Technical Memorandum
SR 9 Corridor Improvement Project

Transportation Inventory Assessment

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Snohomish County Public Works Department

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Chapter 1 Introduction

1.1 Study Area

Washington State Route 9 (SR 9) begins at SR 522, north of Bothell, and parallels Interstate 5 (I-5) going north to the Canadian border at Sumas. SR 9 serves Snohomish, Skagit and Whatcom counties. The portion of SR 9 between SR 522 in the south and SR 530 (Burke Avenue) in the north is the study area for the SR 9 Corridor Improvement Project (Figure 1).

Figure 1: Study Area

1.2 Purpose/Need

The SR 9 Corridor Improvement Project consists of a comprehensive planning and design effort that investigates existing and potential long-range transportation needs along the corridor between SR 522 (in the south) to SR 530 (in the north). The project also aims to provide a clear direction and framework for addressing these short-term and long-range needs.

A critical component of the overall study involves the initial data collection and traffic analysis tasks, i.e. Phase 1, that will ultimately provide the starting point or frame-of-reference for evaluation. This technical memorandum summarizes the information collected for this initial phase of the project, including the following elements: the review of previous and on-going transportation studies, the collection of relevant background data, and analysis of peak period traffic conditions in terms of vehicle delays, level of service, queues, etc.

Phase 2 of the SR 9 Corridor Improvement Project, to be completed at a later date, will involve the preparation of a comprehensive Route Development Plan (RDP) for the same 30-mile segment between SR 522 near Monroe (south boundary) and Schloman Road in Arlington (approximately ¼-mile north of Phase 1 boundary).

The following points demonstrate the need for this study and for a systematic approach to improving this important north-south corridor:

- Population and traffic in Snohomish County has

increased by nearly 40 and 50 percent in the last ten years (1994-2004), respectively;

- Collisions have increased by over 70 percent;
- Peak hour delays at key intersections are significant;
- Significant growth in population, employment, and daily traffic is expected to continue;
- Funding sources for specific projects have been identified; and
- No comprehensive inventory of traffic data has been developed to date.

A busy intersection on SR 9 (WSDOT)

Chapter 2 Study Background

2.1 Review of Local Developments

As a first step in the study process, available literature for relevant transportation studies conducted since 2000[1] (adjacent or near to the SR 9 corridor) was collected and reviewed. These studies provided a preliminary assessment of local traffic impacts and benefits related to future planned transportation improvement projects and/or development projects. In considering these studies, the project team was able to gain a better understanding of current development patterns in the corridor (i.e., intensity of development, land use, etc) and what the future may hold with respect to transportation deficiencies/challenges if these patterns continue. Sources for these studies included the following local agencies:

- City of Arlington
- City of Marysville
- City of Snohomish

2.1.1 City of Arlington

Arlington Center
Traffic Impact Analysis
November 30, 2004

Project Description: A proposed 6,825 square foot general office building project located on the south side of 204th Street NE, just east of 77th Avenue NE. Access to the site would be via an existing driveway off of 204th Street NE shared with the existing Skagit State Bank, located on the west side of the project site. The principal tenant of this office building would be Arlington Physical Therapy.

Trip Generation: The proposed project would generate a total of 10 PM peak hour trips: 2 entering and 8 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located approximately 1,000 feet from SR 9 (via 204th Street NE). Approximately 50 percent of the new site-generated PM peak hour trips would access the project site via the intersection of SR 9/204th Street NE.

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2004)*	*2006 w/o Project*	*2006 w/ Project*
SR 9/204th Street NE	25.8 seconds (C)	28.1 seconds (C)	28.3 seconds (C)

[1] The City of Marysville provided relevant studies between 2002 and 2006.

Recommended Traffic Impact Mitigation Measures: None cited.

Auto Zone – Arlington

Traffic Impact Analysis
August 25, 2004

Project Description: A proposed 7,318 square foot Auto Zone (automobile parts sales) building located on the northeast corner of the 204th Street NE/Olympic Place intersection. Access to the site would be via one driveway on 204th Street NE and one driveway on Olympic Place NE.

Trip Generation: The proposed project would generate a total of 26 new PM peak hour trips: 13 entering and 13 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located approximately 1,000 feet from SR 9 (via 204th Street NE). Approximately 50 percent of the new PM peak hour trips would access the project via the intersection of SR 9/204th Street NE.

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2004)*	*2006 w/o Project*	*2006 w/ Project*
SR 9/204th Street NE	25.8 seconds (C)	27.8 seconds (C)	28.1 seconds (C)

Recommended Traffic Impact Mitigation Measures:

- Construct street improvements along 204th Street NE beyond the project frontage to the east (two adjacent lots). The roadway section (204th Street NE) will be expanded to four lanes with a through lane eastbound, a center two-way left turn lane, a westbound through lane, and a westbound right turn only lane.
- Traffic impact fees paid to the City of Arlington and Snohomish County to mitigate project impacts on City and County roadways. A credit will be given for the 204th Street NE roadway improvements constructed beyond the project frontage.

Arlington MOB

Traffic Impact Analysis
May 22, 2004

Project Description: A proposed 5,817 square foot medical office building project located east of SR 9, west of 77th Avenue NE, and south of 204th Street NE. Access to the site would be provided via a new driveway on 77th Avenue NE.

Trip Generation: The proposed project would generate a total of 20 new PM peak hour trips: 6 entering and 16 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located approximately 1,400 feet from SR 9 (via 204th Street NE and 77th Avenue NE). Based on the project-generated new trip distribution, it is estimated that approximately 5 percent of new trips would use SR 9 to the north and 20 percent of new trips would use SR 9 to the south. These percentages are based on the distribution of customers/patients in the area.

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2004)*	*2009 w/o Project*	*2009 w/ Project*
SR 9/204th Street NE	25.6 seconds (C)	27.6 seconds (C)	27.8 seconds (C)

Recommended Traffic Impact Mitigation Measures: Traffic impact fees paid to the City of Arlington, Snohomish County, and WSDOT to mitigate project impacts on City, County, and State roadways.

Jensen Park Condominium/Townhouses

Traffic Impact Analysis Report
February 24, 2003

Project Description: The proposed project would construct a 26-unit single-family residential condominium/townhouse community. The site is located on the north side of Jensen Farm Lane, just northeast of the intersection of SR 9/204th Street NE.

Trip Generation: The proposed project would generate a total of 14 new PM peak hour trips: 9 entering and 5 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located approximately 2,400 feet from SR 9 (via 204th Street NE, Olympic Place, and Jensen Farm Lane OR via E. Highland Drive, Olympic Place, and Jensen Farm Lane).

Recommended Traffic Impact Mitigation Measures: Traffic impact fees paid to the City of Arlington, Snohomish County, and WSDOT to mitigate project impacts on City, County, and State roadways.

Casperson Plat

Traffic Analysis
April 15, 2002

Project Description: The proposed single family development north of SR 531 and east of 79th Avenue NE would consist of 36 new single family detached lots. Site access to SR 531 is proposed via internal site driveways and streets that share an access with the approved Eagle Heights subdivision.

Trip Generation: The proposed project would generate a total of 36 new PM peak hour trips: 23 entering and 13 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located approximately 1,600 feet from SR 9 (via SR 531 and 85th Avenue NE). Approximately 40 percent of the new PM peak hour trips would access the site via the intersection of SR 9/SR 531.

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2002)*	*2007 w/o Project*	*2007 w/ Project*
SR 9/SR 531	7.2 seconds (A)	11.2 seconds (B)	11.4 seconds (B)

Recommended Traffic Impact Mitigation Measures:

- Construction of an eastbound left-turn storage pocket of 100 feet and a westbound right-turn taper/pocket where the main access (85th Avenue NE) meets SR 531 with the full build out of the approved Eagle Heights and this proposed project.
- Traffic impact fees paid to the City of Arlington, Snohomish County, and WSDOT to mitigate project impacts on City, County, and State roadways.

2.1.2 City of Marysville

Rock Creek North Div II
Traffic Analysis
August 5, 2005

Project Description: A proposed residential development consisting of 143 single-family detached units located along the east side of 83rd Avenue NE, north of Grove Road. There are two site access scenarios being proposed: 1) a single access onto 83rd Avenue NE opposite 72nd Place NE with connectivity to the adjacent developments to the north and south of the site, and 2) two accesses onto 83rd Avenue, one opposite 72nd Place NE and the other opposite 75th Street NE.

Trip Generation: The proposed project would generate a total of 139 new PM peak hour trips: 88 entering and 51 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located approximately 3,500 feet from SR 9 (via SR 528, 83rd Avenue NE, and Grove Street) or approximately 1.4 miles from SR 9 (via 84th Street NE, 83rd Avenue NE, and Grove Street). Approximately 15 percent of the PM peak hour trips would access the site via the intersection of SR 9/SR 528 and 15 percent would access the site via the intersection of SR 9/84th Street NE.

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2005)*	*2011 w/o Project*	*2011 w/ Project*
SR 9/84th Street NE	22.8 seconds (C)	36.9 seconds (D)	37.8 seconds (D)
SR 9/SR 528	17.9 seconds (B)	20.8 seconds (C)	23.1 seconds (C)

SR 9/SR 92	22.9 seconds (C)	36.7 seconds (D)	37.9 seconds (D)
SR 9/Soper Hill Road	13.3 seconds (B)	36.3 seconds (D)	37.2 seconds (D)

Recommended Traffic Impact Mitigation Measures: Traffic impact fees paid to the City of Marysville, City of Arlington, Snohomish County, and WSDOT to mitigate project impacts on City, County, and State roadways.

64th Street Plaza

Transportation Impact Analysis
May 2005

Project Description: The proposed project would consist of a 183,516 square-foot free standing discount superstore. As part of the proposal, a new roadway (87th Avenue NE) would be constructed along the west side of the project site providing access to SR 528 and to the north through other planned residential developments such as Rock Creek North. The proposed discount superstore would include three driveway access points to the proposed 87th Street NE and one right-in/right-out access on 64th Street NE (SR 528).

Trip Generation: The proposed project would generate a total of 592 new PM peak hour trips: 290 entering and 302 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located on the northwest corner of the SR 9/SR 528 intersection. Approximately 57 percent of new site-generated PM peak hour trips would access the site via the SR 9/SR 528 intersection (27 percent to/from the south and 30 percent to/from the north).

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2005)*	*2006 w/o Project*	*2006 w/ Project*
SR 9/84th Street NE	22.5 seconds (C)	23.9 seconds (C)	25.3 seconds (C)
SR 9/SR 528	18.1 seconds (B)	19.7 seconds (B)	30.6 seconds (C)
SR 9/SR 92	23.1 seconds (C)	26.1 seconds (C)	29.6 seconds (C)

Recommended Traffic Impact Mitigation Measures:

- Construct 87th Avenue NE adjacent to project site with curb, gutter, and sidewalks
- Construct a northbound right-turn drop lane on 87th Avenue NE at project's primary access point
- Install traffic signal at new 87th Avenue NE/SR 528 intersection and construct dual eastbound left-turn lanes as well as a dual southbound lef and a dedicated southbound right-turn lane.
- Construct a westbound right-turn lane at right-in, right-out driveway on SR 528

- Construct frontage improvements (curb, gutter, and sidewalks) on the north side of SR 528
- Extend the southbound right-turn lane at SR 9/SR 528
- Traffic impact fees paid to the City of Marysville and Snohomish County to mitigate project impacts on City and County roadways.

Baileys

Traffic Analysis
June 30, 2004

Project Description: The proposed residential development would consist of 202 single-family detached units and is located along the east side of 83rd Avenue NE, opposite from 77th Street NE. Two accesses onto 83rd Avenue NE are being proposed, along with several stub roads connecting with future developments.

Trip Generation: The proposed project would generate a total of 204 new PM peak hour trips: 128 entering and 76 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located approximately 4,000 feet from SR 9 (via 84th Street NE and 83rd Avenue NE) or approximately 1.3 miles from SR 9 (via SR 528 and 83rd Avenue NE). Approximately 15 percent of the new PM peak hour trips would access the site via the SR 9/SR 528 intersection and approximately 15 percent would access the site via the SR 9/84th Street NE intersection.

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2004)*	*2010 w/o Project*	*2010 w/ Project*
SR 9/108th Street NE	26.8 seconds (D)	46.4 seconds (E)	49.8 seconds (E)
SR 9/84th Street NE	24.0 seconds (C)	30.6 seconds (C)	31.4 seconds (C)
SR 9/SR 528	23.5 seconds (C)	11.7 seconds (B)	13.6 seconds (B)
SR 9/SR 92	21.8 seconds (C)	31.0 seconds (C)	32.1 seconds (C)
SR 9/Soper Hill Road	15.0 seconds (B)	26.8 seconds (C)	27.5 seconds (C)

Recommended Traffic Impact Mitigation Measures:

- Transportation Demand Management mitigation fee.
- Traffic impact fees paid to the City of Marysville, City of Arlington, Snohomish County, and WSDOT to mitigate project impacts on City, County, and State roadways.

Rock Creek North

Traffic Analysis
April 12, 2004

Project Description: The proposed project consists of 155-unit single family residential development located along the east side of 83rd Avenue NE, north of Grove Road. A single access to the site is proposed at 83rd Avenue NE, along with several stub roads to connect with future developments.

Trip Generation: The proposed project would generate a total of 157 new PM peak hour trips: 99 entering and 58 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located approximately 3,500 feet from SR 9 (via SR 528, 83rd Avenue NE, and Grove Street) or approximately 1.4 miles from SR 9 (via 84th Street NE, 83rd Avenue NE, and Grove Street). Approximately 15 percent of the PM peak hour trips would access the site via the intersection of SR 9/SR 528 and 15 percent would access the site via the intersection of SR 9/84th Street NE.

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2004)*	*2010 w/o Project*	*2010 w/ Project*
SR 9/108th Street NE	26.8 seconds (D)	40.8 seconds (E)	43.0 seconds (E)
SR 9/84th Street NE	24.0 seconds (C)	26.2 seconds (C)	26.6 seconds (C)
SR 9/SR 528	23.5 seconds (C)	11.7 seconds (B)	13.2 seconds (B)
SR 9/60th Street NE	16.7 seconds (C)	21.7 seconds (C)	22.3 seconds (C)
SR 9/SR 92	21.8 seconds (C)	31.0 seconds (C)	31.9 seconds (C)
SR 9/Soper Hill Road	15.0 seconds (B)	22.7 seconds (C)	23.1 seconds (C)

Recommended Traffic Impact Mitigation Measures:

- Transportation Demand Management mitigation fee.
- Traffic impact fees paid to the City of Marysville, City of Arlington, Snohomish County, and WSDOT to mitigate project impacts on City, County, and State roadways.

Getchell Hill

Traffic Impact Study
July 2003

Project Description: Getchell Hill is a proposed Planned Residential Development (PRD) located in the vicinity of 84th Street NE and 83rd Avenue NE. Upon project build-out in 2009, the proposed development would consist of up to 235 single-family residential units. Vehicular access to/from the northern part of the development is proposed at two driveways on 84th Street NE and two driveways on the future 88th

Street NE extension. Vehicular access to/from the southern part of the development is proposed via driveways on 84th Street NE and 83rd Avenue NE. As part of the subdivision development, the project would construct 88th Street NE through the site to its eastern borders.

Trip Generation: The proposed project would generate a total of 237 new PM peak hour trips: 152 entering and 85 exiting.

SR 9 Site-Related Traffic: The eastern edge of the proposed project (83rd Avenue NE) is located approximately 2,000 feet from SR 9. Approximately 25 percent of the new PM peak hour trips are expected to pass through the SR 9/84th Street NE intersection and 15 percent through the SR 9/SR 528 intersection.

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2003)*	*2009 w/o Project*	*2009 w/ Project*
SR 9/84th Street NE	26.5 seconds (C)	40.9 seconds (D)	44.7 seconds (D)
SR 9/SR 528	> 100 seconds (F)	23.3 seconds (C)	24.4 seconds (C)

Recommended Traffic Impact Mitigation Measures:

- A new traffic signal at the 84th Street NE/67th Avenue NE intersection.
- Provision of pathways throughout the site – particularly in the wide utility easements north/south.
- Traffic impact fees paid to the City of Marysville, Snohomish County, and WSDOT to mitigate project impacts on City, County, and State roadways. A credit for the construction of the 88th Street NE extension should qualify for a credit against the City and County traffic impact fees.

2.1.3 City of Snohomish

Bickford Business Park
Traffic Study
February 13, 2006

Project Description: The proposed project is located along the northern side of SR 9 and the western side of Bickford Avenue. The proposed buildings are expected to range between one to three stories in height and will consist of 17,170 square feet of warehouse, 23,750 square feet of retail, 4,350 square feet of office, a 200 square foot coffee stand, and a 21 unit apartment building.

Trip Generation: It is expected that at ultimate build-out the proposed project could generate approximately 85 new trips (72 business park, 13 apartment) during the PM peak hour: 30 entering and 55 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located adjacent to SR 9. The intersection of 19th Street SE/SR 9 (Bickford Interchange) presently operates and in the future is expected to operate at an unacceptable LOS F with or without the proposed project. The primary reason for this very poor LOS is due to the high volume of vehicles turning right onto SR 9 from Avenue D. It is anticipated that by installing a northbound acceleration lane on SR 9, existing and future LOS at this intersection would improve.

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2005)*	*2008 w/o Project*	*2008 w/ Project*
SR 9/30th Street SE	61.8 seconds (F)	258.8 seconds (F)	291.5 seconds (F)

Recommended Traffic Impact Mitigation Measures: Traffic mitigation fees paid to the City of Snohomish for this project are expected to be sufficient with regards to proportionate share of participation for improvements at affected intersections.

Snohomish Station

Revised Traffic Impact Analysis
February 3, 2006

Project Description: A development consisting of a 326,080 square foot retail site located on the southeast corner of the Bickford Avenue/30th Street SE intersection and a 115 unit multifamily residential site located on the northwest corner of Bickford Avenue/Weaver Road. The two major tenants at the retail site are a home improvement store and a grocery store. Other anticipated tenants include a 16 position gas station, drive through bank, restaurants, and several retail stores.

Trip Generation: The total net new PM peak hour trips for the Snohomish Station development is 921, consisting of 831 retail site trips (412 entering and 419 exiting) plus 90 residential site trips 52 entering and 38 exiting.

SR 9 Site-Related Traffic: Access to the residential component of the proposed project is located approximately 2,500 feet from SR 9 (via Bickford Avenue) and access to the retail component is located approximately 2,200 feet from SR 9 (via 30th Street SE).

PM Peak Hour Average Intersection Delay and Level of Service			
Intersection	*Existing (2005)*	*2008 w/o Project*	*2008 w/ Project*
SR 9/Bickford Avenue Interchange	19.9 seconds (B)	26.0 seconds (C)	42.6 seconds (D)

Recommended Traffic Impact Mitigation Measures:

- Construct half street improvements for frontage on Bickford Avenue, 30th Street SE, and Weaver Road.
- Install a traffic signal at the Bickford Avenue/30th Street SE intersection including channelization improvements.

- Install a traffic signal at the retail main site access driveway to Bickford Avenue.

Bickford Ford Expansion
Traffic Impact Analysis
February 20, 2004

Project Description: The proposed development is located east of Bickford Avenue just north of 56th Street SE/Fobes Road. The first phase of the development includes the development of a 2,200 square foot sales office for trailer sales. The second phase includes the development of a new vehicle service center to replace the existing service area currently located within the existing dealership located on the west side of Bickford Avenue directly across from the proposed project site. Primary access to the proposed development will be via Bickford Avenue, 56th Street SE, and Fobes Road.

Trip Generation: Phases 1 and 2 combined would result in a total of 56 new PM peak hour trips: 11 entering and 45 exiting.

SR 9 Site-Related Traffic: Access to the proposed project is located approximately 2,200 feet from SR 9 (via 56th Street SE). Approximately 35 percent of the new PM peak hour trips would access the site via the intersection of SR 9/56th Street SE and approximately 15 percent would access the site via the SR 9/Bickford Avenue Interchange.

Recommended Traffic Impact Mitigation Measures: The project does not significantly impact the City's transportation infrastructure or adjacent study intersection based on the acceptable service grades obtained under the LOS analysis. Since the intersections operate at an acceptable LOS C or better under the future scenarios with both phases of the expansion, no off-site mitigation measures are recommended or warranted at this time.

2.2 Comprehensive Plan Review

Regional and community comprehensive plans typically provide a unique window from which to view and assess the specific needs of communities and identify the future opportunities that lie ahead to enhance the affected transportation network. A review of local comprehensive plans and relevant local community plans was conducted to establish the backbone for developing an initial list of transportation issues and needs related to the SR 9 corridor (especially for Phase 2 follow-on work). This review helped to identify current issues related to existing traffic conditions, safety concerns, heavy vehicle traffic routes, non-motorized travel, etc. The primary source for this information included the local municipalities in the SR 9 corridor (Cities of Arlington, Lake Stevens, Marysville, and Snohomish), Snohomish County, and WSDOT. Excerpts from each of these Comprehensive Plans are provided below.

2.2.1 City of Arlington

Comprehensive Plan, December 2005

Vision Statement

The City of Arlington will meet its challenge to accommodate regional growth by preserving the best a small city has to offer and by extending this "best" into new development and growth plans. The City will strive to balance growth by safeguarding our standards and values as we encourage economic growth to safeguard our future.

Even as the City evolves into a stronger commercial center, it will continue to retain the feel of its small town rural heritage. To this end, our vision focuses on the City's setting, its economy, social fabric, mobility and housing.

Land Use

Along SR 9, a variety of land uses are designated including Suburban Residential to the south, General Commercial at major intersections (i.e., SR 531, 204th Street NE), and Residential Moderate Density, Old Town Residential, and Old Town Business District to the north.

Transit Service

Community Transit Routes 227 and 230 operate on SR 9 between Division Street and 4th Street. The Arlington Park-and-Ride facility is located at the intersection of SR 9 and 4th Street.

Planned Roadway/Intersection Improvements

- SR 531/SR 9 – add double left-turn channelization on northbound and eastbound approaches
- 4th Street/SR 9 – modify channelization to eliminate westbound and southbound left-turns
- SR 530 (Division Street)/SR 9 – modify channelization or construct roundabout
- SR 530 (Burke Avenue)/SR 9 – add signalization

Specific Goals and Policies

- PL-16.80 - The properties around the SR 9/SR-531 intersection should be planned to become an urban village, with mixed commercial and high-density residential uses.
- PL-16.81 - The entire area surrounding the intersection of SR9/172nd is to be developed as an urban village, with commercial and residential uses integrated, with particular care to insure the interface between the uses works to draw people in and not separate them. Full compliance with the Development Design Guidelines should ensure this.
- PE-5.21 - In the future, as the City grows, the properties around the SR 9/SR 531 intersection will become centralized around many residential neighborhoods. Commercial uses at this intersection will become essential to serving these

neighborhoods, and the commercial designations should be maintained, even if commercial development is not imminent.

2.2.2 City of Lake Stevens: Draft Comprehensive Plan, April 2006

Vision Statement

Recognizing both citizens' desires to maintain the small town atmosphere, and the philosophy and mandates of the Growth Management Act the City of Lake Stevens will grow to a community of 46,000 people within its Urban Growth Area with high densities being concentrated in and around its three growth centers while medium density neighborhoods extend from them to lower density neighborhoods developing on the periphery of the UGA. Care will be taken to ensure that any development is sensitive to the environment and existing residents by reasonably mitigating impacts through all lawful means available.

We intend to be a community of sustainable development. We declare that beautiful yet functional and efficient design is paramount to sustaining a positive development atmosphere and community image. To be sustainable, our community will strive to provide a range of housing that is affordable to our diverse population; and will seek to match jobs to residents to local consumers so that our citizens can find their needs met at home in Lake Stevens.

The City of Lake Stevens strongly endorses the thrust of the Growth Management Act as an essential and responsible series of planning measures that when implemented, will help direct community, regional, and statewide efforts to enhance Washington's quality of life, environmental protection, and economic vitality.

Land Use

The City of Lake Stevens covers about 30% of the total 12.4 square miles of the Lake Stevens Urban Growth Area (UGA). Currently, the city limits encompass SR 9 between SR 92 to the north and Lundeen Parkway to the south. Current land uses along this corridor are Multi-Family Residential, Urban Residential, High Urban Residential, and Public/Semi-Public.

The City intends to annex the entire UGA by 2011. This rather aggressive annexation plan will bring SR 9 between SR 92 to the north and 28th Street SE to the south within the boundaries of the City of Lake Stevens.

Transit Service

Community Transit Route 221 operates on SR 9 through the City of Lake Stevens. The Lake Stevens Park-and-Ride is located at the intersection of SR 9 and 4th Street NE (unincorporated Snohomish County) which serves Community Transit Routes 221, 280, and 425.

Planned Roadway/Intersection Improvements

Widen SR 9 to 4/5 lanes with access control as needed from 176th Street SE to SR 92. Intersection improvements at 132nd Street SE, Marsh Road, US 2, 20th Street SE, SR 204, Lundeen Parkway, SR 96, and SR 92. Use other access management provisions that include: limiting signal spacing to 1 mile or greater, no new signalized intersections, raised median treatments, and limitations on driveway and private road access.

Specific Goals and Policies

4.12.2 Ensure that design of highway accessible/visible commercial uses along SR 92, SR 9, and the Hartford/Machias Road is aesthetically pleasing from both the roadway and the local roads.

2.2.3 City of Marysville Comprehensive Plan, April 2005: Marysville – Our Future

This Comprehensive Plan Update will establish the framework and regulatory guidance in our land use planning to meet current community mandates. These priorities are:

1. Enhance Community Image and Identity
2. Improve Existing Business Opportunities and Expand & Diversify the Economic Base through Business Attraction and Retention Efforts
3. Support Recreation and Tourism Advantages
4. Improve Transportation and Infrastructure
5. Improve Government and Regulatory Environment
6. Enhance Employment and Housing Opportunities through Workforce Education and Training

The City is actively implementing its strategic plan with respect to each of these priorities. Citizens, business leaders appointed and elected officials have committed their time and efforts to taking steps to create a better Marysville. This plan will help realize that vision in terms of shaping, guiding and regulating future development in the Marysville urban growth area.

Some of the focus areas that have emerged in the plan development are revitalizing the downtown and downtown waterfront as a key to the image and identity, tourism and recreation potential of the Marysville community. To that end, the City conducted a separate Downtown Vision Plan. Marysville's Downtown embodies the image and entity of our community to both internal and external visitors.

As we envision the future Marysville, we have chosen to use historical neighborhood areas as the basis for future land use planning. These neighborhoods, centered around historic community services (often commercial uses and schools), are the foundation of new plans for strengthening our neighborhood connections. It is our intent in pursuing

this plan, to effectuate stronger community participation, leadership and an active, caring and involved citizenry.

Land Use

SR 9 is located on a small segment of the eastern boundary of the City of Arlington from 68th Street NE to the north to SR 528 (64th Street NE) to the south in the Getchell Neighborhood Planning Area. Currently designated Urban Growth Areas for the City of Marysville would expand the SR 9 boundary north to 84th Street NE, while Urban Growth Area Expansion Areas have been identified that would expand the SR 9 boundary further north to 94th Street NE and south to Soper Hill Road.

Current land uses on SR 9 in the City of Arlington consist of Community Business and Public Use and are located at the intersection of SR 528 and SR 9.

Transit Service

Community Transit Route 221 operates on SR 9 in Marysville via SR 528.

Planned Roadway/Intersection Improvements

None

Specific Goals and Policies

T.5A.1 Regional and State funding sources should be used to help fund multimodal improvements serving the City of Marysville and regional travel. WSDOT should continue to fund improvements to I-5 and the SR 9 interchanges serving Marysville.

2.2.4 City of Snohomish Comprehensive Plan, February 2005

Vision Statement (Land Use and Transportation System)

We visualize Snohomish to provide ample opportunities to work, live, play and maintain the quality of life that preserves the community's character in its land use.

We visualize Snohomish to provide for residential, commercial and industrial growth that preserves the community's character in its land use.

We visualize Snohomish as a dynamic transportation community giving consideration to motorized and pedestrian transportation.

We visualize Snohomish as a mobile community that includes Trails, paths, paved walkways and safe street crossings are included in transportation planning.

We visualize Snohomish as a designed transportation community that provides easy and safe access to services.

We visualize Snohomish to grow and develop in a planned and coordinated manner and avoid sprawl.

We visualize Snohomish that preserves neighborhood integrity and lessens traffic congestion in residential areas. The use of City streets as through streets for inter-city traffic is be discouraged

Land Use

Between the Snohomish River and 52nd Street SE, SR 9 is within the city limits of Snohomish. On the south end, the predominant land uses are Public, Commercial, and Single Family Residential. In the central area (near Bickford Avenue) the predominant land uses are Industrial, Commercial, and Business Park.

To the north, Single Family and Medium Density Residential are predominant, with the exception of a Business Park designation on the east side of the 56th Street SE/SR9 intersection.

Transit Service

Community Transit Routes 270, 271, 275, 277, and 424 operate on SR 9 between Bickford Avenue and 30th Street SE in the City of Snohomish and utilize the Snohomish Park-and-Ride at Bickford Avenue/SR 9.

Transportation Characteristics

Average Daily Traffic (ADT) on SR 9 through the City of Snohomish ranges from 24,000 south of the city to 22,000 north of the city (2004). In 2010, the ADT is forecast to range from 26,500 south of the city to 25,300 north of the city. In 2030, the ADT is forecast to range from 34,700 south of the city to 36,100 north of the city.

Planned Roadway/Intersection Improvements

None

Specific Goals and Policies

None

2.2.5 Snohomish County: Transportation Element, a Component of the GMA Comprehensive Plan, February 2006

Land Use

Land uses adjacent to SR 9 in the unincorporated areas of Snohomish County consist of predominantly low-density, rural residential uses. However, commercial and industrial uses are also zoned at high-volume arterial intersections/interchanges such as SR 522, Market Street, SR 204, Soper Hill Road, SR 528, and SR 531.

Recommended County Arterial Improvement Projects

SR 9/Lowell-Larimer Connector: rural 2-lane standards (long range)

Supportive State Highway Improvements

- SR 9 from SR 522 to 176th Street SE: widen to 5 lanes with access management provisions that include limited signal spacing to 1 mile or greater, no new signalized intersections, raised median treatments, and limitations on driveway and private road access. (Nickel, 2025)
- SR 9 from 176th Street SE to SR 92: widen to 4/5 lanes with access control as needed. Intersection improvements at 132nd Street SE, Marsh Road, US 2, 20th Street SE, SR 204, Lundeen Parkway, SR 96, and SR 92. Use other access management provisions that include limiting signal spacing to 1 mile or greater, no new signalized intersections, raised median treatments, and limitations on driveway and private road access. (RTID, 2025)
- SR 9 from SR 92 to SR 530: improve three intersections at SR 528, 84th Street NE, and SR 531 to eliminate choke points. Additional turn lanes and channelization will be added at each intersection. (RTID, 2012)

2.2.6 Washington State Department of Transportation: Washington State Highway System Plan 2003-2022, February 2002

The Washington State Department of Transportation (WSDOT) through working partnerships with local agencies and tribes throughout the state has developed the Washington State Highway System Plan (HSP) to help local authorities coordinate their comprehensive planning process with future state highway needs. This coordination helps to ensure that the long-range plans of WSDOT, Regional Transportation Planning Organizations (RTPOs), and Metropolitan Planning Organizations (MPOs) are compatible and mutually supportive. The HSP is updated every two years and guides WSDOT in prioritizing and budgeting for highway projects.

To better coordinate improvement strategies, a database of transportation system solutions was developed in a collaborative effort between the state, regional transportation planning organizations, tribal governments, local jurisdictions, transit agencies, and private transportation providers. The database is not inclusive of all transportation system needs in the state and is most inclusive of state owned and state interest transportation systems. The database is limited to the data that was provided by the participating organizations.

The strategies listed in Table 1 through Table 3 describe the improvements to the SR 9 corridor that are needed to meet the mobility, safety, and economic objectives for the next 20 years, from 2003-2022. It is important to note that these are planning strategies and that the project scope will be refined during the programming and design phases. Major efforts will require extensive public and local agency input, as well as environmental impact analysis prior to selection of a preferred alternative.

Table 1: Mobility Strategies for SR 9 Segments

Milepost	Vicinity Description
Congestion Relief: Where adopted congestion thresholds are surpassed, partner with regional and local governments to make targeted transportation investments.	
0 to 1.82	SR 522 to 212 St. Southeast (SR 524) *Solution: [Rebuild SR 522 interchange.] Widen to 5 lanes.*
1.82 to 4.03	212th St. Southeast (SR 524) to 176th St. Southeast *Solution: Widen from 2 lanes to 4/5 lanes.*
4.03 to 8.42	176th St. Southeast to Marsh St. *Solution: Widen to 4 lanes. Access management.*
7 to 17.49	SR 96 to SR 92 *Solution: Lake Stevens Sub-area Study*
8.42 to 12.14	Marsh Road to US 2 *Solution: Widen to 4 lanes. Access management.*
12 to 18	Lake Stevens vicinity *Solution: Construct 350 stall park and ride lot.*
12.14 to 17.49	US 2 to SR 92 *Solution: Widen to 4/5 lanes and improve US 2/SR 9 interchange.*
15.42 to 15.99	SR 9/SR 204 Intersection *Solution: Construct new interchange between SR 9 and SR 204 at Frontier Village.*
17.49 to 19.26	SR 92 to SR 528 *Solution: Widen to 4 lanes with restricted median.*
19.26 to 26.05	SR 528 to SR 531 *Solution: Widen to 4 lanes with restricted median to Arlington. Study with city the proper treatment of SR 9 within Arlington's city limits.*
26.05 to 29.46	SR 531 to SR 530 *Solution: Study with city the proper treatment of SR 9 within Arlington's city limits. Estimate based on 5-lane roadway section.*
29.46 to 29.79	SR 530 to City of Arlington North of City Limits *Solution: Widen to 4 lanes with Two-way left turn lane (Arlington).*
Access Management: Where cost effective, reduce the number of existing or potential access points by purchasing access rights where future congestion problems are expected.	
0 to 4	SR 522 to 176th St. Southeast *Solution: Purchase of access rights*
4 to 6	176th Street Southeast to 148th Street Southeast *Solution: Purchase of access rights*
6 to 7.4	148th Street Southeast to north of SR 96 *Solution: Purchase of access rights*

Table 2: Safety Strategies for SR 9 Segments

Milepost	Vicinity Description
Risk Reduction: Improve roadways where geometrics, traffic volumes, and speed limits indicate a high accident potential by instituting standards based highway safety solutions.	
16.06 to 19.7	Vernon Road to just north of SR 528 *Solution: Install guardrail for 0.4 mile, Eastbound.*
20.25 to 20.56	84th Street Northeast vicinity *Solution: Install guardrail (0.25 mile), Eastbound.*

Table 3: Economic Initiative Strategies for SR 9 Segments

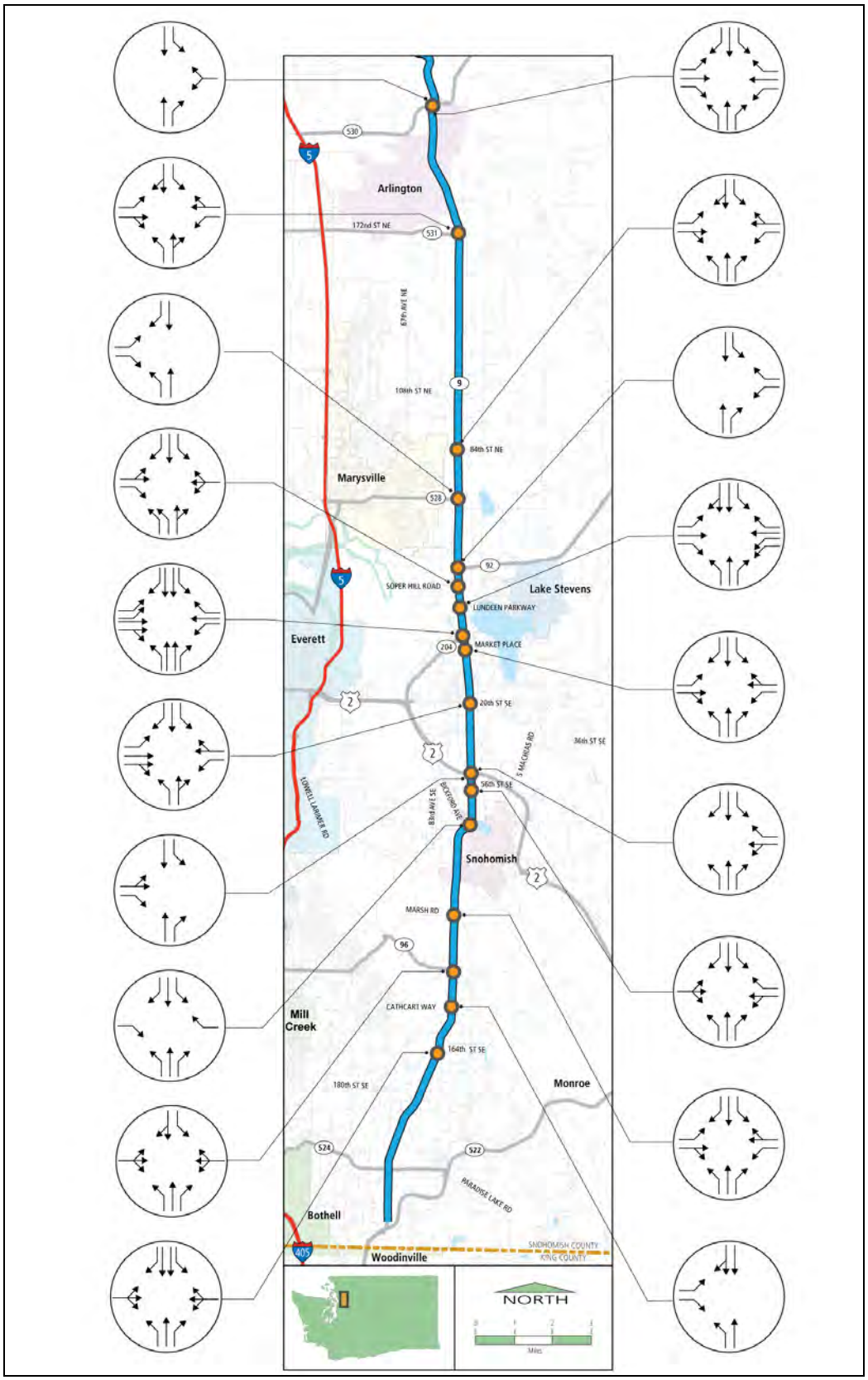
Milepost	Vicinity Description
Heritage Corridor Plans: In partnership, provide support to develop and implement Corridor Management Plans and projects on designated scenic byways to interpret, enhance and access heritage resources.	
29.5 to 98.2	Vicinity Arlington to Vicinity Sumas *Solution: Develop Corridor Management Plan (CMP)*

Chapter 3 Data Collection

3.1 Existing Street Network

The existing roadway network encompassed within the SR 9 study corridor consists of a variety of street types. Roadways range from local two-lane streets to State Highways (e.g., US 2). North-south traffic movements within the study area are primarily concentrated on SR 9, which is one lane in each direction for the most part. The primary east-west routes are SR 524, SR 96, US 2, SR 204, SR 92, SR 528, SR 531, and SR 530. Figure 2 on the following page highlights the 19 study intersections and shows existing lane configurations for each of these locations (by approach).

Figure 2: Existing Lane Configurations



3.2 Average Daily Traffic

Average Daily Traffic (ADT) is defined as the total volume of vehicles passing a point or segment of a roadway facility, in both directions, during a 24-hour period. ADT counts were collected for 20 locations along the SR 9 corridor for a full week in June, 2006.[2]

Figure 3 shows the average daily traffic profile for the SR 9 study area. Northbound and southbound volumes are approximately the same, which is typical of a corridor used predominately by commuters who travel in one direction in the morning and in the reverse direction in the evening. The total (both directions) ADT is between 20,000 and 28,000 vehicles per day in the south end of the corridor. Near Lake Stevens, the ADT spikes to 37,000 vehicles per hour, by far the highest traffic volume in the SR 9 study corridor. To the north of Lake Stevens, ADT levels fall to between 10,000 and 20,000 vehicles per hour.

Figure 3: Average Daily Traffic by Segment (2006)

*All ADT volumes are given in vehicles per day

[2] ADT by vehicle classification were also recorded at 4 locations throughout the SR corridor in order to validate truck volumes from the peak hour intersection traffic counts.

3.3 Peak Hour Intersection Traffic Counts

A total of 19 intersections were evaluated within the limits of this study (Table 4). These intersections were selected through coordination with Snohomish County and WSDOT staff and typically reflect locations where high levels of congestion have been observed and where intersection improvements may be warranted in the future. Several intersections in the Maltby and Clearview areas at the south end of the study area (e.g., 180th Street SE, SR 524, SR 522) were identified as high-congestion intersections, but were not included in this study because they have already been studied as part of WSDOT's SR 9 program.

While the majority of the selected locations are signalized, three of the 19 study intersections are unsignalized with two-way stop control (stop signs on the side street).

Table 4: List of Study Intersections

Signalized Intersections	
• SR 9 & SR 530 (Division Street)	• SR 9 & Market Place
• SR 9 & SR 531 (172nd Street NE)	• SR 9 & 20th Street SE
• SR 9 & 84th Street NE (Getchell Road)	• SR 9 & US 2 Westbound Ramps
• SR 9 & SR 528 (64th Street NE)	• SR 9 & US 2 Eastbound Ramps
• SR 9 & SR 92	• SR 9 & 56th Street SE
• SR 9 & Soper Hill Road	• SR 9 & Marsh Road
• SR 9 & Lundeen Parkway	• SR 9 & SR 96 (Lowell-Larimer Road)
• SR 9 & SR 204	• SR 9 & Cathcart Way
Unsignalized Intersections	
• SR 9 & SR 530 (Burke Avenue)	• SR 9 & 164th Street SE
• SR 9 & Bickford Avenue	

Existing AM and PM peak hour traffic volumes for the selected intersection locations were collected through field observations and manual two-hour traffic counts performed by Traffic Data Gathering (TDG) during a two-week period in early June. Counts were conducted during mid-week and were not taken on holidays or immediately prior to or following holidays. Volumes for the AM peak hour represent the peak hour of traffic between 6:00 AM and 8:00 AM (at each intersection) and PM peak hour volumes reflect the peak hour of traffic between 4:00 PM and 6:30 PM. Figure 4 and Figure 5 show the AM and PM peak hour traffic volumes for the selected intersections.

The volumes shown in Figure 4 and Figure 5 are inclusive of all vehicle types. Heavy vehicles[3] were also counted individually and account for between 6 and 16 percent of the

[3] Heavy vehicles are those vehicles with 3 or more axles.

total intersection approach volumes during the AM peak. High concentrations of heavy vehicles during this time period (both directions) can be found in the Arlington area near SR 530 and in the vicinity of the US 2 interchange. During the PM peak, the percentage of vehicles that are categorized as heavy vehicles is generally lower: between 3 and 8 percent. There are two likely reasons to explain this imbalance of heavy vehicle operations between the AM and PM peak periods. First, daily schedules for the business activities that generate heavy vehicle volumes (i.e., raw material processing, bulk deliveries) favor the morning hours. Second, the relatively higher PM peak congestion levels (see Chapter 4.1.1) are not conducive to the efficient movement of goods and, therefore, are generally avoided.

Figure 4: AM Peak Hour Traffic Volumes

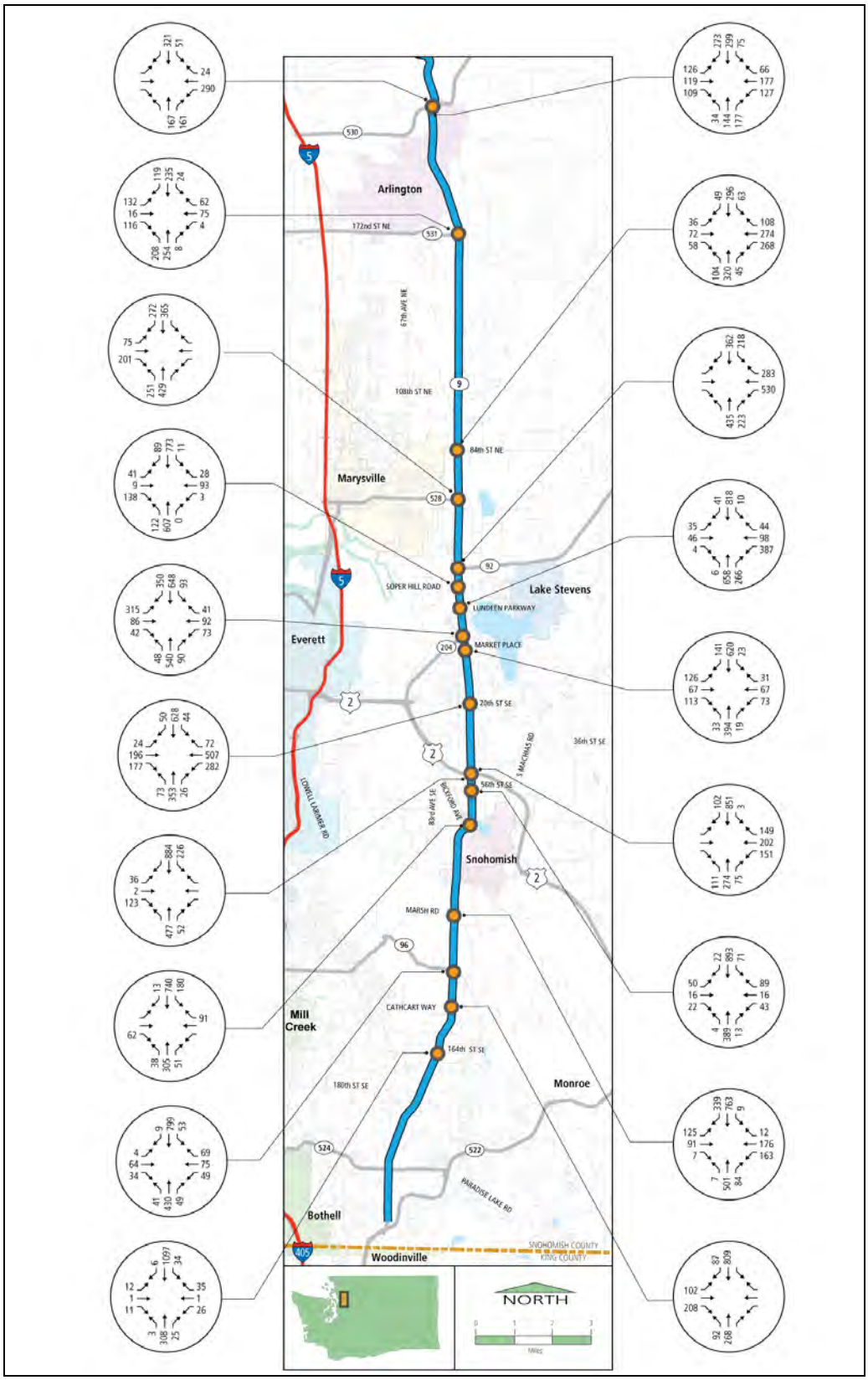
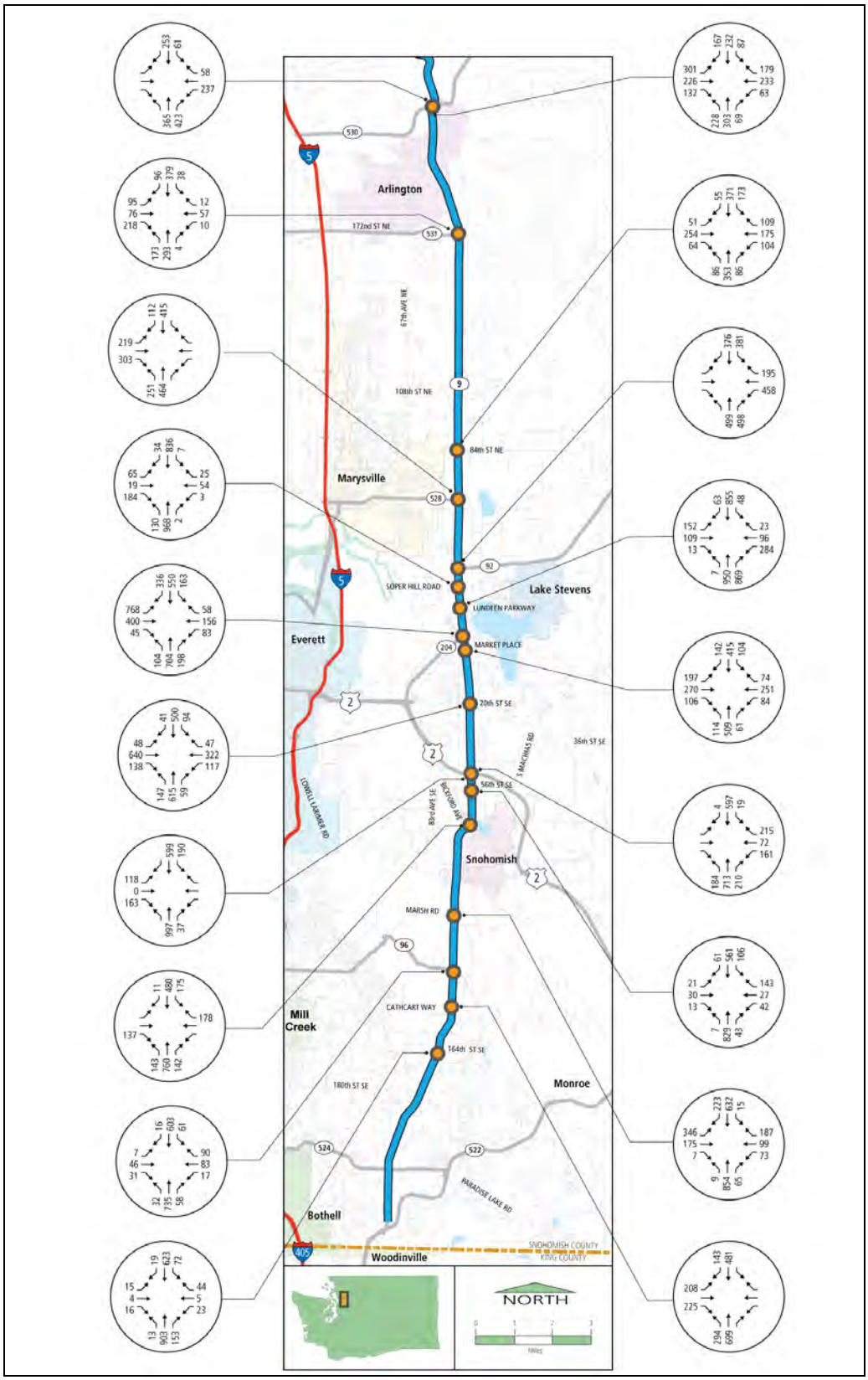


Figure 5: PM Peak Hour Traffic Volumes



3.4 Travel Times

As part of the data collection task, travel time runs were performed for the central part of the study corridor. The primary purpose of the travel time runs was to provide inputs to the micro-simulation and traffic operations modeling effort. Therefore, travel runs were performed for the same corridor segments as those modeled using the VISSIM micro-simulation software (see Chapter 4.2). Travel runs were performed on three separate weekdays in early June 2006 during the AM and PM peak periods for both southbound and northbound travel directions for two corridor segments on SR 9: from Bickford Avenue to the US2 ramps and from SR 92 to Market Place. Average travel times during the AM and PM peak hours for these segments are shown below.

- Between Bickford Avenue and the US 2 ramps

  Northbound
  2 minutes and 12 seconds (AM), 5 minutes and 34 seconds (PM)

  Southbound
  1 minute and 46 seconds (AM), 2 minutes and 8 seconds (PM)

- Between SR 92 and Market Place

  Northbound
  4 minutes and 12 seconds (AM), 6 minutes and 46 seconds (PM)

  Southbound
  3 minutes and 59 seconds (AM), 4 minutes and 59 seconds (PM)

The travel time runs show that it takes longer to travel during the PM peak period than it does during the AM peak period. The finding that congestion levels during the PM peak period are higher is consistent with the data collected for the peak period traffic counts and ADT counts which shows generally higher volumes during the evening hours.

3.5 Accident History

The project team evaluated historical accident data for the SR 9 project area. Accident statistics were evaluated for the study area for the most recent 5 years available from WSDOT, 2001 through 2005. Accident frequency and severity are indicators of potential "problem areas" where roadway and/or intersection deficiencies may exist.

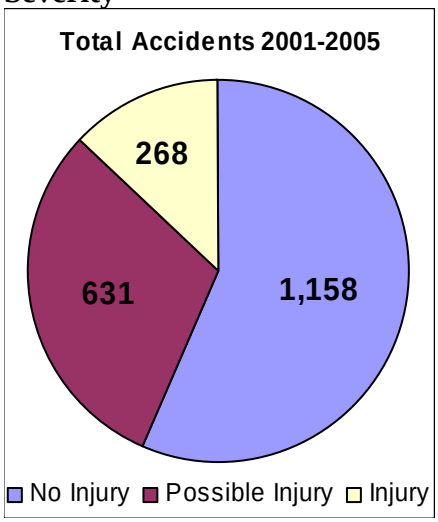
Between 2001 and 2005, a total of 2,057 accidents occurred in the SR 9 project area. The corridor was subdivided into three 10-mile segments and the total number of accidents for each segment is summarized in Table 5. Of these accidents, 913 (44 percent) occurred between SR 522 and the 2nd Street ramps in Snohomish, 823 (40 percent) occurred between the 2nd Street ramps and 84th Street NE near Marysville, and 321 accidents occurred between 84th Street NE and SR 530 in Arlington.

Table 5: Accidents by Location

SR 9 Location	Total Accidents	Percentage
MP 0.0 to MP 10.0 SR 522 to 2nd Street (Snohomish)	913	44%
MP 10.1 to MP 20.0 2nd Street (Snohomish) to 84th Street NE	823	40%
MP 20.1 to MP 29.57 84th Street NE to SR 530 (Burke Avenue)	321	16%

Source: WSDOT Standard Accident History Detail Report, 2006

Figure 6: SR 9 Accidents by Severity



Source: WSDOT Standard Accident History Detail Report, 2006

An evaluation of accident severity data revealed that the majority of accidents, 1,158 of 2,057 (56 percent) resulted in no injury. As recorded at the time of the accident, 631 were reported as possible injury and 268 were reported as injury (see Figure 6).

An evaluation of accident type data (Table 6) showed that 52 percent were classified as rear-end. Rear-end accidents indicate speeding, following too closely, or otherwise not stopping in time to avoid a slower moving or stopped vehicle ahead.

Enter-at-angle, fixed-object, and opposite-direction accidents accounted for approximately 10 percent each (30 percent total) of all accidents that occurred in the corridor between 2001 and 2005. Enter-at-angle accidents occur when one vehicle turns in front of another, resulting in an accident where a vehicle strikes the side of another vehicle. This typically occurs at intersections when drivers do not stop for red lights, or fail to yield to through-traffic when turning. Opposite-direction accidents indicate either driver confusion or inattention. Fixed-object accidents usually occur when a vehicle is traveling at higher speeds and the driver has less time to make decisions about slowing down or turning to avoid an object.

Table 6: Accidents by Type

Total Accidents	Rear End	Enter at Angle	Fixed Object	Overturn	Opposite Direction	Pedestrian Incident	Other
2,057	52%	10%	10%	3%	10%	0%	15%

Source: WSDOT Standard Accident History Detail Report, 2006

High-Accident Locations and Corridors

The SR 9 Corridor contained many High Accident Corridors (HACs) and High Accident Locations (HALs) for the most recent two years of reporting (2004 and 2006). A HAC is defined by WSDOT as a one-mile or longer section of roadway that has experienced a higher than average number of severe accidents over a period of time. A HAL is defined by WSDOT as a section of roadway less than a mile long that experienced a higher than average number of severe accidents over a period of time. See Figure 7 for a comprehensive map showing all HALs and HACs that occurred in the study corridor or at a study intersection in the years 2004 and 2006.

Seven of the nineteen SR 9 study intersections were designated as HALs in either the 2004 or 2006 reporting year:

- SR 9/SR 530 (Burke Avenue)
- SR 9/84th Street NE
- SR 9/Lundeen Parkway
- SR 9/SR 204
- SR 9/Market Place
- SR 9/20th Street SE
- SR 9/164th Street SE

Only one of the locations listed above, 20th Street SE, was designated a HAL in both 2004 and 2006. The highest concentration of HALs is in the Lake Stevens area between 20th Street SE and Lundeen Parkway.

Eight HACs were identified in either the 2004 or 2006 reporting year, some of which are overlapping and all contain the HALs noted above:

- SR 9 between 204th Street SE and just beyond the northern boundary of the study area (Schloman Road)
- SR 9 between SR 531 and Eaglefield Drive
- SR 9 between 84th Street NE and 108th Street NE (approximately)
- SR 9 between Lundeen Parkway and SR 92
- SR 9 between 2nd Street and Lundeen

Figure 7: High Accident Corridors and Locations

Parkway

- SR 9 between 176th Street SE and 156th Street SE
- SR 9 between 197th Street SE and 188th Street SE
- SR 9 between SR 524 and SR 96

The overall length and number of occurrences of the HACs listed above were higher in 2004 than in 2006. HACs are generally focused on the more populated/congested areas of the SR 9 study corridor, with gaps occurring along the more rural segments of the corridor typically between municipality boundaries.

Signage near Marysville highlights traffic safety challenges along the SR 9 corridor (WSDOT)

Chapter 4 Traffic Analysis

4.1 Synchro Peak Hour Analysis

Analysis of roadway and intersection operational performance was performed through use of the Synchro traffic operations analysis package (Version 6, Build series 612) developed by Trafficware, Inc. (Berkeley, California), which evaluates intersection delays and congestion based on procedures similar to those given in the Transportation Research Board (TRB) 2000 Highway Capacity Manual (Chapters 16 and 17). Basic inputs used for Synchro relate primarily to traffic data including traffic volumes, lane geometry (i.e., number of lanes, lane widths, turn-lane storage), signal timing data, pedestrian and bicycle volumes, bus and heavy vehicle traffic levels, and a variety of other data items.

4.1.1 Intersection Delay/Level of Service (LOS)

Level of Service (LOS) is a measure that characterizes operating conditions, as perceived by a driver on a highway, street, or other transportation facility. Although LOS is a qualitative measure, it is used to describe operational conditions using quantitative measures such as speed, travel time, and driver perceptions of comfort and freedom to maneuver in a traffic stream. A range of six LOS designations, ranging from “A” to “F,” are defined in the Transportation Research Board’s 2000 Highway Capacity Manual (HCM). LOS A represents ideal, uncongested operating conditions, and LOS F designates extremely congested, breakdown conditions. LOS B, LOS C and LOS D designate intermediate operating conditions, and LOS E indicates that operating conditions are at or near the roadway’s capacity level.

Table 7 shows the LOS definitions for signalized and unsignalized intersections, following the Transportation Research Board’s 2000 Highway Capacity Manual (HCM) methodology.

Table 7: Intersection Level of Service

Level of Service	Signalized Intersections (seconds of delay)	Unsignalized Intersections (seconds of delay)
A	<10	0-10
B	>10-20	>10-15
C	>20-35	>15-25
D	>35-55	>25-35
E	>55-80	>35-50
F	>80	>50

Source: 2000 HCM, Chapter 15 and 16.

Since the existing conditions traffic data were taken on different days (see Chapter 3.3), some balancing of intersection volumes was necessary to maintain consistency between

adjacent intersections. In other words, some minor adjustments or changes to the volumes were needed to ensure that volumes exiting one intersection are nearly equal to the entering volumes at an adjacent, downstream intersection.

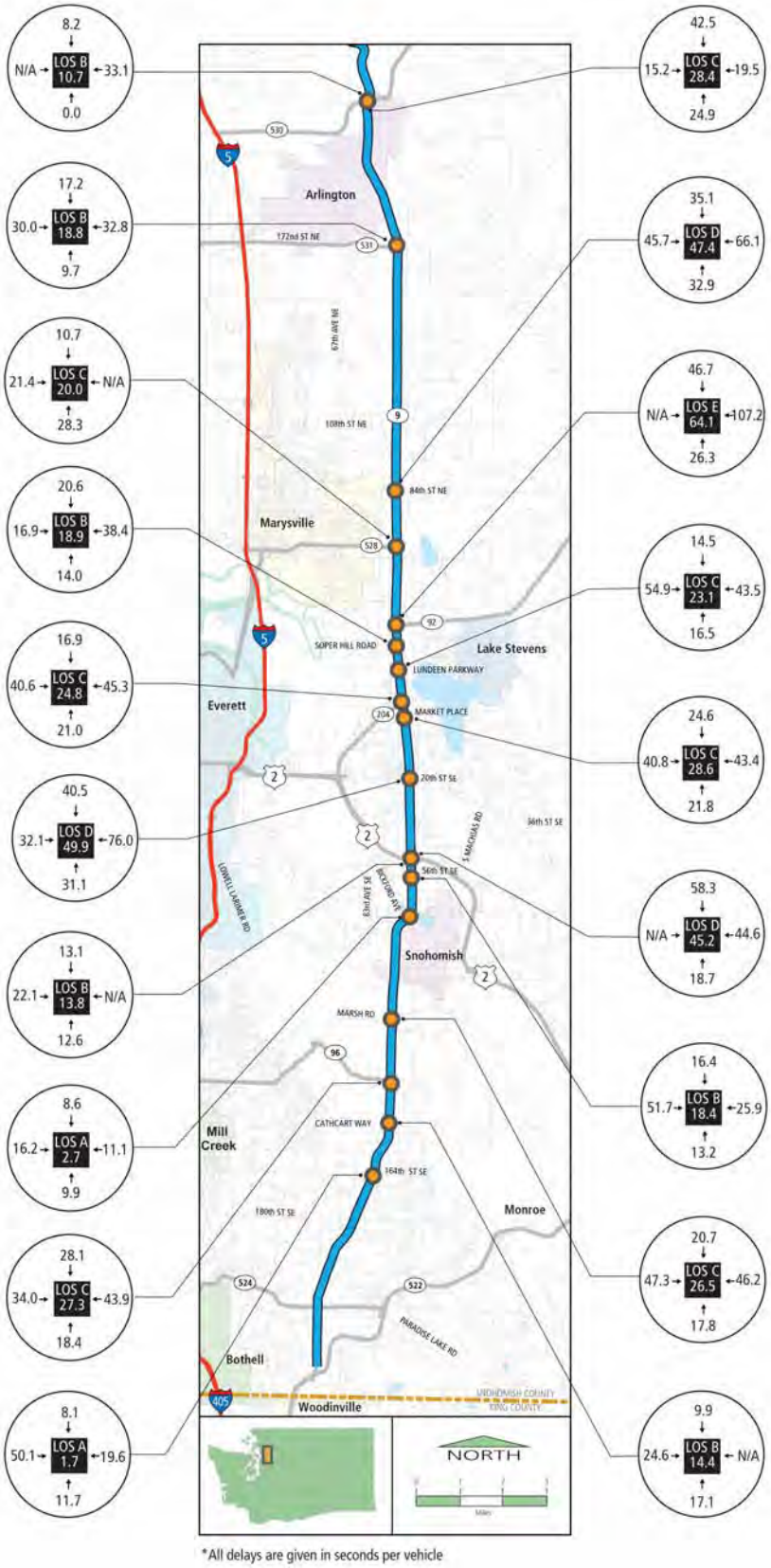
Table 8 and Figures 8 and 9 show the AM and PM peak hour intersection delay and level of service for the 19 study intersections. Generally, vehicle delay (i.e., congestion) is worse during the PM peak hour than during the AM peak hour. The SR 9 intersections with the highest delays include SR 92, 20th Street SE, and 164th Street SE. These intersections operate at LOS E or LOS F during one or both of the evaluated peak hours. The intersection of SR 9/164th Street SE is currently stop-controlled (unsignalized); upgrading this intersection with signalization would significantly improve delay levels. The other two intersections are located near Lake Stevens, the most congested part of the SR 9 study corridor. Reduced delays at these signalized intersections may be achieved through capacity and/or signal phasing improvements.

Table 8: Peak Hour Intersection Delay and Level of Service

		Existing (2004)			
		AM Peak		PM Peak	
Intersection	Signalized?	Delay	LOS	Delay	LOS
SR 530 (Burke Ave)	N	33.1*	D	48.8*	E
SR 530 (Division St)	Y	28.4	C	37.6	D
SR 531 (172nd St NE)	Y	18.8	B	21.4	C
84th St NE	Y	47.4	D	47.9	D
SR 528 (64th St NE)	Y	20.0	C	26.9	C
SR 92	Y	64.4	E	75.3	E
Soper Hill Rd	Y	18.9	B	18.3	B
Lundeen Pkwy	Y	23.1	C	35.0	D
SR 204	Y	24.8	C	37.6	D
Market Pl	Y	28.6	C	51.2	D
20th St SE	Y	49.9	D	55.9	E
US 2 WB Ramps	Y	45.2	D	23.6	C
US 2 EB Ramps	Y	13.8	B	25.6	C
56th St SE	Y	18.4	B	17.4	B
Bickford Ave	N	16.2*	C	28.1*	D
Marsh Rd	Y	26.5	C	54.3	D
SR 96	Y	27.3	C	21.2	C
Cathcart Way	Y	14.4	B	30.9	C
164th St SE	N	50.1*	F	125.7*	F

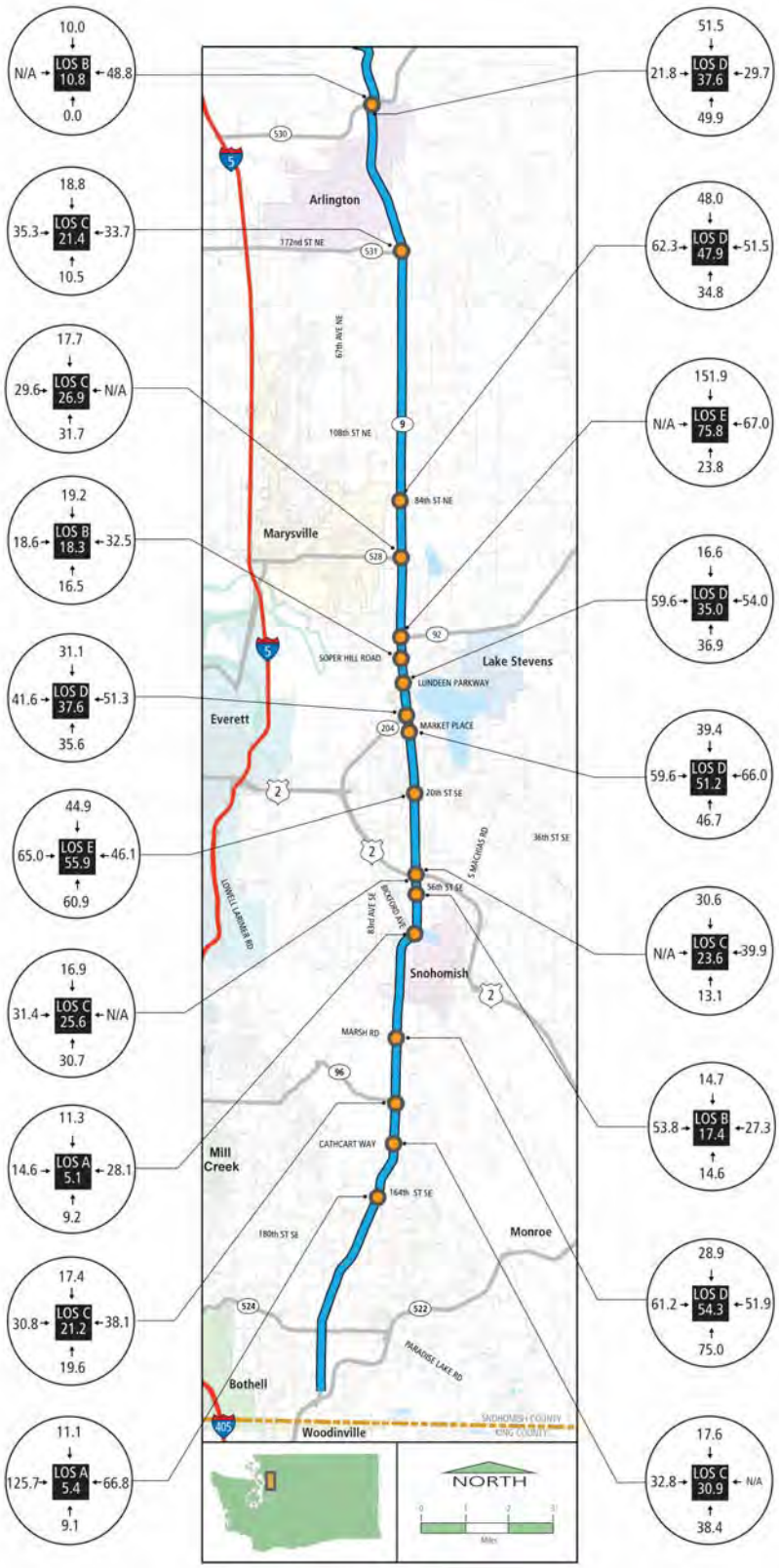
*The delay/LOS reported for unsignalized intersections is representative of the *worst* movement only. For the SR 9 corridor, the delays are on the eastbound and westbound intersecting streets where movements are stop-controlled.

Figure 8: AM Peak Hour Level of Service/Delay



*All delays are given in seconds per vehicle

Figure 9: PM Peak Hour Level of Service/Delay



*All delays are given in seconds per vehicle

4.1.2 Vehicle Queues

Vehicle queues form when arriving vehicles must slow or stop and wait to move through and intersection and the overall arterial system. When the traffic demand exceeds the roadway's capacity, traffic flows become unstable and queues may form. Vehicle queue information taken from the Synchro analysis results, in terms of locations where long wait times and line-ups are likely to occur, is presented in Table 9.

Table 9: Queue Capacity Problem Locations

Intersection	Queue Capacity Problem?			
	Turn Lanes		Through Lanes	
	AM	PM	AM	PM
SR 530 (Burke Ave)				
SR 530 (Division St)	✓	✓		
SR 531 (172nd St NE)				
84th St NE	✓			
SR 528 (64th St NE)				
SR 92	✓	✓		
Soper Hill Rd				
Lundeen Pkwy				✓
SR 204		✓		
Market Pl	✓	✓		
20th St SE	✓			
US 2 WB Ramps			✓	
US 2 EB Ramps				✓
56th St SE				
Bickford Ave				
Marsh Rd		✓		✓
SR 96				
Cathcart Way		✓		
164th St SE				

Queue lengths were evaluated during the AM and PM peak hours for all approaches of each study intersection. Vehicle queues at the study intersection fall into one of two categories: 1) turn-pocket queues, and 2) through-lane queues.

Turn-pocket queues form when the vehicles approaching an intersection must wait until the traffic signal turns green before continuing to turn left or right through the intersection. Problems occur when the number of vehicles entering a left- or right- turn

pocket at any given time exceeds the capacity of the turn pocket, adding delay for other vehicle movements that are obstructed by the queue. Extending the length of the turn pocket would provide relief for the queues and would allow the intersection to operate more efficiently overall. Increasing the number of turn lanes approaching the intersection would also provide additional vehicle storage capacity.

Through-lane queues form when vehicles approaching an intersection must wait until the traffic signal turns green before continuing straight through the intersection. Problems occur when queues extend so far back that all queued vehicles are unable to pass through the intersection (or clear the queue) during the signal's green time. This can cause significant delays for other vehicle movements at that intersection and may even cause delays at nearby intersections due to queues "spilling-back" to adjacent intersections. Increasing the number of through lanes approaching the intersection would provide additional vehicle storage capacity, allowing the intersection to operate more efficiently overall.

The analysis results indicate which of the 19 intersections currently experience queuing problems. For turn-pocket queues, problem locations are those locations where the average peak hour queue is greater than the capacity of the turning pocket. For through-lane queues, problem locations are those locations where the average peak hour queue is greater than 1,000 feet.

4.1.3 Travel Times

Travel times were estimated using Synchro for the segments described in Section 3.4. These segments included the portions of SR 9 between Bickford Avenue and the US 2 ramps and between SR 92 and Market Place. The goal of this exercise was to perform a high-level calibration of the analysis network and determine what level of differences existed between the analysis results and the field-collected data. Differences of greater than 20 percent are commonly expected between travel time calculations and field collected travel times due to the gross-level nature of the analysis-generated values and the variations in traffic conditions during the (field) data collection process. Nonetheless, the majority of the travel times estimated from the Synchro analysis were generally within 20 percent of the field-collected data. The exception was the segment between Bickford Avenue and US 2 ramps for the peak direction: NB travel times in the PM peak hour were significantly higher for the field collected data and SB travel times in the AM peak hour were noticeably higher for the Synchro estimated travel times.

4.2 VISSIM

VISSIM is a microscopic, behavior-based multi-purpose traffic simulation program. The primary application of this software for this project was the provision of 3D animations that represent operating conditions for select corridor segments. In addition to the animations, VISSIM was also used for corridor simulation purposes and was calibrated with the Synchro model (Chapter 4.1) to reasonably match existing operations in terms of traffic flow rates, queuing, and/or delays on SR 9.

Two segments of the SR 9 study corridor (also used for the travel time estimations) were evaluated using the VISSIM traffic simulation software:

- Snohomish area: SR 9 between Bickford Avenue and the US 2 interchange; and
- Lake Stevens area: SR 9 between Market Place and SR 92

These two corridors were chosen to be modeled with VISSIM due to the density of intersections, the segment lengths (approximately two miles each), and the relatively high congestion levels.

4.2.1 Animations

Animation files reflecting the AM & PM peak hour periods were developed to provide 3D visualizations of traffic operations during the heaviest weekday traffic periods. These animations were based on 4-minute video clips of the two study areas. The south segment video files cover the intersections of Bickford Avenue, 56th Street SE, and the US2 ramps. The Lake Stevens video files show the intersections of Market Place, SR 204, Lundeen Parkway, Soper Hill Road, and SR 92.

4.2.2 Travel Times

Travel times were also captured using VISSIM at a planning-level of detail. These travel times were evaluated for the same segments and intersection groupings described in the Synchro analysis and data collection sections. While detailed travel time information was not documented for this report, a comparison of key point-to-point travel times shows that VISSIM-generated data were generally within 15 percent of the Synchro travel time data.

Chapter 5 Next Steps

The existing conditions inventory assessment initiated by this first phase of the SR 9 Corridor Study has been conducted in order to begin integrating the various on-going planning and design efforts along the corridor. By evaluating one of the high-priority segment of SR 9 (from SR 522 north of Bothell to approximately SR 530 in Arlington), a holistic approach to addressing the needs of the facility can and will be pursued for future improvement packages and long-range funding.

The next phase of the SR 9 Corridor Study (Phase 2) will involve the preparation of a comprehensive Route Development Plan (RDP) for the same 30-mile segment between SR 522 near Monroe (south boundary) and Schloman Road in Arlington (approximately ¼-mile north of Phase 1 boundary). The larger goal of the overall study is to investigate current and potential long-range transportation needs along the corridor and to provide a clear direction and framework for addressing potential short-term and long-range deficiencies. The Phase 2 portion of the study will provide a conceptual roadmap for achieving these objectives by developing a set of improvement packages to carry forward into more detailed planning and design.