Avenue SE and Semanski Street S.

Access Management
Access management techniques are used to create an environment where less traffic flow interruptions occur to vehicles on the main line by regulating the location, frequency, and type of access that is granted along a corridor. Access management techniques on SR 410 will be important as development intensifies. WSDOT has jurisdiction over SR 410 and the highway is considered a Managed Access highway with rules governing the frequency and types of access that can be granted as presented in the existing conditions assessment.

Segment 2 is a good example where access management techniques should be considered. As growth occurs within the City, improved access will be needed to make development viable. Reducing the number of driveways and consolidating access points will be an important improvement strategy to address both safety and mobility, while also allowing for more redevelopment opportunities along the corridor. Intersections with Blake Street, Griffin Ave (SR 164), Mountain Villa Drive/Monroe Avenue, and/or Watson Street N could be designed as key intersections from which access points to new local circulation roads and new development is provided. Existing conditions suggest that a two-way left turn lane is an appropriate treatment for portions of Segment 2 until such time that traffic volumes dictate a reduction in the number of access points. Alternatively, a landscaped median may be aesthetically preferable.

East of Watson Street N, access to SR 410 may need to be limited to a few locations. Further corridor improvements will need to be made in combination with access management techniques to continue providing access to adjoining property owners along the corridor.

What are the forecast "system" operations and needs?

The highway level of service methodology only evaluates movement along the SR 410 corridor, or "throughput," and does not consider the operations of the minor streets. Within the study area, a majority of the traffic along the corridor uses only a segment of the corridor since it also serves as the City's "main street." Completing just a "throughput" operations analysis is not reflective of how the corridor serves the residents or businesses of the City. Therefore, system wide 2030 PM peak hour operations were also evaluated to provide an understanding of the delay to all vehicles to and from SR 410 (i.e., the major street and minor street delays). This calculation provides an understanding of the total hours of delay for the system during the PM peak hour.

System wide delay was calculated using the same methodology as presented in the existing conditions assessment. The system wide delay represents the delay (in seconds per vehicle) multiplied by the number of vehicles for the particular movement divided by the number of seconds per hour to provide a total hours of delay. Similar to corridor operations, Segments 1, 2, and 3 were analyzed separately, to recognize that each segment has different roadway characteristics. In addition, the total hours of delay was also calculated for the entire study area. The following summarizes the results of the analysis.

2030 System Operations

Table 9 summarizes the system operations results for the study segments along SR 410 for 2030 baseline conditions. For comparison purposes, the 2009 existing operations are also presented.

Table 9. Existing (2009) and Baseline (2030) PM Peak Hour System Operations

		Total Hours of Delay[1]	
Segment	**MP (limits)**	**2009 Existing**	**2030 Baseline**
Segment 1 – West	22.46 – 24.29	19.0	108.5
Segment 2 – Central	24.29 – 25.12	15.9	73.8
Segment 3 – East	25.12 – 25.82	2.5	8.6
Total		**37.4**	**190.9**

3. The delay (in seconds per vehicle) multiplied by the number of vehicles for each particular movement divided by the number of seconds per hour to provide a total hours of delay.

As shown in the table, the increases in traffic within the study area by 2030 would greatly increase the total hours of delay through the system. The highest system delay would continue to be along Segments 1 and 2 where traffic volumes are anticipated to be highest and the delays greatest.

Future System Needs

The previous intersection and roadway improvements will all contribute significantly to improving overall system performance. Improvements off of the highway corridor also need to be considered in the context of the needs assessment because they could help address specific issues. For example, improving the City's arterial street system to provide additional circulation roadways will lessen the need for improvements along SR 410.

As development occurs within the City, new local circulation roads, or frontage roads, could to be built or existing roads improved so improved access can be provided to properties along the corridor. Segment 2 is a good example of where additional circulation roadways could benefit the community and SR 410. Although the number of driveways may be limited on SR 410 due to access management techniques described earlier, circulation roadways could be created or existing roads improved on the north and south sides of the corridor to allow motorists to access development from the rear. The Dickson Avenue

corridor south of SR 410 is shown in the Comprehensive Plan as a long-term project and is considered in the context of this study. These circulation roadways in combination with improvements to SR 410 will likely improve overall system operations and performance.

What are the future safety needs?

Under existing conditions, the intersection of SR 410/Watson Street N had a collision rate above 1.0 MEV (million entering vehicles). The cause for the high accident rate was inferred to be the result of the intersection being stop-controlled on the minor approach, the close proximity of several driveways, and vehicles turning onto SR 410 having to cross three to four lanes of traffic. The intersection operations went from LOS B under existing conditions to LOS E under future forecast conditions. Any transportation needs identified for this intersection should take the previously identified potential causes of the high accident rate into account.

What are the future non-motorized needs?

An extension of the existing Foothills Trail is planned by King County Parks. The extension will run from the current terminus at 252nd Avenue SE (Semanski Street S) to just north of SE Mud Mountain Road, near the county line between King and Pierce counties. The extension will be a paved path of approximately one mile in length and is planned to eventually cross White River and connect to the Pierce County section of the regional Foothills Trail, which will link Enumclaw with Puyallup. Connections to the trail should be evaluated in all of the improvement concepts.

The missing sidewalks and gaps along the corridor need to be connected, primarily throughout Segments 2 and 3. New traffic control at particular intersection locations should provide for additional pedestrian crossings. Specific consideration should be provided for the Mountain Villa Drive/Monroe Avenue intersection with SR 410. Staff and public input have suggested there are a high number of pedestrians south of the corridor that cross at this location to reach the QFC and the downtown commercial area on the north side. The crossing location should be improved with additional signage or crosswalk treatments to improve safety for pedestrians. In addition, design treatments throughout the corridor should consider use of pedestrian scale lighting.

SR 410 is identified as a bicycle route so the future concepts should include shoulders or designated bicycle lanes through the City.

What are the future transit needs?

King County Metro transit service is expected to continue along the SR 410 corridor in the future. The City of Enumclaw Comprehensive Plan identifies an improvement project entailing a park-and-ride lot along the SR 410 corridor. The Enumclaw Welcome Center at milepost 25.77 may be the site of a future Park & Ride facility, which additionally may also serve transit needs to Mount Rainier National Park and Crystal Mountain Ski area. Providing such a facility will allow for the use of transit or carpooling, and may assist in reducing regional commuter trips along the corridor. Without improved transit service, it is unlikely that form of transportation will be utilized more. Since there are no current transit/bus stops directly on the corridor, no other transit improvements are identified.

What are the key findings from the future needs assessment?

The key findings of the 2030 needs analysis include:

- Forecast population growth through 2030 will result in a proportional increase in traffic on many of the City of Enumclaw roadways. The highest amount of vehicle volume growth will occur along the SR 410 corridor within the City of Enumclaw and to the west. Traffic volumes along the

corridor will increase to approximately 1,450 vph in the westbound direction to the west of the intersection with 244th Avenue SE.

- The capacity of the SR 410 corridor is assumed to be 1,450 vph per lane to the west of the intersection with 244th Avenue SE. Forecast traffic volumes will match the capacity of the corridor by 2030 thereby causing increased congestion and delay relative to existing conditions.

- Residents will likely have a greater interest in alternative modes of transportation or change their travel patterns to make trips during off-peak hours due to the expected increase in congestion along the SR 410 corridor.

- All but three of the unsignalized intersections along the SR 410 corridor are forecast to operate below the WSDOT standard of LOS D. Motorists attempting to enter the corridor from the side streets will find fewer gaps in traffic to make a safe maneuver.

- System delay, measured in the number of hours of congestion, is estimated to significantly increase along the corridor, especially for Segments 1 and 2. Future improvements should recognize the value of improving “throughput,” but also include provisions for side street traffic.

- With increased traffic volumes on the roadways, pedestrians and bicyclists will experience more conflicts with motorized vehicles; especially on routes that do not have sidewalks, adequate shoulders, bike lanes, or pedestrian crossings and signals.

- The City and WSDOT should consider a range of projects to improve the transportation system for all users. Types of projects could include turn lanes at intersections, two-way left turn lanes, new traffic control such as round-abouts or traffic signals, access management strategies, new circulation or frontage roads, expansion of the trail system, new sidewalks and improved pedestrian crossings, adequate bicycle facilities, and expanded transit service and facilities.

- King and Pierce Counties, along with WSDOT, should work together to study the feasibility of another bridged crossing of the White River to provide for improved future connectivity to and from the Enumclaw Plateau.

Description of the Improvement Concepts

Specific transportation improvement concepts were developed to address the issues identified during the transportation needs analysis. In some cases, several alternative concepts were developed for specific segments or locations. The concepts that were developed provide for a “menu of improvements” the City, WSDOT, and the community should consider as project funding becomes available. The concepts fit within the overall corridor design concept that is illustrated in Figure 10.

How were the transportation improvement concepts developed?

An intersection traffic operations model was used to evaluate improvement alternatives. Low-cost improvements were evaluated before more complex and expensive solutions were analyzed. Low-cost improvements included minor traffic control changes, signal timing or phasing changes, or the addition of turn pockets. More complex solutions included the addition of through lanes, changes in traffic control devices, or geometric reconstruction and/or realignment of intersections and roadways. Each improvement project was treated as an integral component of the transportation system as a whole, and the effects of each improvement on adjacent roads and intersections were factored into the analysis.

Beyond the resulting traffic operations, other factors were used in developing the improvement concepts as discussed in the needs analysis. Considerations on how to improve safety, circulation, access, non-motorized connections, freight, and transit facilities were factored into the proposed improvement concepts. The preliminary set of concepts were reviewed with City staff, City Council, WSDOT, business owners, and the general public to solicit additional feedback and ideas. Many of the concepts presented in this section integrate feedback that was provided throughout the corridor study process.

The improvement concepts are summarized by corridor segment. Each study intersection is presented separately, with a discussion about the existing site, issues, priorities, and a description of how each concept affects the specific intersection.

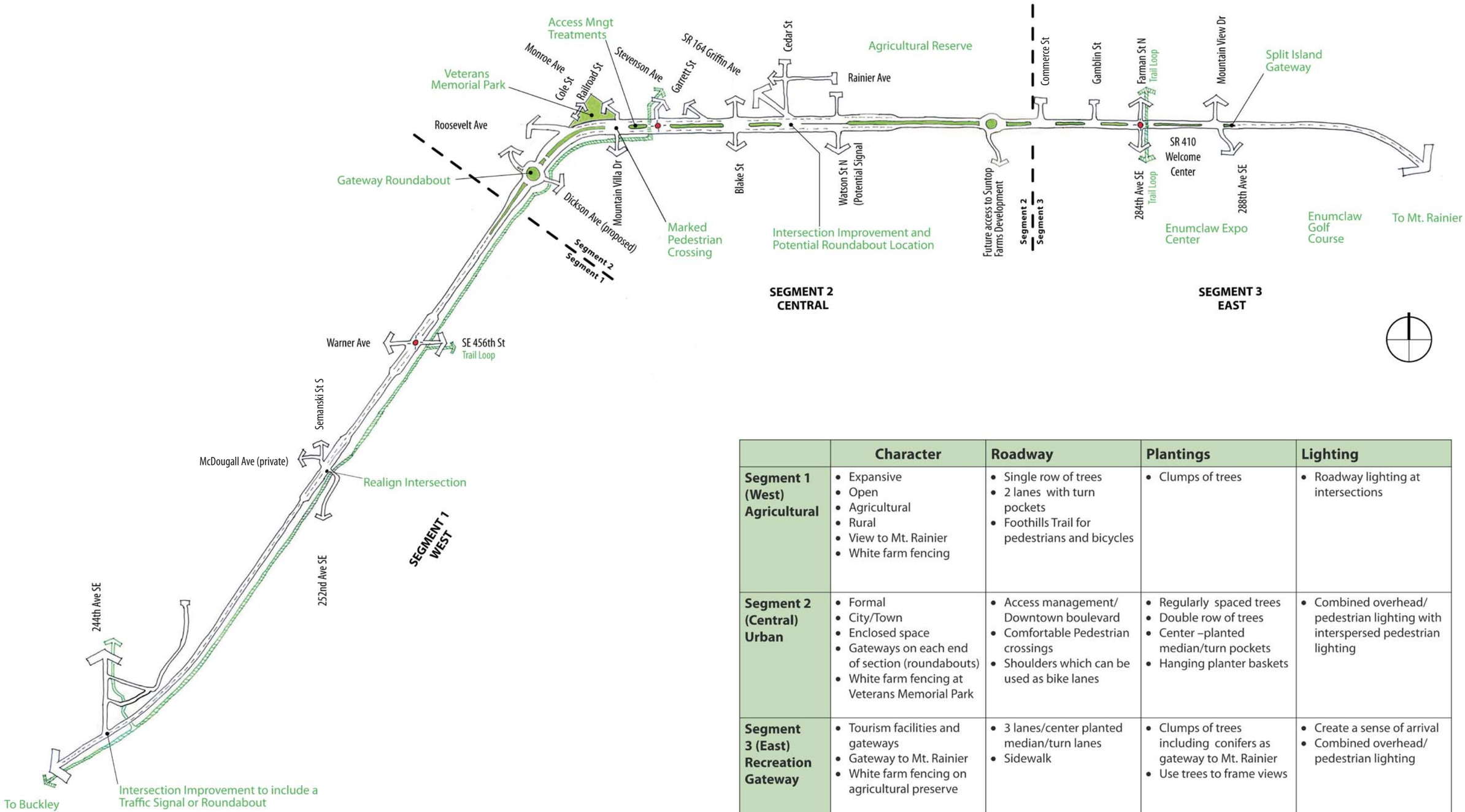
What is the recommended corridor design concept?

The existing character of SR 410 is linked to Enumclaw’s history and current land use pattern. The three segments have a unique and distinctive feeling and character, with an open agricultural or rural feeling in Segment 1 (west), an entry to downtown, its railroad and logging history and urban form in Segment 2 (central), and agricultural and tourism in Segment 3 (east). There are views to Mount Rainier to the southeast and the surrounding foothills through much of the corridor.

The corridor urban design concept illustrated in Figure 10 builds on the rural character of the Enumclaw Plateau, such as a barn with Mt. Rainier in the background. The concept includes corridor-wide elements which unite the three segments and additional elements which further distinguish the distinctions among the three segments. The City is considering a new tourism signage and wayfinding system that may be incorporated into the various improvement concepts at a later date.

How will design continuity along the corridor be achieved?

Continuity in the design concept will be achieved through landscaping, street lighting, pedestrian crossings, white farm fencing treatments as a branding element, and decorative tourism wayfinding signs, gateway monuments, and information kiosks. Round-abouts may be introduced at gateway points (east and west ends of town, plus entries to downtown), to improve traffic flow, and improve safety at intersections with irregular geometry. A discussion about the possible types of lighting, crosswalks, pavement, signing, and stormwater treatment is presented following the presentation of the improvement concepts.



	Character	Roadway	Plantings	Lighting
Segment 1 (West) Agricultural	• Expansive • Open • Agricultural • Rural • View to Mt. Rainier • White farm fencing	• Single row of trees • 2 lanes with turn pockets • Foothills Trail for pedestrians and bicycles	• Clumps of trees	• Roadway lighting at intersections
Segment 2 (Central) Urban	• Formal • City/Town • Enclosed space • Gateways on each end of section (roundabouts) • White farm fencing at Veterans Memorial Park	• Access management/ Downtown boulevard • Comfortable Pedestrian crossings • Shoulders which can be used as bike lanes	• Regularly spaced trees • Double row of trees • Center –planted median/turn pockets • Hanging planter baskets	• Combined overhead/ pedestrian lighting with interspersed pedestrian lighting
Segment 3 (East) Recreation Gateway	• Tourism facilities and gateways • Gateway to Mt. Rainier • White farm fencing on agricultural preserve	• 3 lanes/center planted median/turn lanes • Sidewalk	• Clumps of trees including conifers as gateway to Mt. Rainier • Use trees to frame views	• Create a sense of arrival • Combined overhead/ pedestrian lighting

Recommended Corridor Design Concept

SR 410 Corridor Study

M:\06\06395 SR 410 Corridor Study\6.0 Graphics\corridor_concept.cdr

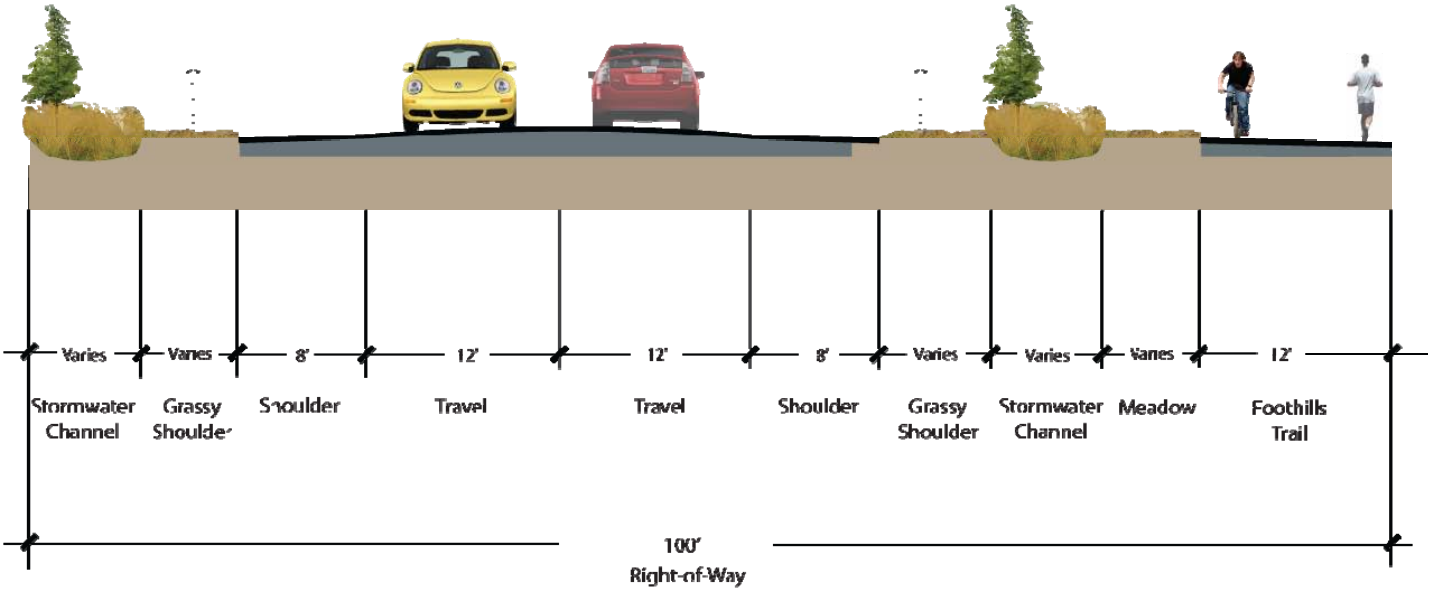
FIGURE **10**

transpoGROUP

What improvement concepts were developed for Segment 1 (West) – "Rural"?

This segment of SR 410 has retained a rural feel, bordered by the Foothills Trail on one side and the back of development on the other. This segment has few intersections and access connections, and provides an open feeling with views to Mt. Rainer to the southeast. The corridor will be primarily a two-lane highway with shoulders and turn pockets, consistent with what is there today. Figure 11 provides an example cross-section of the roadway. A traffic signal or round-about may possibly address operational and safety impacts at 244th Avenue SE. A round-about should be evaluated as a gateway feature where Segments 1 and 2 intersect near Cole Street. The Foothills Trail, as a shared-use path, will accommodate pedestrian, bicycle, and occasional equestrian traffic. Clumps of trees will retain the open feeling and rural views. Farm fencing treatments may be used continuously in this area, or in selected spots to implement the branding identity of the City. Roadway lighting should be provided at intersections to enhance illumination, such as Semanski Street S and Warner Avenue (SE 456th St).

Figure 11. Segment 1 – Example Cross-Section



The following describes current site conditions, issues, priorities, and the improvement concepts developed for the major intersections along Segment 1.

244th Avenue SE Intersection (M.P. 22.48)

Current Site Conditions

SR 410 is oriented southwest-northeast at this location. Channelization consists of one through-lane of traffic in each direction, a left-turn lane heading northeast (turning onto 244th), an acceleration lane merging northeast (receiving left-turning traffic from 244th), and a short right-turn taper heading southwest (turning onto 244th).

244th Avenue SE is oriented north-south and tees into the northern side of SR 410 at a non-standard 60º angle. Channelization consists of a single lane in each direction. There are no dedicated turn lanes.

244th Avenue SE is stop-sign controlled approaching SR 410 (one-way stop); with traffic free-flowing along SR 410.

There are no facilities for pedestrians at the intersection (sidewalks or cross-walks).

Issues to Consider

The intersection operates at LOS F during PM peak traffic hours. Poor intersection operations at this location are due mainly to the 244th Avenue SE approach being stop-controlled, competing against high traffic volumes along SR 410. Therefore vehicles making the southbound to northeastbound left-turn turn (toward Enumclaw) are significantly delayed trying to find a gap in traffic to safely turn onto the highway.

Because the southbound 244th Avenue SE approach has only a single shared lane for left- and right-turning vehicles; vehicles making the southbound to southwestbound right-turn (toward Buckley) are delayed by left turning vehicles waiting for gaps in traffic, and must also then wait for gaps in traffic to turn right onto SR 410.

Evening PM peak hour traffic traveling along SR 410 across the White River also occasionally backs up approaching the Park Avenue traffic signal in Buckley. At such times, vehicles turning onto SR 410 from 244th Avenue SE must wait for acceptable gaps in traffic on SR 410. Although accident rates at this intersection are currently within acceptable limits, these conditions can cause confusion amongst drivers and may increase accidents.

As traffic volumes increase over the next 20 years, the vehicle level of service and safety will continue to decrease.

Intersection Priorities

Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Improve existing and future-year (2030) intersection level of service operations to D or better.
- Install intersection traffic control (traffic signal or round-about) to facilitate safe and efficient 244th Avenue SE side street traffic operations (which is warranted under existing conditions).
- Facilitate circulation of commercial tractor-trailers, logging trucks, pickups and stock trailers.
- Facilitate pedestrians across 244th Avenue SE intersection approach. There are no existing pedestrian facilities on the southern side of SR 410 which would require pedestrians to cross SR 410 at this location. The City has expressed an interest in limiting and discouraging pedestrian crossings at this location in the future with the planned Enumclaw Foothills Trail extension and rather focus those pedestrian crossings to the Warner Avenue (SE 456th St) intersection instead.

Concepts Developed

Future improvement concepts which are presented for consideration at this intersection include Traffic Signal (Figure 12) and Round-about (Figure 13). These two concepts were chosen based on their ability to satisfy the established intersection priorities. Special features and considerations for each of these concepts include:

Traffic Signal (Figure 12)

- Dedicated left-and right-turn lanes southbound on 244th Avenue SE allow free right turn on red.
- Right-turn lane heading southwest on SR 410 facilitates safe slowing for right-turning vehicles (reduced rear-end accident potential), and allows unimpeded flow for through traffic.
- SR 410 “splitter island” facilitates unimpeded flow for vehicles heading northeast; except when pedestrians are crossing. Also facilitates efficient placement of traffic signal poles and arms.
- *Advantages:* Provides safe and efficient traffic operations. Minimal impact to project area footprint. Probably the least-cost option.

Round-about (Figure 13)

- Right-turn “slip-lane” for southbound vehicles turning right onto SR 410 from 244th Avenue.

- Large radius single-lane round-about with inside truck “apron” for efficient circulation of truck/tractor and allowance for inside “trailer drag”.
- *Advantages:* Provides safe and efficient traffic operations. Most efficient for southbound vehicles turning right onto SR 410 – nearly unimpeded.
- *Disadvantages:* More severe impact to project area footprint.

Semanski Street S/ 252nd Avenue SE Intersection (M.P. 23.28)

Current Site Conditions

SR 410 is oriented southwest-northeast at this location. Channelization consists of one through-lane of traffic in each direction, a left-turn lane heading northeast (turning north onto Semanski), and a right-turn lane heading southwest (turning north onto Semanski).

Semanski Street S is oriented north-south and tees into the northern side of SR 410. 252nd Avenue SE is oriented north-south and tees into the southern side of SR 410, offset by about 250 feet to the southwest. Both the northern and southern approach channelization consists of a single lane in each direction. There are no dedicated turn lanes. The geometrics and configuration of the 250 foot offset of these intersections are a safety issue.

Semanski Street S/ 252nd Avenue SE are stop-sign controlled approaching SR 410 on both the north and south intersection approaches (two-way stop); with traffic free-flowing along SR 410.

There are no facilities for pedestrians at the intersection (sidewalks or cross-walks). The Foothills Trail crosses the southern Semanski Street S approach, at the historical but now abandoned Northern Pacific Railroad Company's main track alignment, located approximately 300 feet south of and parallel with SR 410.

Issues to Consider

Future year (2030) traffic at the intersection is predicted to become non-standard, operating at LOS F. Poor future intersection operations are due mainly to the northern Semanski Street S approach being stop-controlled, competing against high traffic volumes along SR 410; similar to the conditions noted for 244th Avenue SE. The southern 252nd Avenue SE approach carries very low traffic volumes, and does not contribute significantly to future level of service degradation.

Vehicles heading southwest on SR 410 making left turns onto Semanski Street S and vehicles crossing SR 410 (north-to-south) on Semanski Street S accomplish these similar maneuvers in one of two ways:

- Stop in the through-lane of SR 410 and wait for a break in traffic. This disrupts the flow of traffic along SR 410 and puts waiting vehicles at higher risk of being rear-ended. Residents report that drivers on SR 410 often pass these waiting vehicles utilizing the northern shoulder, which is illegal and considered unsafe.
- Cross the double-yellow center line (into potential oncoming left-turning traffic) and wait for a break in traffic. Residents report that this is done by drivers who are fearful of being rear-ended or side-swiped by SR 410 traffic coming up from behind or trying to pass on the shoulder. Drivers in this circumstance put themselves at risk of potential head-on collision by performing this illegal and unsafe maneuver.
- Although accident rates at this intersection are currently within acceptable limits, the conditions noted above may increase future accident rates as traffic flow along SR 410 increases.

Due to the short offset distance between the two Semanski Street S and 252nd Avenue SE approaches, there is not enough distance to accommodate a left-turn pocket in both directions along SR 410.

Although not an issue, vehicles crossing SR 410 (south-to-north) currently use the left-turn lane heading northeast on SR 410 as a refuge lane. Residents pulling heavy stock trailers across the intersection view this as a benefit of the existing configuration.

Due to the relatively low side-street traffic volumes at the intersection, especially at the 252nd Avenue SE approach, traffic signal warrants are currently not met and probably will not be in the future. Therefore, improving the side-street level of service to accommodate more future traffic on Semanski Street S may not be a realistic goal.

Intersection Priorities

Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better on SR 410.
- Facilitate traffic safety for turning, entering and crossing vehicle movements.
- Facilitate access to/from and across SR 410.
- Maintain safe crossing for Foothills Trail traffic across Semanski Street S.

Concepts Developed

Future improvement concepts which are presented for consideration at this intersection include Restricted Movements (Figure 14) and Realigned Intersection (Figure 15). These two concepts were chosen based on their ability to satisfy the established intersection priorities. Special features and considerations for each of these concepts include:

Restricted Movements (Figure 14)

- This concept focuses on maintaining future-year level-of-service operations along SR 410 and promoting traffic safety for turning, entering and crossing vehicle movements.
- Channelization remains the same, except that raised curbing would be installed along SR 410 between the two approaches to control access.
- The southern 252nd Avenue SE approach would become right-in and right-out only. Full vehicle access would be maintained at the northern Semanski Street S approach.
- An acceleration/merge lane heading northeast could also be added along SR 410 (in lieu of the raised planter currently shown) to facilitate traffic turning left onto SR 410 from the northern Semanski Street S approach.
- *Advantages:* Enhances traffic safety by eliminating unsafe left-turns and crossing movements heading southwest on SR 410. Enhances level of service on SR 410 by eliminating left turns which currently impede the flow of traffic headed southwest on SR 410. Least cost option.
- *Disadvantages:* Eliminates full access to the southern 252nd Avenue SE approach, which becomes right-in and right-out only.

Realigned Intersection (Figure 15)

- This concept focuses on maintaining future-year level-of-service operations along SR 410; promoting traffic safety for turning, entering and crossing vehicle movements; and enhancing access to/from and across SR 410.
- *Advantages:* Provides left-and right-turn lanes on SR 410 promoting safe and efficient access to Semanski Street. Realigns the southern 252nd Avenue SE approach to provide a single point of intersection, allowing access across SR 410.
- *Disadvantages:* More severe impact to project area footprint. Requires realignment of Foothills Trail crossing of 252nd Avenue SE.

Warner Avenue Intersection (SE 456th Street) (M.P. 23.68)

Current Site Conditions

SR 410 is oriented southwest-northeast at this location. Channelization consists of one through-lane of traffic in each direction, opposing left-turn lane pockets heading northeast and southwest (turning onto Warner), and right-turn pockets heading northeast and southwest (turning onto Warner).

Warner Avenue (SE 456th St) is oriented west-east and intersects SR 410 at a non-standard 52º angle. The western approach channelization consists of a single lane in each direction. The eastern approach channelization consists of a dedicated right turn lane and a combined through/left-turn lane.

All approaches to the intersection are traffic signal controlled, and the intersection currently operates in a "split phase" three-phase mode.

Raised sidewalks exist at each corner of the intersection, and sidewalks continue to the west along Warner Avenue (SE 456th St). Signalized pedestrian crosswalks and curb ramps exist across all four intersection approaches.

The Enumclaw Foothills Trail crosses the eastern Warner Avenue (SE 456th St) approach approximately 300 feet east of and parallel with SR 410, and a local trailhead with parking exists there on the north side of Warner Avenue adjacent to the trail crossing.

Issues to Consider

Future year (2030) traffic at the intersection is predicted to become non-standard, operating at LOS E. Poor future intersection operations are due mainly to the Warner Avenue (SE 456th St) traffic signal approaches being "split-phased", causing inefficient traffic signal operations. In addition, the slightly skewed angle of the intersection results in a relatively long pedestrian crossing time that can reduce LOS during peak traffic periods. This intersection provides a safe pedestrian crossing from residential areas on the east side to school district facilities on the west side.

Intersection Priorities

Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Maintain safe crossing for Foothills Trail traffic across Warner Avenue (SE 456th St). Avoid significant impacts to the existing trailhead and parking area.

Concepts Developed

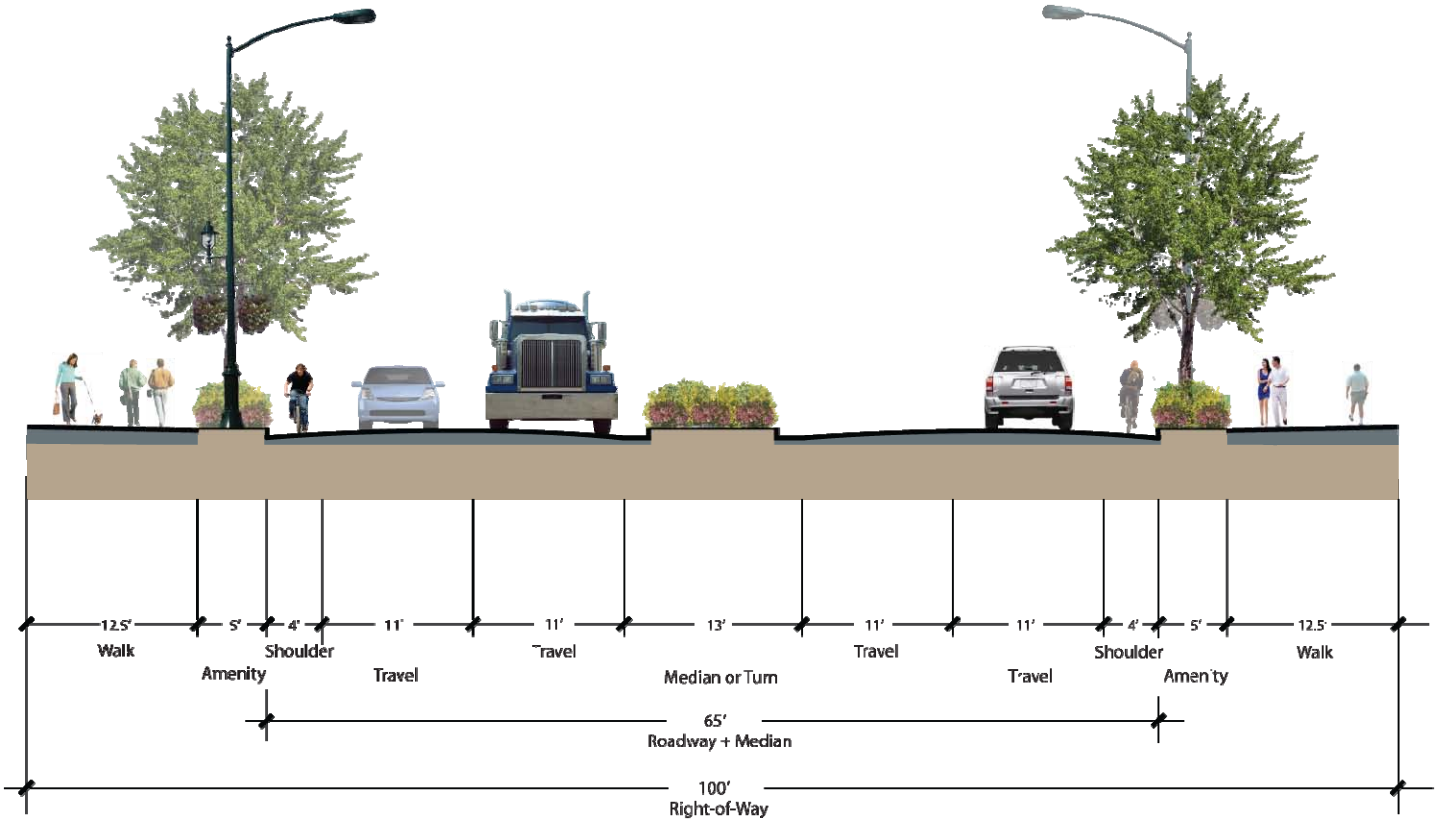
The future improvement concept which is presented for consideration at this intersection includes Widen out Approaches (Figure 16). Special features and considerations for this concept include:

- Widening the western and eastern Warner Avenue (SE 456th St) approaches to add left-turn pockets, aligned across the intersection to allow left-turns "concurrently" (no longer split-phased).
- Sidewalks are provided between the intersection and the existing trailhead for improved pedestrian connectivity.
- Enhanced visibility, new crosswalk and center refuge island for Foothills Trail crossing.
- *Advantages:* Provides improved traffic level-of-service (reduces congestion) on Warner Avenue (SE 456th St).
- *Disadvantages:* Requires widening on the south side of Warner Avenue (SE 456th St).

What improvement concepts were developed for Segment 2 (Central) – "Urban"?

The Central segment would have the most intensive streetscape elements, such as a boulevard "portal" entryway to Enumclaw. This segment would include possible round-abouts at the segment boundaries, street trees, hanging planter (flower) baskets, center landscaped medians andleft-turn lanes, and combined roadway/pedestrian lighting fixtures, as well as individual pedestrian lighting fixtures are suggested treatments. Farm fencing could be added to Veterans Memorial Park to link the area visually to the other segments. Figure 17 illustrates what the Central segment may look like.

Figure 17. Segment 2 – Example Cross-Section



Cole Street Intersection (M.P. 24.14)

Current Site Conditions

SR 410 is oriented southwest-northeast at this location. Channelization consists of one through-lane of traffic in each direction and a left-turn lane heading northeast (turning north onto Cole Street). There is a "restrictive" C-barrier curbing median separating the southwest leg of SR 410.

Cole Street is oriented north-south and tees into the northern side of SR 410 at a non-standard 36º angle. Channelization consists of a single lane in each direction. The southbound lane approaching SR 410 is a dedicated right-turn only lane with a "restrictive" C-barrier curbing median that prevents southbound to northwestbound left turns.

Cole Street is stop-sign controlled approaching SR 410 (one-way stop); with traffic free-flowing along SR 410.

There are no facilities for pedestrians at the intersection (sidewalks or crosswalks).

Issues to Consider

Future year (2030) traffic at the intersection is predicted to become non-standard, operating at LOS F. Poor future intersection operations are due mainly to the Cole Street approach being stop-controlled, competing against high traffic volumes along SR 410.

The angle of the intersection is severely non-standard (54º from perpendicular), requiring drivers entering SR 410 from Cole Street to look far back over their left shoulder. This movement impairs their ability to view oncoming traffic.

Under future conditions, queue lengths approaching SR 410 along Cole Street are predicted to back up and block the existing driveway access to local businesses (located on the northwest side of the intersection) for traffic heading north on Cole Street from SR 410. The existing driveway is located approximately 200 feet north of SR 410. With future geometric improvements, this distance may be reduced to only about 100 feet.

Intersection Priorities

Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Install intersection traffic control (traffic signal or round-about) to facilitate safe and efficient Cole Street traffic operations.
- Improve intersection angle to meet current WSDOT and AASHTO standards (75 to 105 degrees from perpendicular).
- Facilitate circulation of commercial tractor-trailers, logging trucks, pickups and stock trailers.
- Facilitate future access to adjacent businesses when possible and not in conflict with design standards.
- Facilitate the future Dickson Avenue extension and connection to the intersection from the east.
- Introduce traffic calming measures to slow and “calm” vehicle traffic headed northbound into the Enumclaw downtown area.
- Facilitate pedestrians across SR 410, Cole Street, and future Dickson Avenue intersection approaches. Establish sidewalk connectivity along northern side of SR 410. Provide future Foothills Trail connection.
- Provide opportunities for architectural district “gateway” treatments and concepts announcing the entry to the Enumclaw commercial area (Segment 2).

Concepts Developed

Future improvement concepts which are presented for consideration at this intersection are represented in Figures 18 through 22. Figure 18 shows a visualization of how a round-about might look. Round-about concepts were chosen based on their unique ability to satisfy all of the established intersection priorities. However, a future signalized improvement concept could likely occupy the same footprint location as a round-about. A signalized option was not illustrated as part of this study, primarily because signalization may accomplish some, but not all of the intersection priorities.

Special features and considerations shown in Figure 19 include:

- Right-turn “slip-lane” for southbound vehicles turning right onto SR 410 from Cole Street.
- Large radius single-lane round-about with inside truck “apron” for efficient circulation of truck/tractor and allowance for inside “trailer drag”.

- Wide “splitter islands” and crosswalks allowing pedestrians to cross one lane of traffic in each direction (across SR 410) with center pedestrian refuge. This is combined with Foothills Trail access/connection.
- “Around-the-block” access for adjacent businesses. Northeasterly bound vehicles accessing businesses (740/830 Hwy 410, NAPA, ACE Hardware, others) from SR 410 would proceed northeasterly through the round-about, turn left (west) on Roosevelt Avenue, turn left (southwest) on Cole Street, and turn right into the existing businesses driveway.
- Business access for the southwest leg of SR 410 adjacent businesses, that currently utilize an existing right-in, right-out driveway may be able to continue to use that driveway, with the added benefit that a round-about would provide for direct access for northeastbound SR 410 traffic to utilize the round-about as a u-turn facility, heading back southwestbound and then use a right-turn to access via the driveway.
- Provides direct access to adjacent businesses on the west side via a new left-turn pocket south of the round-about..
- Location and geometry is set to receive the future Dickson Avenue Extension from the east.
- *Advantages:* Provides safe and efficient traffic operations. Does not stop traffic. Reduces delay for southbound vehicles turning right onto SR 410 – nearly unimpeded. Controls traffic speed along SR 410 (traffic calming). Provides gateway/streetscape opportunity entering the Enumclaw Commercial area. Minimizes long term operations and maintenance cost.
- *Disadvantages:* Provides less direct access to adjacent businesses for northbound Cole Street traffic. Additional left-turn pocket is required northbound on SR 410 at Roosevelt Avenue. Public non-familiarity with round-abouts:the community as a whole is not accustomed to round-abouts, their advantages and disadvantages, and how to drive them.

Additional features and considerations shown in Figure 22 (Dual Round-abouts) include:

- Future Dickson Avenue extension and connection to SR 410. (An Enumclaw Comprehensive Plan project)
- Foothills Trail crossing Dickson Avenue.
- Additional round-about intersection at Cole Street / Roosevelt Avenue.
- “U-turn” access for adjacent businesses. Northbound vehicles accessing businesses (NAPA, ACE Hardware, others) from SR 410 would turn left at the SR 410 round-about, proceed north on Cole Street to Roosevelt Avenue, U-turn at the Roosevelt Avenue round-about, and turn right into the existing businesses driveway.
- *Advantages:* Improves traffic operations at Cole Street / Roosevelt Avenue. Provides more direct/customary access to adjacent businesses for northbound traffic.
- *Disadvantages:* More complex and possibly confusing due to close spacing of two new round-abouts. Additional construction costs for intersection improvements at Cole Street / Roosevelt Avenue.

Figure 18. Cole Street Improvement Concept Visualization

Roosevelt Avenue Intersection (M.P. 24.32)

Current Site Conditions

SR 410 is generally oriented southwest-east at this location. Channelization consists of one through-lane of traffic in each direction and a right-turn drop-lane heading west (turning onto Roosevelt).

Roosevelt Avenue is oriented west-east and tees into the northwestern side of SR 410. Channelization consists of a single lane in each direction. The eastbound lane approaching SR 410 is a dedicated left-turn only lane. Due to the sharpness of the 51º intersection angle, right turns (southwestbound) are prohibited to prevent vehicles from crossing the centerline when entering onto SR 410.

Roosevelt Avenue is stop-sign controlled approaching SR 410 (one-way stop); with traffic free-flowing along SR 410. The SR 410 alignment generally transitions from the southwest-northeast alignment to an west-east alignment at this intersection.

There are no facilities for pedestrians at the intersection (sidewalks or cross-walks).

Issues to Consider

Future year (2030) traffic at the intersection is predicted to become non-standard, operating at LOS F. Poor future intersection operations are due mainly to the Roosevelt Avenue left-turn approach being stop-controlled, competing against high traffic volumes along SR 410 in both directions.

Intersection Priorities

Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Maintain right-turn access to businesses and neighborhoods for vehicles heading southwest on SR 410.
- Facilitate “around-the-block” access for adjacent Cole St. businesses (ACE Hardware, NAPA, others).

- Facilitate pedestrian access to and across Roosevelt Avenue approach.

Concepts Developed
Future improvement concepts which are presented for consideration at this intersection are represented in Figures 19 through 22. Special features and considerations include:

- Eastbound access onto SR 410 from Roosevelt Avenue is eliminated. Vehicles which now turn left onto SR 410 from Roosevelt Avenue are re-directed to the new round-about at SR 410 / Cole Street.
- Roosevelt Avenue becomes two lanes westbound to receive increased traffic volumes turning right and left from SR 410.
- A partial eastbound lane remains on Roosevelt Avenue to facilitate ingress for Bank customers at 955 Cole Street.
- Sidewalks and crosswalk on north side of SR 410 connecting Roosevelt Avenue to Cole Street and Monroe Avenue.
- *Advantages:* Improves traffic operations (future congestion) and safety. Pedestrians crossing Roosevelt Avenue are subject to vehicle traffic from only one direction.
- *Disadvantages:* Reroutes east bound Roosevelt Avenue through-traffic to the SR 410 / Cole Street intersection.

Mountain Villa Drive / Monroe Avenue Intersection (M.P. 24.29)

Current Site Conditions
SR 410 is oriented west-east at this location. Channelization consists of one through-lane of traffic heading eastbound, two through-lanes heading westbound, and a center two-way left-turn lane approaching from the east and west. The outside westbound lane turns into a dedicated right-turn only lane west to the Roosevelt Avenue intersection.

Monroe Avenue is oriented north to northwest and tees into the northern side of SR 410. Channelization consists of a single lane in each direction. There are no dedicated turn lanes.

Mountain Villa Drive is oriented south and tees into the southern side of SR 410. Channelization consists of one southbound lane, one northbound dedicated left-turn lane, and one through/right-turn lane. Raised sidewalks exist on the southwest and southeast intersection corners, and curb ramps and an west-east crosswalk exists for the Foothills Trail along the southern edge of SR 410.

Monroe Avenue and Mountain Villa Drive are stop-sign controlled approaching SR 410 (two-way stop); with traffic free-flowing along SR 410.

There are no facilities for pedestrians crossing SR 410. Raised sidewalks, curb ramps, and crosswalk exist on the south side of the intersection (crossing Mountain Villa Drive). A pedestrian pathway connects to and crosses the northern approach (Monroe Avenue) with no marked crosswalk.

Issues to Consider
Collisions at this intersection are approaching a relatively high level (nearly 1.0 MEV). The primary cause of identified angle collisions is most likely stop-sign controlled side-street traffic not yielding to approaching vehicles on SR 410.

Residents have identified the need/desire for a controlled pedestrian crossing of SR 410 at Mountain Villa Drive/Monroe Avenue to facilitate foot traffic from residential neighborhoods located south of the intersection traveling to shopping areas (grocery and retail) located north of SR 410. Residents must currently travel roughly about 500 feet to the east, about one-third mile out of their way (per round trip) to use the nearest existing signalized crossing and marked crosswalk of SR 410 located at Garrett Street.

Frequent pedestrian crossings of SR 410 are reported at Mountain Villa Drive. As traffic on SR 410 increases, this pedestrian activity will become increasingly unsafe.

It may be desirable at some future time to introduce westbound U-turn capability (on SR 410) at the intersection if access control measures, such as restrictive medians, are established east of the intersection.

Intersection Priorities
Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Facilitate safe pedestrian crossings of SR 410.

Concepts Developed
Future improvement concepts which are presented for consideration at this intersection are represented in Figures 19 through 22. Special features and considerations include:

Pedestrian Focused

- Pedestrian signal and crosswalk across SR 410.
- *Advantages:* Improved pedestrian safety and convenience.
- *Disadvantages:* Potential decrease in SR 410 traffic level of service (increased delay and congestion).

Vehicle Focused

- Additional eastbound through-lane approaching on SR 410.
- *Advantages:* Facilitates right-turn access into business driveways and Mountain Villa Drive without causing vehicle delay. Improved traffic flow.
- *Disadvantages:* No improvement for pedestrians.

Garrett Street Intersection (M.P. 24.49)

Current Site Conditions
SR 410 is oriented west-east at this location. Channelization consists of one through-lane of traffic heading eastbound, an eastbound left-turn lane (turning onto Garrett), two through-lanes heading westbound, and a westbound left-turn lane (turning into the adjacent car dealership).

Garrett Street is oriented north to northeast and tees into the northern side of SR 410. Southbound channelization consists of a right-turn lane and a single shared through/left-turn lane.

The adjacent car dealership intersection access is oriented south and tees into the south side of SR 410. Channelization consists of a single lane in each direction. There are no dedicated turn lanes.

All approaches to the intersection are traffic signal controlled.

Sidewalks surround the intersection, and crosswalks exist at all four intersection approaches. This intersection is the main pedestrian crossing for the central “Segment 2”.

Issues to Consider
This intersection is predicted to continue functioning efficiently and safely under future traffic conditions. As a future wayfinding and tourism signage project is implemented city wide, the Garrett Street Corridor may function as a downtown large truck/commercial traffic alternative to SR 164 (Griffin Avenue) and to SR 169 (Porter Street).

In the future, it will be necessary to re-stripe SR 410 eastbound to include one additional through-lane of traffic, similar to and in support of other surrounding intersections.

Intersection Priorities
Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

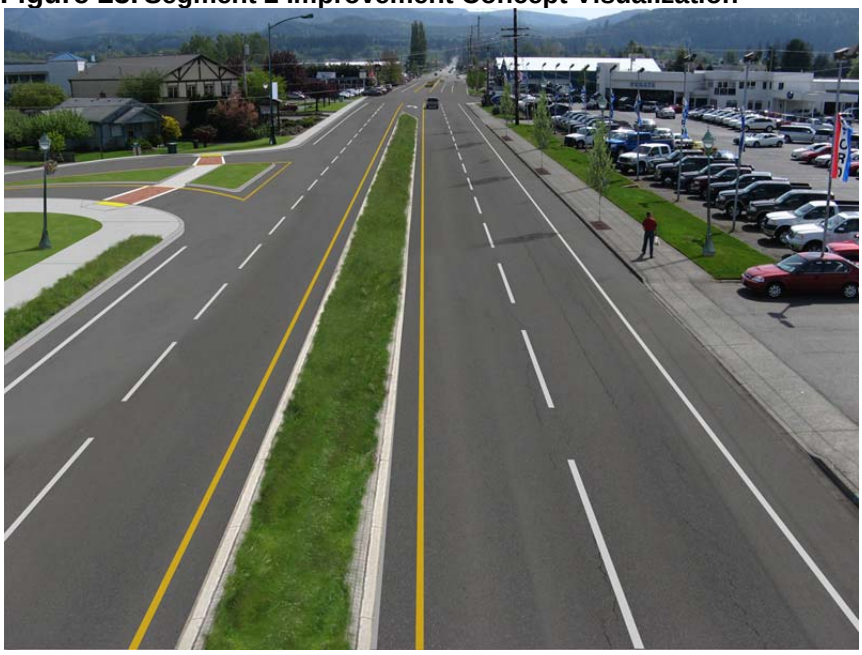
- Maintain future-year (2030) level of service operations at D or better.
- Support two lanes in each direction along SR 410.

Concepts Developed
Future improvement concepts which are presented for consideration at this intersection are represented in Figures 19 through 22. Special features and considerations include:

- Additional through lane eastbound on SR 410.
- *Advantages:* Facilitates right-turn access into business driveways without causing vehicle delay. Improved traffic flow.
- *Disadvantages:* Westbound traffic would have to continue onward to the Monroe/Mountain Villa Drive to the U-Turn pocket at the southeast corner of that intersection.

The proposed five lane concept along Segment 2 is illustrated below in a visualization prepared looking east at the Stevenson Avenue intersection. The improvements discussed for Blake Street, Griffin Avenue (SR 164), and Watson Street N all may assume a similar cross-section. This visualization represents a "restrictive" median concept, which will likely be warranted by the end of the 2030 corridor study planning horizon. In the meanwhile, a combination two-way left turn lane (TWLTL) "non-restrictive" median option together with "restrictive" medians at limited locations may be more appropriate and cost effective.

Figure 23. Segment 2 Improvement Concept Visualization



Stevenson Avenue Intersection (M.P. 24.63)

Current Site Conditions

SR 410 is oriented west-east at this location. Channelization consists of one through-lane of traffic in each direction, and an eastbound left-turn lane (turning onto Stevenson).

Stevenson Avenue is oriented northwest and tees into the north side of SR 410 at a non-standard 36º angle. The approach channelization consists of a single lane in each direction. Stevenson Avenue is stop-sign controlled approaching SR 410.

Sidewalks surround the intersection on all except the northwest corner. There are no marked crosswalks at the intersection.

Issues to Consider

This intersection is predicted to continue functioning efficiently under future traffic conditions.

In the future, it will be necessary to re-stripe SR 410 eastbound to include one additional through-lane of traffic, similar to and in support of other surrounding intersections.

To maximize intersection safety and level-of-service operations, it may desirable to limit side-street access at Stevenson to right-in and right-out. Vehicles desiring to make left-turns in or out can accomplish this at Garret Street, which is signalized, with minimal inconvenience.

Intersection Priorities
Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Maintain intersection traffic safety.
- Support two through-lanes in each direction along SR 410.

Concepts Developed
Future improvement concepts which are presented for consideration at this intersection are represented in Figures 24 to 28. Special features and considerations include:

- Additional through-lane in each direction along SR 410. This decreases traffic congestion on SR 410 and also provides gaps in traffic to decrease delay for vehicles entering SR 410 from Stevenson Avenue.
- Center, landscaped median island to provide access management along the corridor.
- *Advantages:* Maximizes traffic level-of-service. Maximizes traffic safety by eliminating left-turns exiting Stevenson Avenue.
- *Disadvantages:* Traffic would use Garrett Street for left-turns in and out of the surrounding businesses.

Blake Street Intersection (M.P. 24.68)

Current Site Conditions
SR 410 is oriented west-east at this location. Channelization consists of one through-lane of traffic in each direction. There are no turn lanes and left-turning vehicles turning off SR 410 onto Blake Street cause queuing, backups and delay.

Blake Street is oriented north-south and tees into the north and south sides of SR 410. Both the northern and southern approach channelization consists of a single lane in each direction. There are no dedicated turn lanes. There is a utility pole at the southeast corner of the intersection that presents a safety hazard and should be relocated with any future project.

Blake Street is stop-sign controlled approaching SR 410 on both the north and south intersection approaches (two-way stop); with traffic free-flowing along SR 410.

Sidewalks surround the intersection on all except the northeast corner. There are no marked crosswalks at the intersection.

Issues to Consider
The intersection is predicted to operate at LOS D in 2030. The LOS D intersection operations are due mainly to the Blake Street approaches being stop-controlled, competing against high traffic volumes along SR 410. With only one lane of traffic in each direction along SR 410, there few available gaps in traffic that allow vehicles to enter or cross SR 410.

Intersection Priorities
Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Establish sidewalk connectivity at the northeast corner of the intersection heading north and east.

Concepts Developed
Future improvement concepts which are presented for consideration at this intersection are represented in Figures 24 through 28. Special features and considerations include:

- Additional through-lane in each direction along SR 410. This decreases traffic congestion on SR 410 and also provides gaps in traffic to decrease delay for vehicles entering and crossing SR 410 from Blake Street. It also provides easier movement into and out of the numerous business driveways along this segment of the corridor.
- Added left-turn lane in each direction on SR 410 (turning onto Blake Street) to facilitate and shelter left-turning vehicles, and decrease delays for through traffic.
- *Advantages:* Provides improved traffic level-of-service (decreases delay). Improves safety for left-turning vehicles. Facilitates right-turn access into business driveways and Blake Street without causing vehicle delay.

Griffin Avenue (SR 164) Intersection (M.P. 24.82)

Current Site Conditions
This is a state route to state route intersection with SR 410 oriented west-east at this location. Channelization consists of two through-lanes of traffic heading east, one through lane heading west, a westbound left-turn lane (turning into Safeway), and a westbound right-turn lane (turning northwesterly onto Griffin). Left turns are not permitted eastbound.

Griffin Avenue (SR 164). is oriented north to northwest and tees into and terminates at the north approach to SR 410. Channelization consists of a single lane in each direction. There are no dedicated turn lanes. The current private parking lot access aisle configuration is disorganized and does not channelize safe access from the private parking areas to the intersection.

Safeway/Rite-Aid intersection approach is oriented south and tees into the south side of SR 410. Channelization consists of a single lane in each direction. There are no dedicated turn lanes.

All approaches to the intersection are traffic signal controlled. There is currently raised “C-barrier curbing” on the SR 410 approaches to discourage and restrict turning movements.

Sidewalks surround the intersection, and marked crosswalks exist at all four intersection approaches.

Issues to Consider
Future year (2030) traffic at the intersection is predicted to become non-standard, operating at LOS E. Poor future intersection operations are due mainly to high traffic volumes along both SR 410 and Griffin Avenue, with too few through lanes and turn lanes to clear queues during each signal cycle. In addition, Griffin Avenue and Safeway/Rite-Aid intersection approaches are “split-phased”, causing inefficient traffic signal operations. Due to heavy southeast to eastbound left-turning volumes (from Griffin Avenue), these two approaches must likely remain split-phased.

The angle of the intersection is non-standard (25 degrees from perpendicular). This is mainly an issue for large trucks and buses turning right from Griffin Avenue onto westbound SR 410. Large vehicles must pull far out into the intersection at very slow speeds to navigate this turn while avoiding the traffic signal pole at the northwest corner. Because of this, the western centerline approach of SR 410 is tapered further south, causing inefficient utilization of the available street right-of-way.

The intersection is surrounded by commercial properties and access points on all sides. Therefore, options for widening these roadways to provide additional through and turn lane capacity will impact existing properties and access points.

Intersection Priorities

Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Facilitate circulation of buses, commercial tractor-trailers, logging trucks, pickups and stock trailers.
- Provide U-turn and/or left-turn capability to facilitate vehicle turn-around and property/driveway access with introduction of access management treatments.
- Improve traffic safety (crash reduction) at Watson Street N.
- Minimize impacts to existing properties.
- Facilitate future access to adjacent businesses.
- Maintain pedestrian access and circulation to and across the intersection.

Concepts Developed

Future improvement concepts which are presented for consideration at this intersection are represented in Figures 24 through 28. Special features and considerations for each of these concepts include:

Traffic Signal with Restricted Movements (Figure 24)

- This concept focuses on improving Griffin Avenue/SR 410 future traffic operations (decreasing future delays) by concentrating all of the necessary improvements “at the intersection”; versus modifying surrounding intersections to “assist” with the solution.
- Additional through-lane in each direction along SR 410 provides added capacity to clear traffic queues within available “green time”.
- Left-turn lanes in each direction along SR 410, combined with far-side U-turn pockets, add left-turn capability eastbound and U-turn capability both east and west.
- Added right-turn and left-turn pockets on Griffin Avenue provide added capacity to clear traffic queues within available “green time”.
- *Advantages:* Provides improved traffic level-of-service (decreases delay). Provides U-turn capability both east and west. Provides added left-turn eastbound (turning onto Griffin). Improves right-turn geometry (from Griffin onto SR 410). Preserves existing driveway access points. Not dependent on improvements at other intersections.
- *Disadvantages:* Significant impact to gas station at northwest corner. Minor impact to retail businesses and car dealership at northeast corner.

Round-about with Restricted Movements (Figure 25)

- Similar to the traffic signal shown in Figure 24, but introduces a round-about at the intersection with SR 164.
- This concept focuses on improving future traffic operations and safety by combining round-about improvements at Griffin Avenue with access restrictions at Watson Street N.
- Large radius two-lane round-about with inside truck “apron” for efficient circulation of truck/tractor and allowance for inside “trailer drag”.
- Wide “splitter islands” and cross-walks allowing pedestrians to cross one lane of traffic in each direction with center refuge.
- Center access control is installed at Watson Street N for increased safety, making all approaches right-in and right-out.

- *Advantages:* Provides most efficient traffic operations (reduced vehicle delay) at Griffin Avenue. Center access control improves traffic safety (crash reduction) at Watson Street N. Provides U-turn capability in all directions.
- *Disadvantages:* Two-lane round-about with high percentage of truck traffic is potentially more confusing for drivers to navigate. Significant impact to gas station at northwest corner. Minor impact to retail businesses and car dealership at northeast corner. Minor impact to Jack-In-The-Box north of the intersection.

Dual Traffic Signals (Figures 26 and 26B)

- This concept focuses on improving future traffic operations by combining improvements at both Griffin Avenue and Watson Street N.
- Additional through-lane in each direction along SR 410 provides added capacity.
- Added right-turn and left-turn pockets on Griffin Avenue provide added capacity.
- Added U-turn eastbound at Griffin Avenue. This also allows more room for large vehicles (rear wheel drag) turning right from Griffin Avenue onto SR 410.
- Safeway/Rite-Aid Driveway access on south side is removed, reducing the number of required traffic signal phases and allowing more “green time” for heavy traffic volumes along SR 410 and Griffin Avenue.
- Traffic which was using the Safeway/Rite-Aid intersection approach at Griffin Avenue is redirected east to Watson Street N.
- With increased traffic volumes entering and exiting at Watson Street N (resulting from Safeway intersection approach closure), traffic signal warrants are met and a new traffic signal is constructed at Watson Street N.
- *Advantages:* Provides improved traffic level-of-service (decreases delay). Provides U-turn capability eastbound. Improves right-turn geometry (from Griffin onto SR 410). Improves pedestrian flow (less delay) along south side of SR 410. Added traffic signal improves traffic safety (crash reduction) and level-of-service (decreased delay) at Watson Street N.
- *Disadvantages:* Two closely-spaced traffic signals would require WSDOT design deviation approval. Significant impact to gas station at northwest corner. Minor impact to retail businesses and car dealership at northeast corner. Requires on-site re-routing of Safeway/Rite-Aid and shopping center traffic to access from Watson Street N. Improvements at two intersections must be accomplished at the same time.

Round-about with Dickson Avenue Extension (Figure 27)

- This concept includes the same elements as the Round-about with Restricted Movements alternative described previously in Figure 25, and also ties in future improvements and a new north-south street connection to Dickson Avenue.
- Dickson Avenue is connected and improved between Blake Street and Watson Street N.
- The Safeway/Rite-Aid intersection approach at Griffin Avenue is relocated slightly west and extended through to Dickson Avenue.
- *Advantages:* Reduces traffic congestion on SR 410. Improves access and circulation to properties and businesses south of SR 410. Decreases reliance on SR 410 by providing an alternative parallel route to SR 410.
- *Disadvantages:* Required additional traffic signal on SR 410. Requires acquisition of right-of-way to establish the new north-south roadway connection south of Griffin Avenue.

Relocate SR 164 Traffic to Blake Street (Figure 28)

- This concept focuses on re-distributing the high volume of traffic currently concentrated at Griffin Avenue / SR 410 to surrounding intersection and side streets at Blake Street, Watson Street N (North Extension), and Rainier Avenue.
- High volume of left-turns from Griffin Avenue onto SR 410 is relocated to the Blake Street intersection.
- Blake Street is reconstructed (possibly widened) to accommodate three lanes plus heavy vehicle traffic.
- High volume of westbound right-turns from SR 410 onto Griffin Avenue is maintained at Griffin Avenue intersection.
- Access to SR 410 at Griffin Avenue and the Safeway/Rite-Aid driveways are restricted to right-in and right-out, and the existing traffic signal is removed.
- Watson Street N is extended north and connected with Rainier Avenue.
- New traffic signals with pedestrian crossings are installed at Blake Street and Watson Street N.
- The intersection at Griffin Avenue / Blake Street / Rainier Avenue is re-striped and re-signed.
- *Advantages:* Reduces traffic congestion on SR 410. Improves access and circulation to properties, businesses and residences north of SR 410. Decreases reliance on SR 410 by providing another parallel alternative route to SR 410. Provides more regular spacing of pedestrian crossings along SR 410. Preserves existing driveway access points. Added traffic signal improves traffic safety and level-of-service at Watson Street N. Reduces property impacts at existing business locations.
- *Disadvantages:* Requires acquisition of property to establish new north roadway extension at Watson Avenue. Requires widening and reconstruction of Blake Street. Requires one additional traffic signal on SR 410. Rerouted traffic on Rainer Avenue would be disruptive to the residential nature of Rainier Avenue, and may require widening and reconstruction of Rainer Avenue.

Watson Street N Intersection (M.P. 24.92)

Current Site Conditions

SR 410 is oriented west-east at this location. Channelization consists of one through-lane of traffic in each direction, an eastbound left-turn lane (turning north onto Watson), and eastbound right-turn lane (turning south onto Watson), and a westbound left-turn lane (turning south onto Watson).

Watson Street N is oriented north-south and tees into the north and south sides of SR 410. Both the northern and southern approach channelization consists of a single lane in each direction. There are no dedicated turn lanes.

Watson Street N is stop-sign controlled approaching SR 410 on both the north and south intersection approaches (two-way stop); with traffic free-flowing along SR 410.

Sidewalks surround the intersection on all except the northeast corner. There are no crosswalks at the intersection.

Issues to Consider

Future year (2030) traffic at the intersection is predicted to become non-standard, operating at LOS E. Poor future intersection operations are due mainly to the Watson Street N southern approach being stop-controlled, competing against high traffic volumes along SR 410. With only one lane of traffic in each direction along SR 410, there are few available gaps in traffic that allow vehicles to enter or cross SR 410.

Watson Street N is the only intersection with a collision rate above 1.0 MEV. This is most likely the result of the intersection being stop-controlled on the north and south approaches competing against heavy traffic on SR 410 with few gaps in traffic. Vehicles turning left onto SR 410 (northbound to westbound) are faced with five lanes of approaching traffic going through the intersection or turning in different directions, increasing risk of misjudgment while making this turn. Public comments have suggested that the high accident frequency may partially be attributed to a very large tree located within the right-of-way at the northeast corner of this intersection, which may be a potential sight-triangle obstruction. Also landscaping on the southeast corner of the intersection may have been a past potential sight-triangle obstruction, but has since been trimmed back to help with sight visibility issues.

Intersection Priorities

Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Improve traffic safety (crash reduction).

Concepts Developed

Future improvement concepts which are presented for consideration at this intersection are represented in Figures 24 through 28. Special features and considerations include:

Restricted Movements (Figures 24, 25, & 27)

- Additional through-lane in each direction along SR 410. The existing eastbound right-turn lane is converted to a through lane. This decreases traffic congestion on SR 410.
- Centerline curbing is extended through the intersection on SR 410 to prevent unsafe left-turns from Watson Street N onto SR 410. Vehicles desiring to head westbound on SR 410 from the southern Watson Street approach would be required to make a U-turn at the future Suntop Farms round-about located to the east.
- Added U-turn eastbound at Watson Street N (northwest corner).
- *Advantages:* Provides improved traffic level-of-service (decreases delay) by increasing lane capacity along SR 410 and by restricting left-turns onto SR 410. Improves safety by eliminating left-turning vehicles.
- *Disadvantages:* Requires left-turning vehicles turning onto SR 410 to turn right and then U-turn at the next available intersection located about 1/3 mile to the east. Dependent on construction of a round-about to the east. This option is not likely to be well received by local residents and property owners.

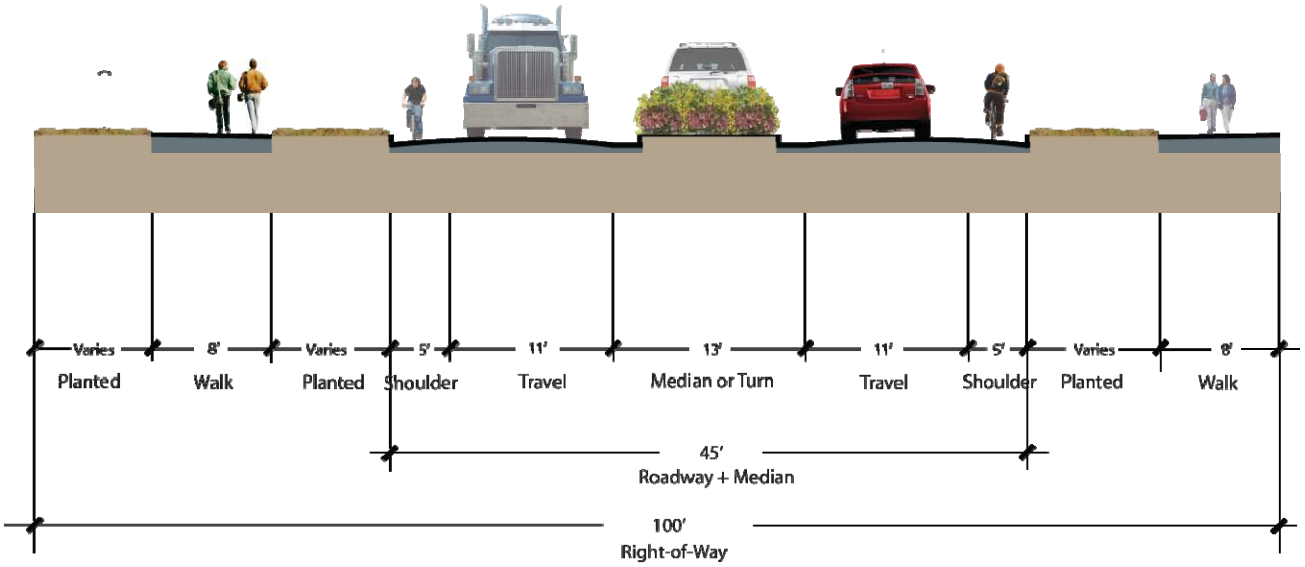
Traffic Signal (Figures 26 & 28)

- A new traffic signal is installed at Watson Street N to increase vehicle level-of-service (decrease delay) and increase traffic safety (crash reduction).
- For this intersection to meet traffic signal warrants, the Safeway/Rite-Aid intersection approach at Griffin Avenue must be abandoned, which causes traffic entering and exiting at that location to re-distribute to Watson Street N.
- *Advantages:* Provides improved traffic level-of-service (decreases delay). Improves vehicle safety (crash reduction). Maintains all right-and left-turning movements accessing to and from Watson Street N.
- *Disadvantages:* Two closely-spaced traffic signals require WSDOT design deviation approval. Requires on-site re-routing of Safeway/Rite-Aid and shopping center traffic to access from Watson Street N. Driveways on Watson Street, serving Safeway and McDonalds are unfavorably offset and have exaggerated potential conflicts that may increase collision frequency there.

What improvement concepts were developed for Segment 3 (East) – "Recreation Gateway"?

The east segment has existing tourism destinations and recreational opportunities, with more planned for the future. These include the Enumclaw Golf Course, Enumclaw Expo Center (formerly King County fairgrounds), and the Enumclaw Welcome Center. In addition, a commercial and large residential development (Suntop Farms PUD) is planned within this segment. This area is on the route to Mount Rainier National Park and Crystal Mountain Ski Area with many seasonal pass-through travelers. This segment would have two travel lanes plus center planted medians/left-turn lanes, and sidewalks. A round-about is suggested for the new intersection serving as the main access to the proposed Suntop Farms PUD residential and commercial development on the south side of SR 410. Street lighting may consist of overhead lightings, as well as pedestrian fixtures where higher pedestrian traffic is anticipated, i.e. with new residential development, the future Welcome Center. Farm fencing could be used on the north side where there is a Farmlands Preservation area, and as part of the gateway landscaping features. Additional fencing could be placed in a figurative or artistic configuration at gateways.

Figure 29. Segment 3 – Example Cross-Section



Suntop Boulevard N (future) Intersection (M.P. 25.29)

Current Site Conditions

SR 410 is oriented west-east at this location. Channelization consists of one through-lane of traffic in each direction, with wide shoulders.

No intersection currently exists at this location, and the construction of a new intersection would be subject to the Suntop Farms development schedule.

Future Issues to Consider

Future development of Suntop Farms PUD is currently under consideration by property owners and developers south of SR 410, approximately mid-way between Watson Street N and Farman Street N. Future development will require establishing a new north-south urban collector (Suntop Boulevard N) that will tee into the south side of SR 410. Heavy future side-street traffic volumes competing against through traffic growth on SR 410 will require establishing future intersection control (traffic signal or round-about) for efficient and safe intersection operations and primary access to/from the PUD.

Intersection Priorities

Priorities established by the City of Enumclaw and developers for selection of concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Install intersection traffic control (traffic signal or round-about) to facilitate safe and efficient Suntop Boulevard N traffic operations.
- Facilitate circulation of commercial tractor-trailers, logging trucks, pickups and stock trailers.
- Facilitate vehicle turn-around for eastbound vehicles on SR 410.
- Introduce traffic calming measures to slow and "calm" vehicle traffic headed westbound into the Enumclaw commercial area (Segment 2).
- Provide opportunities for portal architectural "gateway" treatments and concepts announcing the westbound entry into the Enumclaw commercial area (Segment 2).

After reviewing both traffic signal and round-about concepts; City of Enumclaw, WSDOT officials, and developers have indicated that a round-about is the preferred future traffic control option for this location.

Concepts Developed

A future improvement concept is presented for consideration at this intersection and is represented on Figure 30. Special features and considerations include:

- Right-turn "slip-lane" for eastbound vehicles turning right onto Suntop Boulevard.
- Large radius single-lane round-about with inside truck "apron" for efficient circulation of truck/tractor and allowance for inside "trailer drag".
- Wide "splitter islands" and crosswalks allowing pedestrians to cross one lane of traffic in each direction with center refuge.
- *Advantages:* Provides safe and efficient traffic operations. Does not stop traffic. Controls traffic speed along SR 410 (traffic calming). Provides portal gateway/streetscape opportunity entering Enumclaw commercial area. Minimizes long term signal operations and maintenance cost.
- *Disadvantages:* Public non-familiarity with round-abouts.

Farman Street N Intersection (284th Avenue SE) (M.P. 25.64) and Enumclaw Welcome Center (M.P. 25.77)

Current Site Conditions

SR 410 is oriented west-east at these locations. Channelization consists of one through-lane of traffic in each direction, eastbound and westbound right-turn lanes (turning onto Farman), and eastbound and westbound left-turn lanes (turning onto Farman).

Farman Street is oriented north-south and tees into the north and south sides of SR 410. Both the northern and southern approach channelization consists of a single lane in each direction. There are no dedicated turn lanes.

All approaches to the intersection are traffic signal controlled.

Sidewalks surround the intersection, and marked crosswalks exist at all four intersection approaches.

The planned Enumclaw Welcome Center is located on the south side of SR 410 approximately 700 feet east of Farman Street N. The driveway entrance is planned to accommodate a “City-Bus” design vehicle.

Issues to Consider

North-south alignment across the intersection (along Farman Street) is currently non-standard. Vehicles traveling through the intersection must veer to the right a full lane width as they cross the intersection to avoid hitting oncoming vehicles.

Significant redevelopment of the Enumclaw Expo Center site south of the intersection is anticipated to occur, as well as future development of properties north of the intersection. As these developments occur, side-street traffic along Farman Street will increase both during peak periods and non-peak periods resulting from “event traffic” at the Enumclaw Expo Center.

As traffic increases along Farman Street N, the need for added right-and left-turn lanes accessing SR 410 westbound from Farman Street (north and south approaches respectively) are anticipated to facilitate efficient and safe side-street traffic operations.

Intersection Priorities

Priorities established by the City of Enumclaw for selection of improvement concepts presented at this intersection include:

- Maintain future-year (2030) level of service operations at D or better.
- Facilitate safe and efficient side-street ingress and egress on Farman Street N, considering the future Expo Center redevelopment.

Concepts Developed

Future improvement concepts which are presented for consideration at this intersection are represented on Figure 31. Special features and considerations include:

- Realignment of Farman Street approaching from both the north and south to facilitate safe through and dedicated turning movements. Realignment of the intersection will also help to avoid future “split-phasing” of the intersection to promote efficient traffic signal operations.
- Added right-and left-turn lanes accessing SR 410 westbound from Farman Street approaches north and south, respectively.
- *Advantages:* Maintains efficient traffic level-of-service along both SR 410 and Farman Street. Improves vehicle safety by re-alignment of the north-south through movements.

How will the improvements affect the transportation system?

The intersection and roadway operations were evaluated for each of the improvements to determine how they would affect the SR 410 corridor and intersections. The intersection delay as well as system wide operations were compared to the existing and baseline conditions to provide an understanding of the benefits the improvements would provide from a congestion and performance viewpoint.

Intersection Level of Service

Figure 32 provides a comparison of the intersection delays for the existing, baseline, and "average with improvement" conditions. The "average with improvements" provides an approximation of how intersection delays would be affected, on average, with the improvement options. At a majority of the intersections, delay would decrease significantly with the improvements. Large decreases of delay are observed along Segment 1 and smaller reductions in delay are observed in Segments 2 and 3. At 244th Avenue SE, Semanski Street S, Cole Street, and Roosevelt Avenue the chart shows that delay would be approximately 100 seconds per vehicle or more; however, the proposed improvements would reduce delay to less than 50 seconds per vehicle at all locations. This would translate into a decrease in delay of over 50 percent between 244th Avenue SE and Roosevelt Avenue.

Figure 32. Comparison of PM Peak Hour Intersection Delay

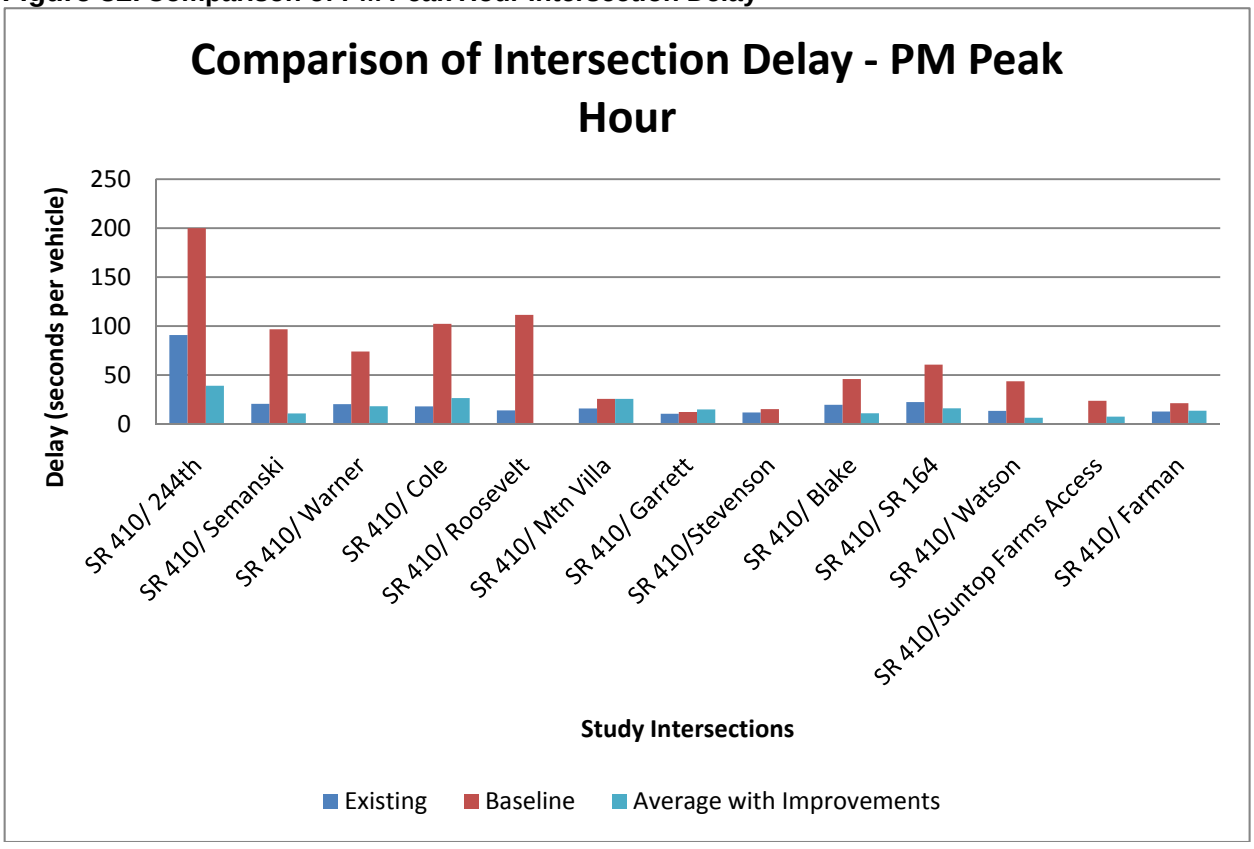


Table 10 provides a summary of the intersection LOS with each improvement option and a comparison to the existing and baseline conditions. As shown in the table, without improvements a majority of the study intersections would have poor operations with LOS E or worse. The proposed improvements would in most cases decrease delay significantly and improve operations to LOS D or better. Intersection operations would worsen at the Semanski Street S and Mountain Villa Drive/Monroe Avenue intersections with SR 410 due to lack of traffic control and increases in traffic volumes. However, although operations at these locations would worsen, intersections adjacent to these locations would improve providing for alternative routes and overall corridor improvements.

Table 10. 2030 With Improvements Weekday PM Peak Hour Intersection LOS Summary

		2009 Existing			2030 Future Baseline				2030 With Improvements		
ID	Intersection	LOS[1]	Delay[2]	V/C[3] or WM[4]	LOS	Delay	V/C or WM	Improvement Option	LOS	Delay	V/C or WM
1	SR 410/ 244th Avenue SE	F	90.9	SB	**F**	**>200**	**SB**	Traffic Signal	D	39	0.98
								Round-about	D	39	-
2	SR 410/ Semanski Street S	C	20.7	SB	**F**	**97**	**SB**	Restricted Movements	**F**	**97**	**SB**
								Realign Intersection	**F**	**>200**	**NB**
3	SR 410/ Warner Avenue (SE 456th St)	C	20.3	0.65	**E**	**74**	**1.02**	Widen Out Approaches	B	18	0.79
4	SR 410/ Cole Street	C	18.0	SB	**F**	**102**	**SB**	Round-about	C	26	-
								Round-about with Dickson Avenue Extension	C	28	-
5	SR 410/ Roosevelt Avenue	B	14.0	SB	**F**	**112**	**SB**	One-way westbound	NA	NA	NA
6	SR 410/ Mountain Villa Dr/Monroe Avenue	C	16.0	NBL	**F**	**>200**	**SB**	5 Lane Section	**F**	**113**	**NBL**
								4 Lane Section with Dickson Avenue Extension	**F**	**106**	**SB**
7	SR 410/ Garrett Street	B	10.6	0.37	B	12	0.60	5 Lane Section	B	15	0.53
8	SR 410/ Stevenson Avenue	B	11.8	SB	C	15	SB	5 Lane Section and Restricted Movements	B	12	SBR
9	SR 410/ Blake Street	C	19.7	NB	**E**	**46**	**NB**	5 Lane Section	**F**	**129**	**NB**
								5 Lane Section with Dickson Avenue	D	31	SBTL
								Relocate SR 164	B	16	0.54
10	SR 410/ Griffin Avenue (SR 164)	C	22.5	0.60	**E**	**61**	**0.98**	Traffic Signal	D	39	0.79
								Round-about	B	11	-
								Dual Traffic Signals	B	11	0.61
								Round-about with Dickson Avenue Extension	B	11	-
								Relocate SR 164	B	12	SBR
11	SR 410/ Watson Street N	B	13.5	NB	**E**	**44**	**NB**	Restricted Movements	B	12	SBR
								Dual Traffic Signals	B	19	0.78
								Restricted Movements w/Dickson Ave Ext	B	12	SBR
								Relocate SR 164	B	15	0.43
12	SR 410/ Farman Street N (284th Ave SE)	B	12.8	0.26	C	21	0.79	Traffic Signal	B	11	0.58
13	SR 410/ Suntop Boulevard N				A	8	-	Round-about	A	8	-

Source: Transpo Group, 2009.
Notes: NA = Not applicable, no delay since intersection would be uncontrolled.
BOLD indicates locations operating below LOS standard.
1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

System Operations

The existing and baseline system operations were compared to the average system operations with the improvements to understand the benefits the improvement concepts would provide. Figure 33 illustrates how the system would operate with the "best" improvement options or those improvements that have the most benefit. As shown in the chart, the best improvement options would decrease the total hours of delay along the system including an approximately 50 percent reduction in total hours of delay along Segment 1, 20 percent along Segment 2, 40 percent along Segment 3 for an overall study area improvement of approximately 40 percent.

Figure 33. Comparison of PM Peak Hour Systemwide Delay

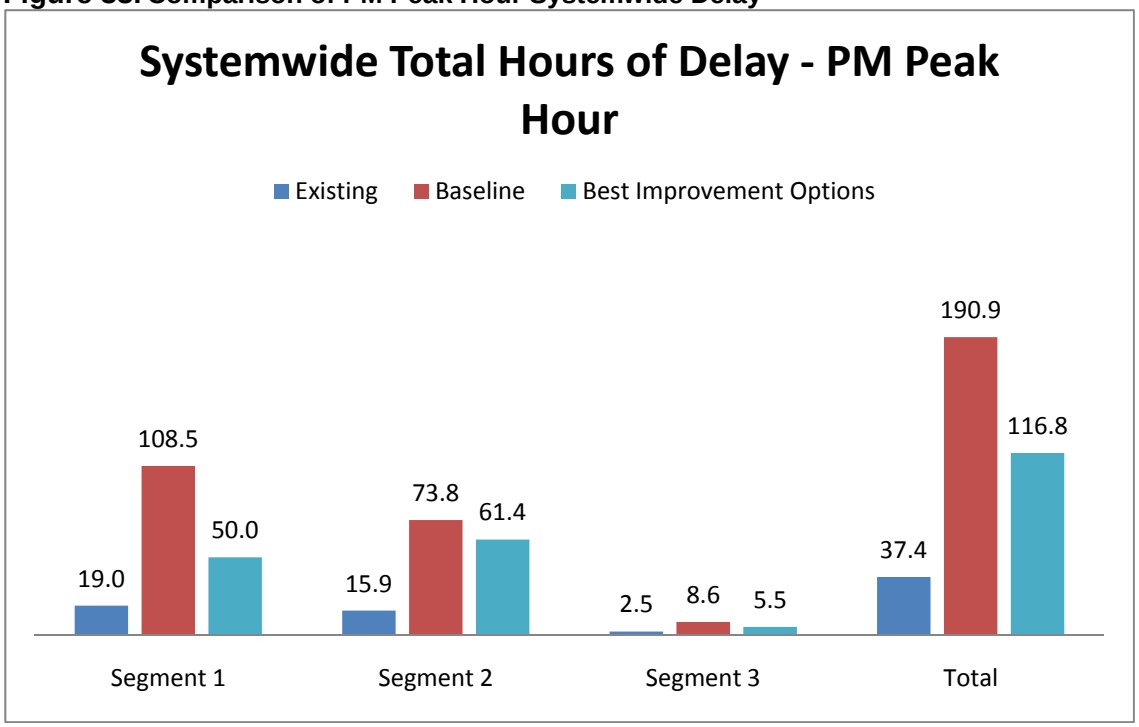


Table 11 provides a summary of the system operations for each segment and the full study area. As show in the table, the best improvement operation would reduce the total hours of delay along each of the segments and along the system as a whole. This is reflective of the intersection LOS where the best improvement would decrease delay significantly and improve intersection operations to LOS D or better. However, depending on the improvement option chosen, there would be varying levels of benefits. With the improvements that provide the least benefit, the overall system delay is still expected to decrease by 25 percent from baseline conditions.

Table 11. 2030 With Improvements PM Peak Hour System Operations

Segment	MP (limits)	Total Hours of Delay[1]		
		2009 Existing	2030 Baseline	2030 Best Improvement Options
Segment 1 – West	22.46 – 24.29	19.0	108.5	50.0
Segment 2 – Central	24.29 – 25.12	15.9	73.8	61.4
Segment 3 – East	25.12 – 25.82	2.5	8.6	5.5
Total		**37.4**	**190.9**	**116.8**

1. The delay (in seconds per vehicle) multiplied by the number of vehicles for each particular movement divided by the number of seconds per hour to provide a total hours of delay.

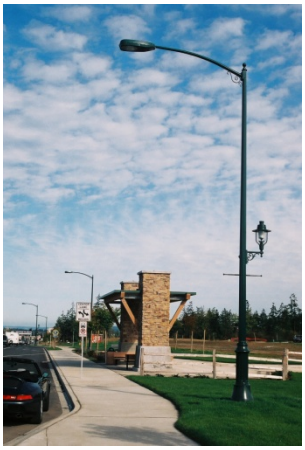
What is the Potential for Use of Low Impact Development Techniques?

The potential exists to use above ground low-impact development stormwater management techniques (LID) in the SR 410 right-of way, either in center-planted medians or in planting strips between the roadway and the sidewalk. This approach could benefit water quality and provide a visual amenity within the corridor.

What streetscape features will be incorporated into the design of the corridor?

Lighting

Both overhead roadway and pedestrian-scaled lighting can be incorporated into the corridor design as a visually unifying element, and for safety.



Overhead light poles would also have pedestrian-scaled lighting mounted on arms lower on the pole within the Central segment

Overhead Roadway Lighting

Overhead roadway lighting would likely be installed throughout the corridor with particular emphasis in Segment 2, at intersections, and high activity areas. WSDOT illumination standards would apply. Several factors may determine the appropriate spacing of overhead lights, including the height and type of luminaries, as well as the desired arrangement of light poles along the roadway, i.e. opposite, staggered, etc. In addition, spacing of overhead roadway lighting will depend on a photometric analysis to meet illumination standards within the segment. Light poles that are aligned directly across the street from each other (opposite arrangement) are more visually unifying, creating order within the streetscape. Additionally, opposite arrangement allows for spanning the street with banners or holiday lights. Light poles within Segment 2 and potentially at gateway points and at the future Enumclaw Welcome Center may also be equipped with banner and planter mounts. Stand alone banner poles may also be added at strategic points, separate from illumination needs.

Pedestrian-scaled Lighting

An example of a decorative pedestrian-scaled light installed in Downtown

Pedestrian-scaled lighting may be incorporated within Segments 2 and 3 in order to provide a safer walking environment while also creating a sense of order and a strong edge along the sidewalk. Pedestrian lighting may consist of stand alone, decorative pedestrian-scaled poles interspersed with overhead roadway lighting.

Overhead roadway light poles will also have pedestrian-scaled luminaires mounted on arms at the same height as the stand alone pedestrian lighting. The style of luminaire and poles (both overhead and stand alone poles) may be consistent with what has been used in previous projects within the Downtown, i.e. Cole Street. Light poles within Segment 2, and possibly other strategic locations, may also be equipped with banner and planter mounts.

Crossing Treatments

Special surface treatments may be utilized for pedestrian crossings within Segment 2 and at major intersections throughout the corridor, in order to draw special attention to locations where pedestrians are crossing SR 410. Such treatments may also add a character to the Commercial area, i.e. providing a unique and distinctive look. Potential surface treatments options may include a heat-stamped colorized asphalt treatment, inlaid thermoplastic, colored and/or stamped concrete, or conventional painted or thermoplastic treatments in a traverse pattern (two 12" wide parallel lines) or zebra pattern. Criteria for choosing an appropriate treatment may include balancing factors such as ease of installation, durability and ability to repair damaged areas without having to replace entire treatment, and versatility in terms of color and design. All special crosswalk surface treatments would have a traverse pattern defining both the outer edge of the crossing area and where vehicles are to stop or yield. In addition, in some areas it may be appropriate to install an advanced yield lines to provide sight distance and keep vehicles from encroaching on the crosswalk area.

Zebra pattern crosswalk.

DuraTherm®, an inlaid thermoplastic crosswalk treatment.

Stamped concrete with traverse pattern defining the crosswalk edge, and an advanced vehicle stop bar.

StreetPrintXD®, a heat-stamped, colorized asphalt treatment.

Street Trees and Landscaping

Street trees and landscaping planting areas provide a visually unifying element and help define the character and scale of the street environment. These elements help soften and buffer the impact of roadways, parking lots, and other adjacent uses by adding color, texture and visual variety along the corridor. Trees may be incorporated along both sides of the roadway. Trees can be planted in a more formal arrangement within Segment 2 to help unify the overall design, create a distinctive "identity" for the City, and enhance the pedestrian environment.

Visibility of Adjacent Businesses

Trees can be selected and located as a unifying element while also balancing visibility to businesses. Appropriate tree selection will consider a number of factors that affect visibility through street tree and landscape planting areas, such as the overall tree form, tree spacing, tree branching height, leafing pattern, and mature height of shrub and groundcover planting.

Street trees should be located to allow visibility to adjacent businesses.

Responding to Existing and Future Infrastructure

Street tree locations will need to be located to respond to existing and future infrastructure along the SR 410 corridor, such as existing utilities, lighting, overhead power lines, driveway locations and adjacent uses. In particular, the overhead power lines on the south side of the corridor will need to be accommodated by planting tree species that respond well to periodic pruning and training.

Farm Fencing

Farm fencing may be provided at targeted locations along the corridor as a unifying element that plays on the City's agricultural and equestrian heritage. Potential locations for farm fencing include Veteran Memorial Park and where there are currently agricultural land uses adjacent to the SR 410 corridor in Segments 1 and 3. Such fencing can enhance the corridor users' experience as well.

Tourism Signage and Wayfinding

The City is currently developing a tourism signage and wayfinding system that would be integrated with the City's identity theme. Signage may be incorporated throughout the corridor as a unifying element that also serves to highlight local attractions and events. Signs may be located at key entry points and event or decorative seasonal banners may be added to light poles.

How will pedestrian safety be addressed?

Signage

Sign that indicates specific location of pedestrian crossing.

Sign that indicates frequent pedestrian crossing within a specified area.

A system of distinct signage that indicates the presence of pedestrians and draws attention to designated pedestrian crossings of SR 410 is recommended as part of any roadway improvements. The signage system should generally comply with MUTCD guidelines and likely consist of layers of signage, including signs that generally indicate the presence of pedestrian crossings within a given distance, i.e. text that says "ahead " or" next 3 blocks", approach signs placed a given distance away from crosswalks at unsignalized crossings, and signs placed directly adjacent to crosswalks, indicating the specific place where pedestrians are required to cross the street. These latter signs may also be accompanied with arrows that point downward at the crosswalk. Signage will likely be more frequent within the Segment 2 (Commercial area) where pedestrian crossing activity is highest.

Pedestrian Crossings at Signalized Intersections

All signalized pedestrian crossings would likely consist of a traverse pattern (two one-foot wide parallel lines painted or thermoplastic) defining the edge of the crosswalk area. These lines are a minimum 10 feet apart within Segment 2, and may be 6 to 8 feet apart within the West or East segments. Specialized pavement treatment can be utilized as a unifying character element and to call special attention to pedestrians. See crossing treatments section above. Pedestrian refuge areas can be incorporated where there is a median within the Central segment. The minimum width for pedestrian refuge areas is 6 feet, but should match the width of the crosswalk area whenever possible. ADA-compliant curb ramps should be placed at all corners of all intersections where sidewalks are present. Countdown pedestrian and audible signals may be installed at all signalized intersections.

A traverse pattern is painted on the street to define the edge of this special crosswalk treatment.

Pedestrian Crossings at Unsignalized Intersections

Multiple approach signs may be used to indicate pedestrian crossing activity, particularly for unsignalized intersections

Pedestrian crossings at unsignalized intersections should be minimized and limited to round-abouts and one other intersection location within the corridor. Specifically, the latter is recommended to be placed within Segment 2 at Mountain Villa Drive / Monroe Avenue where a significant amount of pedestrian crossing activity occurs between the QFC grocery store and other retail uses, and a high density residential mobile home development approximately one-third of a mile to the south at Dickson Avenue. This housing development serves a significant elderly population who frequently walk across SR 410 to the QFC. The proposed crosswalk location would be approximately 800 feet from the nearest crossing, which is to the east at Garrett Street. This crossing should have similar crosswalk treatment to other pedestrian crossings within Segment 2, but would likely also incorporate an advanced stop line placed in accordance with the MUTCD to provide for adequate sight and stopping distance. Vehicles would be expected to stop at the stop line when pedestrians are visible at the crosswalk. In addition, a "look" stencil with arrows pointing in both directions of the roadway may be incorporated into the crosswalk so that it is visible as pedestrians descend the curb ramp, reminding and encouraging them to look both ways before proceeding. Pedestrian crossing signage with pedestrian-activated flashers or beacons may be placed in the vicinity of the state route crossing location. In addition, advanced warning signage that indicates a pedestrian crossing ahead should be placed prior to the actual crossing location.

Pedestrian crossings at round-abouts will consist of yield lines, marked crosswalks and refuge islands. Crosswalk treatments will be similar to what is described above, and may include "look" stencils in each leg of the crossing, i.e. from roadway edge and from pedestrian refuge.

An advanced stop line may be installed at unsignalized crosswalks to provide for adequate stopping and sight distance.

A "look" stencil may be incorporated into the crosswalk to encourage pedestrians to look both ways, particularly at unsignalized intersections.

A pedestrian crossing sign with flashers.

How much would the improvements cost?

Planning level project cost estimates have been prepared for each of the improvement concepts at Cole Street and Griffin Avenue (SR 164) intersections. These locations were identified by City staff and City Council as high priorities locations for improvement. The City intends to pursue funding at these locations through state and federal grant programs as well as through developer contributions or mitigations. The project cost estimates will assist the City in developing an overall funding strategy for the improvements.

The project cost estimates take into consideration items such as illumination, signage, curb/gutter, storm drain, water treatment facilities, curb ramps, landscaping, traffic control, pedestrian amenities, roadway widening/realignment, right-of-way, and design and construction engineering. The cost estimates are provided in Appendix D.

The Cole Street round-about is estimated to cost approximately $2.7 million. If Dickson Avenue is extended and improved to Cole Street, it is estimated to add another $1.7 million to the total cost.

Improvements to Griffin Avenue (SR 164) and Watson Street N range in cost from $2.6 to $4.6 million depending on the alternative. Completion of the surrounding local street system such as Dickson Avenue or Rainier Avenue could add another $0.8 to $1.8 million to the total project cost.

The planning level cost estimates will need to be updated and refined as the designs are finalized.

What are the key outcomes from the improvement concepts?

Below is a brief summary of the key outcomes of the improvement summary:

- In many locations, there are several improvement options to choose from. The preferred option for specific locations or segments of the corridor should be identified with additional engineering design, environmental analysis, and public outreach as funding becomes available.

- There are advantages and disadvantages to most, if not all, the improvement concepts that were identified. The various concepts developed for specific locations should be carefully examined as they move forward to identify those project components of highest priority by the community.

- Improvements along Segment 1 primarily focus on intersection treatments and traffic control. The location with the greatest need for improvement along this segment is the intersection of 244th Avenue SE. Traffic signal warrants have been met today and two possible improvement concepts have been developed for consideration. One concept includes a traffic signal and the other a round-about.

- There are a number of improvement concepts for Segment 2 that can be phased in over time as development occurs or as funding is available. The corridor is recommended to be widened to five lanes along the majority of this segment, with significant intersection improvements needed at Cole Street and Griffin Avenue. The improvements to the SR 410 corridor should be complemented with improved local street connectivity such as completion of Dickson Avenue. Many of the concepts integrate both corridor and local street improvements to address operations, safety, and connectivity issues along this segment.

- Many of the improvements along Segment 3 will be tied to the Suntop Farms PUD, such as a new round-about at the intersection with Suntop Bouelvard N. Other improvements include the Enumclaw Welcome Center and modifications to the intersection with Farman Street N. Improved channelization between Suntop Farms PUD and Farman Street N is likely a low cost solution that could be implemented soon to improve safety and access to adjoining properties.

- Intersection, corridor, and system analyses were completed to understand how the concepts would perform. The results indicate the improvement concepts will improve safety along the corridor, reduce overall system delay, and meet City and WSDOT LOS standards.

- The concepts throughout the corridor are consistent with the specific urban design strategies and typical roadway cross-sections identified for each segment. The concepts incorporate other important design criteria such as landscaping, pedestrian facilities, crossings, signing, and lighting.

Environmental Considerations

This section provides an overview of the type of environmental review, expected permits related to environmental conditions, and potential environmental constraints associated with design and permitting of the improvement concepts.

The preliminary design concepts show typical cross sections and plan view drawings of the improvements. The concepts provide a significant improvement to transportation efficiency and safety, non-motorized transportation, recreational opportunities, and visual/aesthetic conditions. They also include considerable opportunities to provide environmental benefits related to stormwater and compatibility of the roadway with adjacent land uses. Improvements to stormwater storage and drainage could also have potentially positive impacts on localized flooding.

What type of environmental review may be required?

Review under the State Environmental Policy Act (SEPA) and potentially the National Environmental Policy Act (NEPA) will apply to SR 410 improvements once they proceed to the permitting stage. Because the improvements will occur primarily within the existing state route right-of-way (ROW), which is predominantly a previously disturbed area, it is not expected that there would be potential for significant, adverse impacts that could not be mitigated. Therefore, the appropriate SEPA review would likely be a SEPA Checklist supporting a DNS or MDNS threshold determination. Because the City of Enumclaw is the proponent, it would most likely be the SEPA lead agency; however if WSDOT and/or the County share in implementation of the proposal, the agencies will need to determine which one will serve as the lead agency (WAC 197-11-926). While not required by SEPA, given that other agencies will have jurisdiction over portions of the project, it is suggested that the City circulate the SEPA Checklist for agency comment before issuing a threshold determination (WAC 197-11-335), particularly since local area Tribes may want to comment.

WSDOT's Local Agency Guidelines (LAG) Manual provides policies and standards for local agencies to follow when using Federal Highway Administration (FHWA) funds for transportation projects. NEPA review would be required if the project includes federal funding or other federal action. Federal funding would be administered through WSDOT's Highways and Local Programs Office, which would also review the required NEPA environmental documents. Procedures for NEPA compliance are included in the WSDOT Environmental Procedures Manual (http://www.wsdot.wa.gov/Publications/Manuals/M31-11.htm). If review under NEPA is required, it is expected that the appropriate NEPA document would be an Environmental Classification Summary (ECS) with a Documented Categorical Exclusion (DCE). The DCE would be supported by reports documenting effects of the project on elements of the environment for which there is a potential for significant impact (such as a Surface Water report, or a Wetlands Report if impacts to wetlands are expected). A DCE may be used if these reports demonstrate lack of a significant impact.

The City of Enumclaw's Critical Area Regulations (Enumclaw Municipal Code [EMC] Chapter 19.02) address standards and required mitigation for land use activities in frequently flooded areas, geologically hazardous areas, aquifer recharge areas, wetlands, streams and watercourses, and fish and wildlife conservation areas (EMC 19.02.050). Pedestrian trails in critical areas, except in wetlands, are exempt from the need for a Critical Areas Permit if they meet certain criteria per EMC 19.02.020(B). Other potentially applicable regulations (related to alteration of streams and wetlands) include the Federal Clean Water Act, for which related permits are implemented at the Federal level by the US Army Corps of Engineers, and at the State level by the Washington State Department of Ecology (WSDOE) and State regulations regarding habitat for priority species. Further, the Washington State Shoreline Management Act (SMA; WAC 173-18 and WAC 173-20) would apply to portions of the project. It is not clear how the SMA is currently locally implemented, prior to City adoption of a Shoreline Master Program (SMP), which is in progress. At the time an improvement is ready for permitting, it is expected the SMA will be implemented locally by City of Enumclaw. The City's SMP will apply to shoreline jurisdiction areas within the City and its UGA.

What types of permits related to environmental conditions may be required?

The following permits related to environmental conditions may potentially be required for the project, depending on the actual design, confirmation of the types of wetlands that may be affected, and the project's degree of impact:

- City of Enumclaw Critical Area Permit(s) if streams or wetlands, their buffer areas are to be altered. Within buffers, this would not apply if proposed alterations are located only in previously disturbed areas.
- If the project design involves wetland or stream alteration, it is recommended that both the Corps of Engineers and Washington DOE should be contacted regarding the possible need for permits. Permits may include a Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife (WDFW) and/or a Section 404 permit from the Corps.
- City of Enumclaw Shoreline Use Permit. Because the City's shoreline designations and associated regulations do not yet exist, it is unclear what the permit process will be.
- National Pollution Discharge Elimination System (NPDES) Construction Permit from WSDOE.

In addition to the above environmental permits, a variety of permits may be required by WSDOT, such as for utilities within the ROW. WSDOT has an established set of procedures for permitting roadway projects with State jurisdiction. However, this summary addresses potential environmental issues rather than general permitting issues.

What are the potential environmental constraints?

This section provides an overview of potential environmental constraints associated with the project. It is not intended to be a definitive list of impacts, but rather to bring to light issues that may require further investigation during design development and permitting. Elements of the environment that are typically included in SEPA and NEPA review provided the context for this review. However, not all elements are discussed because of their limited potential for negative impacts due to the project location and existing conditions.

The review was conducted based on existing maps and documents provided by the City or available on the City's website. The City's Draft Characterization Report that is part of development of its SMP, published in July 2008, contained a number of maps that were used in this summary. The study was also based on maps, documents and data available online from the United States Department of Agriculture (USDA) Soils Survey, Washington State Department of Archaeology and Historic Preservation (DAHP) and WSDOE. The final Characterization Report was published in January 2010.

It should be noted that most of the improvement concepts will take place within existing ROW, and so will not directly affect property that has not previously been identified as part of the corridor.

Wetlands

The City of Enumclaw Wetland Inventory Map (1998) is an advisory map showing the following potential wetlands in the immediate project vicinity. The wetlands have not been delineated or rated.

- Segment 1
    - Middle White River Wetlands 7, 10, 11 and 12 appear to abut the northwest side of the ROW, but are generally just outside of Segment 1, and it appears that only Wetland 10 abuts the ROW within Segment 1. Wetlands 6, 8 and 9 are located in the same general area but further from the ROW and project boundary. Due to the shape of Wetlands 10-12 on the map, they may have been disturbed in the past by construction within the SR 410 ROW.

  - Boise Creek Wetland 8 appears to abut the northwest side of the ROW in Segment 1. Due to the wetland's shape, it may have been disturbed in the past by construction in the ROW.

- Segment 2
  - Boise Creek Wetland 2A is located south of the ROW, and would not likely be affected due to its distance from the ROW.
  - Boise Creek Wetland 1 appears to abut the south side of the ROW. Due to the wetland's shape, it may have been disturbed in the past by construction in the ROW.
  - Upper Newaukum Creek Wetland 26 is a large wetland that appears to abut the north side of the ROW. Due to the wetland's shape, its southern edge may have been disturbed in the past by construction in the ROW.
- Segment 3
  - Upper Newaukum Creek Wetland 31 is located north of the ROW, and would not likely be affected due to its distance from the ROW.

Delineation and rating of wetlands that appear to abut the ROW would be needed if the project would disturb any of these wetlands or would create new disturbed areas within their buffers (see EMC 19.02.090(C)) for wetland buffer widths associated with the various wetland ratings). Wetland ratings would be needed to determine the required buffer and applicable regulations. EMC Chapter 19.20 Critical Areas Regulations calls for no net loss of wetland function and value, but allows for alteration of low function and value wetland areas in conjunction with off-site mitigation. Wetland delineation and rating would also determine whether the Corps of Engineers and WSDOE have jurisdiction. The wetland study, if needed, should also address regulatory compliance and mitigation.

Hydraulic Project Approval (HPA) from WDFW may be required if alteration of a wetland adjacent to a stream is to occur.

A Section 404 permit from the Corps of Engineers could be required if disturbance to a wetland or its buffer is proposed, if the wetland is a "jurisdictional wetland." Typically, a jurisdictional wetland has a hydrological connection to navigable waters.

Wetlands Conclusion: Further investigation, and potentially local and federal permits and mitigation, may be required if an improvement alters a wetland or a currently undisturbed area within a wetland buffer.

Streams

Boise Creek is located in the vicinity of Segment 1. It is a Shoreline of the State (see Land and Shoreline Use below) and contains a number of fish species (see Habitat Areas and Fish in Boise Creek below). With perennial flow and the presence of fish, Boise Creek would likely be considered a Department of Natural Resources (DNR) Water Type F under EMC Section 19.02.100, requiring a 75-foot-wide buffer. The SR-410 ROW is more than 75' from the creek; therefore, it is not expected that the project would directly affect the creek or its buffer.

According to the Suntop Farms Wetland and Stream Analysis Report by ABPB Consulting, LLC, October 2004 (Suntop Report), there is a ditched stream running north toward SR 410 from within the Suntop Farms property, which is located south of SR 410 in Segment 2. The source of this ditched stream is overflow from a spring on the Suntop Farms property (water from the spring has been historically used for irrigation on the farm). According to the Suntop Report, this ditched stream acts as the headwater for Clear Creek. The Suntop Report considers the spring-ditch a Type 3 water under the EMC, requiring a 50' buffer; however, it appears the EMC code section defining stream and watercourse types was revised subsequent to the 2004 Suntop Report. Type 3 has been revised to Type F for fish-bearing streams with

intermittent flow, and requires a 75' buffer. The distance from SR 410 will need to be confirmed to ensure that the project does not affect the buffer.

Additionally, there are ditches in, adjacent to, or crossing the ROW in all three project segments. Further investigation is needed to determine whether any of these ditches would be regulated as streams and subject to EMC Section 19.02.100, including determining their stream classification and buffer width requirement.

Hydraulic Project Approval (HPA) from WDFW may be required if alteration of a "water of the State," including streams, is to occur.

Streams Conclusion: Ditches may need to be evaluated in all project segments to determine whether they are regulated under EMC Section 19.02.100, and the distance from the SR 410 will need to be confirmed to ensure that improvements do not affect the buffer of the Type 3 stream near Segment 2. A HPA permit may be required for alteration of a regulated stream.

Flood Plains

Portions of the ROW in Segment 1 are within the 100 year flood plain associated with Boise Creek, as identified on the City's Comprehensive Plan Frequently Flooded Areas Map (June 2005) and on the City's SMP update mapping. Flood plains are considered critical areas under EMC Chapter 19.02 Critical Areas Regulations, and requirements in EMC Section 19.02.190(A) Special Flood Hazard Areas will apply.

Flood Plains Conclusion: Issues related to construction in flood plain are expected to be addressed through engineering design for the roadway and utilities.

Erosion

While the City's Comprehensive Plan Geologically Hazardous Areas Map (June 2005) does not show Erosion Hazard Areas within the project area, erosion is a potential construction hazard. Additionally, soil types in Segment 3 point to some potential erosion hazard risk. The King County soils map for Enumclaw from (King County Soil Survey Soil Conservation Service, USDA, in cooperation with the Washington Agricultural Experiment Station, published in 1973) shows that area soils in the eastern portion of Segment 3 include some areas of Everett Gravelly Sandy Loam with 5 to 15 percent slopes (EvC). EvC soils have a slight to moderate erosion hazard risk. The potential for erosion should be considered in this area, and if it is determined that actual conditions could be considered an Erosion Hazard Area under EMC Chapter 19.02, construction in this area will need to include appropriate mitigation as defined in EMC Sections 19.02.230 – 19.02.270. Soils in Segments 1 and 2 have at most a slight erosion hazard risk.

Erosion Conclusion: The potential for erosion should be considered Segment 3, and appropriate mitigation as defined in EMC Sections 19.02.230 – 19.02.270 could be required.

Other Geologic Hazard Areas

The project is located within a Seismic Hazard Area according to Comprehensive Plan Geologically Hazardous Areas Map (June 2005).

Other Geologic Hazard Areas Conclusion: Roadway engineering design would address seismic hazard potential.

Stormwater / Water Quality and Quantity

The City has adopted the Washington Department of Ecology 2005 Western Washington Stormwater Manual (2005 Manual) and any amendments to the 2005 Manual (EMC Section 14.10.070). Additionally, the City will be forming a stormwater utility to comply with the National Pollution Discharge Elimination System (NPDES) Phase 2 permitting requirements. Stormwater management, for both quality and flow

control, will need to be in accordance with the City's stormwater regulations, currently the DOE 2005 Manual.

The SMP Update Characterization Report maps (Figure 23) shows Segment 1 containing priority areas for stormwater treatment, wetland creation and/or stormwater rerouting; stream realignment, reconnection to floodplain, and/or creation of side channels; and protection and conservation. Areas near Segment 1 are shown as priority areas for hydrologic rehabilitation (filling of ditches and wetland rehabilitation). The Segment 3 segment between the two Newaukum Creek wetlands is shown as a priority area for hydrologic rehabilitation (filling of ditches and wetland rehabilitation); and stream realignment, reconnection to floodplain, and/or creation of side channels.

Stormwater / Water Quality and Quantity Conclusion: Stormwater management, for both quality and flow control, will need to be in accordance with the 2005 Manual.

Habitat Areas and Fisheries

Boise Creek, which is in the vicinity of Segment 1, is known to support a number of priority fish species, including Chinook Salmon, Coast Resident Cutthroat, Coho Salmon, Pink Salmon, Rainbow Trout, Sockeye, and Steelhead Trout, according to the City's SMP Update Draft Characterization Report (Figure 18). Chinook Salmon are listed as a federal endangered species. Several of the species supported by Boise Creek are also listed as priority species by WDFW. If work were to occur in this area, it would need to comply with EMC Chapter 19.02 Critical Areas Regulations. However, as stated above, no alterations are proposed in Boise Creek or its buffer.

A Section 404 permit from the Corps of Engineers could be required if work is to occur in an area that has been or has the potential to be designated as a fish and wildlife habitat conversation area (EMC 19.02.190(D) Wetlands Development Standards). The City's Comprehensive Plan Habitat Map (Figure 11.2, June 2005) shows an area of wildlife habitat in Segment 1 that should be further investigated.

Habitat and Fisheries Conclusion: Further investigation is needed regarding the City-identified habitat area Segment 1.

Hazardous Materials

A review of current hazardous sites on the Washington Department of Ecology February 2009 Hazardous Sites List (accessed online, February 19, 2009) showed no sites in the project area or immediate vicinity. Sites on the list have undergone a Site Hazard Assessment study and been ranked by WSDOE. Identified sites are primarily located in Downtown Enumclaw. There is potential that hazardous sites or underground storage tanks could be encountered during construction; however, that potential is very low. If any such sites are identified within the project area prior to permitting or found during construction, applicable federal, state and local regulations would apply.

Hazardous Materials Conclusion: Prior to permitting, a review of the current WSDOE Hazardous Sites List should be conducted, and land uses directly adjacent to areas affected by project construction that have potential for discovery of hazardous materials should be identified.

Land and Shoreline Use

Because many of the improvements will occur within existing ROW and will not change any existing uses, land use compatibility is not expected to be a significant issue. The project includes different designs for the three segments. These designs are based on the character of the segments and types of land uses adjacent to the roadway in those areas. Potentially sensitive uses adjacent to the project area include some existing residential uses in Segment 1. The future residential development adjacent to Segment 3 (Suntop Farm) is being planned with commercial uses and stormwater facilities abutting the roadway. Other adjacent existing and planned uses are primarily commercial, light industrial and public institutional (Boise Creek corridor which is in recreational use). It should be noted that the project is consistent with

the Puget Sound Regional Council's (PSRC) Rural Town Centers and Corridors program as discussed in VISION 2040, and WSDOT's directive calling for context sensitive solutions.

Noise is one component of land use compatibility that could become an issue if traffic volumes were to increase. The project would increase capacity in Segment 2, but not in Segments 1 or 3; however, it would also include traffic calming in Segment 2, which would reduce vehicle speeds in Segment 2 and could also result in reduced vehicle noise. Proposed street trees and landscaping would also somewhat reduce noise from vehicles using SR 410 compared to the existing condition. Therefore noise is not expected to be a significant issue.

There are no lands identified for agricultural and forest resource use abutting the project area, so pressure to convert such land uses to more urban uses is not a concern associated with the project. According to the Comprehensive Plan Natural Resource Lands Map (June 2005), there is prime farmland located outside the UGA to the southeast of Segment 1, but due to its location outside the UGA and the project's treatment of Segment 1 as a more rural/agricultural area, pressure to convert is not likely to be an issue.

Requirements related to the Shoreline Management Act (SMA) and the locally adopted Shoreline Master Program (SMP) that implements the SMA will need to be considered because several portions of the project area are within the shoreline jurisdiction area. The shoreline jurisdiction applies within 200 feet (ft) landward of the ordinary high water mark (OHWM) of shorelines of the state and associated wetlands. It is not clear how the shoreline jurisdiction area is currently regulated. The City is in the process of developing its first Shoreline Master Program. By the time permitting occurs, the City is expected to have an adopted SMP. The Final adopted version of the SMP is expected by June 30, 2010.

Shoreline jurisdiction areas relevant to the project are:

- A portion of Segment 1 (south of Warner Avenue) is located within the shoreline jurisdiction area for Boise Creek. Since this area is within the UGA, the designation that currently applies is King County's Rural shoreline designation.
- The shoreline jurisdiction area associated with wetlands associated with Newaukum creek that appear to abut the ROW in Segment 2 includes portions of the Segment 2 ROW.

In the City's SMP Update Characterization Report Maps, shoreline jurisdiction areas associated with Boise Creek are shown as Shoreline Management Zone (SMZ) Area 3, and with Newaukum Creek as SMZ Area 1. These areas will be subject to the City's future adopted shoreline designation. The areas along the Enumclaw Foothills Trail, east and west of SR 410 and also near the future Suntop Farms Phase 3 (future PUD) will also be part of the designation.

Land and Shoreline Use Conclusion: Land use impacts such as incompatibilities, pressure to convert rural areas, or noise effects on sensitive uses are not likely to be an issue; however, a Shoreline Use Permit may be required.

Historic and Cultural Resources

A review of historic places on the DAHP online database on February 19, 2009 showed no identified historic sites in the project area or immediate vicinity. Identified historic sites in Enumclaw are primarily located within Downtown Enumclaw. There could be potential for unearthing cultural resources; however, due to the location of the project within previously disturbed areas, this potential is expected to be none to slight.

Historic and Cultural Resources Conclusion: No impacts expected; however, as part of environmental review, it is suggested that the City consult with area tribes and DAHP to confirm that no cultural resources are known to exist in areas that will be altered.

Recreation

Parks located near the ROW include: Veteran's Triangle Park, Scott Park, Veteran's Memorial Park, and Enumclaw Park/County Fairgrounds. It is possible concepts at the Cole Street intersection may require portions of the Triangle Park.

The City's Official Trails Plan Map (June 2008) shows the following in the project area:

- Boise Creek Trail along SR 410 corridor through Segment 1 up to approximately Garrett Street in Segment 2, where the trail crosses the roadway and turns north to connect with Garrett Street.
- A possible bikeway along SR 410 from near Garrett Street in Segment 2 to beyond the eastern project boundary.
- An extension of the possible bikeway from SR 410 northwest along SR 164 (in Segment 2), where crossings will need to be considered.

Recreation Conclusion: The improvements present opportunities to improve trail connections, aesthetics, stormwater, and both safety and comfort of non-motorized travelers. The project also presents opportunities for improved connections between recreational resources. While this may increase use of some resources, overall benefits would likely be positive.

Traffic and Non-Motorized Transportation

The main concerns are safety, particularly for non-motorized travelers but also for vehicles, and traffic operations. In Segment 2, the project would restrict access to some unsignalized intersections of local streets with SR 410. This would somewhat reduce connectivity in the area; however, overall improvements in efficiency and connectivity would occur with the project, in particular non-motorized connectivity.

The City's operational standard for intersections is LOS D for signalized and LOS E for unsignalized intersections. Based on the assessment of existing and future conditions, the identified improvement concepts will address all safety and operational issues. However, without improvements, future conditions will continue to worsen along the corridor as summarized in the future corridor needs assessment.

Non-motorized safety and comfort are important considerations, both because of City goals and because the roadway is part of a designated bicycling route in the King County Bicycling Guidemap (2006).

The improvement concepts take these issues into account, and seek to considerably improve conditions for non-motorized travel. In addition to safety improvements, improved conditions for non-motorized travel will include pedestrian comfort and other features to make walking and biking in the corridor more attractive, and to enhance non-motorized connections. While transportation impacts will need to be considered, this overview does not anticipate they will be a topic of significant negative effect.

Traffic and Non-Motorized Transportation Conclusion: Impacts to transportation are expected to be positive.

Air Quality

Air quality associated with road projects is generally related to 1) short-term construction, and 2) changes to traffic volumes and operations resulting from the project. Short term area quality effects are expected with any construction project. For long term effects, while there may be increases in traffic volumes in the corridor, idling associated with intersection delays generally is a larger issue than overall traffic volumes. However, the concepts significantly reduce system delays and would are not expected to contribute negatively to air quality. Further, round-abouts and other traffic control features are expected to help offset air quality impacts from traffic, and improvements to non-motorized facilities would also help to reduce potential emissions.

Air Quality Conclusion: Negative impacts are not expected.

Climate Change and Greenhouse Gases

WSDOE is currently working to determine how review of climate change issues will be implemented as part of SEPA review. The project would also improve conditions for non-motorized travel, which would help to reduce greenhouse gas emissions, if these improvements result in an increase in non-motorized trips and a corresponding decrease (or lesser increase) in the number of motorized trips.

Climate Change and Greenhouse Gases Conclusion: If WSDOE has guidelines for analysis in place at the time of project design and permitting, such guidelines should be followed.

Environmental Justice

This topic is identified under NEPA. It includes assessment of whether the project would negatively affect concentrations of low income or minority residents, through issues such as noise or other land use incompatibilities, pressure for land use conversion affecting minority of low income areas, reduced access to recreation and other services and destinations because of changes to transportation connections and/or safety, and aesthetic impacts.

Environmental justice impacts are unlikely to occur or be significant because:

- The wide existing ROW means limited need for construction outside the ROW;
- The improvements primarily affect non-residential areas;
- The improvements would enhance non-motorized connections;
- The improvements would result in both vehicular and non-motorized safety enhancements; and
- The improvements would not be expected to generate significant change in noise, land use incompatibilities or pressure for conversion of land in areas of concentrated poor or minority populations.

Environmental Justice Conclusion: No significant environmental justice impacts are expected.

Utilities

It is expected that the project may involve some relocation of utilities within the ROW. Further investigation will be needed to determine how the existing location of utilities would be affected by the proposed improvements to each segment of the corridor, and the degree of utility relocation that could be required.

Impacts to water and sewer demand and capacity would not be expected from the proposed improvements; road widening in and of itself would not increase the need for utilities other than stormwater facilities as described above in this document.

Utilities Conclusion: Relocation of utilities and associated permitting is likely. Further investigation is needed to determine the degree of relocation needed.

What elements have the potential for negative environmental impacts?

This section provides a list of the elements of the environment that could potentially be negatively affected by the improvements, based on the above summary of available information. Again, it is not intended to be a definitive list, but rather to serve as a guide for further investigation during design development and permitting. Areas with expected positive impacts or elements for which mitigation is built into the proposed design are not listed below.

Based on preliminary review of the available environmental information and the improvement concepts, the following environmental elements should be further evaluated during design development and permitting for potential negative impacts. The degree of potential impact is also shown.

- Wetlands and Streams: minimal to low potential to negatively affect wetlands; somewhat greater potential to affect streams. High potential to affect ditched watercourses, with further investigation needed to determine whether these will be regulated as streams.
- Stormwater Management / Water Quality and Quantity: analysis to comply with the 2005 Manual will be needed; potential impacts would be addressed through project design.
- Potential Construction-Related Erosion: minimal to low potential for impact.
- Habitat Areas, including Fish in Boise Creek: low potential for impact in a limited area within Segment 1.

What design opportunities should be considered to mitigate potential impacts?

The improvement concepts present many opportunities to address potential environmental issues through design, to provide positive impacts, and/or to considerably minimize/mitigate impacts. It is expected that environmental constraints that cannot be effectively mitigated will be limited. Potential opportunities to benefit the environment are summarized below.

- Opportunities to improve traffic operations and safety for vehicles and non-motorized travel.
- Opportunities to provide stormwater management facilities where they do not currently exist, and to address potential water quality and erosion issues with stormwater storage in the ROW through Low Impact Development (LID) techniques. LID stormwater facilities could potentially be integrated with medians and pedestrian elements.
- Opportunities to provide clear pedestrian and vehicle connections between recreational resources and other destinations, and to improve an existing trail.
- Where there may be potential for wetland and/or stream impacts, there would likely be opportunities for off-site mitigation that would provide benefits to area wetland and/or stream conditions.

Recommended Next Steps

The SR 410 Corridor Study identifies improvements along the corridor to increase safety, alleviate traffic congestion, enhance local circulation and access patterns, and expand existing non-motorized facilities. The improvements are intended to be implemented over time, as development occurs, and as funding becomes available. Below is a list of the recommended next steps the City should follow in order to implement the projects identified in the study.

- Integrate the findings of the study into the next update of the Comprehensive Plan. The long-term project list within the Transportation Element should be reflective of the improvements identified in the corridor study.
- Integrate improvements into the annual update of the City's six-year transportation improvement program as funding or other opportunities arise.
- Work with King County, WSDOT, and PSRC to integrate the improvements into the state and regional plans.
- Prioritize the improvements within the corridor study based on input from City Council, the community, and/or a more detailed prioritization process that utilizes the performance measures summarized in the study. Conversations with City Council have indicated the improvements at Cole Street and Griffin Avenue (SR 164) are of highest priority.
- Pursue state and federal grant funding for improvements at Cole Street and Griffin Avenue (SR 164) intersections. Submit a grant application to PSRC under the rural corridor program to implement a high priority project.
- Consider the feasibility of potential lower cost ways to implement some of the improvements more quickly. Complete improvements where minimal disturbance to adjoining land uses or the existing roadway is required. Potential locations meeting these criteria include the corridor segment between Garrett Street and Griffin Avenue or the segment between Suntop Farms PUD and Farman Street N. Both locations could likely be channelized consistent with the study recommendations with only a minor amount of sidewalk, landscaping, and curb/gutter improvements.
- Require mitigation from new development that impacts the corridor.
- Evaluate local funding mechanisms to match against potential grants. Consider items such as updating the City's traffic impact fee program, or developing a local improvement district or transportation benefit district.