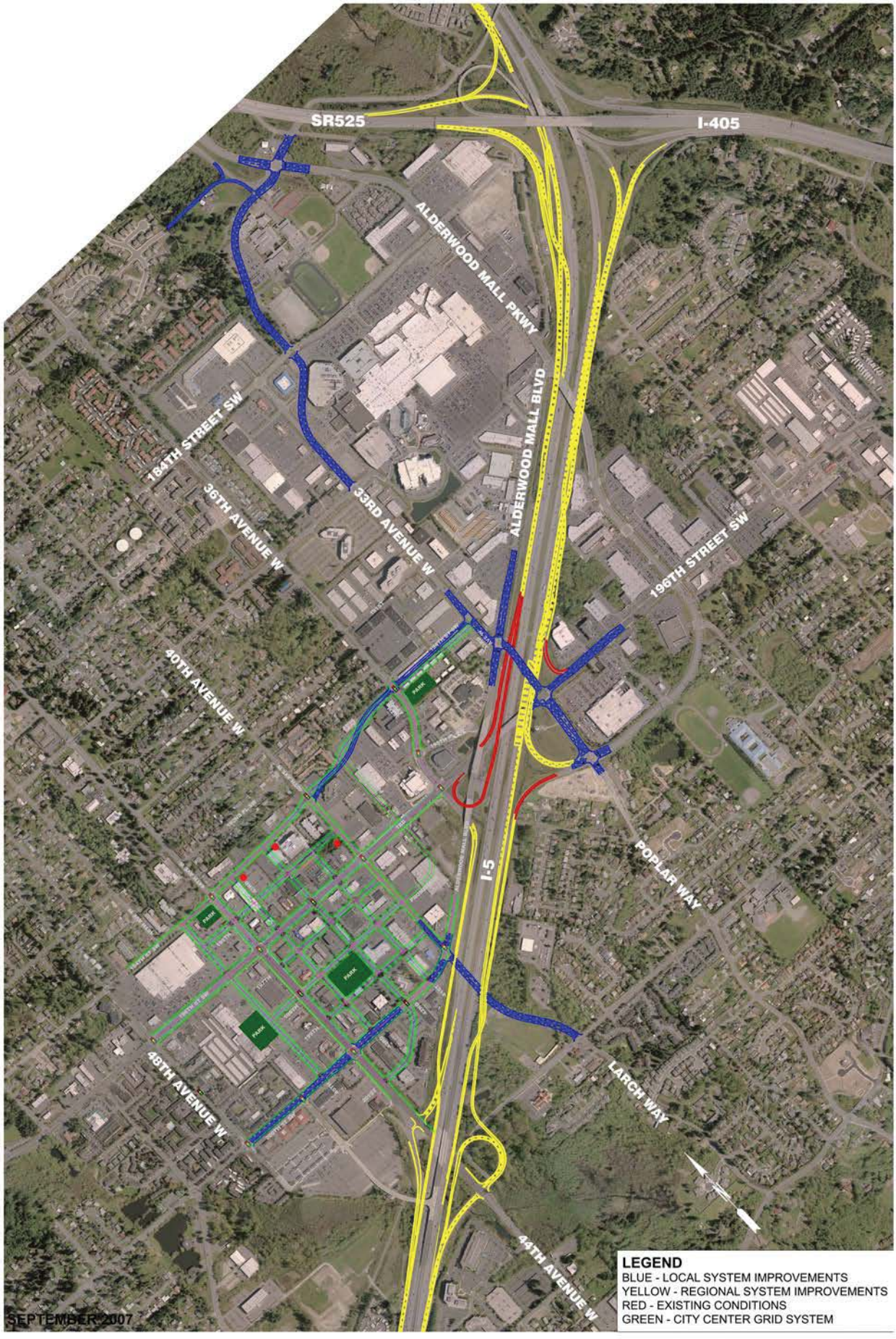
LYNNWOOD CITY CENTER ACCESS STUDY



LEGEND
BLUE - LOCAL SYSTEM IMPROVEMENTS
YELLOW - REGIONAL SYSTEM IMPROVEMENTS
RED - EXISTING CONDITIONS
GREEN - CITY CENTER GRID SYSTEM

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Washington State Department of Transportation

CITY OF Lynnwood

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Perteet

Executive Summary

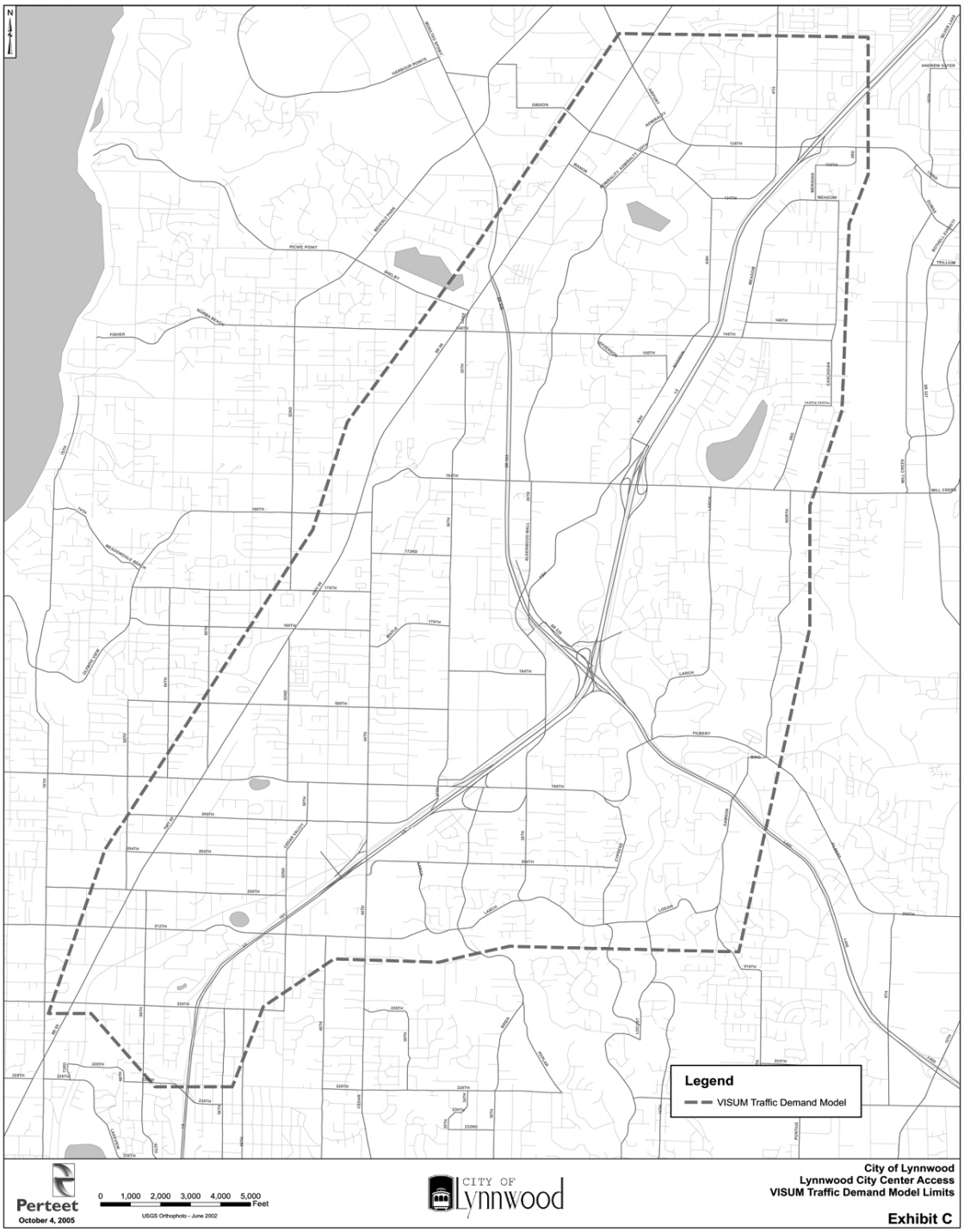
The area designated as the Lynnwood City Center is one of three urban centers adopted by Snohomish County. The City Center is considered a growing commercial core in Lynnwood and is bordered by I-5 to 194th Street SW from the south to the north and 52nd to 36th Avenue W from the west to the east. In order to fulfill the requirements under the Growth Management Act (GMA) of an urban center, Lynnwood recently rezoned this area to encourage higher density land use for the City Center by permitting development of mid-rise buildings up to 34 stories high. With the rezoning, the square footage in the area is anticipated to increase from approximately 4 million to 9 million square feet by 2020 and to 12 million square feet by 2032, in effect tripling the occupancy potential in the Lynnwood City Center area. As density and the resulting demand to the transportation system increase in the area, access improvements to the transportation system will become more critical in meeting the overall goal in the region of an urban center in Lynnwood.

Among the major challenges for Interstate access into Lynnwood include the limited number of I-5 crossings around Lynnwood and the limited number of access points between I-5 and Lynnwood. There are three routes to cross I-5 in Lynnwood, through 44th Avenue W, the 196th Street SW overcrossing, and more recently through the Alderwood Mall Pkwy overcrossing. In addition, Lynnwood currently has one complete interchange, the 196th Street interchange, along with 164th Street SW serving as a northern interchange access point. Notably, the 164th Street interchange via Ash Way is widely used as an alternative route into the Alderwood Mall area. In addition, there are two incomplete interchanges in Lynnwood, one along 44th Avenue W and the other at the I-405/SR525 interchange. Both the 44th Avenue and I-405/SR525 interchanges provide I-5 access solely to and from the south; yet preliminary review of PM peak hour movements indicate demand is substantially higher to and from the north.

To address opportunities to improve access into Lynnwood both from the local and regional transportation systems, a Study Support Team was formed consisting of members from the City of Lynnwood, Snohomish County, WSDOT, FHWA and Perteet to conduct the Lynnwood City Center Access Study. As shown in Figure 1 in the following page, the boundaries of the study area extend from the I-5/128th Street SW interchange on the north to the I-5/220th Street SW interchange on the south, to SR99 on the west, to North/Dawson Road on the east.

Once the project area was defined, the Study Support Team approved the approach used to analyze traffic for this study. A design year of 2032 was recommended with the Baseline Transportation System identified to include only projects with a high degree of certainty of being constructed by 2032. The latest Puget Sound Regional Council (PSRC) regional model was correlated with the City of Lynnwood VISUM Base Transportation Model. Once correlations between the two sets of data were confirmed, the City of Lynnwood data was extrapolated to 2032. To analyze traffic operations for existing and design year conditions, VISSIM was used for freeway operations and SYNCHRO for city streets and freeway ramp terminals to determine the level of service. For signal timing of the local street network, SYNCHRO signal timing in a VISSIM microsimulation was used.

Figure 1: Limits of Study Area



A set of concepts to address the access needs of the Lynnwood City Center were developed at the July 11, 2007 Design Charrette. Using the VISUM traffic-demand model, changes in PM peak hour traffic volumes were analyzed. Concepts were screened out that did not produce significant changes in PM peak hour traffic volumes; had undesirable impacts to existing buildings, neighborhoods and parks; had fatal flaws; had adverse operational impacts to the interstate mainline; and were outside the jurisdiction of the City of Lynnwood or WSDOT.

Study Objectives

Based on concepts developed at the July 11, 2006 Design Charrette, concepts were selected according to the following objectives:

- Identify concepts that would move local trips from the I-5 corridor and onto the local transportation system.
- Select concepts that would reduce congestion on the principal arterials with I-5 interchanges to relieve congestion at those interchanges.
- Identify concepts that might improve the congestion-related High Accident Corridor (HAC)/High Accident Locations (HAC) in the Study Area.

The following concepts were selected for additional analysis:

Local Transportation System Improvements:

- Concept 6 – Extend 33rd Avenue W to Alderwood Mall Parkway.
- Concept 9 - New link across I-5 between 33rd Avenue W and Poplar Way.
- Concept 11 - New connection across I-5 between 40th Avenue W and Larch Way.
- Concept 10 and 44 combined – This would create a new east-west corridor along 194th Street SW linking SR99 to Alderwood Mall Boulevard (Concepts 56 and 57 would also be considered as part of this combination).
- Concept V - Widen 200th between 44th and 48th to 5 lanes.
- Concepts 38, 41 and I combined – This would create a new continuous east-west corridor that would link SR99 to the SR525/Alderwood Mall Boulevard interchange and possibly relieve congestion on 196th Street SW. It would be more effective than just Concepts 31 and I alone originally identified in the October, 2006 SST meeting. This concept was added by the City as worth considering after the SST meeting.

Regional Transportation System Improvements to be evaluated with Local Transportation System Improvements:

- Concept 1 - New Ramp - SB I-5 to WB SR525 (recently canceled by WSDOT).
- Concept 2 - New Braided Ramp - EB SR525 to SB I-5.

Regional Transportation System Improvements to be evaluated only after evaluating effectiveness of Local Transportation System Improvements:

- Concept 25 - Create NB and SB CD system on I-5 to connect Lynnwood interchanges. Provide SB off-ramps and NB on-ramps at 44th Avenue W.

The following Regional Transportation System Improvements have not been removed from consideration yet. Additional traffic demand modeling work must first be conducted to determine possible effectiveness, which may immediately eliminate them.

- Concept VI – New ramp from SB I-5 to Alderwood Mall. The proximity of the I-5/I-405/SR525 system interchange makes this concept not feasible as a direct connection to I-5. It may be feasible as part of a CD system such as Concept 25.
- Concept VII – New ramp from EB SR525 to NB I-5. This concept would be a complementary ramp to Concept 2, WSDOT's TPA project. It would complete the system interchange.
- Concept VIII - Reconfigure SR525 and Alderwood Mall Parkway interchange to simplify current split interchange configuration and create easier access into Lynnwood.

Based on the analyses, the following concepts were not pursued due to fatal flaws as summarized below:

Local System Improvements

Concept	Description	Fatal Flaw
Concept 44	A new east-west corridor along 194th St SW linking SR99 to Alderwood Mall Blvd.	Property impacts to residential neighborhoods and park lands considered undesirable between 44th Ave W and SR99.
Old Concept 10	New connection along 195th Pl SW between 36th Ave W and Alderwood Mall Blvd. Note this concept was revised from the description in Technical Memorandum #7 as the new east-west corridor along 194th St SW between 33rd and 40th Ave W. Concept 10 with the revised concept description is a recommended concept for future construction.	This option attracts low traffic volumes and is not considered cost effective.
Concept 56	New loop connection between WB 196th St SW to Alderwood Mall Blvd (examined as part of combination of concepts with Concepts 10 and 44 to create a new east-west corridor along 194th Street SW linking SR99 to Alderwood Mall Boulevard).	• Low traffic demand for this concept. • Existing church and other buildings restrict placement of the ramp. • Cannot fit adequate design radius for ramp between 195 Pl SW and 196th St SW.
Combination of Concepts 38, 41 and I	A new east-west corridor to link SR99 to the SR525/Alderwood Mall Boulevard interchange which would include widening of Maple Road.	This option attracts traffic volumes which are considered too low to be cost effective and impacts to residential neighborhoods considered undesirable.

Local and Regional System Improvements

Concept	Description	Fatal Flaw
Concept 57	New off-ramp from existing SB I-5/196th off-ramp to 195th Pl SW/36th Ave W (examined as part of combination of concepts with Concepts 10 and 44 to create a new east-west corridor along 194th Street SW linking SR99 to Alderwood Mall Boulevard).	• Insufficient weave distances and safety concerns due to high traffic volumes predicted for this concept which would require a minimum of 3 lanes between 196th St and I-405/SR525 interchanges. • Two auxiliary lanes required along I-5 and under I-405/SR525 to accommodate the forecasted traffic volume. Existing bridge piers on I-405/SR525 allow room to fit an extra lane on I-5 but require I-5 to be rechannelized by a minimum of 6 feet to the east.
Concept VI	A new ramp from southbound I-5 to Alderwood Mall Blvd.	Not geometrically feasible due to location of existing and proposed ramps in the area.

Concept 25	A north- and southbound collector-distributor (CD) system on I-5 to connect Lynnwood interchanges. A modified version of this concept is recommended as a Braided Ramp System discussed in Technical Memorandum #8 and #9.	• Insufficient weave distances and safety concerns due to proposed number of CD lanes required to support traffic volumes. • Existing bridge piers constrain the number of lanes that will fit under the existing structures. • High traffic volumes and necessary weaves would create back-ups into mainline and create safety concerns.

Note that several variations of the CD system were examined but each continued to produce similar challenges with insufficient weave distances and safety concerns. As a result, the CD system concept was replaced by a braided ramp system as the recommended concept to improve the Lynnwood interchanges and to address the study objectives listed previously.

Key Findings

The study area (Interstate 5 from MP 178.5 to MP 187.5) is a high collision corridor. WSDOT has **recently ranked this area as having the 2nd and 3rd worst collision corridors in Washington State.** The data analyzed indicates a strong correlation between collisions and congestion. The analysis concluded that the high rate of collisions will continue to increase unless capacity improvements and/or interchange improvements are completed.

The Study Support Team selected 33 signalized intersections to study. Existing and Design Year (2032) level of service (LOS) for the PM peak hour was determined for these study intersections using Synchro (Build 614). Today, five of the study intersections operate at LOS E or F. In addition, several of these intersections have specific approaches that are operating at LOS F. Due to the large increases in arterial traffic volumes, 23 of the 33 intersections studied operate at LOS E or F by the Design Year (2032). The results of the VISSIM model support these results, showing extensive queuing that impacts freeway operations.

Traffic forecasts for the design year (2032) indicate the local arterial system volumes increase at a greater rate than volumes on I-5. 164th Street SW and 44th Avenue W increase by 50 percent or more by the Design Year (2032), and 196th Street SW nearly doubles in traffic. I-5 traffic volumes increase 5 to 20 percent near these arterials with very little growth northbound through the 44th Avenue W and 196th Street SW interchange areas.

Congestion along I-5 through the City of Lynnwood occurs in the north direction during the evening commute. Mainline densities and speeds through the study area generally result in LOS D or better throughout the study corridor. By 2032, independent of arterial congestion, the freeway operates at LOS E or F throughout most of the study area during PM peak hour. Nearly all merge sections operate at LOS E or F.

Currently, I-5 between 128th Street SW and 220th Street SW operates during the PM peak hour with speeds above 45 mph. Some sections of merge areas, particularly in the outside lanes, operate with speeds 40 to 50 mph which indicates mild congestion. Travel time on I-5 between 220th Street

SW and 128th Street SW in the northbound direction increases from 7.8 minutes today to 10.5 minutes in the year 2032. In the southbound direction, travel time for this same section of I-5 increases from 7.1 minutes today to 8.0 minutes in the year 2032.

Overall traffic volumes on I-5 do not change significantly with the Local System Improvements; however the Poplar Way crossing of I-5 results in an increase in off ramp trips and an increase in on ramp trips at the 196th interchange. The result is a decrease in traffic volume on mainline I-5 between the off and on ramps. There is in no net change south and north of the interchange.

The addition of regional improvements, particularly the interchange at 44th Avenue W, improves access to the City Center area. With southbound access at 44th Avenue W from I-5, there is a decrease in vehicular demand exiting I-5 at 164th Street SW, 196th Street SW, and 220th Street SW compared to the Baseline alternative. There is about a 5 percent increase in demand entering at 164th Street SW and I-405/SR525. In the northbound direction, an on ramp at 44th Avenue W would increase demand exiting the freeway at I-405 and SR525. I-5 mainline volume increases between 44th Avenue W and I-405. There is also a decrease in traffic on Alderwood Mall Parkway, likely a result of traffic shifts from the 196th Street SW interchange to 44th Avenue W.

A combined system of both Local and Regional System Improvements provides the greatest overall benefit. The following summarizes the key findings:

- Increased access to/from I-5 within the City in the design year (2032) during the PM peak hour.
    - Baseline alternative serves 8,120 vph at the 196th Street SW and 44th Avenue W interchanges.
    - Local and Regional System Improvement alternative serves 11,360 vph at the 196th Street SW and 44th Avenue W interchanges.
- Improved intersection operations.
    - 25 of the 31 study intersections operate at LOS E or F with the Baseline alternative.
    - 19 of the 31 study intersections operate at LOS E or F with the Local and Regional System Improvement alternative.
- Operations on I-5 mainline improve slightly.
    - 7.7 minutes travel time southbound and 9.3 minutes northbound with the Baseline alternative.
    - 7.6 minutes travel time southbound and 9.1 minutes northbound with the Local and Regional System Improvement alternative.

It is recommended that any additionally analysis in the area focus on how each of the conceptual improvements can be implemented over time.

Phasing Recommendations

Phasing of the concepts will be dependent on future funding opportunities. This may mean that some concepts will move forward before others due to the availability of specific funds for a project or due to a particular development opportunity. Concept 1, the proposed SB I-5 off-ramp to WB SR525, was canceled by WSDOT effective June 21, 2007 due to lack of support within WSDOT to pursue the project. WSDOT's decision was based on insufficient demonstrated need for the ramp as shown by the traffic demand forecasts, in addition to the perceived shortfall in the available TPA funding to construct the project. This project would have completed a missing movement at the system interchange, and provided an alternate access into Lynnwood from the north.

Suggested phasing of the projects is as follows:

1. Concept 2: Braiding of I-405 SB/SR525 SB/196th ramps (current WSDOT TPA project). This project would both improve safety (addressing a WSDOT recognized high collision area), and capacity in this segment of I-5.
2. Concept 9: Poplar Way overcrossing of I-5 between 33rd Avenue W and 196th Street SW. This project has benefits to relieve congestion at the I-5/196th Interchange ramps that is affecting I-5 mainline operations, and on the local arterial system.
3. Concept 6: New arterial across soon-to-be former Lynnwood High School site linking the SR525/Alderwood Mall Blvd interchange and 184th Street SW. This improves access to the Alderwood Mall area as well as to the future Lynnwood City Center area by providing an alternate route to Alderwood Mall Parkway. (Note: Concept description has been revised from Technical Memorandum #9 as the concept is now better defined).
4. Concept V: 200th Street SW widening from 3 to 5 lanes between 44th Avenue W and 48th Avenue W. This was a "missing link" to the other improvements already planned for in the widening of 200th Street SW between 40th Avenue W and SR99.
5. Part of Concept 25a: Completion of I-5/44th Avenue interchange to include NB on-ramp and SB off-ramp. This will require braiding of the SB 196th on-ramp to I-5 from the new SB 44th Avenue off-ramp. This is an important project for improving access into the Lynnwood City Center. More traffic currently access Lynnwood from the north than from the south, yet this interchange currently only provides access to and from the south. As Lynnwood continues to grow as the South Snohomish County urban center, the limited access to and from the north will contribute to increased congestion at the 196th interchange.
6. Concept 10: 194th Street SW connection between 33rd and 40th Avenue W. This project would provide new access from the northern portion of the City Center to the Alderwood Mall area and likely relieve congestion on 196th Street SW. (Note: Concept description revised from Technical Memorandum #7 as this concept was modified to address fatal flaws).
7. Part of Concept 25a: Braiding of NB 196th to I-5 on-ramp and NB I-5 to SB I-405 off-ramp. This project would both improve safety (addressing a high collision area), and capacity in this segment of I-5.
8. Concept 11: 40th Avenue W undercrossing of I-5 between 40th Avenue W and Larch Way. This project has benefits to help relieve congestion at the I-5/44th Avenue ramps that could affect I-5 mainline operations, and provides an alternate route to and from the City Center area across I-5.

Brief Description and Conclusion of Technical Memorandums

Technical Memorandum #1: Traffic Demand Modeling Approach

This section details the approach that will be used to generate future year traffic for the Lynnwood City Center Access Feasibility Study and possible Access Point Decision Report (APDR).

Design Year

Recommendation: A Design Year of 2032.

Traffic Demand Model

Recommendation: The latest PSRC regional model in conjunction with the City of Lynnwood. VISUM Base Transportation Model updated to 2032 and expanded in geographic scope to include external areas of importance.

Baseline Transportation System for Design Year

Recommendation: Only those projects that have a high degree of certainty of being constructed by the Design Year should be included in the Baseline Transportation System.

Traffic Demand Model Output

Recommendation: AM and PM peak hour volumes will be generated for the year of opening (anticipated to be between 2012 and 2014) and design year (2032).

Technical Memorandum #2: Existing Conditions Traffic Analysis Approach

This section details the approach that will be used to analyze existing condition traffic operations for the Study.

Existing Condition Baseline Year

Recommendation: Use existing traffic counts from 2004 and 2005.

Traffic Operations Analysis

Recommendation:

- Use VISSIM for freeway operations including mainline and freeway merge analysis to produce volume/density and volume/speed results.
- Use SYNCRHO for City streets and freeway ramp terminals to produce Highway Capacity Manual 2000 (HCM) Level of Service (LOS).
- Use SYNCHRO signal timing in a VISSIM microsimulation of the local street network.

Technical Memorandum #3: Design Year Traffic Operations Analysis Approach

This section details the approach that will used to analyze Design Year condition traffic operations for the Study.

Design Year Traffic Volumes

Recommendation: Year 2030 traffic volumes will be generated by the City of Lynnwood VISUM traffic demand model, checked with the 2030 Puget Sound Regional Council (PSRC) screen line traffic data, extrapolated to 2032 at the growth rates agreed to in Technical Memorandum #1.

Traffic Operations Analysis Package
Recommendation:

- Use VISSIM for freeway operations including mainline and freeway merge analysis to produce volume/density and volume/speed results.
- Use SYNCRHO for City streets and freeway ramp terminals to produce Highway Capacity Manual 2000 (HCM) Level of Service (LOS).
- Use SYNCHRO signal timing in a VISSIM microsimulation of the local street network.

Technical Memorandum #4: Collision Analysis

This section provides a summary and analysis of collision data for the Study. The study area is one of the worst collision corridors in the State. The collision rate was significantly higher in the southbound direction than in the northbound direction.

The data analyzed indicates a strong correlation between collisions and congestion, and concluded that the high rate of collisions will continue to increase unless capacity and/or interchange improvements are completed. Interchange complexity, primarily spacing and weaving lanes, also appears to be contributing to the high collision rate. Reducing collisions by implementing improvements that reduce congestion could consist of the following:

- Capacity improvements to the local arterial system that either remove trips from the I-5 corridor, or reduce backups on the I-5 ramps.
- Access improvements at the on and off ramps.
- Improvements that would provide additional capacity on I-5.

Additionally, the highest rates of occurrence were seen in the vicinity of the 196th Street Interchange, I-405/SR525 Interchange, and 164th Street Interchange so efforts to reduce collisions in these segments would produce the greatest benefit.

Technical Memorandum #5: Existing Conditions Traffic Operations Analysis

This section details the results of the existing condition traffic operations for the PM peak hour that was conducted for the Study. Traffic counts used in this study were conducted within the past three years. Travel times for northbound and southbound for the I-5 corridor during the PM peak hour were recorded in April 2006. Travel time information was used to help calibrate the VISSIM traffic operations analysis.

Congestion along I-5 through the City of Lynnwood occurs in the north direction during the evening commute. Operational analysis for the freeway mainline and interchange ramp merge/diverge areas was conducted based on existing traffic volume, speed, and travel time data collected. Mainline densities and speeds through the study area generally result in a LOS of D or better throughout the study corridor.

I-5 between 128th Street SW and 220th Street SW operates during the PM peak hour with speeds above 45 mph. Some sections of merge areas, particularly in the outside lanes, operate with speeds 40 to 50 mph which indicates mild congestion.

Most of the study intersections operate under LOS C to E. 220th Street SW and the I-5 northbound ramp intersection operate at LOS F and have a queue that extends from the eastbound approach

through the southbound ramps. Several intersections have an overall LOS of E or better but have approaches that are failing. One example is the 128th Street SW and I-5 northbound ramp intersection. The northbound approach operates at LOS F and queues back on to the freeway impact freeway operations in the outside lanes.

Technical Memorandum #6: Design Year (2032) Traffic Operations Analysis

This section presents the results of the Design Year (2032) traffic operations for the PM peak hour that was conducted for the Lynnwood City Center Access Study.

Traffic forecasts for the design year (2032) indicate large increases in traffic volumes on the arterials with significantly smaller rate of increase along I-5. 164th Street SW and 44th Avenue W increase by 50 percent or more by the Design Year (2032), and 196th Street SW nearly doubles in traffic. I-5 traffic volumes increase 5 to 20 percent near these arterials with very little growth northbound through the 44th Avenue W and 196th Street SW interchange areas. Arterial congestion queues onto the freeway mainline in both the north and southbound direction.

Independent of arterial congestion, the freeway operates at LOS E or F throughout most of the study area. Nearly all merge sections operate at LOS E or F. Travel time on I-5 between 220th Street SW and 128th Street SW in the northbound direction increases from 7.8 minutes today to 10.5 minutes in the year 2032. In the southbound direction, travel time for this same section of I-5 increases from 7.1 minutes today to 8.0 minutes in the year 2032.

Technical Memorandum #7: Screening of Design Charrette Concepts

This section documents the approach used to screen the concepts developed at the July 11th Design Charrette, as well as other concepts suggested by the Study Support Team. The concepts that remain after the screening will be further analyzed in the Access Needs Report.

The following concepts were selected for additional analysis:
Local Transportation System Improvements:

- Concept 6 – Extend 33rd Avenue W to Alderwood Mall Parkway.
- Concept 9 - New link across I-5 between 33rd Avenue W and Poplar Way.
- Concept 11 - New connection across I-5 between 40th Avenue W and Larch Way.
- Concept 10 and 44 combined – This would create a new east-west corridor along 194th Street SW linking SR99 to Alderwood Mall Boulevard (Concepts 56 and 57 would also be considered as part of this combination).
- Concept V - Widen 200th between 44th and 48th to 5 lanes.
- Concepts 38, 41 and I combined – This would create a new continuous east-west corridor that would link SR99 to the SR525/Alderwood Mall Boulevard interchange and possibly relieve congestion on 196th Street SW. It would be more effective than just Concepts 31 and I alone originally identified in the October, 2006 SST meeting. This concept was added by the City as worth considering after the SST meeting.

Regional Transportation System Improvements to be evaluated with Local Transportation System Improvements:

- Concept 1 - New Ramp -SB I-5 to WB SR525 (recently canceled by WSDOT).

- Concept 2 - New Braided Ramp -EB SR525 to SB I-5.

Regional Transportation System Improvements to be evaluated only after evaluating effectiveness of Local Transportation System Improvements:

- Concept 25 - Create NB and SB CD system on I-5 to connect Lynnwood interchanges. Provide SB off-ramps and NB on-ramps at 44th Avenue W.

The following Regional Transportation System Improvements have not been removed from consideration yet. Additional traffic demand modeling work must first be conducted to determine possible effectiveness, which may immediately eliminate them.

- Concept VI – New ramp from SB I5 to Alderwood Mall. The proximity of the I-5/I-405/SR525 system interchange makes this concept not feasible as a direct connection to I-5. It may be feasible as part of a CD system such as Concept 25.
- Concept VII – New ramp from EB SR525 to NB I-5. This concept would be a complementary ramp to Concept 2, WSDOT's TPA project. It would complete the system interchange.
- Concept VIII - Reconfigure SR525 and Alderwood Mall Parkway interchange to simplify current split interchange configuration and create easier access into Lynnwood.

Technical Memorandum #8: Concept Refinement, Traffic Operations

This section documents the groupings of concepts from Technical Memorandum #7, the resulting travel pattern changes, and the traffic operations. Concepts that did not provide to have at least a 20 percent reduction in volume at an intersection's critical approach or a 10 percent reduction on a congested freeway segment were screened from further consideration.

Overall traffic volumes on I-5 do not change significantly with the Local System Improvements; however the Poplar Way crossing of I-5 results in a decrease in traffic volume between the off and on ramps along mainline I-5. Furthermore, the addition of regional improvements, particularly the interchange at 44th Avenue W, improves access to the City Center area. A combined system of both Local and Regional System Improvements provides the greatest overall benefit. The following summarizes the key findings:

- Increased access to/from I-5 within the City in the design year (2032) during the PM peak hour.
    - Baseline alternative serves 8,120 vph at the 196th Street SW and 44th Avenue W interchanges
    - Local and Regional System Improvement alternative serves 11,360 vph at the 196th Street SW and 44th Avenue W interchanges
- Improved intersection operations
    - 25 of the 31 study intersections operate at LOS E or F with the Baseline alternative
    - 19 of the 31 study intersections operate at LOS E or F with the Local and Regional System Improvement alternative
- Operations on I-5 mainline improve slightly
    - 7.7 minutes travel time southbound and 9.3 minutes northbound with the Baseline alternative
    - 7.6 minutes travel time northbound and 9.1 minutes northbound with the Local and Regional System Improvement alternative.

Technical Memorandum #9: Concept Refinement, Geometric and Configuration Characteristics

The focus of this technical memorandum is on the geometric and configuration characteristics of the different concepts. Each concept selected for further analysis from Technical Memorandum #7 was examined in greater geometric detail and described accordingly.

Notably, the collector-distributor system (CD system) was modified into a braided ramp system due to the limited amount of space available to fit in the number of lanes required from the traffic demand model while achieving adequate weave distances. Furthermore, existing bridge piers on the I-405/SR522 structure restricted the number of lanes that would fit underneath. Therefore, a braided ramp system (Concept 25a) was examined as the improved alternative to connect interchanges along Lynnwood. A new I-5 braided off-ramp to the I-405/SR525 interchange was also added to Concept 25a in order to fit the connection from the braided ramp system back onto NB I-5 prior to the I-405/SR525 structure.

Initial opinion of cost estimates in 2007 dollars was provided as listed below:
Local Transportation System Improvements: $108 and $140 million (note: this estimate has been revised from Technical Memorandum #9 and updated in Technical Memorandum #11 as concepts were better defined).
Regional Transportation System Improvements:

- Concept 1 – New Ramp – SB I-5 to WB SR525 (recently canceled by WSDOT)
  - At-Grade Alternative: $17 million
  - Two Flyover Alternatives: $45 million each
- Concept 2 – New Braided Ramp
  - EB SR525 to SB I-5
  - $13 and $17 million
- Concept 25a – New Braided Ramp System on I-5
  - Connect Lynnwood Interchanges
  - $167 and $213 million

Technical Memorandum #10: Draft Environmental Screening

This section documents the environmental screening completed for this Study. The environmental screening was completed by overlaying available GIS data onto the various project footprints and adjacent areas to calculate potential impacts to environmental elements for each project. This screening will provide detail for analysis of environmental considerations during project planning and help develop strategies for future environmental regulatory approval.

For this report the environmental screening was divided into three categories:

- Natural resources, which include critical areas that are typically regulated by local, state, and federal law;
- Natural hazards, which are areas, resources, and/or critical areas/natural systems and processes that pose a potential hazard to people and property; and
- The human environment, which considers how the project may affect people and their quality of life.

Initial screening indicates that there are no fatal flaws in the concepts identified due to environmental impacts and these concepts do not result in impacts above the impact levels of the United States Army Corps of Engineer's nationwide permit.

Technical Memorandum #11: Fatal Flaw Analysis and Phasing Recommendations

This section summarizes the fatal flaws and recommended phasing of the concepts identified from the initial screening described in Technical Memorandum #7, and provides an order of magnitude cost opinion at the end of this memorandum. Following the discussion of the fatal flaw analysis, preliminary design deviations are also listed in this memorandum. The fatal flaws and phasing recommendations were summarized earlier in this Executive Summary.

There were no fatal flaws identified due to environmental reasons. Furthermore, these concepts do not result in wetland impacts above the impact levels of a United States Army Corps of Engineer's nationwide permit.

However, in order to fit the necessary lanes under the existing 196th Street SW and Alderwood Mall Pkwy structures, the following shoulder width deviations may be required:

- Shoulder widths along northbound I-5 under 196th Street SW may need to be decreased on both the left and right side to 2 feet to fit in an auxiliary lane to exit onto I-405/SR525.
- Shoulder widths along northbound I-5 may need to be decreased on the right side to 2 feet under Alderwood Mall Pkwy.
- Shoulder width along the proposed exit ramp onto I-405/SR525 may need to be decreased on both the left and right side to 2 feet under Alderwood Mall Pkwy.
- Shoulder widths for the proposed I-405/ SR525 to southbound I-5 ramp may need to be decreased on the right side to 5 feet under Alderwood Mall Pkwy.

Technical Memo #1

Lynnwood City Center Access Study
Traffic Demand Modeling Approach

Perteet

TO: **David Mach, P.E., Project Manager, City of Lynnwood**

FROM: **Peter De Boldt, P.E., Project Manager**
Mike Birdsall, Traffic Modeling Lead

DATE: **December 19, 2005**

RE: **Traffic Demand Modeling Approach**

This memorandum details the approach that will be used to generate future year traffic for the Lynnwood City Center Access Feasibility Study and possible Access Point Decision Report (APDR). The general traffic demand modeling approach was discussed with representatives of WSDOT, the City of Lynnwood, and the Perteet team at a meeting held at WSDOT's Northwest Region Dayton office on August 31, 2005. It was also discussed at the Study Support Team meetings of September 13, 2005, October 11, 2005, November 8, 2005 and December 13, 2005.

The proposed approach to traffic demand modeling is consistent with that used on other Feasibility Studies and APDR's in the region.

Design Year
Recommendation: A Design Year of 2032 is recommended.
Background: A Design Year of 2032 is recommended for traffic demand modeling. If improvements are constructed, their construction is anticipated to begin no earlier than 2008, and no later than 2012. A Design Year of 2032 provides at least a 20-year planning horizon from the time the construction of any improvements is anticipated to begin. This 20-year planning horizon is consistent with Section 1425.05(4)b of the WSDOT Design Manual. If it becomes known that construction will not begin by 2012, the Design Year will be adjusted accordingly. .A Design Year of 2032 can be extrapolated from the with Puget Sound Regional Council's (PSRC) 2030 EMME/2 Traffic Demand Model using a growth rate agreed to by the Study Support Team. At the December 13th SST meeting, growth rates of 0.9% per year growth in population, and a 2.3% per year growth in employment were discussed. These growth rates are consistent with PSRC growth rates in the Lynnwood area for the years between 2020 and 2030.

Traffic Demand Model
Recommendation: The latest PSRC regional model in conjunction with the City of Lynnwood VISUM Base Transportation Model, updated to 2032 and expanded in geographic scope to include external areas of importance is recommended.
Background: PSRC recently updated its regional travel demand model. This regional model is certified by FHWA for performing transportation analysis in the PSRC area. The model is designed to forecast regional traffic flows, particularly along the freeways and major arterials. However, the model doesn't contain many of the local arterials and collectors. The City of Lynnwood has a 2020

VISUM Travel Demand Model that is easily updated to 2032. The City model includes a much more detailed roadway network than the regional model. This study will take advantage of both models in generating future traffic forecasts for evaluating various improvement options. Specifically:

1. The latest PSRC regional model will be used to generate existing and future baseline volumes on the freeway and other major arterials at the "external stations" immediately outside of the study area;
2. The regional model's forecasts at the external stations will be used to control the external and through travel of the City model;
3. The City model will be used to generate traffic forecasts on the arterials, streets, ramps and intersection turning volumes within the study area;

To improve the analysis, more network details will be added to the City model to include all arterials and freeway links in the study area and slightly beyond. In the expanded study area, Traffic Analysis Zones (TAZ's) will be added by subdividing the PSRC model's zones similar to the TAZ's in the Snohomish County Travel Demand Model.

Baseline Transportation System for Design Year

Recommendation: Only those projects that have a high degree of certainty of being constructed by the Design Year should be included in the Baseline Transportation System for the Design Year. If a project is likely to be constructed by the Design Year, it should be included in the Baseline Transportation System.

Background: There are a variety of projects within the study area that may be constructed before the Design Year. Figure 2 identifies these projects. Sources of funding are anticipated to come from three major sources, the Transportation Project Account (TPA, transportation package passed by the 2005 Washington State Legislature), the Regional Transportation Improvement District (RTID, yet to be approved by voters in the region), and local sources such as the City or County. A vote on the RTID projects is yet to be scheduled. The principal project that has been identified that relies on City or County funding is the City's Maple Road Extension project (specific funding has not yet been identified for this project).

Traffic Demand Model Output

Recommendation: AM and PM peak hour volumes will be developed. These will be generated for the year of opening (anticipated to be between 2012 and 2014) and design year (2032). Daily volumes will be manually calculated from the peak hour model outputs.

Background: The PSRC regional model and Lynnwood VISUM traffic demand model will provide the year of opening (anticipated to be between 2012 and 2014) and 2030 traffic volumes to analyze traffic operations for the study's Feasibility Study phase, and possible future Access Point Decision Report (APDR). The 2030 traffic volumes will be extrapolated to the Design Year 2032 assuming a 0.9% per year growth in population, and a 2.3% per year growth in employment. These growth rates are consistent with PSRC growth rates for the years between 2020 and 2030. Traffic volumes will include AWDT volumes, AM, and PM peak hour period volumes. Traffic volume information will be produced for both a "no build" option as well as options that include proposed improvements. In addition to improvements proposed as part of this study, those improvements identified in the PSRC Regional Transportation Plan, those in the City of Lynnwood Comprehensive Plan – Transportation Element, and others identified by the Study Support Team will be included. The area for which the VISUM model will produce traffic volumes for operational analysis extends from the I-5/128th St SW interchange on the north to the I-5/220th St SW interchange on the south, to SR99 on the west, to North/Dawson Road on the east (see Figure 1). If

as the study moves forward it becomes known that the year of opening will not be 2010, or the design year of 2032 does not provide a 20-year planning horizon, each will be adjusted accordingly.

Endorsement

The Study Support Team has reviewed this technical memorandum, and concurs with it.

Study Support Team	Initial
FHWA Northwest Washington - Elizabeth Healy	
WSDOT NW Region - Rick Mitchell	
WSDOT NW Region Traffic - Shuming Yan	
WSDOT HQ Asst. State Design Engineer - Nancy Boyd	
Snohomish County – Steve Thomsen	
City of Lynnwood - Jeff Elekes	

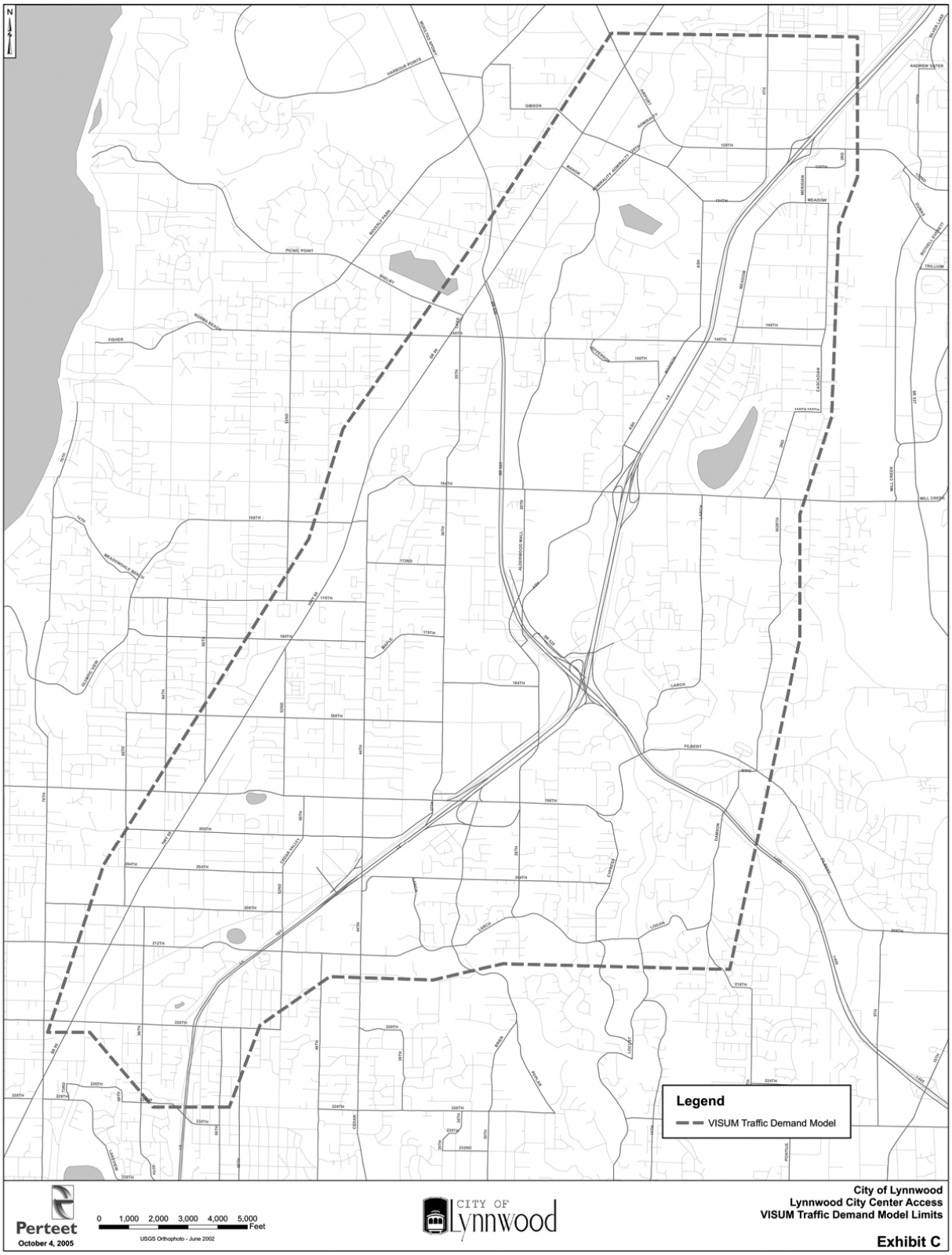


FIGURE 1 – Limits of Traffic Demand Model Focus.

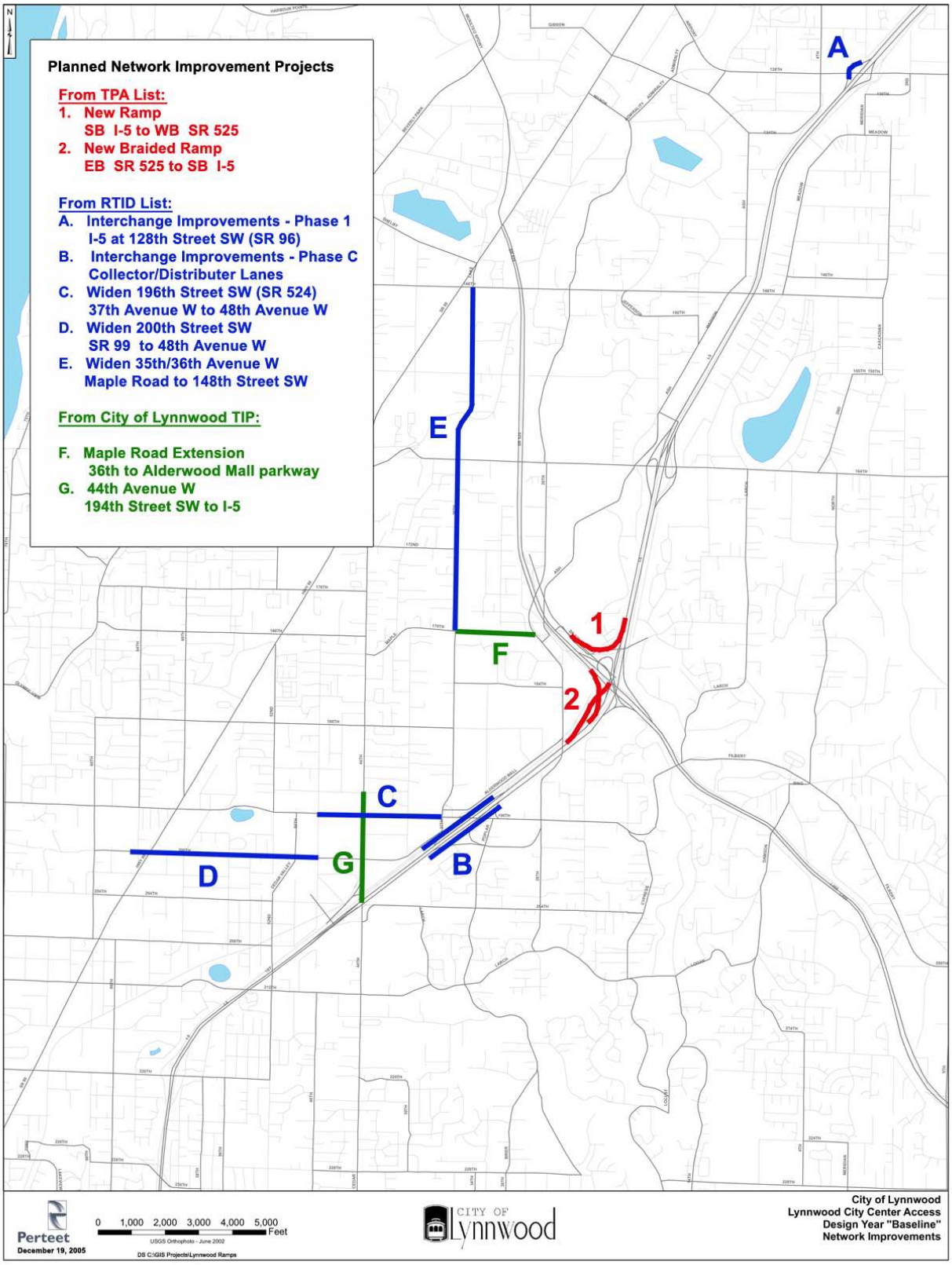


FIGURE 2 – Design Year (2032) Baseline Network Improvements

Technical Memo #2

Lynnwood City Center Access Study
Existing Conditions Traffic Analysis Approach

Perteet

TO: **David Mach, P.E., Project Manager, City of Lynnwood**

FROM: **Peter De Boldt, P.E., Project Manager**
Michael Stringam, P.Eng., Traffic Analysis Lead

DATE: **March 14, 2006**

RE: **Existing Conditions Traffic Operations Analysis Approach**

This memorandum details the approach that will be used to analyze existing condition traffic operations for the Study.

The proposed approach to traffic operations analysis is consistent with that used on other Feasibility Studies and APDR's in the region.

Existing Condition Baseline Year
Recommendation: Use existing counts from 2004 and 2005.
Background: Traffic counts for all of the locations to be analyzed as part of the study were conducted in 2004 or 2005 (see Figure 1 for summary of available counts).

Traffic Operations Analysis
Recommendation: Use VISSIM for freeway operations including mainline and freeway merge analysis to produce volume/density and volume/speed results. Use SYNCRHO for City streets and freeway ramp terminals to produce Highway Capacity Manual 2000 (HCM) Level of Service (LOS). Use the SYNCHRO signal timing in a VISSIM microsimulation of the local street network.
Background: The FHWA publication *Guidelines for Applying Microsimulation Software, July 2004*, describes that microsimulation models such as VISSIM excel in areas of complex transportation systems under congested conditions where analytical systems such as HCM tend to break down. Within our study area, the segment of I-5 between 44th Ave W and 164th Street SW has multiple weave areas, and congested freeway ramps. These conditions tend to have a cumulative impact where congestion at one point impacts traffic operations at upstream locations. HCM methodology focuses on point condition analysis and tends to be overly optimistic in reporting traffic operations under these circumstances, and therefore we do not recommend its use for this study. An additional benefit of VISSIM is that it provides a tool to visually illustrate traffic operations at meetings. If the Study moves into an APDR phase, the SST will revisit whether HCM methodology for freeway operations should be conducted.

The Consultant team will meet with FHWA, WSDOT and the City to agree upon the parameters to be used in the VISSIM traffic simulation model before the simulation work is completed.

The use of SYNCHRO for analysis of City streets and freeway ramp terminals will provide optimized signal timing for the local transportation system, and provide HCM Level of Service information for the local transportation system. This tool is already used by the City on their local street system and works well. Signal timing from SYNCHRO will be used in the VISSIM micorsimulation of the local street network.

The approach outlined above provides the necessary analysis of existing traffic operation conditions. It also provides a point of reference to compare conditions when changes to the transportation system are considered. Locations where existing condition traffic operations analysis are to be conducted is shown in Figure 2. These analysis locations were chosen because they capture both freeway operations and key locations on the local transportation system that might be affected by changes to the transportation system within the study area.

Endorsement

The Study Support Team has reviewed this technical memorandum, and concurs with it.

Study Support Team	Initial
FHWA Northwest Washington - Elizabeth Healy	
WSDOT NW Region - Rick Mitchell	
WSDOT NW Region Traffic - Shuming Yan	
WSDOT HQ Access & Hearings Manager - Barb De Ste. Croix	
Snohomish County – Jay Larson	
City of Lynnwood - Jeff Elekes	

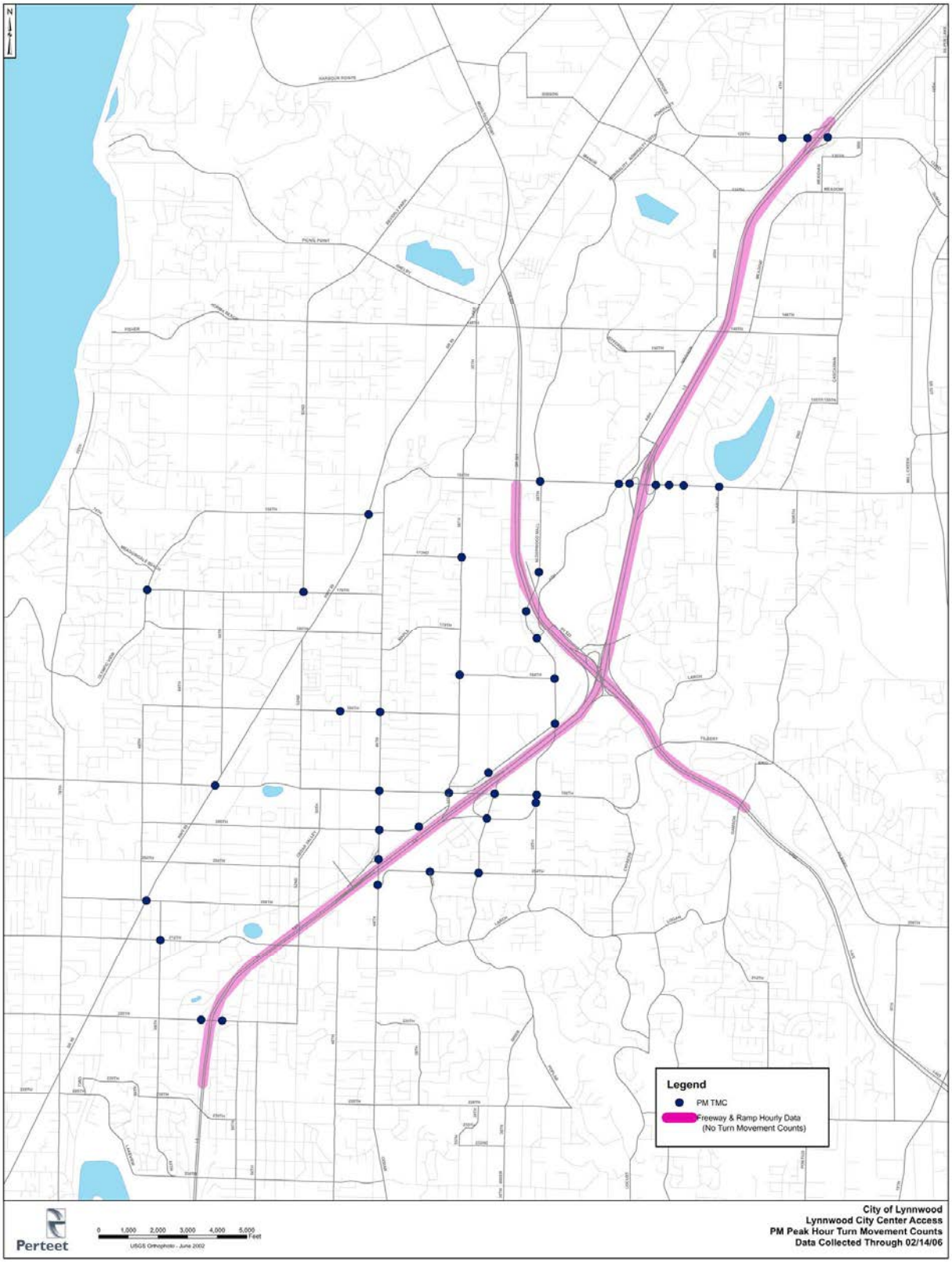


FIGURE 1 – Available Traffic Counts

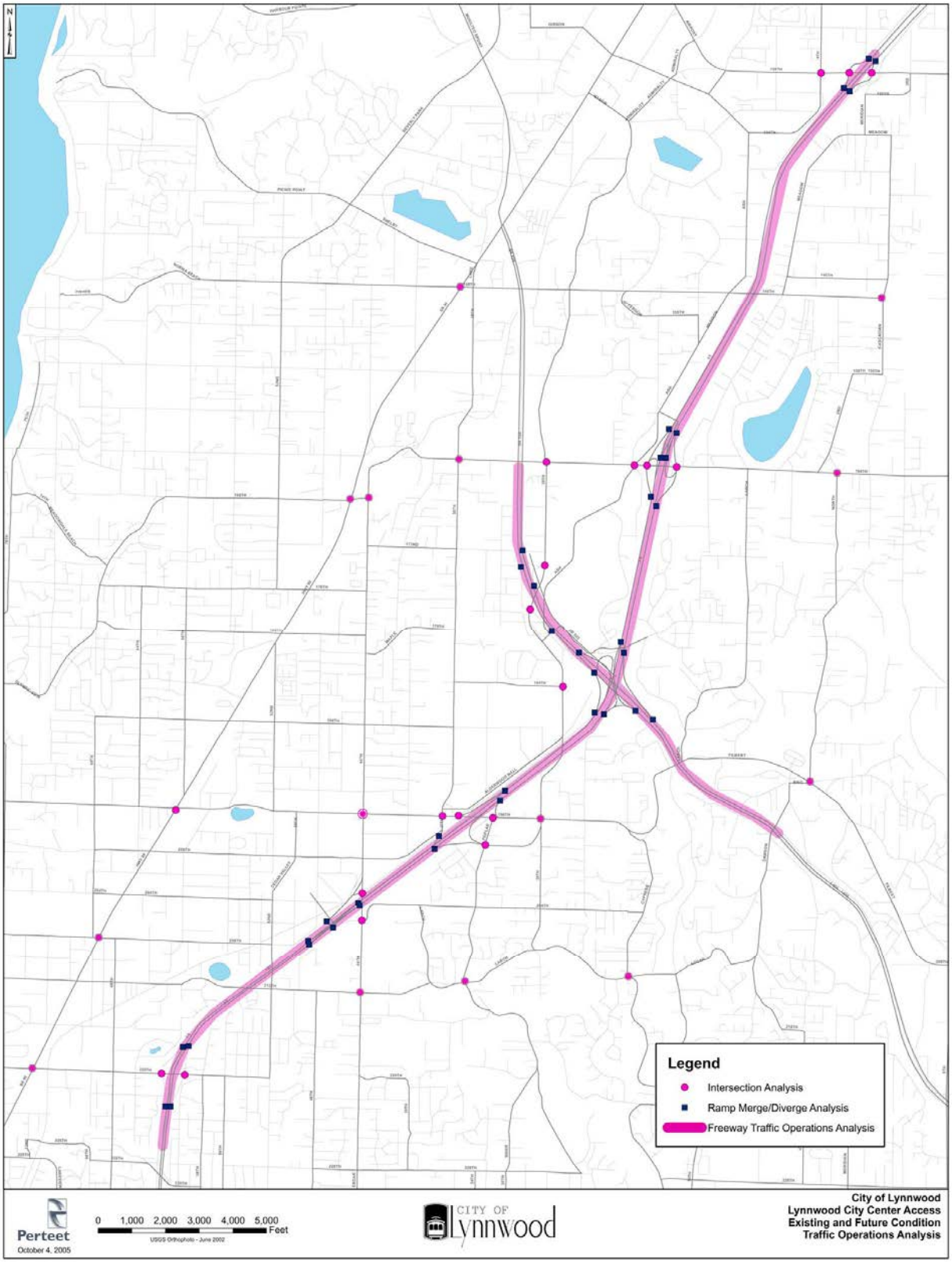


FIGURE 2 – Locations where Existing Conditions Traffic Operations is to be Conducted

Technical Memo #3

Lynnwood City Center Access Study
Design Year Traffic Operations Analysis Approach

Perteet

TO: **David Mach, P.E., Project Manager, City of Lynnwood**

FROM: **Peter De Boldt, P.E., Project Manager**
Michael Stringam, Traffic Analysis Lead

DATE: **March 14, 2006**

RE: **Design Year Traffic Operations Analysis Approach**

This memorandum details the approach that will be used to analyze Design Year condition traffic operations for the Study.

The proposed approach to traffic operations analysis is consistent with that used on other Feasibility Studies and APDR's in the region.

Design Year Traffic Volumes
Recommendation: Year 2030 traffic volumes will be generated by the City of Lynnwood VISUM traffic demand model, and checked with the 2030 Puget Sound Regional Council (PSRC) screen line traffic data. A Design Year of 2032 was recommended and accepted in Technical Memorandum #1 for the Study. After correlation between the 2030 Lynnwood and PSRC is confirmed, the Lynnwood data will be extrapolated to 2032 at the growth rates agreed to in Technical Memorandum #1.
Background: The Study Support Team in Technical Memorandum #1 agreed to a Design Year of 2032. Growth rates of 0.9% per year for population, and 2.3% per year for employment were agreed to in the same document to bring the 2030 Traffic Demand Model forward to the Design Year of 2032. The Baseline Network Improvements illustrated in Figure 2 of Technical Memorandum #1 will be used as the transportation network in the Traffic Demand Model for the study's Design Year. Additional system improvements will be added to the Baseline Network as agreed to by the Study Support Team, and the Traffic Demand Model rerun. The goal of the additional system improvements will be to alleviate congestion points identified in the Baseline Network analysis.

Traffic Operations Analysis Package
Recommendation: Use VISSIM for freeway operations including mainline and freeway merge analysis to produce volume/density and volume/speed results. Use SYNCRHO for City streets and freeway ramp terminals to produce Highway Capacity Manual 2000 (HCM) Level of Service (LOS). Use the SYNCHRO signal timing in a VISSIM microsimulation of the local street network.
Background: The FHWA publication *Guidelines for Applying Microsimulation Software, July 2004*, describes that microsimulation models such as VISSIM excel in areas of complex transportation systems under congested conditions where analytical systems such as HCM tend to break down. Within our study area, the segment of I-5 between 44th Ave W and 164th Street SW has multiple weave areas, and congested freeway ramps. These conditions tend to have a cumulative

impact where congestion at one point impacts traffic operations at upstream locations. VISSIM will be used to report performance measures such as density and speeds that provide a better overview of traffic operations. HCM methodology focuses on point condition analysis and tends to be overly optimistic in reporting traffic operations under these circumstances, and therefore we do not recommend its use for this study. An additional benefit of VISSIM is that it provides a tool to visually illustrate traffic operations at meetings. If the Study moves into an APDR phase, the SST will revisit whether HCM methodology for freeway operations should be conducted.

The Consultant team will meet with FHWA, WSDOT and the City to agree upon the parameters to be used in the VISSIM traffic simulation model before the simulation work is completed.
The use of SYNCHRO for analysis of City streets and freeway ramp terminals will provide optimized signal timing for the local transportation system, and provide HCM Level of Service information for the local transportation system. This tool is already used by the City on their local street system and works well. Signal timing from SYNCHRO will be used in the VISSIM micorsimulation of the local street network.

Locations where traffic operations analysis is to be conducted are shown in Figure 1. Traffic operations analysis for the Design Year may not be conducted in the outer areas of the study area if it is found that there are not significant traffic volume shifts in these areas resulting from transportation improvements beyond the Baseline Network. The Study Support Team will be the decision maker on whether those outer study areas would be dropped from traffic operations analysis.

Endorsement
The Study Support Team has reviewed this technical memorandum, and concurs with it.

Study Support Team	Initial
FHWA Northwest Washington - Elizabeth Healy	
WSDOT NW Region - Rick Mitchell	
WSDOT NW Region Traffic - Shuming Yan	
WSDOT HQ Access & Hearings Manager - Barb De Ste. Croix	
Snohomish County – Jay Larson	
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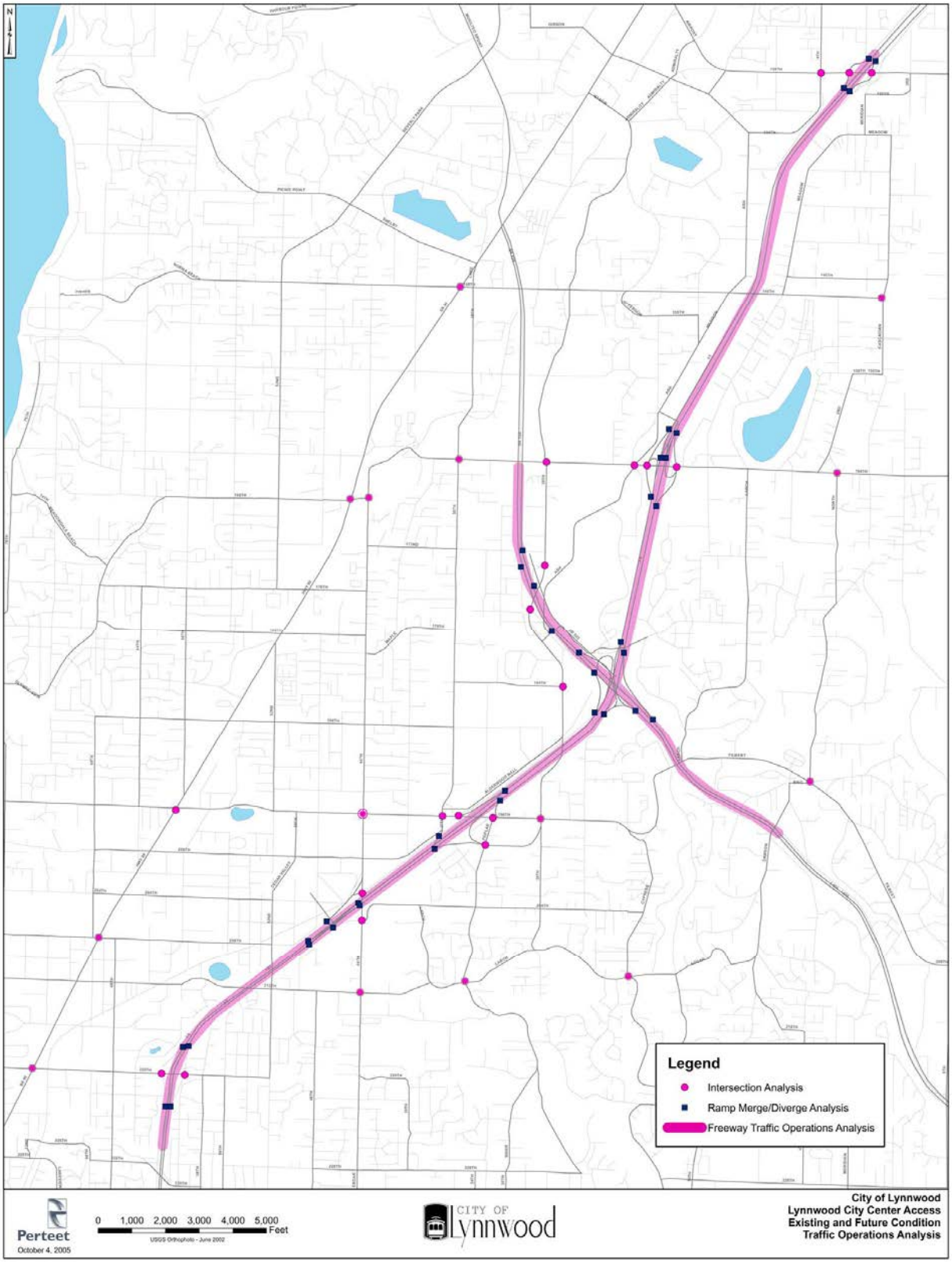


FIGURE 1 – Locations where Design Year Traffic Operations Analysis is to be conducted.

Technical Memo #4

Lynnwood City Center Access Study
Collision Analysis
I-5/I-405/SR525

TO: **David Mach, P.E., Project Manager, City of Lynnwood**

FROM: **Peter De Boldt, P.E., Project Manager**

DATE: **April 20, 2006; Revised May 22, 2006, Revised September 12, 2006**

RE: **Collision Summary and Analysis Interstate 5**
Collision Summary and Analysis Interstate 405\SR525

PURPOSE OF MEMO

This memo provides a summary and analysis of collision data for the Lynnwood City Center Access Study. The summary of collision data within this memo was limited to Interstate 5, Interstate 405, and State Route 525. In addition to summarizing the collision data, a brief collision analysis was conducted. Analysis was provided to determine patterns that exist between the collision rate in comparison to traffic volumes, time of day, and historical trends.

COLLECTION OF ACCIDENT INFORMATION

Collision data was obtained and compiled for a three year period. The most current available information was obtained through the Washington State Department of Transportation's Data Office. The available information was for the period January 2002 to December 2004. The WSDOT *2006 "draft" Accident Review* was also available and utilized for the summary and analysis.

INTERSTATE 5
SUMMARY OF COLLISION HISTORY

The study area (Interstate 5 from MP 178.5 to MP 187.5) is predominately defined by the Washington State Department of Transportation as a corridor with higher than average severe collisions. **WSDOT recently ranked the study area as containing the 2nd and 3rd worst collision corridors in Washington State.** The ranking was based on a calculated annual cost to society.

The high number of collisions is attributed to multiple factors. However, analysis presented below concludes that traffic congestion combined with complex ramp/interchange geometries play a role in the high number of collisions.

The analysis concluded that the high rate of collisions will continue to increase unless capacity improvements and/or interchange improvements are completed. Planning and design of future projects within the study area should consider the following:

- Southbound accidents were more common than northbound collisions.
- Mileposts 181.0 to 184.0 (196th to 164th) had the highest rate of collisions.
- Mileposts 181.0 to 184.0 had more severe collisions representing a higher annual cost to society.
- Rear end collisions were the primary accident type followed by fixed objects and overturn.
- Within the study area the State has designated 3 High Accident Corridors and 9 High Accident Locations (See Figure 7).

INTERSTATE 5
STATISTICAL ANALYSIS

Statistical analysis of the Collision History between January 2002 and December 2004 concluded the following:

- Over 1,800 collisions were recorded within the 8 mile long study area.
- Over 60% of all collisions occurred in the southbound direction.
- The average number of collisions per mile was 69 per year.
- The number of yearly collisions was highest between milepost 181.00 to 184.00 (90 collisions per mile per year).
- The documented fatalities all occurred between milepost 181.00 to 184.00.
- Rear end collisions accounted for 72% of all collisions.
- Fixed object and overturn collisions accounted for 18% of all collisions.
- Annual cost to society is $8.3 million per year (WSDOT 2006 Review).

INTERSTATE 5
COLLISIONS CATEGORIZED BY TYPE

The following table summarizes the type of collisions that occurred between January 2002 and December 2004 along Interstate 5 (I-5) from MP 178.5 to MP 187.5. The collision information includes the mainline I-5 accidents as well as the collisions at on ramps and off ramps.

Table 1
Collisions By Collision Type
I-5 MP 178.5 to 187.5 January 2002 to December 2004

Collision Type	NB Collisions	SB Collisions	Total Collisions	Percent
Animal	1	1	2	0.1%
Bicycle	1	1	2	0.1%
Pedestrian	1	4	5	0.3%
Hitting construction material	6	2	8	0.4%
Non-collision	5	3	8	0.5%
Fire In Vehicle	4	7	11	0.6%
Roadway Ditch	15	11	26	1%
One parked--one moving	6	9	15	1%
Head on	12	10	22	1%
Angle collision	10	32	42	2%
Vehicle overturned	**34**	**23**	**57**	**3%**
Fixed Object	**127**	**160**	**287**	**15%**
Rear End	**517**	**832**	**1349**	**72%**
Other	15	15	30	2%
Total	**754**	**1110**	**1864**	

INTERSTATE 5
COLLISION RELATIONSHIP TO TRAFFIC VOLUME

It is fairly common that collisions have a correlation to volume and congestion. Figures 1 and 2 below provide a graphical representation for the study area.

Figure 1 – Southbound Collisions By Time of Day
Three Year Period January 2002 to Dec 2004

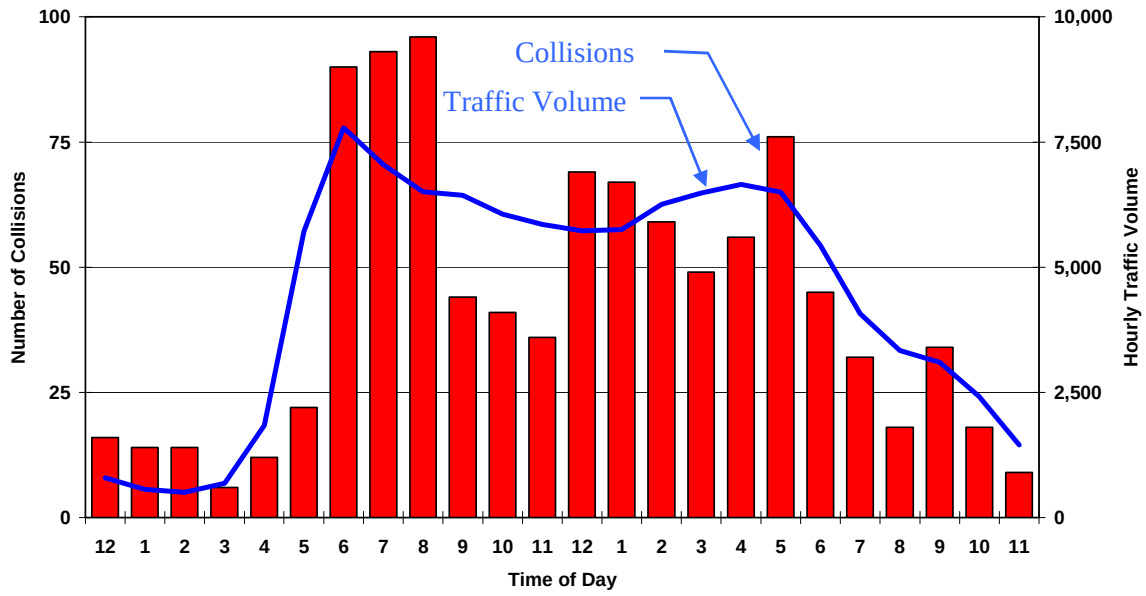
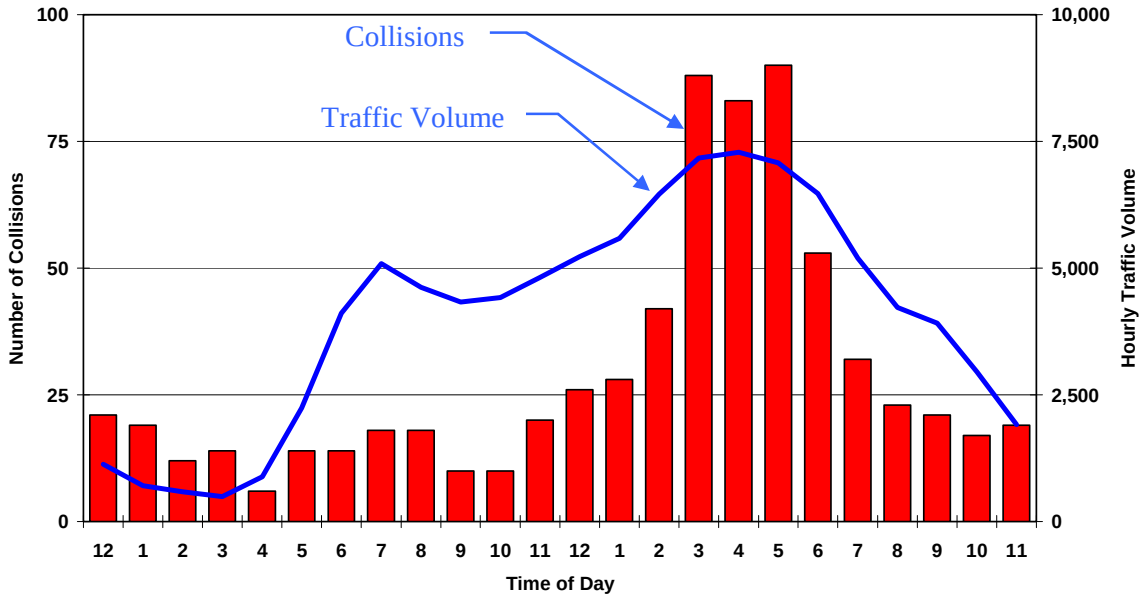


Figure 2 – Northbound Collisions By Time of Day
Three Year Period January 2002 to Dec 2004



Southbound

The southbound direction, as shown in Figure 1, had a high number of collisions during the morning, evening, and afternoon. Rear end type collisions were the prevailing collision type. Rear end collisions are typical in high volume/congested locations. However, since collisions occurred at a high rate throughout the day, outside of peak hours, it may imply that factors such as weaving and highway/ramp geometry should be reviewed and receive consideration during future planning efforts.

Northbound

Northbound traffic, as shown in Figure 2, had a high collision rate during the PM peak. Outside of the PM peak hours the northbound direction has a fairly steady occurrence rate throughout the rest of the day. Considering the high percentage of rear end type collisions and the highest collision rate occurring during peak traffic, data suggests that collisions in the northbound direction are primarily congestion related.

INTERSTATE 5

COLLISIONS PER MILE

To determine the locations within the study area that had the highest collision rate, the collision data was analyzed at ½ mile intervals. Figures 3 and 4 provide a graphical representation. On average, the study area had 69 collisions per mile per year. As represented in Figures 3 and 4, the collision rate between mileposts 181.0 to 181.4 had a higher rate of collisions per year. The section from 181.0 to 184.0 averaged 90 collisions per mile per year. The following figures also show that the interaction between mainline and interchange ramps has a correlation to the collision rate.

Figure 3 – Southbound Collisions By Milepost
Three Year Period January 2002 to Dec 2004

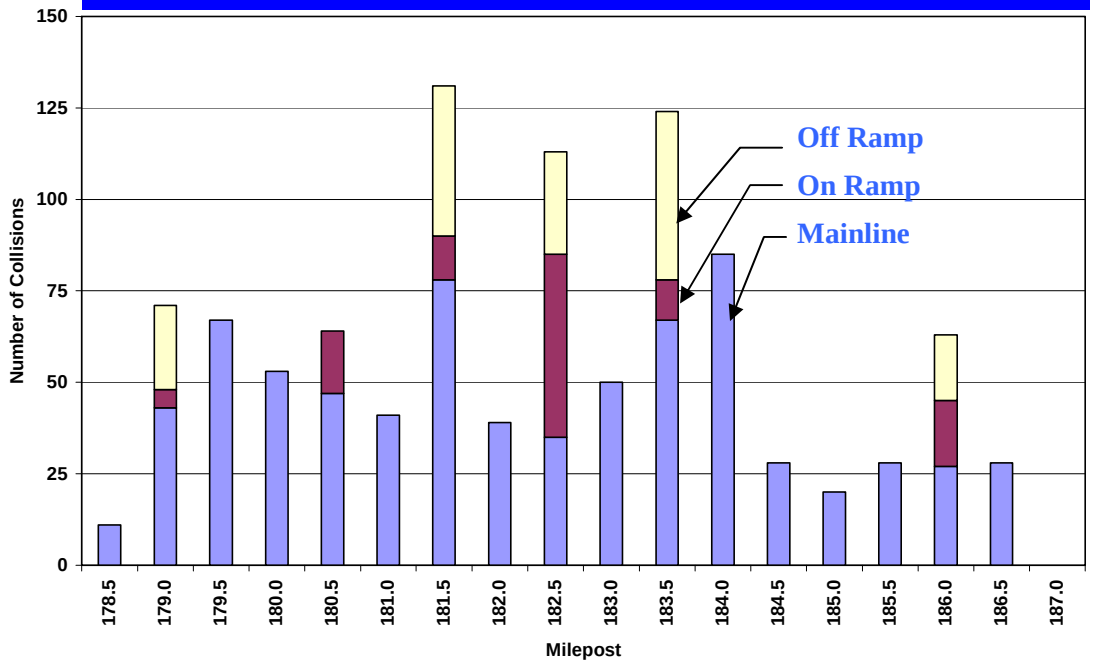
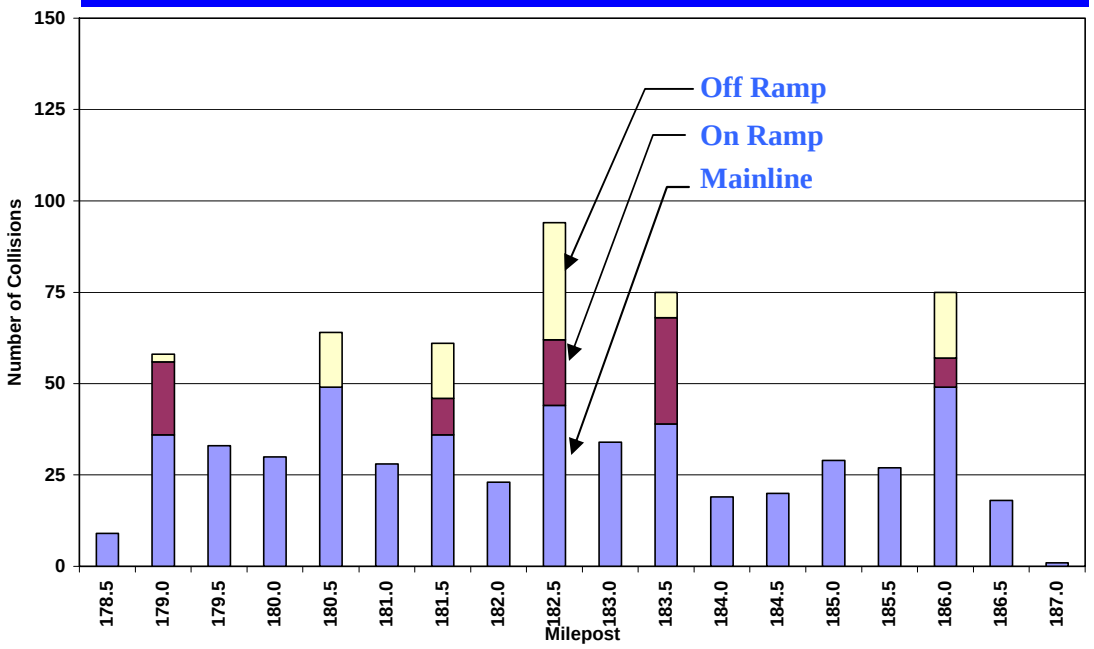


Figure 4 – Northbound Collisions By Milepost
Three Year Period January 2002 to Dec 2004



Southbound

As represented in Figures 3 and 4, the southbound direction had a notably higher number of collisions than the northbound direction. The collision rate between milepost 181.0 to 184.0 was almost twice as high as the rate for the northbound direction. By comparison, the mainline in the southbound direction appeared to be much more impacted by the ramp/mainline interaction than what the northbound direction experienced.

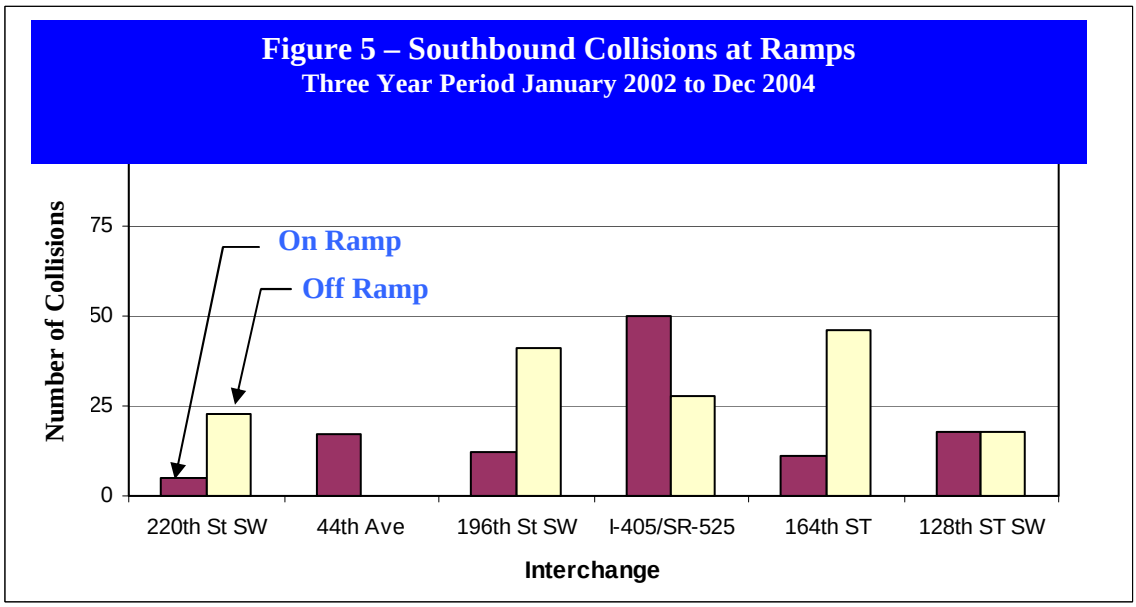
Northbound

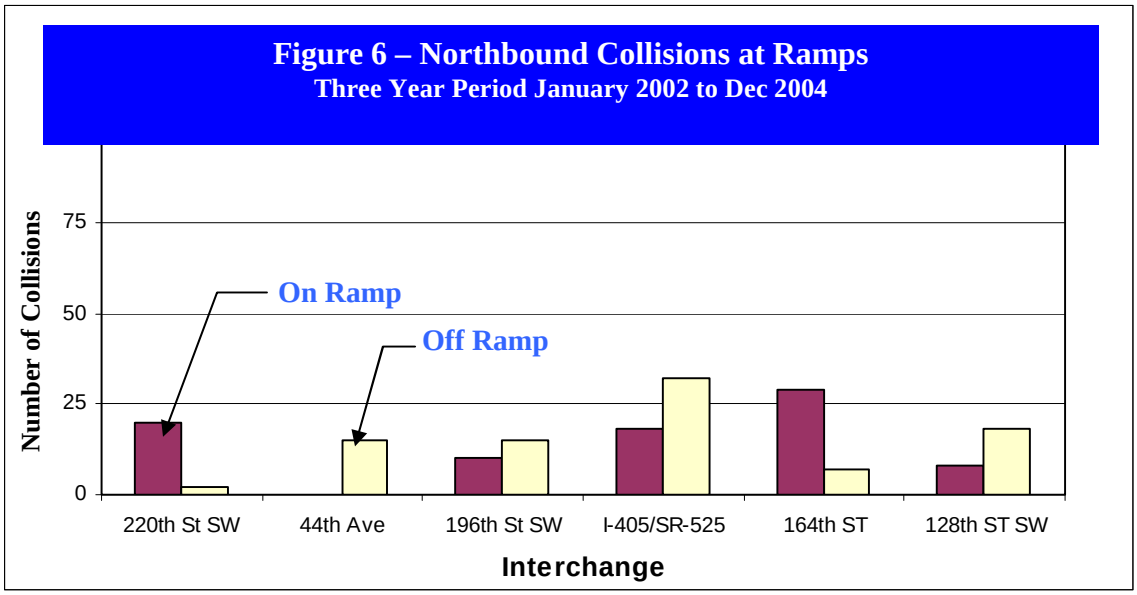
The northbound direction had a lower collision rate than that of the southbound direction. At interchange locations the collision rate on the mainline was only slightly higher than along stretches that were not at access points. Therefore, it is apparent that the ramp/mainline interaction is functioning much better for northbound traffic than for the southbound.

INTERSTATE 5

COLLISIONS AT RAMPS

As shown above (Figures 3 and 4) the collision rate is highest at on ramps and off ramps. Higher collision rates at ramp locations is expected based on added variables that drivers are expected to respond to. To better understand the collision occurrence at the ramps, Figures 5 and 6 are provided below.





Southbound

The ramps at 196th, I-405/SR525, and 164th experienced a higher collision occurrence rate than other ramps within the study area. Reviewing the lane configurations, it is notable that the interchanges are each connected by add/drop lanes, are closely spaced together, and have a relatively short area for drivers to weave.

Northbound

In general, the northbound ramps had fewer collisions than the southbound ramps. Reviewing the lane configurations, it is evident that the northbound is similar to the southbound direction with multiple weaving areas, add/drop lanes, and close intersection spacing. However, the lower collision rate may suggest that the weave is operating more efficiently than in the southbound direction.

INTERSTATE 5
WSDOT ACCIDENT HISTORY – HIGH ACCIDENT LOCATIONS AND CORRIDORS

The Washington State Department of Transportation (WSDOT) has a special designation for locations with higher than average collision histories. Collisions with a higher than average collision history are defined as follows:

High Accident Location (HAL) – Spot locations less than a mile in length that have a higher than average rate of severe collisions during the previous two years.

High Accident Corridor (HAC) – Sections of highway more than a mile in length that have a higher than average rate of severe collisions over a continuous period of time.

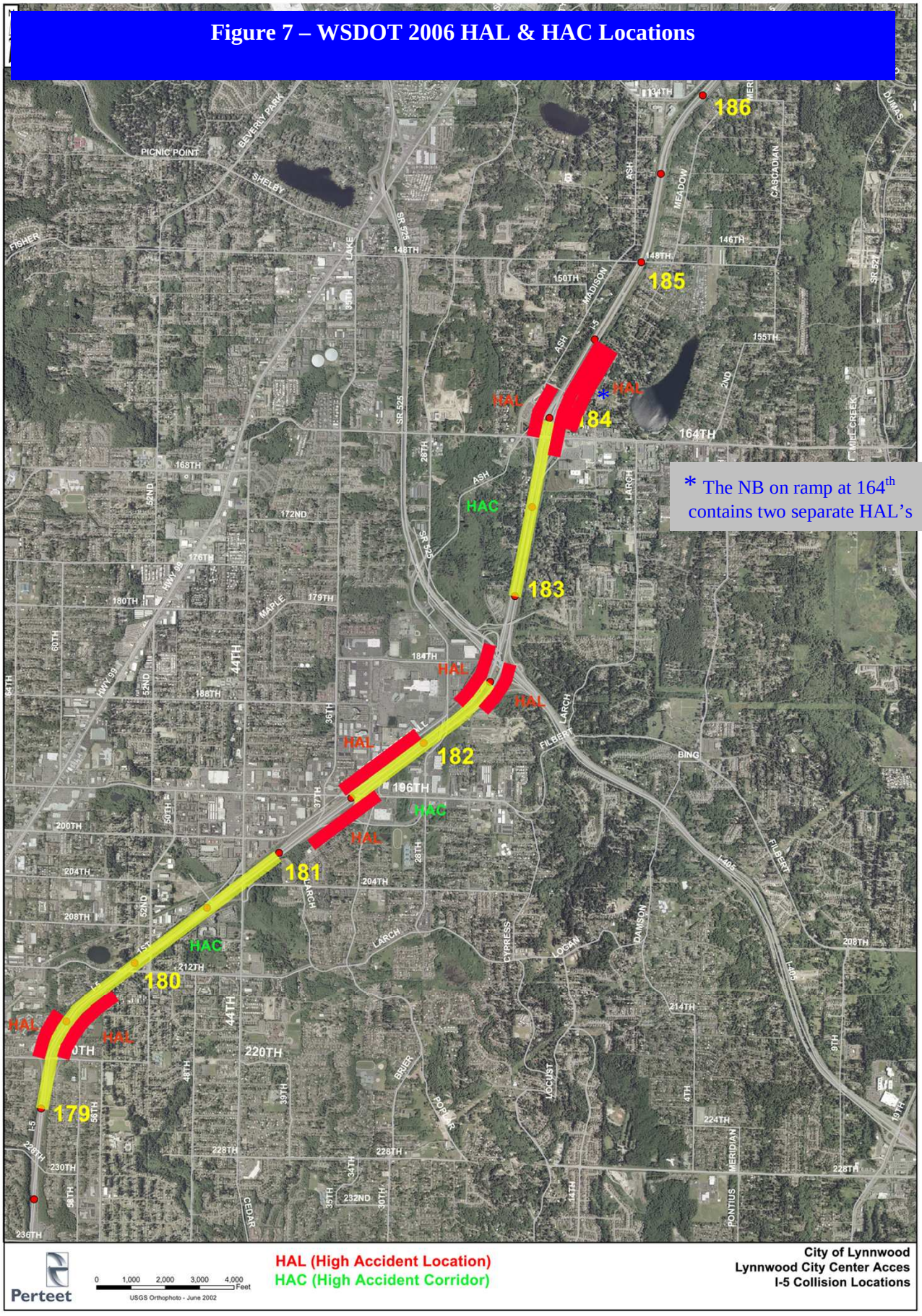
Collision history for the state highway system is reviewed by WSDOT on a bi-annual basis. For this study the WSDOT *2006 Accident Review* provided the most current information available.

The *2006 Accident Review* noted that the study area contained 3 High Accident Corridors (HAC) and 9 High Accident Locations (HAL). Figure 7 shows the designated locations and corridors. Table 2 lists the locations of the HACs and Table 3 lists the locations of the HALs.

Table 2
High Accident Corridor (HAC) within Study Area

Begin MP	End MP	Description
179.00	180.99	Mainline I-5 in both directions. Two HALs located within this HAC at the 220th Street Interchange.
181.50	182.49	Mainline I-5 in both directions. This section has add/drop lanes along both NB and SB between the 196th Street Interchange and the I-405/SR525 Interchange. Four HALs are located within this HAC.
183.00	183.99	Mainline I-5 in both directions. This section is just north of the 1-405/SR525 Interchange and extends to the 164th Street Interchange. Three HALs are located within this HAC.

Figure 7 – WSDOT 2006 HAL & HAC Locations



* The NB on ramp at 164th contains two separate HAL's

Table 3 High Accident Locations (HAL) within Study Area			
Begin MP	**End MP**	**Travel Direction**	**Description**
179.29	179.52	I-5 Southbound	HAL is on the Off Ramp/220th Street Interchange.
179.30	179.88	I-5 Northbound	HAL is on the On Ramp/220th Street Interchange.
181.16	181.60	I-5 Northbound	HAL is on the Off Ramp/196th Street Interchange.
181.50	181.98	I-5 Southbound	HAL is on the Off Ramp/196th Street Interchange.
182.30	182.70	I-5 Southbound	HAL is on the I-5 On Ramp from I-405.
182.35	182.63	I-5 Northbound	HAL is on the Off Ramp/SR525 Interchange.
183.80	184.47	I-5 Northbound	HAL is on the On Ramp/164th Street Interchange – EB 164th Street Traffic to NB I-5.
183.90	184.47	I-5 Northbound	HAL is on the On Ramp/164th Street Interchange – WB 164th Street Traffic to NB I-5.
183.88	184.16	I-5 Southbound	HAL is on the Off Ramp/164th Street Interchange.

The HACs and HALs are all grouped at interchanges. Therefore the summary information provided below has been provided by the related Interchange.

HAC vicinity I-5/220th Street Interchange

This accident corridor contained two HAL locations. One is located along the Southbound off ramp and the other is located along the Northbound on ramp. Table 4 summarizes the collisions for this corridor.

Table 4 Collisions within HAC vicinity I-5/220th Street Interchange			
Designation	**Description**	**Collisions**	**Fatalities**
HAC	Mainline I-5 MP 179.9 to 180.99	591	0
HAL	SB Off Ramp	15	0
HAL	NB On Ramp	13	0
	Total	**619**	**0**

Within this corridor rear end collisions were predominate, accounting for over 60% of all collisions. Fixed objects accounted for over 15% of all collisions. The southbound direction had a significantly higher number of collisions than the northbound direction (394 SB and 223 NB).

HAC vicinity I-5/196th Street Interchange to I-5/I-405/SR525 Interchange
This accident corridor contains four HAL locations. Table 5 summarizes the collisions for this corridor.

Table 5
Collisions within HAC vic. I-5/196th Street Interchange to I-5/I-405/SR525 Interchange

Designation	Description	Collisions	Fatalities
HAC	Mainline I-5 MP 181.50 to 182.49	296	3
HAL	NB Off Ramp to 196th Street	9	0
HAL	SB Off Ramp to 196th Street	20	0
HAL	SB On Ramp from I-405	19	0
HAL	NB Off Ramp to NB SR525	18	1
	Total	**362**	**4**

Within this corridor the collisions in the southbound direction were significantly higher than in the northbound direction. The southbound direction had over twice the number of collisions than the southbound direction (256 collisions compared to 106 collisions). Rear end collisions accounted for over 55% of the collisions, sideswipe accounted for over 15% and fixed objects/overturn accounted for over 20%.

Taking a closer look at the individual ramps, it was noted that a high number of fixed object and overturn collisions was occurring. With the exception of the newly constructed SB off ramp at 196th Street, all the ramps listed as HALs had fixed object/overturn accidents accounting for 44% to 94% of the collisions.

HAC vicinity I-5/I-405/SR525 Interchange to I-5/164th Street Interchange
This accident corridor was not listed during the 2004 review. The corridor contains three HAL locations. Table 6 summarizes the collisions for this corridor

Table 6
Collisions within HAC vic. Interchange *I-5/I-405/SR525 Interchange to I-5/164th Street Interchange*

Designation	Description	Collisions	Fatalities
HAC	Mainline I-5 MP 183.00 to 183.99	273	1
HAL	NB On Ramp from EB 164th Street	8	0
HAL	NB On Ramp from WB 164th Street	8	0
HAL	SB Off Ramp to 164th Street	28	0
	Total	**317**	**1**

Similar to the other two high accident corridors within the study area this HAC had a higher collision occurrence in the southbound direction (188 compared to 129). Collisions were primarily rear end type with the exception of the NB loop on ramp that had fixed objects account for 25% of the collisions.

INTERSTATE 5
COMPARISON OF WSDOT 2004 REVIEW AND 2006 REVIEW

Accident data within the 2004 review and the 2006 review indicate an increase in total collisions. Two of the HALs listed in 2004 were not listed during the 2006 review (I-5 NB on ramp at 44th and SB off ramp to I-405). However the 2006 review added 2 new HAL locations and a new HAC. The new HAC was from MP 183.0 to MP 183.9. The two new HALs were located at the NB on ramp from 164th and the NB on ramp from 220th.

The addition of a HAC suggests that collisions within the study are on the rise. However, a complete study of past histories compared to the three year data utilized for this report is beyond the scope of this analysis.

INTERSTATE 5
CONCLUSION

The I-5 study area is a high collision corridor. WSDOT has listed the corridor as one of the worst collision corridors in the state. The data analyzed indicates a strong correlation between collisions and congestion. Interchange complexity, primarily spacing and weaving lanes, also appears to be contributing to the high collision rate. Reducing collisions by implementing improvements that reduce congestion could consist of the following:

- Capacity improvements to the local arterial system that either remove trips from the I-5 corridor, or reduce backups on the I-5 ramps.
- Access improvements at the on and off ramps.
- Improvements that would provide additional capacity on I-5.

Prioritizing improvements is a difficult task. However concentrating efforts to reduce collisions within the areas of the HALs and HACs would produce the greatest benefit.

INTERSTATE 405/SR525
SUMMARY OF COLLISION HISTORY

The study area for 405/SR525 is primarily limited to the vicinity of the interchange with Interstate 5 (see Figure 14). Interstate 5 is also the defined breakpoint where I-405 ends and SR525 begins. By milepost this study looked at the following:

- I-405 Milepost 26.0 to 30.5
- SR525 Milepost 0.0 to 1.5

In 2004, the I-405/SR525 study area was predominately defined by the Washington State Department of Transportation as a corridor with higher than average severe collisions. **However, the available information from WSDOT's 2006 review indicates that the location is no longer defined as a corridor with higher than average severe collisions**.

The analysis also concluded that the safety improvements are a result of the following:

- Completion of I-405 widening for HOV lanes.
- Completion of SR525 Widening.

INTERSTATE 405/SR525
STATISTICAL ANALYSIS

Statistical analysis of the Collision History between January 2002 and December 2004 concluded the following:

- Over 500 collisions were recorded within the 6 mile long study area.
- SB collisions on I-405 were much higher than the NB (70% vs. 30%).
- The average number of collisions per mile was 30 per year.
- The highest concentration of collisions was located along I-405 from milepost 29.0 to 30.5.
- Rear end collisions accounted for 50% of all collisions.
- Fixed object accounted for 33% of all collisions accounted.

INTERSTATE 405/SR525
COLLISIONS CATEGORIZED BY TYPE

The following table summarizes the type of collisions that occurred between January 2002 and December 2004 along Interstate 405 MP 26.0 to SR525 MP 1.5. The collision information includes the mainline collisions as well as the collisions at on ramps and off ramps.

Table 7
Collisions By Collision Type
I-405 MP 26.0 to SR525 MP 1.5
January 2002 to December 2004

Collision Type	NB Collisions	SB Collisions	Total Collisions	Percent
Head On	1		1	0.2%
Hitting Construction Materials	1	4	5	0.9%
Fire started in vehicle	3	2	5	0.9%
One parked--one moving	3	7	10	2%
Roadway Ditch	4	8	12	2%
Vehicle overturned	3	9	12	2%
Angle Collision	16	9	25	5%
Fixed Object	73	106	179	33%
Rear End	73	199	272	50%
Other	9	12	21	4%
Total	**186**	**356**	**542**	

INTERSTATE 405/SR525
COLLISION RELATIONSHIP TO TRAFFIC VOLUME

As seen in the analysis of Interstate 5 mainline, it is fairly common that collisions have a correlation to volume and congestion. Figures 8 and 9 below provide a graphical representation for the I-405/SR525 study area.

Figure 8 – Southbound Collisions By Time of Day
Three Year Period January 2002 to Dec 2004

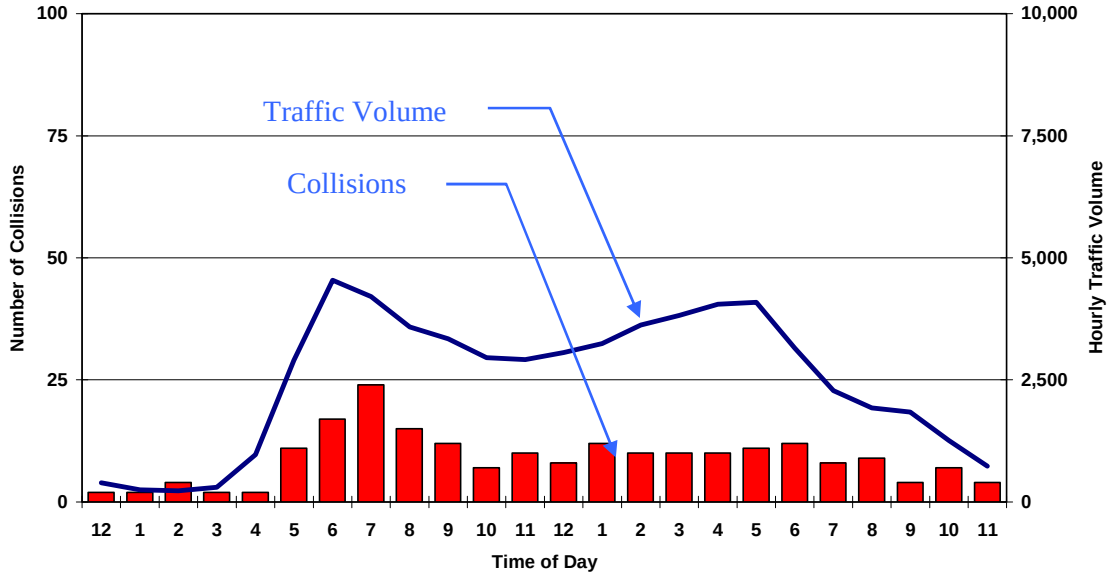
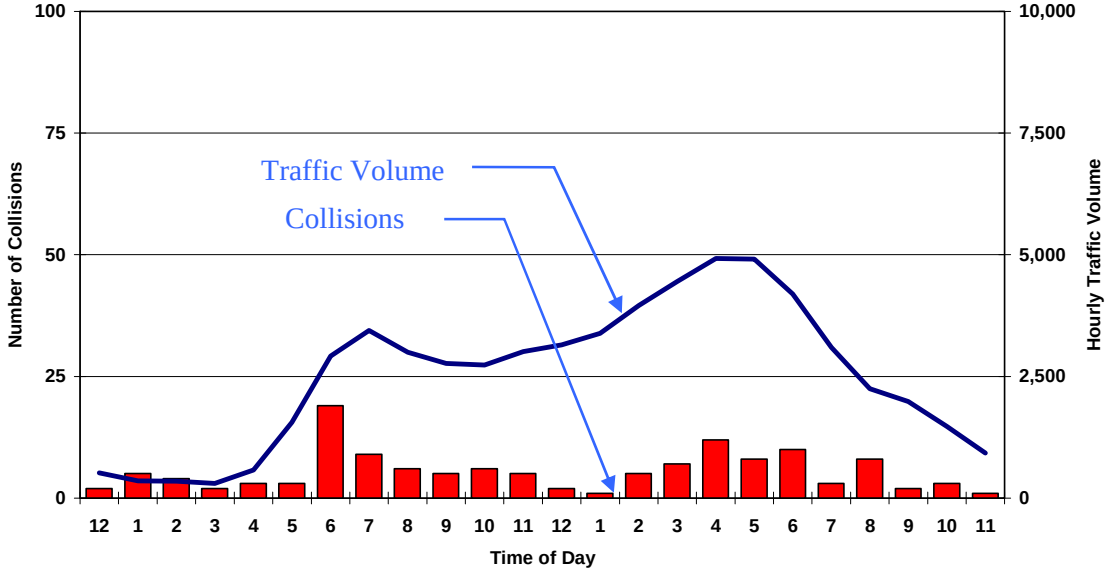


Figure 9 – Northbound Collisions By Time of Day
Three Year Period January 2002 to Dec 2004



In comparison to data collected for I-5, this section of I-405/SR525 appears to be functioning fairly well. The collision occurrence rate is higher during the morning commute but overall is well below the numbers within the I-5 study area.

INTERSTATE 405/SR525
COLLISIONS PER MILE

To determine the locations within the study area that had the highest collision rate, the collision data was analyzed at ½ mile intervals. Figures 10 and 11 provide a graphical representation. On average the study area had 30 collisions per mile per year. As represented in Figures 3 and 4, the collision rate between I-405 milepost 29.0 to SR525 milepost 0.0 had a higher rate of collisions per year (69 per mile per year). As shown in the figures, the higher collision rate is in the vicinity of the I-5 Interchange/Ramps.

Figure 10 – Southbound Collisions By Milepost
Three Year Period January 2002 to Dec 2004

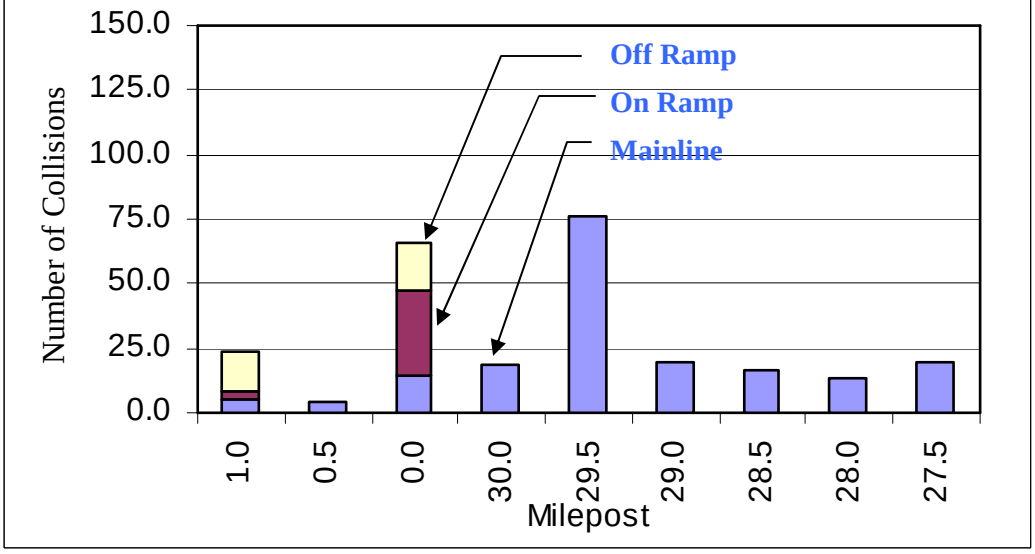
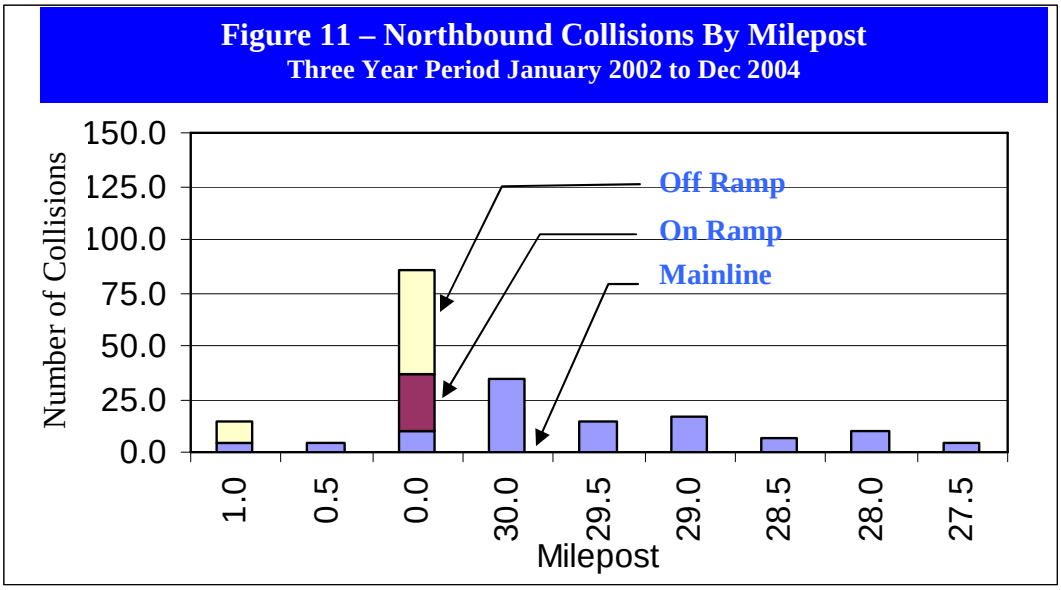


Figure 11 – Northbound Collisions By Milepost
Three Year Period January 2002 to Dec 2004



INTERSTATE 405/SR525
COLLISIONS AT RAMPS

As shown above (Figures 10 and 11), the collision rate is highest at on ramps and off ramps. Higher collision rates at ramp locations is expected based on added variables that drivers are expected to respond to. To better understand the collision occurrence at the ramps, Figures 12 and 13 are provided below.

Figure 12 – Southbound Collisions at Ramps
Three Year Period January 2002 to Dec 2004

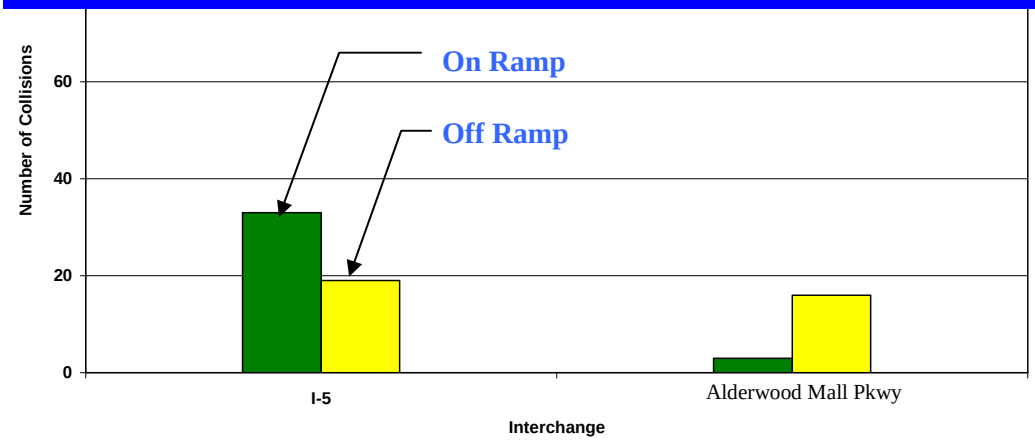
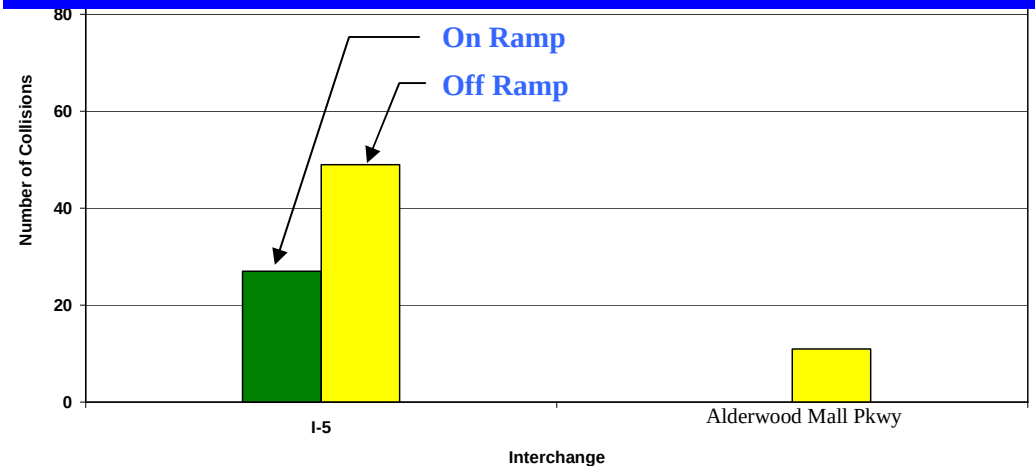


Figure 13 – Northbound Collisions at Ramps
Three Year Period January 2002 to Dec 2004



Ramps to Alderwood Mall Parkway

The on ramps and off ramps for Alderwood Mall Parkway have a relatively low number of collisions. In 2004, this location (southbound off ramp), was listed by WSDOT as a high accident location (HAL). However, according to WSDOT's 2006 review, the location is no longer listed as a HAL. This would suggest that improvements completed during 2003 or 2004 provided safety enhancements.

Ramps at I-5

The on ramps and off ramps at I-5 experienced a fairly high number of collisions. As noted in the accident summary and analysis for I-5 the collisions were primarily associated with congestion. However, the high number of northbound off ramp collisions was notably higher than the other ramps. Therefore, during consideration of future improvements, further analysis of this ramp should be considered.

INTERSTATE 405/SR 525
WSDOT ACCIDENT HISTORY – HIGH ACCIDENT LOCATIONS AND CORRIDORS

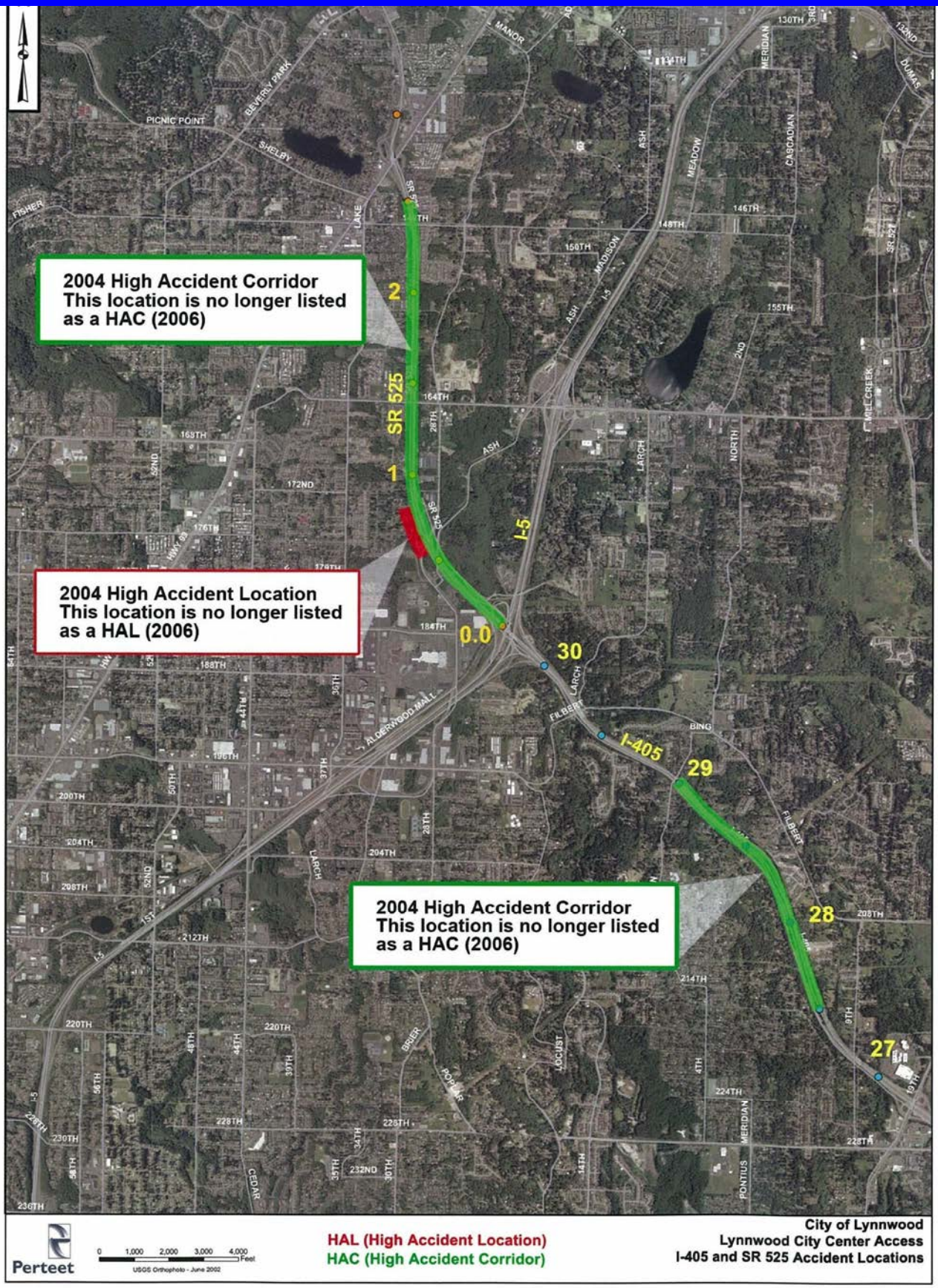
Accident history for the state highway system is reviewed by WSDOT on a bi-annual basis. For this study the WSDOT *2006 "draft" Accident Review* provided the most current information available.

Within the study area, WSDOT does not currently list I-405, SR525, the ramps to Alderwood Mall Parkway or the ramps to I-5 as a HAL or HAC.

INTERSTATE 405/SR 525
COMPARISON OF WSDOT 2004 REVIEW AND 2006 REVIEW

The 2004 bi-annual review predominately listed the study area as a high accident corridor containing a HAL at the SR525 ramps to Alderwood Mall Parkway (see Figure 14). The HALs and HACs listed in 2004 were eliminated during the 2006 review. The 2004 review was done prior to several construction projects reaching substantial completion. The 2006 review was the first review following construction that included several significant safety enhancements. Removal of the HALs and HACs under the 2006 review suggests that the study area has seen an increase in safety from recent projects.

Figure 14 – WSDOT 2006 HAL & HAC Locations



INTERSTATE 405/SR525

CONCLUSION

The I-405/SR525 study area currently functions well in comparison with I-5. The collision summary suggests that recent capacity improvements have improved overall safety. However, the analysis indicated that the ramps to I-5 have a higher rate of collisions and should be evaluated for possible safety enhancements on future projects.

TECHNICAL MEMORANDUM CLOSING STATEMENT

The collision summary and analysis provided above suggests that the Interstate 5 study area has one of the highest occurrence rates of collisions in the State. Both directions of I-5 have areas classified as HALs and HACs, and southbound has a higher number of collisions than northbound within the same timeframe. To reduce the current collision trend, the following steps are recommended:

- Evaluate the local arterial networks for capacity and operational improvements that will reduce congestion on the I-5 ramps and their associated merge/diverge areas.
- Evaluate the local arterial networks for opportunities to improve capacity to remove trips from I-5.

If the two steps above do not address the collision trend, further evaluation of the entire network could include:

- Evaluate potential interchange improvements that minimize overlapping weave areas.
- Evaluate potential capacity enhancements on I-5.

The information presented in this paper shows that there is a collision problem on I-5 that is caused by congestion, interchange complexity, and insufficient interchange spacing. This paper also provides information that demonstrates that recent improvements to I-405/SR 525 have enhanced safety. Recommendations are provided for transportation improvements that should help alleviate the I-5 collision problems.

The information within this memo provides a summary of collision data collected for the sole purpose of evaluating the need for future roadway improvements within the noted study area. Use of the information for other purposes is strictly prohibited under State and Federal Law.

ENDORSEMENT

The Study Support Team has reviewed this technical memorandum, and concurs with it.

Study Support Team	Initial
FHWA Northwest Washington - Elizabeth Healy	
WSDOT NW Region - Rick Mitchell	
WSDOT NW Region Traffic - Shuming Yan	
WSDOT HQ Access & Hearings Manager - Barb De Ste. Croix	
Snohomish County – Jay Larson	
City of Lynnwood - Jeff Elekes	

Perteet

Technical Memo #5

Lynnwood City Center Access Study
Existing Conditions Traffic Operations Analysis

TO: **David Mach, P.E., Project Manager, City of Lynnwood**

FROM: **Peter De Boldt, P.E., Project Manager**
Tresia Bass, Traffic Analysis Lead

DATE: **September 7, 2006**

RE: **Existing Conditions Traffic Operations Analysis**

This memorandum presents the results of the existing condition traffic operations for the PM peak hour that was conducted for the Study. The traffic operations analysis in this Technical Memorandum is consistent with the approach outlined in Technical Memorandum #2.

The following summarizes data collection, model calibration, and existing traffic conditions.

Data Collection

New traffic counts were conducted at 16 locations to supplement existing traffic volume information, available from WSDOT, City of Lynnwood, and Snohomish County. Traffic counts used in this study were conducted within the past three years. The counts used are included in Appendix A.

Existing signal timing and phasing for each of the traffic signals analyzed was collected from WSDOT, Snohomish County and the City of Lynnwood. This information was input into a Synchro traffic operations model to determine existing conditions PM peak hour level of service (LOS) at the signalized intersections.

Travel times for northbound and southbound for the I-5 corridor during the PM peak hour were recorded in April 2006. Travel time information was used to help calibrate the VISSIM traffic operations analysis.

VISSIM Model Calibration

Freeway operations were modeled using the VISSIM microsimulation traffic analysis package. Microsimulation was chosen as the primary analysis tool for the freeway operations because of the complexity of traffic operations within the study area. Microsimulation provides a comprehensive analysis of how the traffic on the I-5 mainline and interchanges within the study area impact one

another. The impact of how congestion at one interchange might affect adjoining interchanges cannot be evaluated using the Highway Capacity Manual methodologies.

Once the VISSIM model was developed, several series of runs were made for existing PM peak hour conditions and compared to the average travel time and volume data collected to determine how well the model was approximating existing freeway conditions. The goal of the calibration was for the VISSIM traffic operations model values to be within ten percent of existing conditions.

Before default values were adjusted, traffic flow at several on ramps and merge areas was low compared to the count data. The model showed congestion levels on these ramps greater than we see today. Traffic in the model was queued up on the ramps and not accessing the freeway mainline. With less traffic accessing the freeway, several of the merge areas on the freeway were not showing enough congestion. For instance, the traffic volume accessing I-5 southbound from I-405 and SR 525 is over 2,300 vehicles per hour. Parameters were adjusted to depict the aggressive behavior and serve the traffic volume on these ramps.

As discrepancies between the model and existing conditions were observed, model parameters and assumptions were adjusted to bring the model into close correlation with existing data. The resulting VISSIM model traffic volumes are within five percent of existing count data. The VISSIM model travel times are slightly higher than existing data, nine percent in the southbound direction and two percent in the northbound direction.

Exhibits 1 and 2 depict existing data compared to VISSIM output. Existing data is shown in solid lines and the model output in dashed lines.

The following text describes key factors considered or adjusted in the VISSIM model.

Exhibit 1.
Model Calibration - Traffic Volume Comparison

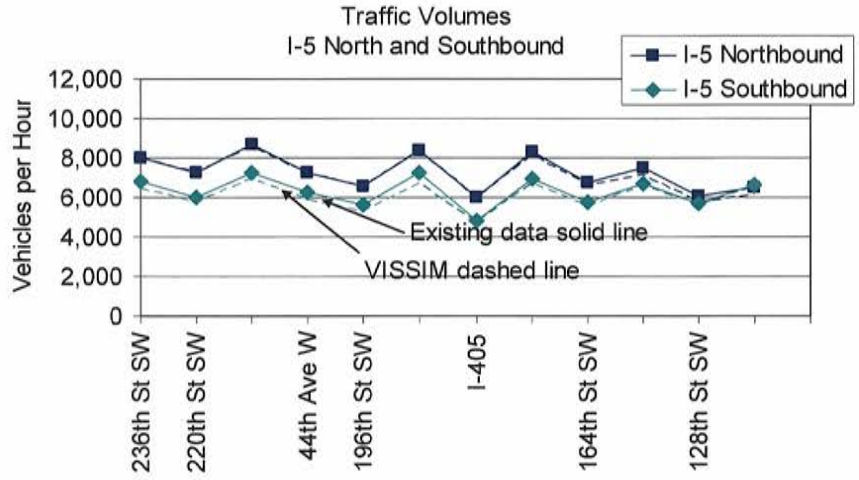
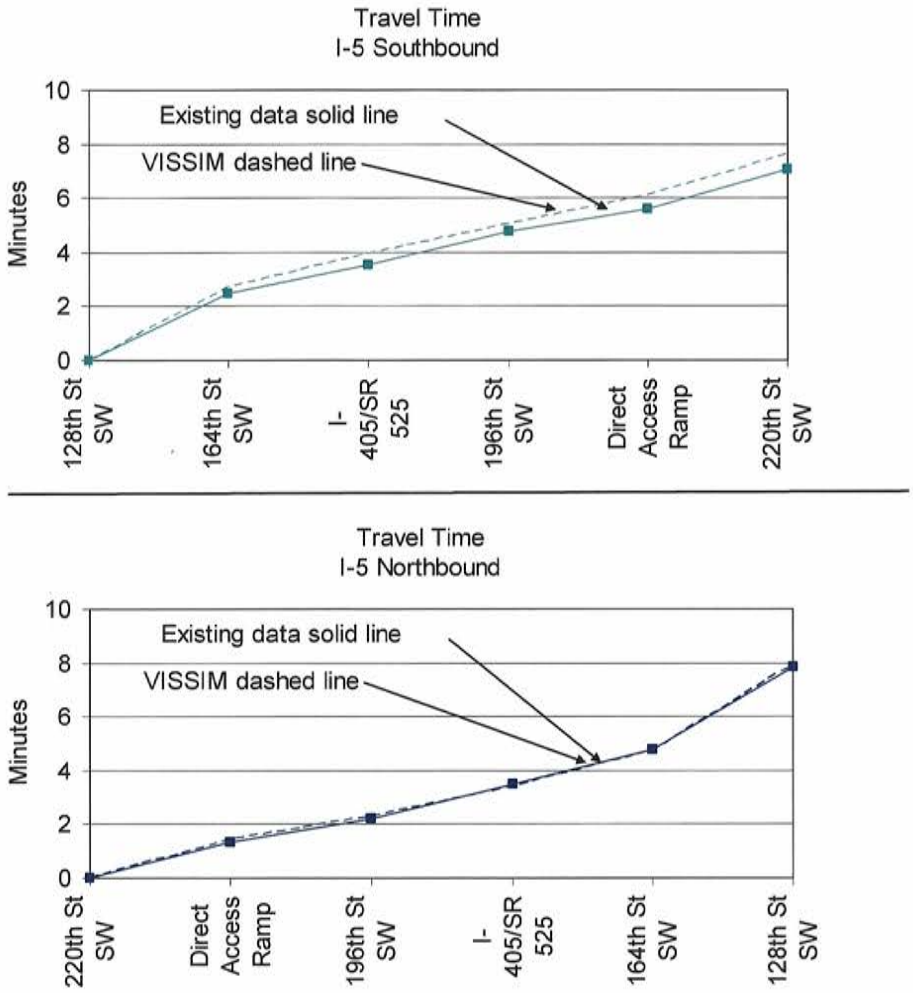


Exhibit 2.
Model Calibration – Travel Time Comparison



Geometrics
The VISSIM package is very sensitive to the geometry of the freeway alignments under study. Small variances in geometry can have a large affect on analysis results. Therefore, care was taken to reflect existing horizontal geometries as accurately as possible. Aerial photogrammetry was used to establish horizontal curvature, interchange locations, on and off ramp gore points, and acceleration and deceleration lane lengths.

Vehicle Type and Classification Data
Four basic vehicle types were included in the model: Single Occupant Vehicles (SOVs), High Occupancy Vehicles (HOVs), transit vehicles (buses), and trucks. There is up to 82 percent of single occupancy vehicles, between 12 and 17 percent HOV, less than one percent transit, and up to five percent freight.

Speed
The default freeway speed distribution was used for the I-5 corridor which assigns speeds between 55 through 70 mph to the traffic composition. Reduced speed areas on ramps were based on speed advisory signs.

Look Back Distances
As a vehicle approaches the off ramp it desires to take, drivers move to the outside lanes (assuming an outside ramp). The distance back from the off ramp where the driver begins to make the necessary lane changes to the outside is called the "look back distance". The default value in the model is 656.2 feet and the value was increased up to 4,000 feet in some locations. Typically off ramps are signed much greater than 650 feet from an exit and vehicles begin to maneuver much earlier. Known decision making patterns and engineering judgment were also used to assess the reasonableness of the assumptions and modifications made.

Ramp Meters
Several of the ramps on I-5 operate with ramp meters during the PM peak hour. Discussions with the WSDOT Traffic Management Center indicate that the on-ramp from eastbound SR525/northbound I-405 and from 44th Avenue W to southbound I-5 is ramp metered about half the time during the PM peak hour. The ramp metering was turned off to evaluate the higher congestion scenario for I-5.

Table 1 lists the VISSIM default parameters modified to calibrate the model, a description of the parameter, the default value, and the adjusted range.

Table 1.
Parameters Adjusted to Calibrate Model

Parameter Name	Description	Default Value	Adjusted Range
Lane Change Distance or "Look back distance"	distance where a vehicle begins to attempt to change lanes	656.2 feet	656.2~4000
Average Standstill Distance	average desired stop distance between stopped vehicles	6.56 feet	4.0~6.56
Headway Time (CC1)	Temporal gap that a driver wants to keep	0.9 sec	0.7~1.0
Standstill Distance	desired stop distance between stopped vehicles	4.92 feet	4.0~4.92
Car Following Variation	how much more distance than desired safe distance a driver wants to keep	13.12 feet	10~13.12
Max Deceleration (Trailing)	maximum deceleration rate for the trailing vehicle	-9.84ft/s^2	-9.84~-13.85
Accepted Deceleration (Own)	accepted deceleration rate for the lane changer	-3.28 ft/s^2	-3.28~-6.0
Accepted Deceleration (Trailing)	accepted deceleration rate for the trailing vehicle	-1.64 ft/s^2	-1.64~-5.28

The CC1 variable listed as headway in the VISSIM driver behavior settings for freeway links is defined as the absolute minimum headway value in seconds that a driver will accept before applying his/her brakes for an emergency stop. It is not to be confused with "headway" as defined by the 2000 Highway Capacity Manual which VISSIM defines as the "Following Distance" plus the car length of the leading vehicle (if the front bumper of both vehicles is referenced). The CC1 variable is one of 11 variables in an equation VISSIM uses to set the Following Distance and saturation flow rates.

Existing Traffic Operations

Local Intersections

The Study Support Team selected 32 signalized intersections to study. Existing level of service (LOS) for the PM peak hour was determined for these study intersections using Synchro (Build 614). The Highway Capacity Manual (HCM) LOS and delay is reported for this study. Results of the existing condition PM Peak hour Synchro LOS analysis are summarized in Exhibit 3.

Level of service can be reported for each approach or for the overall intersection which is an average of approach delays. Reporting overall intersection level of service is typical for signalized locations. However, if a certain approach queues through to another signal or onto another facility (such as when a local arterial queue backs onto a freeway ramp), the magnitude of these impacts are not clear when reporting the overall level of service.

Additionally Synchro does not capture the impact of freeway congestion backing onto local arterials and multiple access points along a roadway. For instance, 164th Street SW and 128th Street SW are both congested arterials due to many factors including several driveway access points between signals. The level of service reported in this section is for the local intersections, and does not reflect the arterial operations along the entire stretch.

Most the study intersections operate with an overall LOS D or better which is within the city and State standard. However as described above, several of these intersections have specific approaches that are operating at LOS F. An example is the I-5 northbound ramp/128th Street SW intersection on the east side of I-5. The northbound approach to the signal is operating at a LOS F. The 50th percentile queues extend over 700 feet from the intersection towards I-5, and the 95th percentile queues extend over 950 feet. The northbound (off ramp) approach has a volume to capacity ratio of 1.05 during the peak hour. When the volume is greater than the capacity, for every signal cycle the traffic on this approach is not cleared and the queue continues to build. Field studies show a queue from this approach onto I-5 extending up to a quarter mile along the shoulder of the freeway. Table 2 summarizes those intersections that on an overall basis operate at LOS D or better, but have specific approaches with LOS E or worse.

Table 2.
Study Intersections with LOS E or F Approaches

Intersection	Overall Intersection LOS, Ave Delay (sec/veh)	Approach w/ LOS E or F – LOS, Ave Delay (sec/veh)
128th St SW/4th Ave W	D, 53	EB – E, 59
		NB – E, 59
		SB – E, 64
128th St SW/I5 SB ramps	C, 25	SB – E, 69
128th St SW/I-5 NB ramps	D, 48	NB – E, 55
148th St SW/SR 99	D, 44	WB – E, 59
164th St SW/36th Ave W	D, 42	SB – E, 63
164th St SW/Ash Way	D, 43	SB – E, 59
164th St SW/I-5 SB ramps	C, 29	SB – E, 65
168th St SW/SR 99	D, 40	EB – E, 63
168th St SW/44th Ave W	C, 28	WB – E, 65
196th St SW/SR 99	E, 71	**EB – F, >80**
		WB – F,86
196th St SW/44th Ave W	E, 63	WB – E,69
		NB – E, 62
		SB – E, 73
196th St SW/36th Ave W	D, 39	EB – E, 59
196th St SW/Alderwood Mall Pkwy	D, 52	WB – E, 60
		NB – E, 61
30th Pl/Alderwood Mall Pkwy	D, 35	EB – E, 76
		WB – E, 67
Poplar Way/Alderwood Mall Pkwy	E, 60	**NB – F, >90**
208th St SW/SR 99	E, 68	**EB – F, >90**
212th St SW/44th Ave W	D, 47	EB – E, 63
212th St SW/Poplar Way	D, 49	EB – E, 77
220th St SW/SR99	D, 55	EB – E, 60
		WB – E, 70
220th St SW/I-5 NB ramps	F, >90	**EB – F, >90**

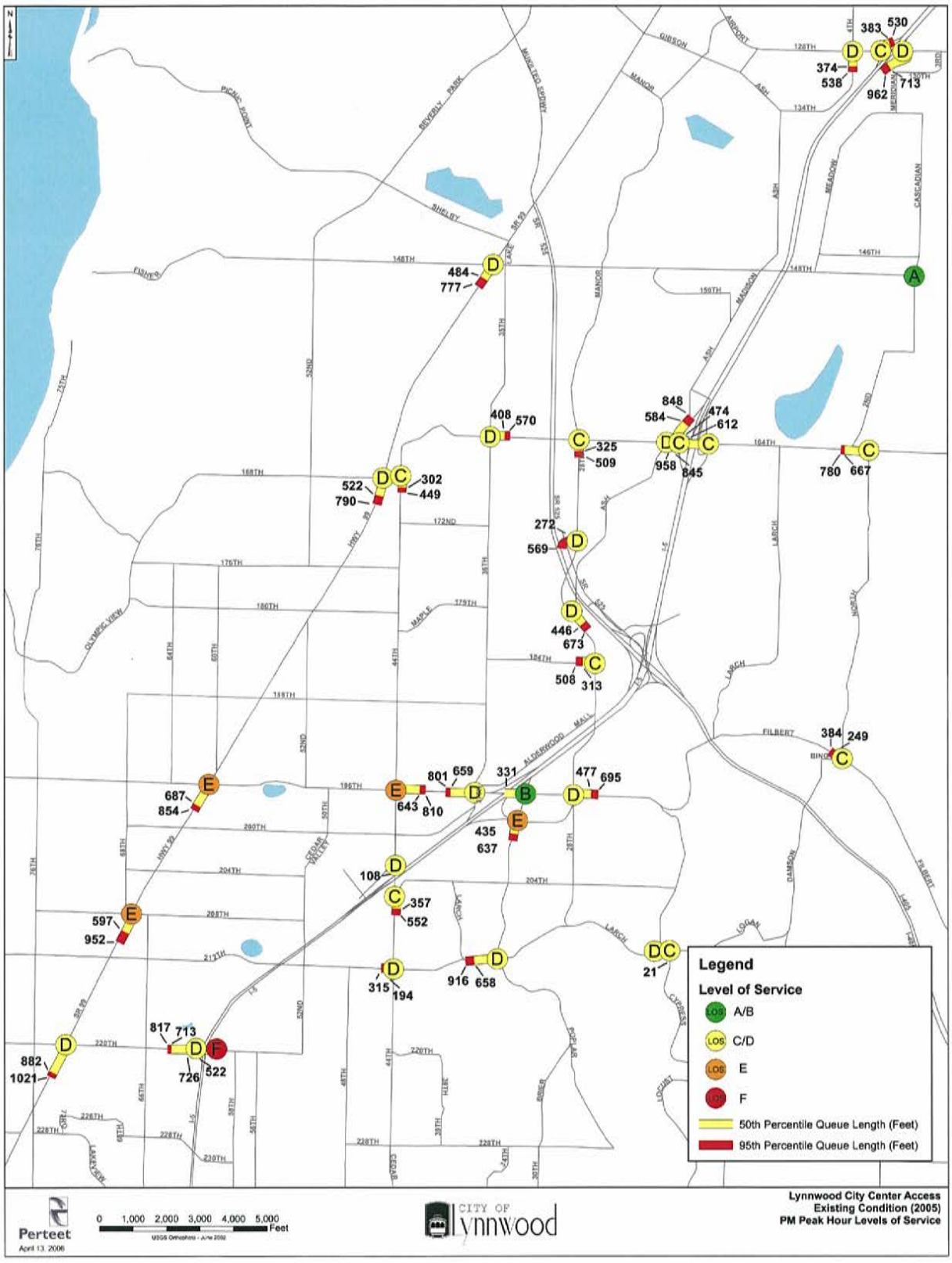


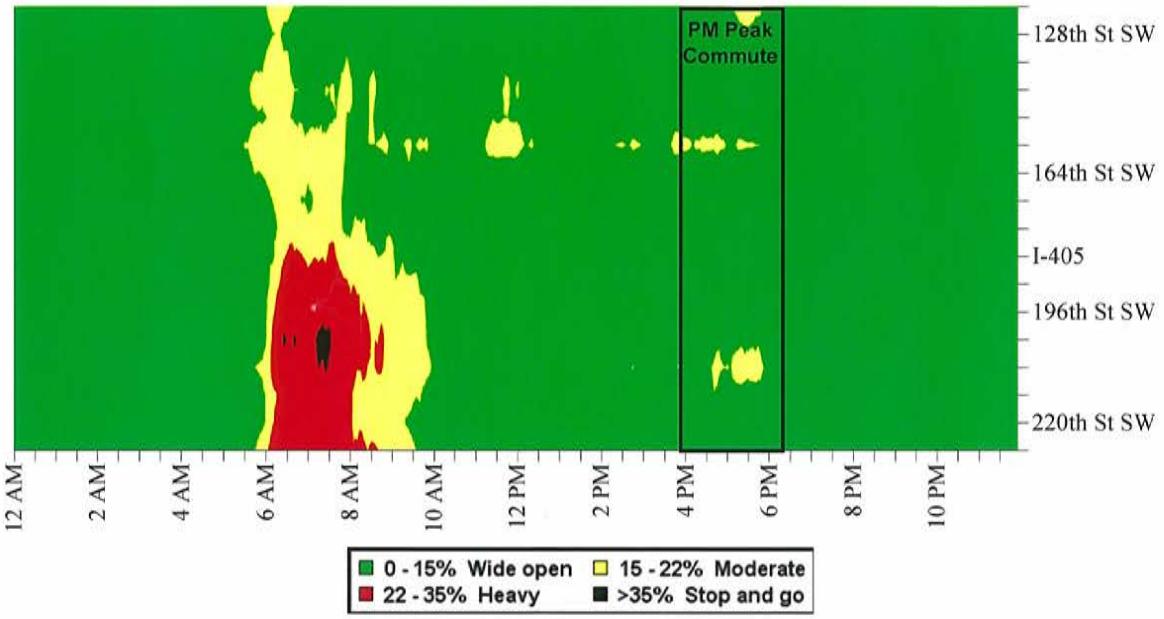
Exhibit 3 – Existing PM Peak Hour Intersection Level of Service

Freeway

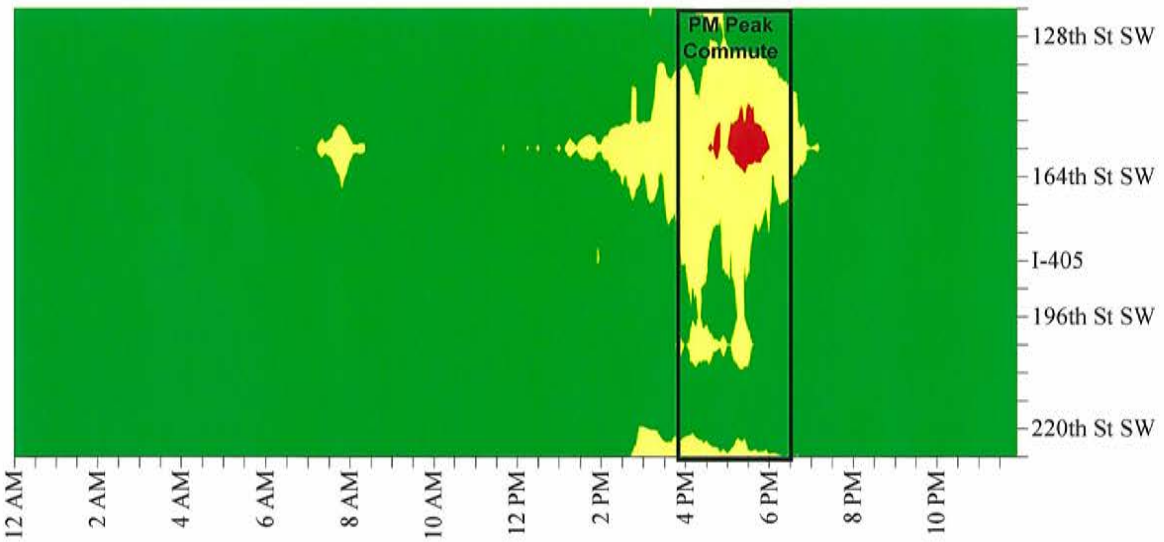
I-5 through the City of Lynnwood experiences congestion in the north direction during the evening commute. This is illustrated in Exhibit 4, a congestion diagram provided by WSDOT.

Exhibit 4. Existing Congestion Diagram

I-5 Southbound
Average Weekday March 2006



I-5 Northbound
Average Weekday March 2006



Operational analysis for the freeway mainline and interchange ramp merge/diverge areas was conducted based on existing traffic volume, speed, and travel time data collected. Mainline densities and speeds through the study area generally result in a LOS of D or better throughout the study corridor. Complete results are included in Tables 3 and 4 below.

Table 3. Mainline Density, LOS, and Speed

Freeway Segment	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour	Flow Rate (pc/h/ln)
I-5 Southbound					
128th St SW Off to 128th St SW On	27	D	56	5,600	1,510
128th St SW on to 164th St SW Off	32	D	56	6,560	1,770
164th St SW Off to 164th St SW On	27	D	56	5,570	1,500
164th St SW On to I-405 SB Off	24	C	61	6,710	1,450
I-405 SB Off to I-405 On	21	C	61	4,680	1,260
I-405 On to SR 524 Off	24	C	60	6,700	1,440
SR 524 Off to SR 524 EB On	24	C	60	5,260	1,420
SR 524 EB On to 44th Ave W Off	31	D	51	5,850	1,580
44th Ave W Off to 220th St SW Off	36	E	51	6,930	1,860
220th St SW Off to 220th St SW On	29	D	53	5,740	1,550
I-5 Northbound					
220th St SW Off to 220 th St SW On	34	D	58	7,250	1,960
220th St SW On to 44th Ave W Off	32	D	58	8,540	1,840
44th Ave W Off to SR524 Off	32	D	60	7,170	1,930
SR 524 Off to Alderwood Mall Pkwy On	30	D	60	6,580	1,770
Alderwood Mall Pkwy On to SR524 On	28	D	60	7,700	1,660
SR 524 On to I-405 Off	30	D	60	8,340	1,800
I-405 Off to I-405 NB On	27	D	60	5,950	1,600
I-405 On to 164th St SW Off	30	D	58	8,160	1,760
164th St SW Off to 164th St SW On	31	D	58	6,600	1,780
164th St SW On to SR 96 Off	41	E	47	7,140	1,920
128th St SW Off to 128th St SW On	33	D	47	5,730	1,550

Table 4. Merge Area Density, LOS, and Speed

Freeway Segment	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour	Flow Rate (pc/h/ln)
I-5 Southbound					
128th St SW On	33	D	40	6,460	1,290
164th St SW On	22	C	60	6,590	1,320
I-405 On	22	C	59	6,590	1,320
SR 524 EB On	25	C	46	5,780	1,160
44th Ave SW On	31	D	44	6,800	1,360
220th St SW On	26	D	49	6,380	1,280
I-5 Northbound					
220th St SW On	32	D	54	8,540	1,710
Alderwood Mall Pkwy On	27	D	56	7,650	1,530
SR 524 On	25	C	55	8,260	1,380
I-405 NB On	29	D	55	8,130	1,630
164th St SW On	36	E	42	7,240	1,450
128th St SW On	22	C	56	6,150	1,230

Conclusions

I-5 between 128th Street SW and 220th Street SW operates during the PM peak hour with speeds above 45 mph. Some sections of merge areas, particularly in the outside lanes, operate with speeds 40 to 50 mph which indicates mild congestion.

Most of the study intersections operate under LOS C to E. 220th Street SW and the I-5 northbound ramp intersection operates at LOS F and has a queue that extends from the eastbound approach through the southbound ramps. Several intersections have an overall LOS of E or better but have approaches that are failing. One example is the 128th Street SW and I-5 northbound ramp intersection. The northbound approach operates at LOS F and queues back on to the freeway impact freeway operations in the outside lanes.

Endorsement

The Study Support Team has reviewed this technical memorandum, and concurs with it.

Study Support Team	Initial
FHWA Northwest Washington - Elizabeth Healy	
WSDOT NW Region - Rick Mitchell	
WSDOT NW Region Traffic - Shuming Yan	
WSDOT HQ Access & Hearings Manager – Barb ~~St. Croix~~ De Ste. Croix	
Snohomish County – Jay Larson	
City of Lynnwood - Jeff Elekes	

Technical Memo #6

Lynnwood City Center Access Study
Design Year (2032) Traffic Operations Analysis

TO: **David Mach, P.E., Project Manager, City of Lynnwood**

FROM: **Peter De Boldt, P.E., Project Manager**
Tresia Bass, Traffic Analysis Lead

DATE: **September 7, 2006**

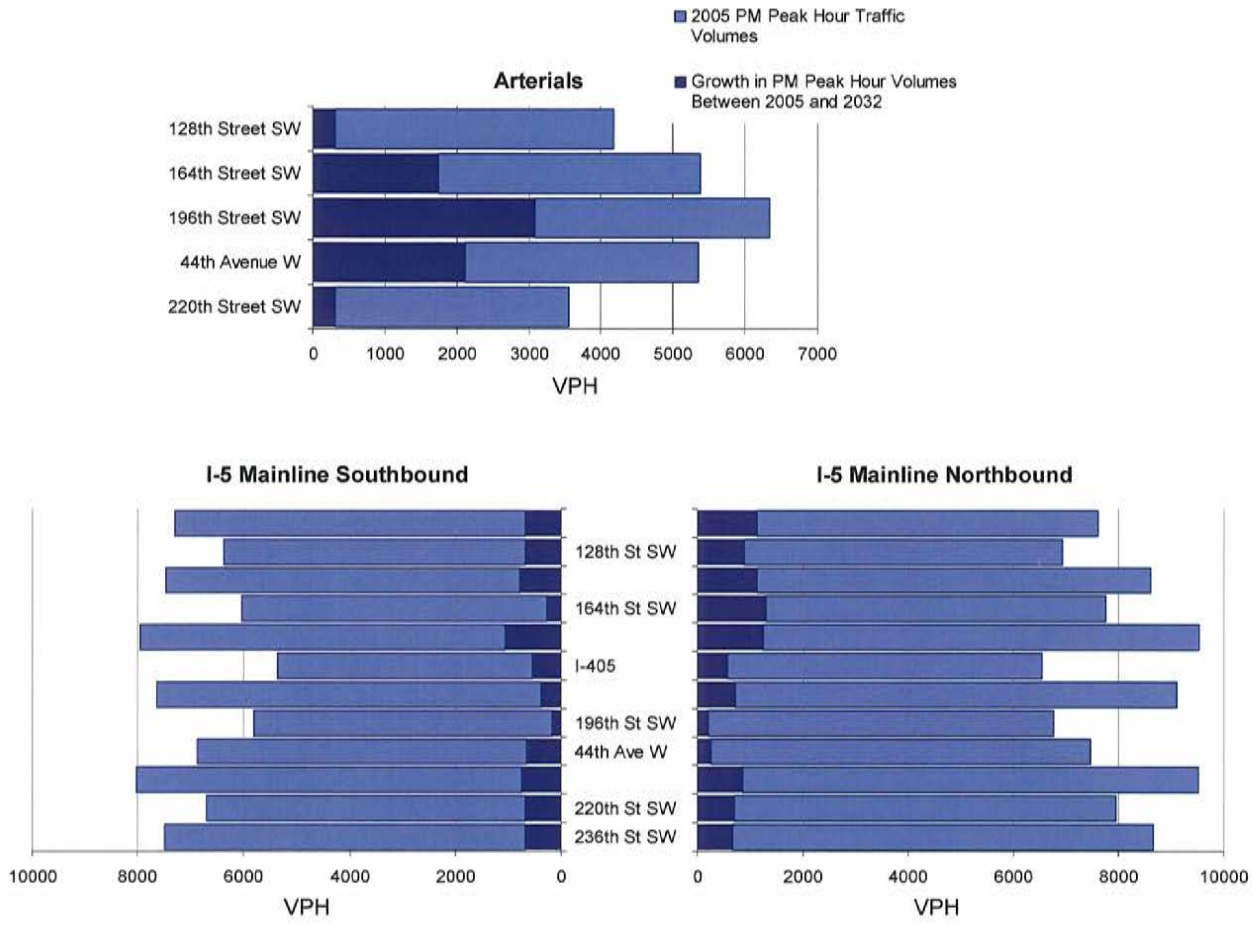
RE: **Design Year (2032) Traffic Operations Analysis**

This memorandum presents the results of the Design Year (2032) traffic operations for the PM peak hour that was conducted for the Lynnwood City Center Access Study. The traffic operations analysis in this Technical Memorandum is consistent with the approach outlined in Technical Memorandum #2.

Traffic Forecasts

Traffic forecasts for the design year (2032) indicate the local arterial system volumes increase at a greater rate than volumes on I-5. 164th Street SW and 44th Avenue W increase by 50 percent or more by the Design Year (2032), and 196th Street SW nearly doubles in traffic. I-5 traffic volumes increase 5 to 20 percent near these arterials with very little growth northbound through the 44th Avenue W and 196th Street SW interchange areas. Today's traffic volume and 2032 growth on the arterials and I-5 is shown in Exhibit 1.

Exhibit 1 – PM Peak Hour Arterial and I-5 Traffic Volume Growth



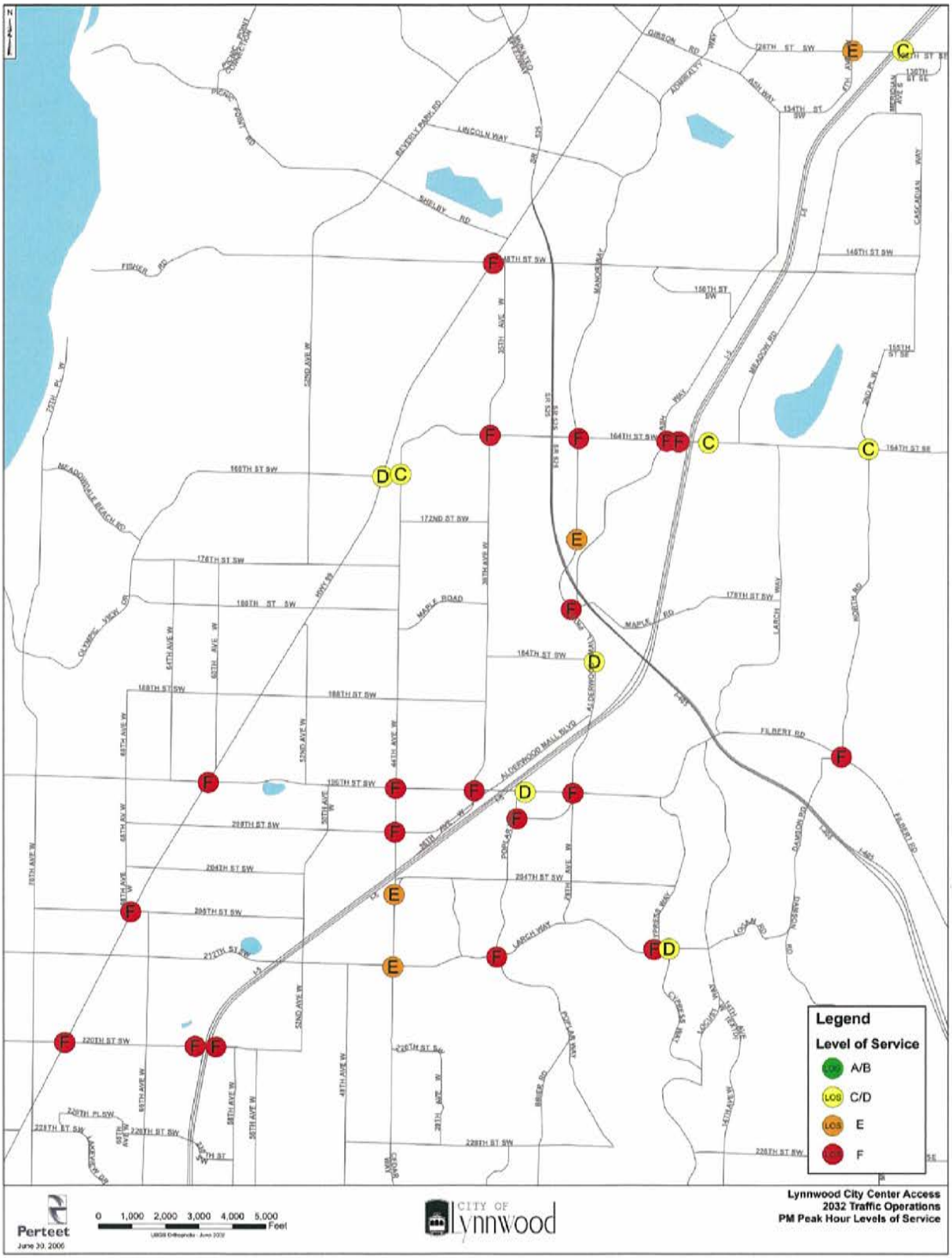
Design Year (2032) Traffic Operations

Local Intersections

The Study Support Team selected 33 signalized intersections to study. Existing and Design Year (2032) level of service (LOS) for the PM peak hour was determined for these study intersections using Synchro (Build 614). When conducting the level of service analysis for the Design Year conditions, it was assumed that the improvements associated with the Design Year Baseline Network Improvements identified in Technical Memorandum #1 had been implemented.

Today, five of the study intersections operate at LOS E or F. Due to the large increases in arterial traffic volumes, 23 of the 33 intersections studied operate at LOS E or F by the Design Year (2032). The results of the VISSIM model support these results, showing extensive queuing that impacts freeway operations. Results of the PM Peak hour Synchro LOS analysis are summarized in Exhibit 2.

Exhibit 2 – Design Year (2032) PM Peak Hour Intersection Level of Service



Freeway

The freeway operations were analyzed using two approaches. The first approach used a VISSIM model with freeway ramps connected to the signals at the ramp terminus. The analysis in the first approach indicates that in the Design Year (2032), arterial congestion will severely impact freeway operations which caused the microsimulation model to "freeze". The second approach disconnected the arterial system so demand volumes entered the freeway at the ramps. This approach allowed the team to identify potential freeway operational issues not related to the local arterial system.

The following summarizes the two approaches. The first section summarizes the VISSIM model with freeway ramps connected to the arterial system and describes the interaction between the two. The second section summarizes the freeway operations in the design year compared to today.

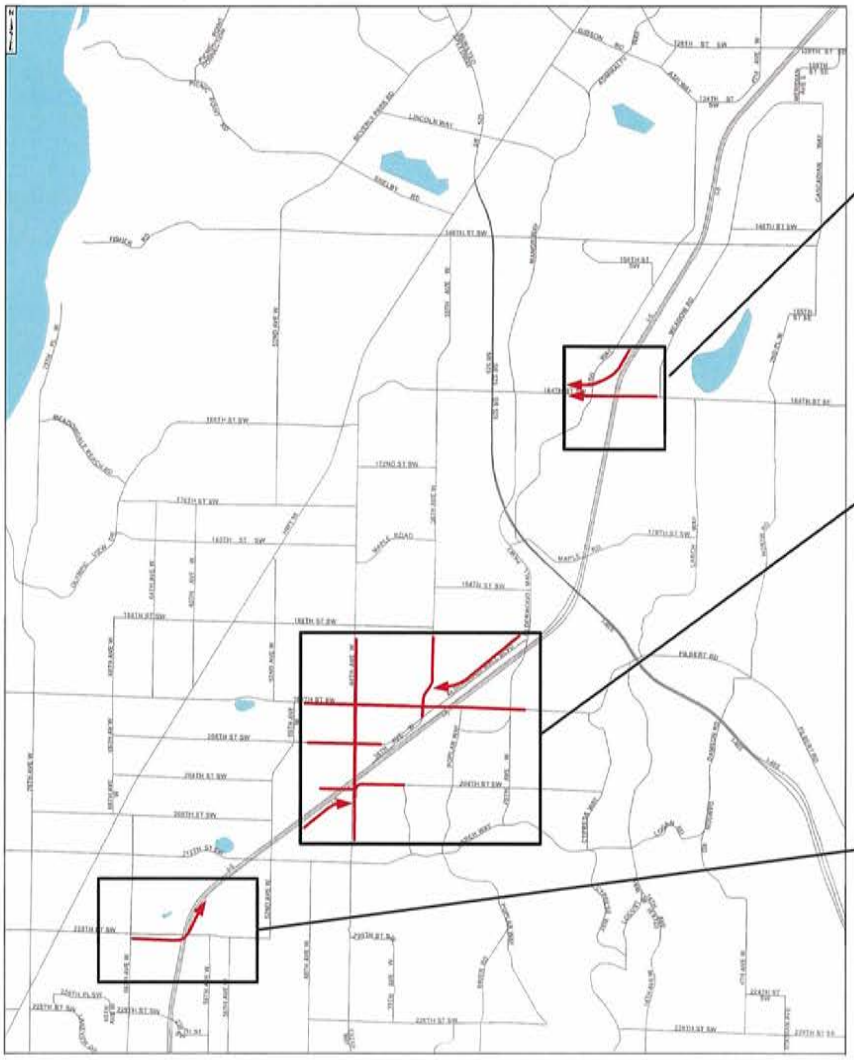
Approach 1 - Freeway and Arterial System Operations

A high level of congestion on the arterials associated with the freeway interchanges causes many of the interchange ramps to queue onto the freeway mainline. When this happens within VISSIM it tends to disproportionately impact freeway operations on the mainline. One example is that congestion from 196th Street SW impacts the southbound off ramp and backs onto the freeway during the PM peak hour. Southbound traffic exiting to 196th Street SW queues onto the shoulder or right side lanes through to the I-405 interchange. This limits the ability of traffic to access I-5 from I-405. Similar conditions occur at the 164th Street SW southbound off ramp and the 44th Avenue W northbound off ramp.

Exhibit 3 depicts congestion areas in the I-5 interchange areas that results from congestion on the arterial system.

Mainline densities and speeds through the study area were collected using VISSIM; however due to the high level of congestion from the arterials, the values were not calculable. For instance, in the southbound direction, a third of the demand for the Design Year (2032) was unable to reach 220th Street SW. This traffic was "stuck" in queues to the north. The VISSIM model essentially freezes after 10 minutes with travel times jumping from 8 minutes to over 25 minutes as shown in Exhibit 4.

Exhibit 3 – Design Year Congestion Areas



Key Findings from Design Year Analysis

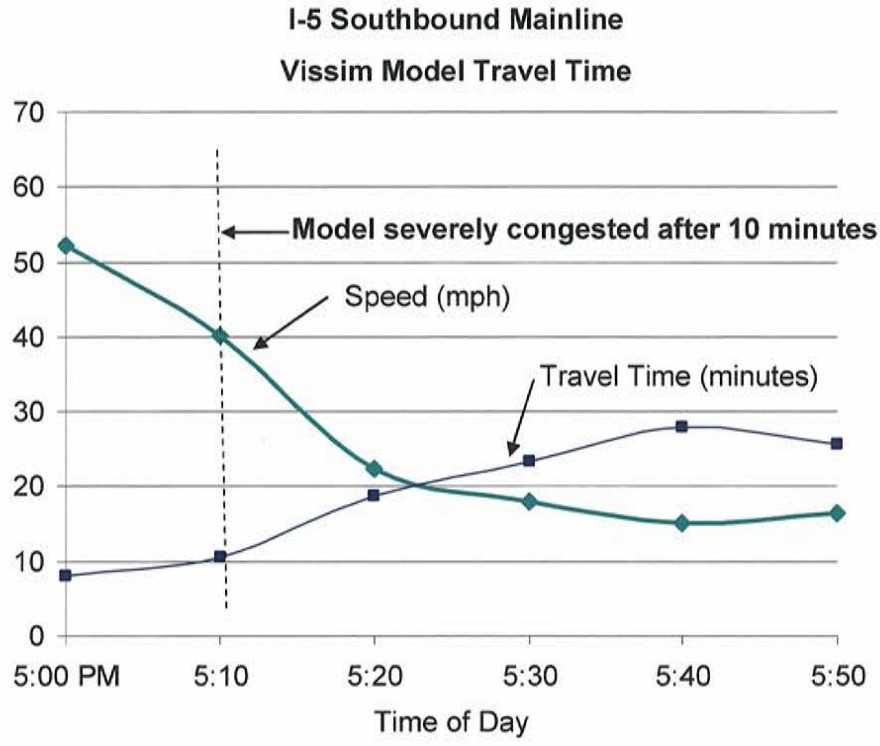
The 164th Street SW interchange area is overcapacity, particularly in the westbound direction. Southbound traffic exiting from I-5 conflicts with the westbound movement and queues back onto the mainline.

An additional lane is provided on both 196th Street SW and 44th Avenue W in each direction; however traffic increases by 2,000 to 3,000 vph.

Arterial queues at the 44th Avenue W off ramp back onto I-5 northbound and congestion at the 196th Street off ramp backs onto I-5 southbound.

Traffic turning onto I-5 northbound from eastbound 220th Street SW queues today in the PM peak hour. In the year 2032, 220th Street SW traffic increases by 10 percent increasing eastbound queues.

Exhibit 4 – I-5 Southbound Mainline VISSIM Speed and Travel Time



When traffic demand increases at such a great rate, peak spreading occurs (people choose to travel earlier in the afternoon or later in the evening). The forecast analysis assumed some peak spreading; however the VISSIM microsimulation model indicates further peak spreading would occur given current capacity constraints.

Approach 2 - Freeway System Operations

The following summarizes the second approach conducted to determine freeway operations through the merge and weave sections. The ramps were disconnected from the arterial system in the VISSIM model to determine separately how the freeway would operate with forecasted volumes. This approach is similar to the Highway Capacity Methodology in that it analyzes freeway operations with traffic demand and does not include downstream impacts. This analysis identifies problem areas not discovered in the first approach.

Tables 1 and 2 summarize the LOS, density, speed, and volume. Most of the northbound freeway mainline and merge areas within the study area operates at LOS E or F in the year 2032. These same locations generally operate at LOS D or better today.

The volume reported in Tables 1 and 2 is traffic served or throughput. Throughput is less than the demand where congestion exists. For instance, I-5 northbound between the 44th Avenue W off ramp to 196th Street SW off ramp, the section operates at LOS E and serves less traffic than today though traffic demand is slightly higher. Most other sections serve more traffic than today but experience greater congestion.

Travel time on I-5 between 220th Street SW and 128th Street SW in the northbound direction increases from 7.8 minutes today to 10.5 minutes in the year 2032. In the southbound direction, travel time for this same section of I-5 increases from 7.1 minutes today to 8.0 minutes in the year 2032.

Table 1. Mainline Density, LOS, and Speed

Freeway Segment	2032 Density (pc/mi/ln)	2032 LOS	2032 Speed (mph)	2032 Length (ft)	2032 Vehicles Per Hour	2032 Flow Rate (pc/h/ln)	Existing Density (pc/mi/ln)	Existing LOS	Existing Speed (mph)	Existing Vehicles Per Hour
I-5 Southbound										
128th St SW Off to 128th St SW On	32	D	54	4,380	6,450	1,740	27	D	56	5,600
128th St SW on to 164th St SW Off	37	E	54	9,130	7,420	2,000	32	D	56	6,560
164th St SW Off to 164th St SW On	30	D	54	3,490	5,970	1,610	27	D	56	5,570
164th St SW On to I-405 SB Off	28	D	59	2,010	7,690	1,660	24	C	61	6,710
I-405 SB Off to I-405 On	23	C	59	4,330	5,030	1,360	21	C	61	4,680
I-405 On to 196th St SW Off	25	C	60	1,690	7,060	1,520	24	C	60	6,700
196th St SW Off to 196th St SW EB On	24	C	60	6,390	5,380	1,450	24	C	60	5,260
196th St SW EB On to 44th Ave W On	36	E	48	2,110	6,410	1,730	31	D	51	5,850
44th Ave W Onto 220th St SW Off	43	E	48	4,490	7,530	2,030	36	E	51	6,930
220th St SW Off to 220th St SW On	35	D	49	3,640	6,290	1,700	29	D	53	5,740
I-5 Northbound										
220th St SW Off to 220 th St SW On	54	F	38	4,750	7,540	2,030	34	D	58	7,250
220th St SW On to 44th Ave W Off	52	F	38	1,430	9,050	1,950	32	D	58	8,540
44th Ave W Off to 196th St SW Off	47	F	40	5,330	6,980	1,880	32	D	60	7,170
196th St SW Off to Alderwood Mall Pkwy On	44	E	40	2,480	6,500	1,750	30	D	60	6,580
Alderwood Mall Pkwy On to 196th St SW On	43	E	40	1,950	7,950	1,720	28	D	60	7,700
196th St SW On to I-405 Off	44	E	43	790	8,770	1,890	30	D	60	8,340
I-405 Off to I-405 NB On	39	E	43	3,120	6,200	1,670	27	D	60	5,950
I-405 On to 164th St SW Off	48	F	37	3,700	8,340	1,800	30	D	58	8,160
164th St SW Off to 164th St SW On	49	F	37	5,440	6,720	1,810	31	D	58	6,600
164th St SW On to 128th St SW Off	48	F	43	9,030	7,610	2,050	41	E	47	7,140
128th St SW Off to 128th St SW On	38	E	43	3,640	6,070	1,640	33	D	47	5,730

Table 2. Merge Area Density, LOS, and Speed

	2032					Existing			
Freeway Segment	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour	Flow Rate (pc/h/ln)	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour
I-5 Southbound									
128th St SW On	58	F	26	7,360	1,470	33	D	40	6,460
164th St SW On	26	D	58	7,690	1,540	22	C	60	6,590
I-405 On	24	C	59	7,040	1,410	22	C	59	6,590
196th St SW EB On	53	F	26	6,410	1,280	25	C	46	5,780
44th Ave SW On	39	E	38	7,470	1,490	31	D	44	6,800
220th St SW On	30	D	47	7,030	1,410	26	D	49	6,380
I-5 Northbound									
220th St SW On	59	F	31	9,050	1,810	32	D	54	8,540
Alderwood Mall Pkwy On	57	F	30	7,890	1,580	27	D	56	7,650
196th St SW On	59	F	25	8,700	1,450	25	C	55	8,260
I-405 NB On	45	F	39	8,350	1,670	29	D	55	8,130
164th St SW On	81	F	19	7,600	1,520	36	E	42	7,240
128th St SW On	23	C	59	6,680	1,340	22	C	56	6,150

Conclusions

Traffic forecasts indicate large increases in traffic volumes on the arterials and a 10 to 20 percent increase in traffic on I-5. 44th Avenue W and 196th Street SW arterials have the highest arterial growth and the greatest degradation in operations in the year 2032. These arterials operate as a single interchange area with traffic to and from the north accessing 196th Street SW and traffic to and from the south accessing 44th Avenue W. Arterial congestion queues onto the freeway mainline in both the north and southbound direction.

Independent of arterial congestion, the freeway operates at LOS E or F throughout most of the study area. Nearly all merge sections operate at LOS E or F. Travel time on I-5 between 220th Street SW and 128th Street SW in the northbound direction increases from 7.8 minutes today to 10.5 minutes in the year 2032. In the southbound direction, travel time for this same section of I-5 increases from 7.1 minutes today to 8.0 minutes in the year 2032.

Endorsement

The Study Support Team has reviewed this technical memorandum, and concurs with it.

Study Support Team	Initial
FHWA Northwest Washington - Elizabeth Healy	
WSDOT NW Region - Rick Mitchell	
WSDOT NW Region Traffic - Shuming Yan	
WSDOT HQ Access & Hearings Manager – Barb ~~St. Croix~~ De Ste. Croix	
Snohomish County – Jay Larson	
City of Lynnwood - Jeff Elekes	

Technical Memo #7

Lynnwood City Center Access Study
Screening of Design Charrette Concepts

TO: **David Mach, P.E., Project Manager, City of Lynnwood**

FROM: **Peter De Boldt, P.E., Project Manager**

DATE: **September 11, 2006 (Revised October 4, 2006, October 31, 2006 and November 27, 2006)**

RE: **Screening of Design Charrette Concepts**

Summary

This memorandum documents the approach used to screen the concepts developed at the July 11th Design Charrette, as well as other concepts suggested by the Study Support Team. The concepts that remain after the screening will be further analyzed in the Access Needs Report. The principal focus of the screening approach used was to:

- Identify concepts that would move local trips from the I-5 corridor and onto the local transportation system;
- Select concepts that would reduce congestion on the principal arterials with I-5 interchanges to relieve congestion at those interchanges; and
- Identify concepts that might reduce the congestion-related HAC/HAL locations in the Study Area.

A variety of methodologies were employed in the screening process. These consisted of:

- A broad-screening methodology that was employed at the October 10, 2006 Study Support Team meeting. The Study Support team screened out concepts that:
    1) Were not consistent with planned land use;
    2) Had fatal flaws (environmental, geometric, statutory, etc.);
    3) Were not necessary for, or didn't improve, access to the city center;
    4) Had adverse operational impact to interstate mainline; and
    5) Were outside the jurisdictional control of City of Lynnwood and/or WSDOT.
- Using the study's VISUM traffic-demand mode,l each individual concept from the Design Charrette was tested to identify PM Peak hour traffic volume changes at critical screenline locations. This provided a preliminary assessment of the impacts each concept had on the transportation system.

As a result of the screening process, the following concepts were selected for additional analysis:

Local Transportation System Improvements:

- Concept 6 – Extend 33rd Avenue W to Alderwood Mall Parkway.
- Concept 9 - New link across I-5 between 33rd Avenue W and Poplar Way.
- Concept 11 - New connection across I-5 between 40th Avenue W and Larch Way.
- Concept 10 and 44 combined – This would create a new east-west corridor along 194th Street SW linking SR99 to Alderwood Mall Boulevard (Concepts 56 and 57 would also be considered as part of this combination).
- Concept V - Widen 200th between 44th and 48th to 5 lanes.
- Concepts 38, 41 and I combined – This would create a new continuous east-west corridor that would link SR99 to the SR525/Alderwood Mall Boulevard interchange and possibly relieve congestion on 196th Street SW. It would be more effective than just Concepts 31 and I alone originally identified in the October, 2006 SST meeting. This concept was added by the City as worth considering after the SST meeting.

Regional Transportation System Improvements to be evaluated with Local Transportation System Improvements:

- Concept 1 - New Ramp -SB I-5 to WB SR 525.
- Concept 2 - New Braided Ramp -EB SR 525 to SB I-5.

Regional Transportation System Improvements to be evaluated only after evaluating effectiveness of Local Transportation System Improvements:

- Concept 25 - Create NB and SB CD system on I-5 to connect Lynnwood interchanges. Provide SB off-ramps and NB on-ramps at 44th Avenue W.

The rest of this memorandum documents the different concepts generated at the Design Charrette, and the different methodologies used to screen the concepts carried forward in the Access Needs Report. The end of the memorandum describes how the effectiveness of the different concepts will be grouped together and evaluated.

Design Charrette Concepts

The different concepts identified at the July 11, 2006 Design Charrette are summarized in the following table. The concepts were grouped into three categories: "Local," "Interstate/Limited Access," and "Non-SOV" concepts. These concepts are also illustrated on the attached figure labeled "Design Charrette Concepts."

Design Charrette Concepts from 7-11-06

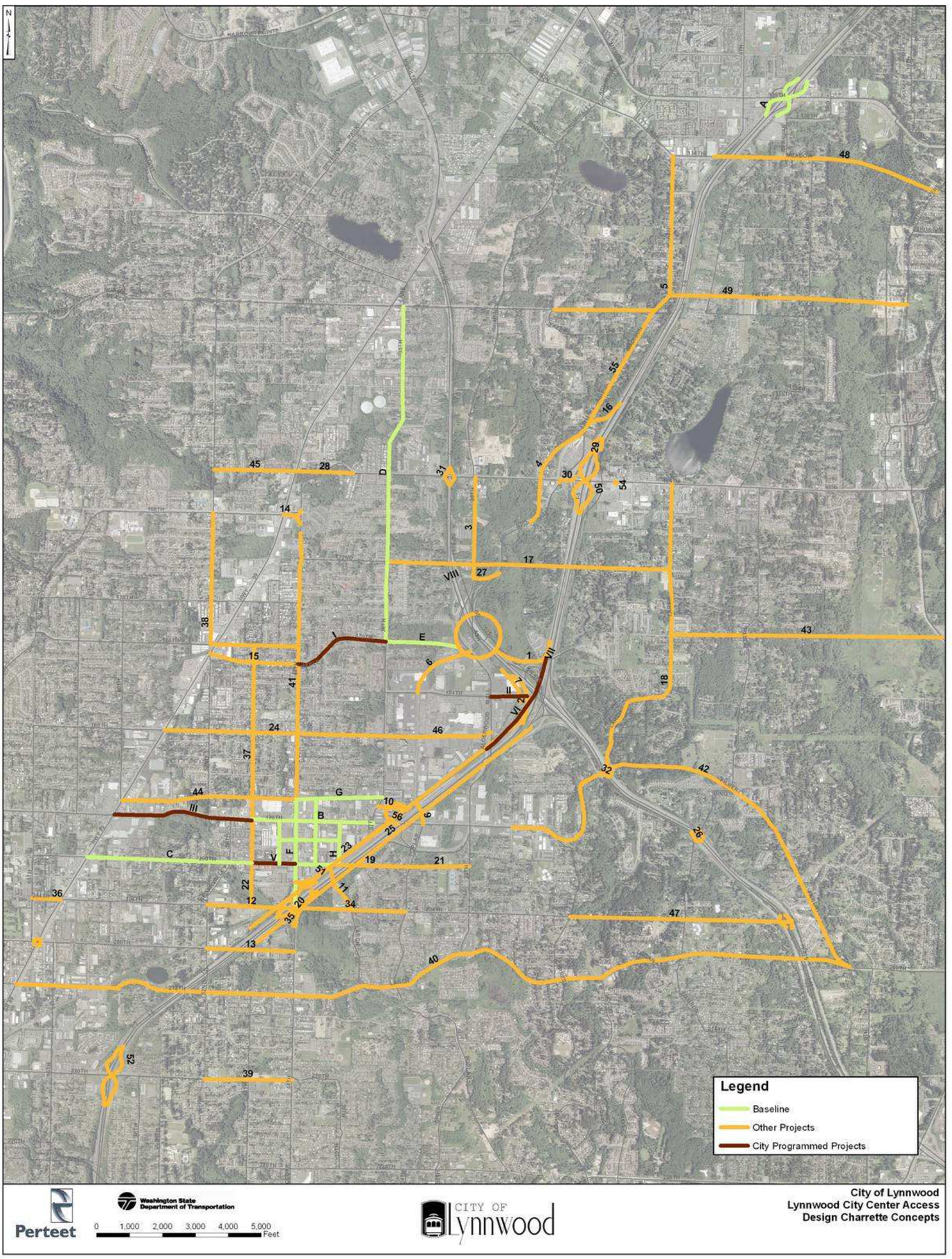
Concept #	Brief Description
	"Local" System Improvements
3	Widen Alderwood Mall Parkway to 5 lanes - SR 525 Ramps to 164th St. SW
4	Relocate Ash Way away from I-5/164th Interchange - Ash Way Park & Ride to Alder Way
5	Connect 148th St SW across I-5 - Jefferson Way to Meadow Road
6	Extend 33rd Ave W to Alderwood Mall Parkway - 184th St SW to Alderwood Mall Parkway
7	Connect Ash Way to Beech Road
8	New connection between Alderwood Mall Parkway and Filbert Road
9	New connection across I-5 between 33rd Ave W and Poplar Way
10	New connection along 195th Pl SW between 36th Ave W and Alderwood Mall Boulevard
11	New connection across I-5 along 40th Ave W between Alderwood Mall Blvd and 204th St SW
12	New connection across I-5 along 204th St SW between 52nd Ave W and Larch Way
13	New connection across I-5 along 208th St SW between 52nd Ave W and 44th Ave W
14	Change intersection of 44th Ave W and 168th St SW to make the 44th Ave W to 168th St the through movement
15	Connect Maple Road to SR 99 between 44th Ave W and SR 99
17	New connection across I-5 along 172nd St SW corridor between 36th Ave W and Larch Way. Eliminate Ash Way South of 172nd St SW. Create roundabout at 172nd St SW and Ash Way South
18	Improve Larch Way corridor between 164th St SW and 196th St SW to full arterial standards
19	New connection across I-5 along 200th St SW between 40th Ave W and Poplar Way
21	New connection along 200th St SW between Poplar Way and 28th Ave W
22	Extend 48th Ave W south to connect to 204th St SW
24	Improve 188th St SW between 36th Ave W and SR 99
27	Tie Ash Way into Alderwood Mall Parkway at SR 525 interchange. Eliminate Ash Way to south
28	Improve connection along 164th St SW to SR 99
30	Prevent movement from SB I-5 off-ramp at 164th St SW to SB Ash Way
33	Widen Poplar Way between I-5 ramps and 212th St SW
34	Widen 204th St SW between 44th Ave W and Poplar Way
35	Remove signal at 204th ST SW and 44th Ave W and realign 204th St SW with NB I-5 off-ramp signal
36	Modify 208th St SW and SR 99 intersection and improve 204th St SW between 68th Ave W and SR 99 to encourage use of 204th St SW instead of 208th St SW
37	Improve 48th Ave W between 200th St SW and 180th St SW
38	Improve 180th St SW, create better connection along 180th St SW to 52nd Ave W. Improve 52nd Ave W north to 168th St SW
39	New connection along 220th St SW between 52nd Ave W and 44th Ave W

40	Improve 212th St SW corridor between SR 99 and connect to 208th St SW east of I-405
41	Widen 44th Ave W from 194th St SW to 168th St SW
42	Improve SR 524 corridor between 24th Ave W and 208th St SW east of I-405
43	New connection between Larch Way and SR 527 along Maple Road/178th St SW corridor
44	New/improved connection along 194th St SW between 44th Ave W and SR 99
45	Improved connection between SR 99 and 52nd Ave W along 164th ST SW corridor
46	Improved connection between 36th Ave W and Alderwood Mall Boulevard along 188th St SW corridor on south side of Alderwood Mall
47	New connection/improvements along 204th St SW corridor between Larch Way and Filbert Road on east side of I-405. New interchange on I-405 St SW extension
48	New connection across I-5 between 4th Ave W and SR 527 along 134th St SW/Meadow Road/Dumas Road corridor
49	New/improved connection along 148th St SW corridor across I-5 between Jefferson Way and SR 527
54	Eliminate signal on 164th St SW at Wal-Mart entrance. Use access off of Larch Way instead
55	Improve Ash Way between Ash Way Park & Ride and 148th St SW
56	New loop connection between WB 196th St SW to Alderwood Mall Boulevard
58	New connection from 40th Avenue W/194th St SW to Alderwood Mall Boulevard/195th St SW
	Interstate or Limited Access System Improvements
1	New Ramp - SB I-5 to WB SR 525
2	New Braided Ramp - EB SR 525 to SB I-5
16	Move SB I-5 ramp at 164th St SW north of Park & Ride
20	Complete interchange at I-5/44th Ave W to provide SB off-ramp and NB on-ramp
23	Extend SB I-5 ramp from 196th St SW to also exit at 44th Ave W (SB CD system)
25	Create NB and SB CD system on I-5 to connect Lynnwood interchanges. Provide SB off-ramps and NB on-ramps at 44th Ave W
26	New interchange at I-405 and Damson Road
31	Create new interchange at SR 525 and 164th St SW
32	New partial interchange at I-5 and Filbert Road. Interchange would be a NB off-ramp and SB on-ramp
50	SPUI at I-5/164th St SW interchange
51	SPUI at I-5/44th Ave W interchange
52	SPUI at I-5/220th St SW interchange
53	Flyover ramp for SB I-5 off-ramp at I-5/164th ST SW interchange to get traffic over Ash Way and headed westbound
57	New off-ramp from existing SB I-5/196th off-ramp to 195th Pl SW/36th Ave W

Design Charrette Concepts to Promote Non-SOV's from 7-11-06	
Concept #	**Brief Description**
29	Complete Ash Way Park & Ride direct access to north on I-5
A	Improve/modify direct access connection at I-5/46th Ave W to encourage higher HOV usage
B	Enhance Interurban Trail and provide network of bike lanes
C	Use 46th Ave W Park & Ride lot for light rail
D	Transit corridor connecting BAT on SR 99 near 148th St SW to Lynnwood City Center along 35th Ave/36th Ave W corridor

E	Create Lynnwood Link between Edmonds Community College/Lynnwood Park and Ride/City Center/Alderwood Mall/Lynnwood High School

Other Concepts Proposed after the Design Charrette	
Concept #	**Brief Description**
I	Widen Maple from 44th to 36th – Local System Improvement
II	Extend 184th from Alderwood Mall Parkway to Beech Road – Local System Improvement
III	Widen 196th to 7 lanes from 48th through SR 99 – Local System Improvement
IV	Not used.
V	Widen 200th between 44th and 48th to 5 lanes – Local System Improvement
VI	Ramp from SB I5 to Alderwood Mall (original funding request concept) – Interstate Improvement. *Because of proximity to the I-5/I-405/SR525 system interchange, this could only be implemented as part of a C-D system.*
VII	EB SR525 to NB I5 Ramp – Interstate Improvement
VIII	Reconfigure SR525 and Alderwood Mall Parkway interchange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City of Lynnwood
Lynnwood City Center Access
Design Charrette Concepts

Screening Methodology From October 10, 2006 Study Support Team meeting

The October 10, 2006 Study Support Team (SST) meeting used a broad approach to concept screening. This screening approach used the traffic-demand modeling work described later in this technical memorandum as supporting information to identify promising concepts. The screening approach developed by the SST screened out concepts that:

1) Were not consistent with planned land use;
2) Had fatal flaws (environmental, geometric, statutory, etc.);
3) Were not necessary for, or didn't improve access to the city center;
4) Had adverse operational impact to interstate mainline; and
5) Were outside the jurisdictional control of City of Lynnwood and/or WSDOT.

Using these screening criteria, the Study Support Team identified the following Local Transportation System improvements as being worthy of additional consideration:

- Concept 6 – Extend 33rd Avenue W to Alderwood Mall Parkway.
- Concept 8 - New link between Alderwood Mall Parkway and Filbert Road. *(Although this concept was suggested at the SST meeting, it was found afterward that it was not in the jurisdictional control of the City or WSDOT, criteria 5. It will therefore not be carried forward in this study).*
- Concept 9 - New link across I-5 between 33rd Avenue W and Poplar Way.
- Concept 11 - New connection across I-5 between 40th Avenue W and Larch Way.
- Concept 33 - Widen Poplar Way between I-5 ramps and 212th Street SW. *(Although this concept was suggested at the SST meeting, it was found afterward that it was not in the jurisdictional control of the City or WSDOT, criteria 5. It will therefore not be carried forward in this study).*
- Concept 10 and 44 combined – This would create a new east-west corridor along194th Street SW linking SR99 to Alderwood Mall Boulevard.
- Concept 41 - Widen 44th Avenue W from 194th Street SW to 168th Street SW.
- Concept I - Widen Maple from 44th to 36th.
- Concept V - Widen 200th between 44th and 48th to 5 lanes.

SST members felt it was important to carry forward the two WSDOT Transportation Partnership Account (TPA) projects as part of any analysis package. These are Concepts 1 and 2.

The SST members added the following Regional System improvements to be considered if the Local Transportation System improvements and the two TPA projects identified above do not meet the access needs of the Lynnwood City Center:

- Concept 25 – Create NB and SB CD system on I-5 to connect Lynnwood interchanges. Provide SB off-ramps and NB on-ramps at 44th Avenue W
- Concept VI - Ramp from SB I-5 to Alderwood Mall. *This was the concept for which study funding was originally acquired. Existing ramps in the area will make it difficult to implement a direct connection. It may be possible as part of a CD system such as Concept 25.*
- Concept VIII – Reconfigure SR525 and Alderwood Mall Parkway interchange. Idea is to simplify current split interchange configuration to create easier access into Lynnwood, and to support Concepts 1 and 2.

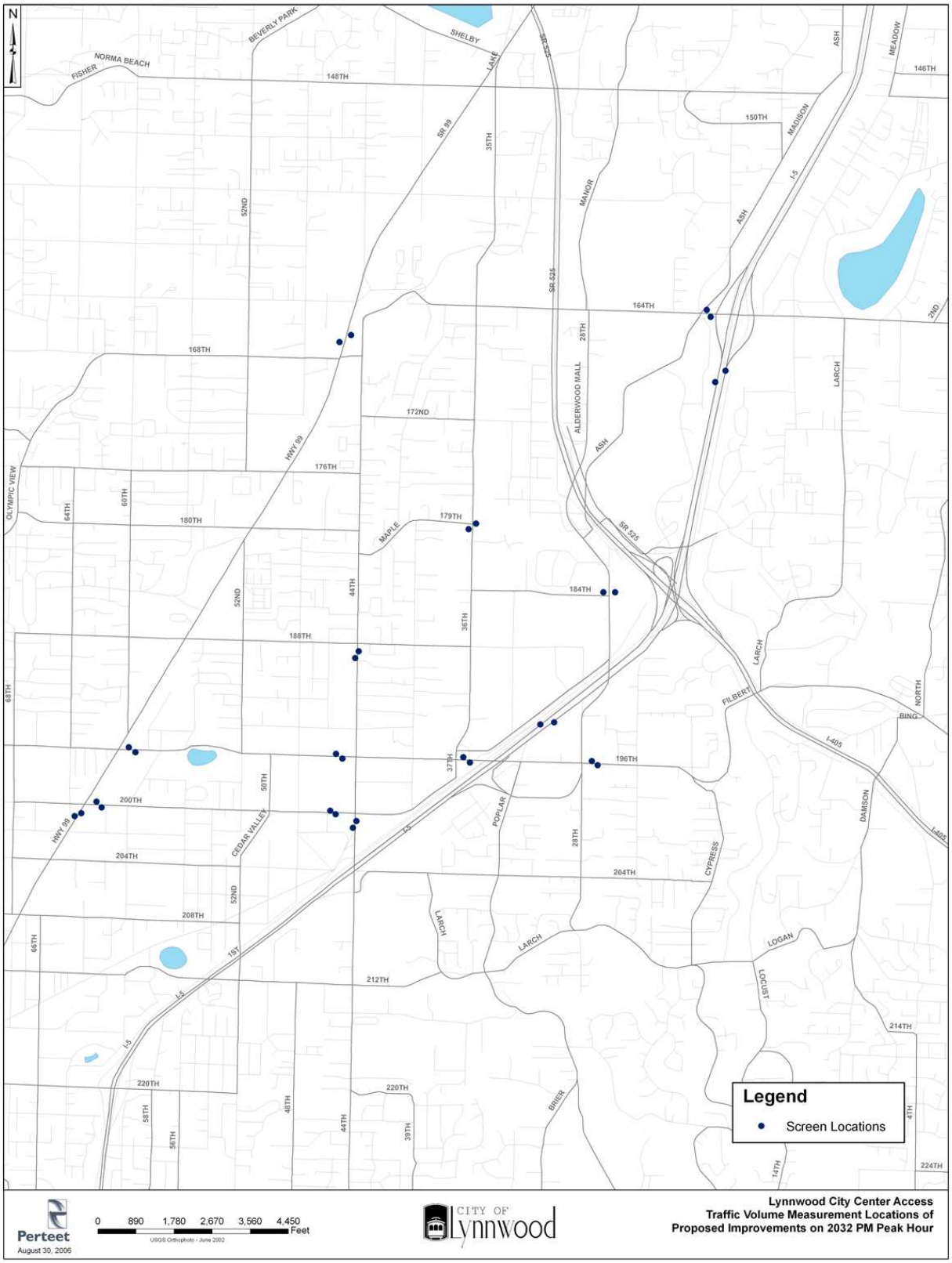
These last Regional System improvements were only to be considered after Local Transportation System improvements were first evaluated for effectiveness.

Individual Concept Traffic Demand Model Testing

To provide additional quantitative information for concept screening, each concept generated at the Design Charrette was individually incorporated into the Design Year Baseline VISUM Traffic Demand model. The Traffic Demand model was run for each individual concept, and the model recorded volume changes at 15 screenline locations in the transportation system. The 15 screenline locations were on critical local arterials, as well as on the regional transportation links, and captured the volume shifts generated by each concept. The goal of these screenline locations was to determine the effectiveness of each concept at maximizing the use of the local transportation system. Locations of these screenlines are shown in the figure on the following page labeled "Traffic Volume Measurement Locations of Proposed Improvements on 2032 PM Peak Hour."

Changes from the traffic volumes predicted by the Design Year 2032 Baseline Transportation System at each of the 15 screen line locations were then evaluated. The purpose was to identify concepts that achieved the following goals:

- Identify concepts that would move trips from the I-5 corridor and onto the local transportation system. This was to ensure that local trips remained on the local transportation system.
- Select concepts that would reduce congestion on the principal arterials with I-5 interchanges to relieve congestion at those interchanges. By reducing congestion on the arterials associated with the I-5 interchanges, operations on I-5 would benefit from reduced congestion on the ramps leading to and from I-5.
- Identify concepts that might reduce the congestion related HAC/HAL locations in the Study Area. Because most of the HAC/HAL locations are congestion related, reducing traffic volumes at these locations would have a beneficial impact.


N
BEVERLY PARK
SHELBY
NORMA BEACH
FISHER
148TH
LAKE
SR 525
146TH
MEADOW
ASH
150TH
MADISON
SR 99
35TH
I-5
52ND
MANOR
ASH
SR 525
164TH
2ND
168TH
28TH
ALDERWOOD MALL
LARCH
172ND
HWY 99
ASH
176TH
OLYMPIC VIEW
64TH
60TH
180TH
MAPLE
179TH
SR 525
184TH
52ND
44TH
36TH
188TH
LARCH
FILBERT
NORTH
BING
68TH
I-405
37TH
196TH
200TH
50TH
HWY 99
CEDAR VALLEY
POPLAR
28TH
DAMSON
I-405
204TH
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CYPRESS
52ND
208TH
LARCH
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LOGAN
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1ST
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LOCUST
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214TH
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220TH
220TH
58TH
56TH
48TH
44TH
39TH
BRIER
4TH
14TH
224TH
Legend
Screen Locations
Perteet
August 30, 2006
0 890 1,780 2,670 3,560 4,450 Feet
USGS Orthophoto - June 2002
CITY OF Lynnwood
Lynnwood City Center Access
Traffic Volume Measurement Locations of
Proposed Improvements on 2032 PM Peak Hour

Individual Concept Traffic Demand Modeling Analysis

In order to meet the goals identified above, each concept was evaluated against the following criteria:

1. Find concepts that would meet the goal of moving trips with local demand from the I-5 mainline, thereby providing an operational benefit to I-5. The Highway Capacity Software (HCS) freeway module provides the following level of service for a freeway mainline segment. This assumes a 4-lane segment, level terrain, and a peak hour factor of 1.0.

	Volume Range (Vehicles/hour/lane)	Volume Range (Vehicles/hour for I-5 in Lynnwood)
LOS A	Less than 750 vphpl	Less than 3,000 vph
LOS B	750 to 1,260 vphpl	3,000 to 5,040 vph
LOS C	1,260 to 1,775 vphpl	5040 to 7,100 vph
LOS D	1,775 to 2,150 vphpl	7,100 to 8,600 vph
LOS E	2,150 to 2,400 vphpl	8,600 to 9,600 vph
LOS F	Over 2,400 vphpl	Over 9,600 vph

   This table was used as a basis to determine concepts that had volume changes that might have an appreciable affect on I-5 mainline operations. Theoretical capacity of the I-5 mainline in the Lynnwood area is 9,600 vehicles per hour (this does not take account of the effect of merge/diverge areas which occurs through much of the study area). For a benefit of one Level of Service (LOS) grade, such as from LOS E to LOS D, a reduction of 1,000 vph would need to occur.

   The 2032 Design Year PM Peak Hour volume (demand) on I-5 between 196th Street SW and I-405 is 9,120 vehicles per hour northbound, and 7,640 vehicles per hour southbound. In order to have an appreciable affect on improving I-5 mainline operations through this weave section, concepts that would have a volume reduction of at least 400 vehicles per hour were sought. This value represents about 5% of the Design Year PM Peak hour volumes, and could have an appreciable beneficial impact on I-5 traffic operations. Four-hundred vehicles per hour is about half of a letter grade LOS improvement. So if the freeway were operating at LOS F, this level reduction in traffic could improve the section to LOS E.

2. Select concepts that would meet the goal of reducing traffic volumes on the I-5 interchange arterials sufficiently to have a traffic operational benefit. Arterial operations are typically controlled by the operation of the intersections. To demonstrate the traffic volume reduction needed to have an appreciable benefit, the intersection of 196th Street SW and 44th Avenue West was analyzed with a reduction in volume to the critical movements. In the year 2032 under baseline PM Peak conditions, the intersection operates at LOS F with 84 seconds of delay per vehicle. For this intersection to operate at LOS E with less than 80 seconds of delay per vehicle, a 200 vph decrease on the critical movement would need to occur. Using this as a basis, those concepts that had a volume decrease of more than 200 vehicles during the Design Year PM peak hour on critical arterials with I-5 interchanges were sought. Critical arterials identified were 164th Street SW, 196th Street SW, and 44th Avenue W. With improved operations of the I-5 ramp intersections, less congestion could occur on the I-5 ramps, and therefore create fewer ramp traffic operation impacts on the I-5 mainline.

3. To meet the third goal select those concepts where potential safety benefits might occur at the HAC and/or HAL locations identified in the Collision Analysis Technical Memorandum. Those were considered to be concepts that reduced screen line traffic volumes within the HAC/HAL locations by at least 100 vehicles. Because most of the collisions in the HAC/HAL locations were congestion-related, it would be beneficial to reduce the traffic volumes. Concept 2 (the new WSDOT braided ramp at EB SR 525 to SB I-5) would be an example of a concept with potential safety benefits.

4. An additional methodology was utilized after concepts were initially identified using the criteria 1, 2 and 3 above. This methodology considered those concepts, that when grouped together, appear to have the possibility for reducing volumes on critical arterials that have I-5 interchanges. Separate traffic demand model runs were not conducted for these combined concepts, but instead discussions were held with City staff who best know the area's traffic operations to identify candidate combinations. An example of the combined concepts would be Concepts 10 and 44 which independently show some promise, but not quite enough to meet the other criteria outlined above. However, combined together they may meet those criteria.

The table on the following pages summarizes the volume shifts generated for each of the concepts from the Design Charrette at each of the 15 screenlines discussed earlier. This table was developed by preparing separate VISUM traffic demand model runs for the Design Year PM Peak hour for each of the Design Charrette concepts. The numbers provided in the table indicate the change in volume for each of the screenlines between the Design Year Baseline Transportation network and the Concept under consideration. This table was used to identify concepts that met the criteria described above.

Map No.	Improvement Tested	I5 SB s/o 164th	I5 SB n/o 196th	I5 NB s/o 164th	I5 NB n/o 196th	196th e/o 37th EB	196th e/o 37th WB	164th e/o Ash EB	164th e/o Ash WB	SR-99 s/o 200th NB	SR-99 s/o 200th SB	SR-99 n/o 168th NB	SR-99 n/o 168th SB	196th e/o SR-99 EB	196th e/o SR-99 WB	196th e/o 44th EB	196th e/o 44th WB	196th e/o Pkwy EB	196th e/o Pkwy WB	44th s/o 200th NB	44th s/o 200th SB	44th s/o 188th NB	44th s/o 188th SB	200th e/o 44th EB	200th e/o 44th WB	200th e/o SR-99 EB	200th e/o SR-99 WB	36th s/o Maple Rd NB	36th s/o Maple Rd SB	Aldwd Pkwy s/0 184th NB	Aldwd Pkwy s/0 184th SB
1	Concept #1 - New Ramp -SB I-5 to WB SR 525.	123	-111	23	-40	11	2	-48	-113	-8	5	-7	-24	-14	-9	-10	15	0	4	3	2	-7	6	10	3	9	0	8	10	50	7
2[1]	Concept #2 - New Braided Ramp -EB SR 525 to SB I-5.	45	-1242	16	-22	25	17	-153	-64	18	-7	-1	-83	10	0	21	55	3	-8	-72	-6	0	-33	-6	12	6	-4	-46	179	58	81
3	Concept #3 - Widen Alderwood Mall Parkway to 5 lanes - SR 525 Ramps to 164th Street SW	-96	-20	8	-7	-9	-19	-42	126	8	0	0	-41	-1	0	-5	11	-5	1	-12	-11	-1	-52	16	43	1	-1	-44	87	93	188
4[2]	Concept #4 - Relocate Ash Way away from I-5/164th Interchange -Ash Way Park-and-Ride to Alder Way.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Concept #5 - Connect 148th Street SW across I-5 - Jefferson Way to Meadow Road.	21	85	25	-6	-53	-41	-341	-252	-6	1	11	-42	3	-5	-43	-9	-26	-14	-11	-49	-4	-50	48	29	2	-1	26	97	-1	63
6	Concept #6 - Extend 33rd Avenue W to Alderwood Mall Parkway - 184th Street SW to Alderwood Mall Parkway.	-56	-4	20	10	-14	-10	-127	21	-12	5	9	0	5	-4	-30	8	7	7	18	-15	-2	13	16	-48	8	-3	237	233	392	369
7	Concept #7 - Connect Ash Way to Beech Road.	-224	-128	-25	-91	-27	-69	-153	150	11	5	-25	-49	-10	-1	11	-5	-5	-23	-98	-28	-8	-33	111	120	39	-4	14	172	-168	-157
8	Concept #8 - New connection between Alderwood Mall Parkway and Filbert Road.	-24	-36	-67	-47	-228	-168	-157	-123	-48	20	-2	-67	-34	21	-9	18	-374	-291	-237	-124	-4	-51	23	215	16	-8	3	173	-5	12
9	Concept #9 - New connection across I-5 between 33rd Ave W and Poplar Way.	-10	102	-5	24	-934	-504	-77	-35	-10	6	-4	-57	-38	21	-117	13	25	-39	-246	-108	-8	-46	13	251	-34	-25	8	146	-34	-32
10	Concept #10 - New connection along 195th Pl SW between 36th Avenue W and Alderwood Mall Boulevard.	-147	-129	14	-19	-4	-16	-173	55	9	1	2	-30	-4	-5	28	27	114	-1	-15	39	-9	-16	-110	-40	-24	-7	15	246	-48	60
11	Concept #11 - New connection across I-5 along 40th Avenue W between Alderwood Mall Boulevard and 204th St SW.	-90	27	7	-37	-214	-156	-142	46	-31	-2	-6	-25	-44	0	-29	-5	-38	-30	-547	-593	-10	-52	29	91	-24	-14	14	125	1	60
12	Concept #12 - New connection across I-5 along 204th Street SW between 52nd Avenue W and Larch Way.	-13	-1	16	-14	-59	-26	5	45	33	-7	0	-3	16	-66	-46	-74	-9	-16	-253	-279	0	-5	53	0	-5	67	-30	-4	-11	19
13	Concept #13 - New connection across I-5 along 208th Street SW between 52nd Avenue W and 44th Avenue W.	2	3	-10	-22	-3	-22	5	24	13	2	0	2	6	-21	3	-12	0	-13	-74	-134	0	0	7	-2	6	26	0	-7	-7	13
14	Concept #14 - Change intersection of 44th Avenue W and 168th Street SW to make the 44th Avenue W to 168th Street the through movement.	2	5	3	-4	-2	2	4	4	-2	-1	127	-34	-1	-5	-10	2	1	0	-7	9	-5	-37	0	21	-5	1	8	0	-28	18
15	Concept #15 - Connect Maple Rd to SR 99 between 44th Ave W and SR 99.	12	-1	-15	-13	0	-1	12	32	1	5	7	-61	-31	-5	-32	-1	4	-1	-1	-12	-23	-87	8	24	-12	-1	48	173	-30	36
16	Concept #16 - Move SB I-5 ramp at 164th Street SW north of Park-and-Ride.	145	165	58	4	-96	56	-266	-1292	29	7	-9	46	14	-9	-26	26	12	3	-37	-1	0	-28	-5	-7	-10	-2	-50	4	-18	-45
17	Concept #17 - New connection across I-5 along 172nd Street SW corridor between 36th Avenue W and Larch Way. Eliminate Ash Way South of 172nd Street SW. Create roundabout at 172nd Street SW and Ash Way South.	-49	-38	-32	73	-52	-49	-331	-102	-6	9	-22	37	30	-15	-25	-22	-27	-5	-36	-42	-2	-15	15	-6	4	-19	14	95	0	-88
18	Concept #18 - Improve Larch Way corridor between 164th Street SW and 196th Street SW to full arterial standards.	-143	-21	-47	-15	15	10	-164	29	7	2	-2	-38	16	0	-5	9	8	-7	-36	9	-4	-51	-7	5	-4	-4	-2	139	-10	51
19	Concept #19 - New connection across I-5 along 200th St SW between 40th Ave W and Poplar Way.	-112	75	11	22	-631	-391	-158	9	-30	8	2	-58	-8	22	-142	-14	5	-37	-312	-217	-5	-47	19	298	-53	-47	1	129	-131	-64
20	Concept #20 - Complete interchange at I-5/44th Avenue W to provide SB off-ramp and NB on-ramp.	-37	501	-62	142	88	-14	-300	-97	3	-17	6	-13	8	4	-321	-316	11	-3	553	261	-1	-42	-8	-19	-8	48	87	28	-60	-68
21	Concept #21 – New connection along 200th St SW between Poplar Way and 28th Avenue W.	0	-10	10	4	31	3	-13	10	-2	1	-4	-40	-7	-16	-18	-9	54	-12	-12	6	1	4	2	32	9	-5	4	0	-13	18
22	Concept #22 - Extend 48th Ave W south to connect to 204th Street SW.	0	2	-12	-9	0	-2	-4	28	-17	-8	-3	0	-15	-19	-15	3	10	0	-48	-31	-1	-1	57	14	-22	11	17	2	0	8
23	Concept #23 - Extend SB I-5 ramp from 196th Street SW to also exit at 44th Avenue W (SB CD system).	-66	203	23	42	322	-263	-165	10	14	14	2	48	13	-27	8	-325	3	5	371	-313	-11	-41	38	-159	-60	59	61	35	0	23
24	Concept #24 - Improve 188th Street SW between 36th Avenue W and SR 99.	5	6	0	0	0	1	5	1	0	1	0	-23	-1	-3	-6	0	0	0	-3	-5	-1	-28	0	14	-1	0	1	0	1	17
25	Concept #25 - Create NB and SB CD system on I-5 to connect Lynnwood interchanges. Provide SB off-ramps and NB on-ramps at 44th Avenue W.	-97	0	182	601	-235	27	-172	33	46	15	-17	-72	34	-10	-205	-6	10	-19	-244	422	-2	-50	-137	108	58	-42	64	159	-94	70
26	Concept #26 - New interchange at I-405 and Damson Road.	-74	5	-204	32	-24	-13	-236	105	-7	23	-2	83	-15	14	-35	100	-65	29	-7	-27	-4	-43	67	43	-27	0	51	30	146	46
27	Concept #27 - Tie Ash Way into Alderwood Mall Parkway at SR 525 Interchange. Eliminate Ash Way to south.	140	55	-1	68	-23	17	7	-131	-4	5	2	-4	-32	-4	-30	7	2	8	6	-38	0	-25	22	-32	0	-12	19	62	25	-149
28	Concept #28 - Improve connection along 164th ST SW to SR 99.	-137	-58	-6	-40	-37	-1	-176	36	-2	0	77	154	-10	-7	-23	4	-2	0	-4	-18	0	17	35	-16	0	1	5	-9	19	6
29	Concept #29 - Complete Ash Way Park-and-Ride direct access to north on I-5.	-32	8	-46	-9	-9	3	-218	21	-3	0	1	0	-3	-2	2	3	-4	1	-2	-5	0	3	-6	-1	-2	1	10	-12	-22	31
30	Concept #30 - Prevent movement from SB I-5 off-ramp at 164th Street SW to SB on Ash Way.	-157	0	-12	-39	-8	-7	-272	-1344	41	4	-5	58	16	-8	-9	5	7	-15	-34	-7	3	-28	-8	29	-7	1	-38	5	43	114
31	Concept #31 - Create new interchange at SR 525 and 164th Street SW.	-90	-73	-12	11	-8	-15	-168	16	2	-2	26	-85	-35	-2	-21	3	72	6	-32	13	-8	-86	-9	58	-11	5	-2	46	51	263
32	Concept #32 - New partial interchange at I-5 and Filbert Road. Interchange would be a NB off-ramp and SB on-ramp.	-85	76	-139	159	-11	-3	-113	31	-5	15	-6	-57	-41	-18	-18	9	-30	-67	-115	-33	-4	-33	-88	5	0	2	66	55	-22	93

Map No.	Improvement Tested	I5 SB s/o 164th	I5 SB n/o 196th	I5 NB s/o 164th	I5 NB n/o 196th	196th e/o 37th EB	196th e/o 37th WB	164th e/o Ash EB	164th e/o Ash WB	SR-99 s/o 200th NB	SR-99 s/o 200th SB	SR-99 n/o 168th NB	SR-99 n/o 168th SB	196th e/o SR-99 EB	196th e/o SR-99 WB	196th e/o 44th EB	196th e/o 44th WB	196th e/o Parkway EB	196th e/o Parkway WB	44th s/o 200th NB	44th s/o 200th SB	44th s/o 188th NB	44th s/o 188th SB	200th e/o 44th EB	200th e/o 44th WB	200th e/o SR-99 EB	200th e/o SR-99 WB	36th s/o Maple Rd NB	36th s/o Maple Rd SB	Aldwd Pkwy s/0 184th NB	Aldwd Pkwy s/0 184th SB
33	Concept #33 - Widen Poplar Way between I-5 ramps and 212th St SW.	-47	-54	-12	-41	-31	2	-98	10	14	0	1	-6	-3	-1	-30	2	110	0	-3	-10	0	-5	33	-12	3	0	-26	-16	56	34
34	Concept #34 - Widen 204th Street SW between 44th Avenue W and Poplar Way.	-14	-35	-9	-21	-20	-3	-60	12	26	0	0	-3	9	-1	-6	-1	-4	-5	-10	32	-2	-4	-2	9	1	-2	1	-16	25	25
35	Concept #35 - Remove signal at 204th ST SW and 44th Avenue W and realign 204th Street SW with NB I-5 off-ramp signal.	-39	-1	7	-26	-51	36	-58	25	13	-1	0	-5	0	-5	-30	14	-3	4	-90	6	-1	-3	83	10	0	-8	42	-39	13	13
36	Concept #36 - Modify 208th Street SW and SR 99 intersection and improve 204th Street SW between 68th Avenue W and SR 99 to encourage use of 204th ST SW instead of 208th Street SW.	4	5	-5	-13	-22	-2	9	-2	215	1	-7	-24	1	-18	7	-3	-2	0	-35	-15	-12	-36	-1	19	6	-15	-26	0	1	14
37	Concept #37 - Improve 48th Avenue W between 200th Street SW and 180th Street SW.	2	-2	-3	13	-8	-12	10	1	21	-9	5	-49	36	4	-13	5	-5	-10	-20	6	-35	-63	9	18	-11	-28	-40	164	17	23
38	Concept #38 - Improve 180th Street SW, create better connection along 180th Street SW to 52nd Avenue W. Improve 52nd Avenue W north to 168th Street SW.	-124	-141	-45	-47	-8	0	-179	9	-111	-6	269	-19	-14	-12	-42	5	0	2	100	-6	-44	-166	116	-30	-20	-21	124	82	-72	28
39	Concept #39 - New connection along 220th Street SW between 52nd Avenue W and 44th Avenue W.	-117	0	30	17	-31	7	-151	65	-7	6	0	-45	-13	-15	-59	-10	1	-14	-18	-32	-11	-45	17	35	-6	0	0	60	-28	106
40	Concept #40 - Improve 212th Street SW corridor between SR 99 and connect to 208th Street SW east of I-405.	-49	-63	2	-73	-10	25	-142	-62	-6	-7	-6	-42	-21	-12	-49	-31	51	34	-2	30	0	0	68	8	-2	-13	40	-13	-70	-43
41	Concept #41 - Widen 44th Avenue W from 194th Street SW to 168th Street SW.	-77	-60	4	-55	-21	2	-101	28	0	3	-16	-25	-6	-5	-33	-7	3	0	-2	-21	60	32	41	11	-6	3	27	187	19	27
42	Concept #42 - Improve SR 524 corridor between 24th Avenue W and 208th Street SW east of I-405.	-16	-34	3	-27	-32	0	-65	12	-8	3	-1	-14	2	3	-21	1	77	79	-19	-16	1	-30	24	32	0	-4	12	-13	-8	27
43	Concept #43 - New connection between Larch Way and SR 527 along Maple Road/178th Street SW corridor.	-13	0	-14	-8	-17	17	34	-5	30	2	-13	-33	1	-18	12	27	6	72	-36	16	-5	-48	2	17	2	-4	18	166	81	49
44	Concept #44 - New/improved connection between 44th Avenue W and SR 99 along 194th Street SW corridor.	-20	-54	1	-39	-32	6	-65	11	41	-11	6	-3	-372	-177	-3	15	-3	0	-28	-5	-13	-7	10	-16	-23	-25	-37	198	41	42
45	Concept #45 - Improved connection between SR 99 and 52nd Avenue W along 164th ST SW corridor.	-58	-49	-5	-39	-36	0	-91	35	-3	0	0	54	-9	-3	-23	4	-1	0	-3	-17	-1	8	34	7	0	0	-26	-7	43	5
46	Concept #46 - Improved connection between 36th Avenue W and Alderwood Mall Boulevard along 188th Street SW corridor on south side of Alderwood Mall.	1	4	5	-6	-31	-3	-4	2	26	0	-4	1	16	-4	1	0	-3	1	-19	-21	-11	0	5	0	-4	-7	23	0	-39	8
47	Concept #47 - New connection/improvements along 204th Street SW corridor between Larch Way and Filbert Road on east side of I-405. New interchange on I-405 Street SW extension..	-115	-89	-291	-67	34	60	-145	55	-21	10	-12	-58	-34	16	-27	67	32	83	-12	13	-1	-14	52	-21	-29	-2	84	-33	4	-28
48	Concept #48 - New connection across I-5 between 4th Avenue W and SR 527 along 134th Street SW/Meadow Road/Dumas Road corridor.	-83	2	-21	-9	-48	-16	-248	-89	-12	1	-1	59	-13	-10	-42	-4	-14	-7	-3	-43	-14	8	26	30	1	-1	19	9	34	122
49	Concept #49 - New/improved connection along 148th Street SW corridor across I-5 between Jefferson Way and SR 527.	32	19	73	-30	-58	-54	-320	-227	5	0	6	1	7	3	-30	3	-20	-26	-20	-26	9	7	49	31	4	-12	23	4	17	56
50	Concept #50 - SPUI at I-5/164th Street SW Interchange.	-119	-56	71	-3	-35	-14	-38	132	15	7	-6	-57	11	0	-23	-4	-4	-26	-34	-36	0	-55	1	39	-6	0	-5	62	-5	91
51	Concept #51 - SPUI at I-5/44th Avenue W Interchange	2	1	12	-1	6	0	8	28	1	7	0	-35	-11	8	3	-3	0	-19	-234	-1	-1	-14	-47	17	-8	-23	-37	178	11	21
52	Concept #52 - SPUI at I-5/220th Street SW Interchange	-107	67	21	-13	9	1	-137	28	38	12	-3	-29	21	0	5	-9	142	-16	-10	8	0	-50	6	-21	9	5	-38	107	-8	77
53	Concept #53 - Flyover ramp for SB I-5 off-ramp at I-5/164th ST SW Interchange to get traffic over Ash Way and headed westbound.	-133	-54	37	-41	-22	-40	-58	-804	26	-3	-6	-61	8	-19	-21	-28	-3	-9	-30	-39	-11	-53	21	35	3	-2	-23	72	59	106
54	Concept #54 - Eliminate signal on 164th Street SW at Wal-Mart entrance. Use access off of Larch Way instead.	-66	-20	29	19	0	12	38	-61	-6	2	2	2	-10	-10	-13	6	0	17	21	-8	0	-10	3	12	-6	5	19	-16	-22	-17
55	Concept #55 - Improve Ash Way between Ash Way Park-and-Ride and 148th Street SW.	-67	1	23	-10	-20	-3	-86	40	29	3	-8	-62	18	1	3	7	-1	0	-30	9	-2	-55	-8	25	-4	0	-2	104	1	144
56	Concept #56 - New loop connection between WB 196th Street SW to Alderwood Mall Boulevard.	-136	-38	2	-65	-48	-626	-152	6	-16	9	0	-28	-41	-38	-3	-115	2	-42	-122	-1	-2	-3	-81	195	-18	30	-37	-9	70	47
57	Concept #57 - New off-ramp from existing SB I-5/196th off-ramp to 195th Street SW/36th Avenue W.	-108	276	14	52	263	-691	-189	-32	-13	28	-10	-54	-64	23	110	249	-20	-26	-67	-45	-9	-49	104	108	-12	-1	25	158	8	-77
58	Concept #58 - New connection from 40th Avenue W/194th Street SW to Alderwood Mall Boulevard/195th Street SW.	-94	-78	27	-15	13	-13	-128	36	2	1	-7	1	6	-1	42	32	-8	-2	-7	24	0	-13	-120	-69	-28	-9	12	-10	-33	67
59	Concept #59 - Widen Maple from 44th to 36th	2	4	-9	2	-2	-1	7	38	-1	2	2	-41	-2	-1	-7	3	4	0	-2	-1	-13	-35	-6	19	-3	0	16	-2	-25	27
60	Concept #60 - Extend 184th from Alderwood Mall Parkway to Beech Rd	-3	0	-12	-20	-5	-1	6	20	-3	0	0	0	0	0	-7	0	-4	1	0	-4	0	0	9	0	2	1	7	0	80	14
61	Concept #61 - Widen 196th to 7 lanes from 48th through SR 99	-89	-64	-15	-21	-4	-12	-139	37	42	2	0	-82	118	83	15	16	5	-6	-59	-14	-9	-70	-6	36	-34	-54	-38	96	43	68
VI[3]	Concept VI – New ramp from SB I-5 to Alderwood Mall [3]	449	-950	43	107	290	-44	-338	-464	-46	-16	-4	-64	-76	-5	29	73	39	8	-212	-23	-6	-65	-107	383	-44	58	-17	-449	-5	78
VII	Concept VII – New ramp from EB SR525 to NB I5	25	-87	104	-104	-13	0	-133	-23	33	6	0	-42	-5	-2	2	-2	26	1	-14	-17	-12	-29	16	25	-5	5	103	44	-1	136

1. Note that Concept 2 had a significant reduction on the I-5 SB volumes north of 196th Street because the braided connection was assumed to connect in south of the screen line location. This may or may not be an accurate assumption. Specific locations of where the connection might be made will be determined during the next phases of the study, and a more detailed analysis of volume/traffic operations impacts will then be conducted.
2. Concept 4 did not have model run conducted. It was assumed that it would not shift volumes at the screenlines, but because it is simply moving Ash Way further west with no other changes.
3. Concept VI had a significant reduction on the I-5 SB volumes north of 196th Street because of where the ramp connection was made to the I-5 mainline. This may or may not be an accurate assumption. If this concept moves forward, it would likely only be feasible as part of a CD system or Concept 2 because of the existing ramps in the area.

Based on the traffic demand modeling screening methodologies, the following build concepts met the criteria for additional study.

Concept	Meets Criteria 1	Meets Criteria 2	Meets Criteria 3	Meets Criteria 4	Comment
Concept 1 - New Ramp -SB I-5 to WB SR 525.	No	No	Yes	No	WSDOT TPA project. Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles north of 196th.
Concept 2 - New Braided Ramp -EB SR 525 to SB I-5	No	No	Yes	No	WSDOT TPA project. Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles north of 196th.
Concept 5 - Connect 148th Street SW across I-5 -Jefferson Way to Meadow Road.	No	Yes	No	No	Meets criteria 2 on 164th.
Concept 6 – Extend 33rd Avenue W to Alderwood Mall Parkway	No	No	No	Yes	This concept, when combined with Concept 1, may have benefits of relieving congestion on both 164th and 196th that individual testing of the traffic demand model is not currently showing.
Concept 7 – Connect Ash Way to Beech Road	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles south of 164th & north of 196th
Concept 8 - New link between Alderwood Mall Parkway and Filbert Road.	No	Yes	No	No	Meets criteria 2 on 196th.
Concept 9 - New link across I-5 between 33rd Avenue W and Poplar Way.	No	Yes	No	No	Meets criteria 2 on 196th. Meets criteria 3 by reducing traffic on I-5 mainline south of 164th.
Concept 11 - New connection across I-5 between 40th Avenue W and Larch Way.	No	Yes	No	No	Meets criteria 2 on 44th.
Concept 12 – New connection across I-5 along 204th St SW btwn 52nd Ave W and Larch Way	No	Yes	No	No	Meets criteria 2 on 44th.
Concept 16 - Move SB I-5 ramp at 164th Street SW north of Park-and-Ride.	No	Yes	No	No	Meets criteria 2 on 164th.
Concept 17 – New connection across I-5 along 172nd St SW corridor btwn 36th Ave W and Larch Way. Eliminate Ash Way south of 172nd St SW. Create roundabout at 172nd St SW and Ash Way South	No	Yes	No	No	Meets criteria 2 on 164th.
Concept 18 – Improve Larch Way corridor btwn 164th St SW and 196th St SW to full arterial standards	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline south of 164th.
Concept 19 – Connect 200th St SW across I-5 to Poplar Way	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline south of 164th.
Concept 20 - Complete interchange at I-5/44th Ave W to provide SB off-ramp and NB on-ramp.	No	Yes	No	No	Meets criteria 2 on 164th and 196th.
Concept 23 - Extend SB I-5 ramp from 196th Street SW to also exit at 44th Avenue W (SB CD system).	No	Yes	No	No	Meets criteria 2 on 196th.
Concept 25 - Create NB and SB CD system on I-5 to connect Lynnwood interchanges. Provide SB off-ramps and NB on-ramps at 44th Avenue W.	No	Yes	No	No	Meets criteria 2 on 196th and 44th.
Concept 26 – New interchange at I-405 and Damson Road	No	Yes	No	No	Meets criteria 2 on 164th.
Concept 28 – Improve connection along 164th St SW to SR 99.	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline south of 164th.
Concept 29 – Complete Ash Way Park-and-Ride direct access to north on I-5.	No	Yes	No	No	Meets criteria 2 on 164th.
Concept 30 - Prevent movement from SB I-5 off-ramp at 164th Street SW to SB on Ash Way.	No	Yes	Yes	No	Meets criteria 2 on 164th. Meets criteria 3 by reducing traffic on I-5 mainline south of 164th.
Concept 38 - Improve 180th Street SW, create better connection along 180th Street SW to 52nd Avenue W. Improve 52nd Avenue W north to 168th Street SW.	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles south of 164th, and north of 196th
Concept 39 - New connection along 220th Street SW between 52nd Avenue W and 44th Avenue W.	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline south of 164th.
Concept 47 – New connection/improvements along 204th St SW corridor between Larch Way and Filbert Road on east side of I-405. New interchange on I-405 at 204th St SW extension.	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline south of 164th.
Concept 48 – New connection across I-5 btwn 4th Ave W and SR 527 along 134th St SW/Meadow Rd/Dumas Rd corridor.	No	Yes	No	No	Meets criteria 2 on 164th.
Concept 49 - New/improved connection along 148th Street SW corridor across I-5 between Jefferson Way and SR 527.	No	Yes	No	No	Meets criteria 2 on 164th.
Concept 50 – SPUI at I/5/164th St SW Interchange	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline south of 164th.
Concept 51 – SPUI at I/5/44th Ave W Interchange	No	Yes	No	No	Meets criteria 2 on 44th.
Concept 52 – SPUI at I/5/220th St SW Interchange	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline south of 164th.
Concept 53 - Flyover ramp for SB I-5 off-ramp at I-5/164th ST SW Interchange to get traffic over Ash Way and headed westbound.	No	Yes	Yes	No	Meets criteria 2 on 164th. Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles south of 164th.
Concept 56 - New loop connection between WB on 196th Street SW to Alderwood Mall Boulevard.	No	Yes	Yes	No	Meets criteria 2 on 196th. Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles south of 164th.
Concept 57 - New off-ramp from existing SB I-5/196th off-ramp to 195th Street SW/36th Avenue W	No	Yes	Yes	No	Meets criteria 2 on 196th. Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles south of 164th.
Concept 10 and 58 combined– This would create a new east-west corridor along194th St SW linking SR99 to Alderwood Mall Boulevard.	No	No	Yes	Yes	Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles south of 164th, and north of 196th. Meets criteria 4 by creating a continuous alternative corridor to 196th that could relieve congestion on the 196th corridor.
Concept 10 and 44 combined – This would create a new east-west corridor along194th St SW linking SR99 to Alderwood Mall Boulevard.	No	No	Yes	Yes	Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles south of 164th, and north of 196th. Meets criteria 4 by creating a continuous alternative corridor to 196th that could relieve congestion on the 196th corridor.
Concepts 38, 41 and I combined – This would create another east-west corridor btwn SR525 and SR99	No	No	No	Yes	Meets criteria 4 by creating a continuous east-west corridor that may relieve congestion on the 196th corridor.
Concept VI – New ramp from SB I-5 to Alderwood Mall. *Note that this is only feasible as part of a C-D system.*	No	Yes	Yes	No	Meets criteria 2 on 164th & 44th. Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles north of 196th.
Concept VII – New ramp from EB SR525 to NB I-5	No	No	Yes	No	Meets criteria 3 by reducing traffic on I-5 mainline by over 100 vehicles north of 196th.

Some of the build concepts identified above are mutually exclusive (for example, Concepts 16 and 53 could not both be implemented). Others are not feasible because of comments received from Snohomish County (Concept 16). Some concepts have a fatal flaw, and others, while appearing to have promise, are outside of the study area and cannot be implemented by the City of Lynnwood. For these reasons, the following concepts were screened from additional consideration.

- Concept 5. This is very similar to Concept 49, the difference being that Concept 49 extends the proposed improvements slightly further (to SR527). Concept 49 would be carried further for additional study.
- Concept 16. This concept was eliminated after discussions with Snohomish County because there is a new development just recently approved at this location. It would also just move traffic about in the same small area, and not likely create any significant operational benefit. All of the traffic now going through the Ash Way/164th Street intersection would still have to do so.
- Concept 19. This concept would serve many of the same general movements as Concept 11, yet be much more difficult to construct because of geometric challenges of getting under I-5, constructing a new arterial through an existing residential neighborhood, and constructing a new arterial through Alderwood Middle School. Instead of Concept 19, Concept 11would be considered further.
- Concepts 20 and 23. These concepts are very similar to Concept 25, without the benefit of completing all directions of the existing interchange at 44th Avenue. Instead of Concepts 20 and 23, Concept 25 would be considered further.
- Concept 29. This concept is currently proposed as part of Sound Transit's Phase 2 program, and should be evaluated as part of that program.
- Concept 39. This concept would go through the middle of Mountlake Terrace Elementary, making it difficult to implement.
- Concept 47. While this concept may hold some promise, it is outside the Study limits. If it were to move forward, it would require an IJR outside the City of Lynnwood that Lynnwood could not lead.
- Concept 48. This concept is very similar to Concept 49 in terms of providing an alternative crossing of I-5. Concept 49 would be carried further for additional study.
- Concept 50. WSDOT recently completed improvements to the I-5/164th Street SW interchange. Removing these improvements and replacing the interchange with a Single Point Urban Interchange would be a political and budgeting challenge.
- Concept 51. This would become a subset of the I5/44th Avenue W interchange configurations considered for Concept 25. It will be considered as part of the Concept 25 analysis.
- Concept 53. This concept is likely to be very expensive, with limited regional benefits. It would help alleviate congestion on the southbound I-5 off-ramp at 164th Street by allowing traffic to flyover the ramp intersection, and the nearby intersection of 164th with Ash Way. By doing so though, it would eliminate the existing primary access from the north into Alderwood Mall.
- Combined Concept 10 and Concept 58. This concept achieves most of the same benefits as Concept 10 that is proposed to be studied as a combined Concept with Concept 44. It differs slightly from that concept in the alignment between 40th Avenue W and Alderwood Mall Boulevard. If the idea of a combined concept in this area generates desired traffic benefits on a global scale, more detailed analysis will be conducted to determine which of the two

combined concepts actually generates the most localized traffic operations benefits, as well as which is more feasible from a construction/cost perspective.

Conclusions and Recommendations

Based on the information outlined in this Technical Memorandum, it is recommended that the following concepts be further analyzed in the Access Needs Report:

Local Transportation System Improvements:

- Concept 6 - Extend 33rd Avenue W to Alderwood Mall Parkway.
- Concept 9 - New link across I-5 between 33rd Avenue W and Poplar Way.
- Concept 11 - New connection across I-5 between 40th Avenue W and Larch Way.
- Concept 10 and 44 combined – This would create a new east-west corridor along 194th St SW linking SR99 to Alderwood Mall Boulevard (Concepts 56 and 57 would also be considered as part of this combination).
- Concept V - Widen 200th between 44th and 48th to 5 lanes
- Concepts 38, 41 and I combined – This would create a new continuous east-west corridor that would link SR99 to the SR525/Alderwood Mall Boulevard interchange and possibly relieve congestion on 196th St SW. It would be more effective than just Concepts 31 and I alone originally identified in the October, 2006 SST meeting. This concept was added by the City as worth considering after the SST meeting.

Regional Transportation System Improvements to be evaluated with Local Transportation System Improvements:

- Concept 1 - New Ramp -SB I-5 to WB SR 525.
- Concept 2 - New Braided Ramp -EB SR 525 to SB I-5.

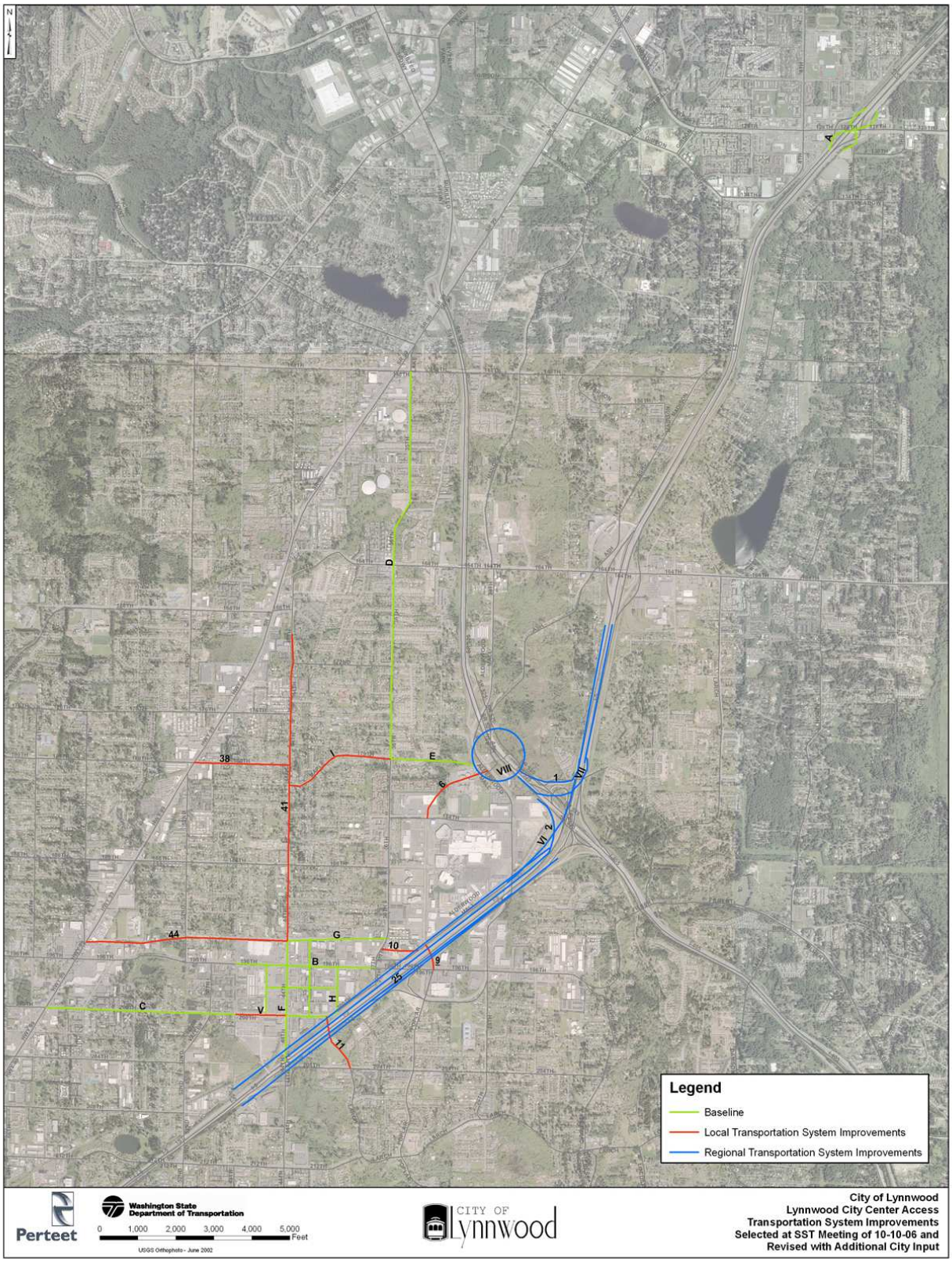
Regional Transportation System Improvements to be evaluated only after evaluating effectiveness of Local Transportation System Improvements:

- Concept 25 - Create NB and SB CD system on I-5 to connect Lynnwood interchanges. Provide SB off-ramps and NB on-ramps at 44th Avenue W.

The following Regional Transportation System Improvements have not been removed from consideration yet. Additional traffic demand modeling work must first be conducted to determine possible effectiveness, which may immediately eliminate them. If they are not eliminated for this reason, they may be included in future evaluations if supported by the Study Support Team.

- Concept VI – New ramp from SB I5 to Alderwood Mall. This was the concept for which study funding was originally acquired. The proximity of the I-5/I-405/SR525 system interchange make this concept not feasible as a direct connection to I-5. It may be feasible as part of a CD system such as Concept 25.
- Concept VII – New ramp from EB SR525 to NB I-5. This concept would be a complementary ramp to Concept 2, WSDOT's TPA project. It would complete the system interchange. This was not originally identified as being a concept to carry forward by the SST in the October meeting, but had been cited earlier as being necessary to study because it would complete the system interchange.
- Concept VIII - Reconfigure SR525 and Alderwood Mall Parkway interchange to simplify current split interchange configuration and create easier access into Lynnwood.

These concepts are illustrated in the following figure labeled Transportation System Improvements Selected at SST meeting of 10-10-06 and revised with additional City input.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City of Lynnwood
Lynnwood City Center Access
Transportation System Improvements
Selected at SST Meeting of 10-10-06 and
Revised with Additional City Input

The next step will be to evaluate the effectiveness of the Local Transportation System concepts in *Technical Memorandum 8*. This will be done by first developing Design Year 2032 VISUM PM Peak hour volumes (assuming that all of the Local Transportation System concepts are implemented as a group). Concepts would then be selectively removed from the Design Year VISUM model and new traffic volumes generated to evaluate the impacts each concept had individually on traffic volumes at the critical screenline locations identified in this Technical Memorandum. Those concepts that have little impact at reducing volumes at the screenline locations would be identified and recommendations made to the Study Support Team to remove them from further consideration.

After confirming local transportation system concepts with the Study Support Team, traffic operational analysis will be conducted following the approach documented in *Technical Memorandum 6*. This analysis would compare traffic operational benefits of the Local Transportation System concepts to the 2032 Design Year Baseline Conditions.

If the Local Transportation System concepts alone are not sufficient to meet the access requirements of the Lynnwood City Center, *Technical Memorandum 9* would be developed to compare traffic operational benefits if both the Local Transportation System concepts and the Regional Transportation System concepts identified above were implemented. *Technical Memorandum 9* would compare traffic operations between this combined system and the 2032 Design Year Baseline Conditions documented in *Technical Memorandum 6*.

The City is working with Community Transit and Sound Transit to determine if by locating the terminus of Sound Transit's Phase 2 Light Rail Transit (LRT) line within the City Center area, a higher non-single occupancy vehicle (SOV) distribution might be justified. The preliminary analysis indicates that a non-SOV target of 35-40% may be achievable within the City Center area, with enhanced transit service. This compares with a distribution of 27% non-SOV in the current City and PSRC traffic demand models. The City's concurrent City Center Grid project is looking at if changes in non-SOV use may be justified, and how they would be achieved. This additional analysis still needs to be conducted and then approved by the Study Support Team before a revised mode split could be used in the Access Study. How a revised mode split would be used also needs to be agreed to by the Study Support Team.

Endorsement

The Study Support Team has reviewed this technical memorandum, and concurs with it.

Study Support Team	Initial
FHWA Northwest Washington - Elizabeth Healy	
WSDOT NW Region - Rick Mitchell	for Rick Mitchell.
WSDOT NW Region Traffic - Shuming Yan	
WSDOT HQ Access & Hearings Manager – Barb De Ste. Croix	for Barb De St. Croix
Snohomish County – Jay Larson	
City of Lynnwood - Jeff Elekes	

Technical Memo #8

Lynnwood City Center Access Study
Concept Refinement, Traffic Operations

TO: **David Mach, P.E., Project Manager, City of Lynnwood**

FROM: **Peter De Boldt, P.E., Project Manager**
Tresia Bass, Traffic Analysis Lead

DATE: **May 7, 2007 (Revised June 6, 2007)**

RE: **Concept Refinement, Traffic Operations**

Based on the preliminary traffic demand evaluations conducted on the concepts in Technical Memorandum #7, several concepts were grouped to better assess their effectiveness as a system. This memorandum documents the groupings of concepts, the resulting travel pattern changes, and the traffic operations. Details of the specific concepts are described in Technical Memorandum #9.

Concept Groupings

Concepts from Technical Memorandum #7 were grouped into two categories which included the following.

Local System Improvements

- Concept 6 – Extend 33rd Avenue W to Alderwood Mall Parkway
- Concept 9 – New Link across I-5 between 33rd Avenue W and Poplar Way
- Concept 11 – New connection across I-5 between 40th Avenue W and Larch Way
- Concept 10 and 44 combined – This would create a new east-west corridor along 194th St SW linking SR 99 to Alderwood Mall Boulevard or 33rd Avenue W (concepts 56 and 57 would also be considered as part of this combination)
- Concept V – Widen 200th St SW between 44th Avenue W and 48th Avenue W to 5 lanes.
- Concepts 38, 41 and I combined – This would create a new continuous east-west corridor that would link SR 99 to the SR 525/Alderwood Mall Boulevard interchange and possibly relieve congestion on 196th Street SW. This concept was added by the city as worth considering after the November 14, 2006 SST meeting.
- Concept 1 – New ramp southbound I-5 to westbound SR 525
- Concept 2 – New braided ramp eastbound SR 525 to southbound I-5. It was assumed that the new braided ramp from eastbound SR 525 to southbound I-5 would maintain access to the 196th Street off ramp from both southbound SR 525 and northbound I-405.

Constructing a new corridor between SR 99 and Alderwood Mall Boulevard (combined Concepts 10 and 44) would impact a neighborhood of single family homes between 44th Avenue W and SR 99. The concept also would impact Wilcox Park. It was determined these impacts were significant so this segment was dropped from further consideration.

Constructing a new corridor by combining Concepts 38, 41 and I also was dropped from further consideration because it would significantly affect a neighborhood of single family homes. There also turned out to be a limited demand for the corridor (about 260 westbound and 380 eastbound during the PM Peak hour in 2032).

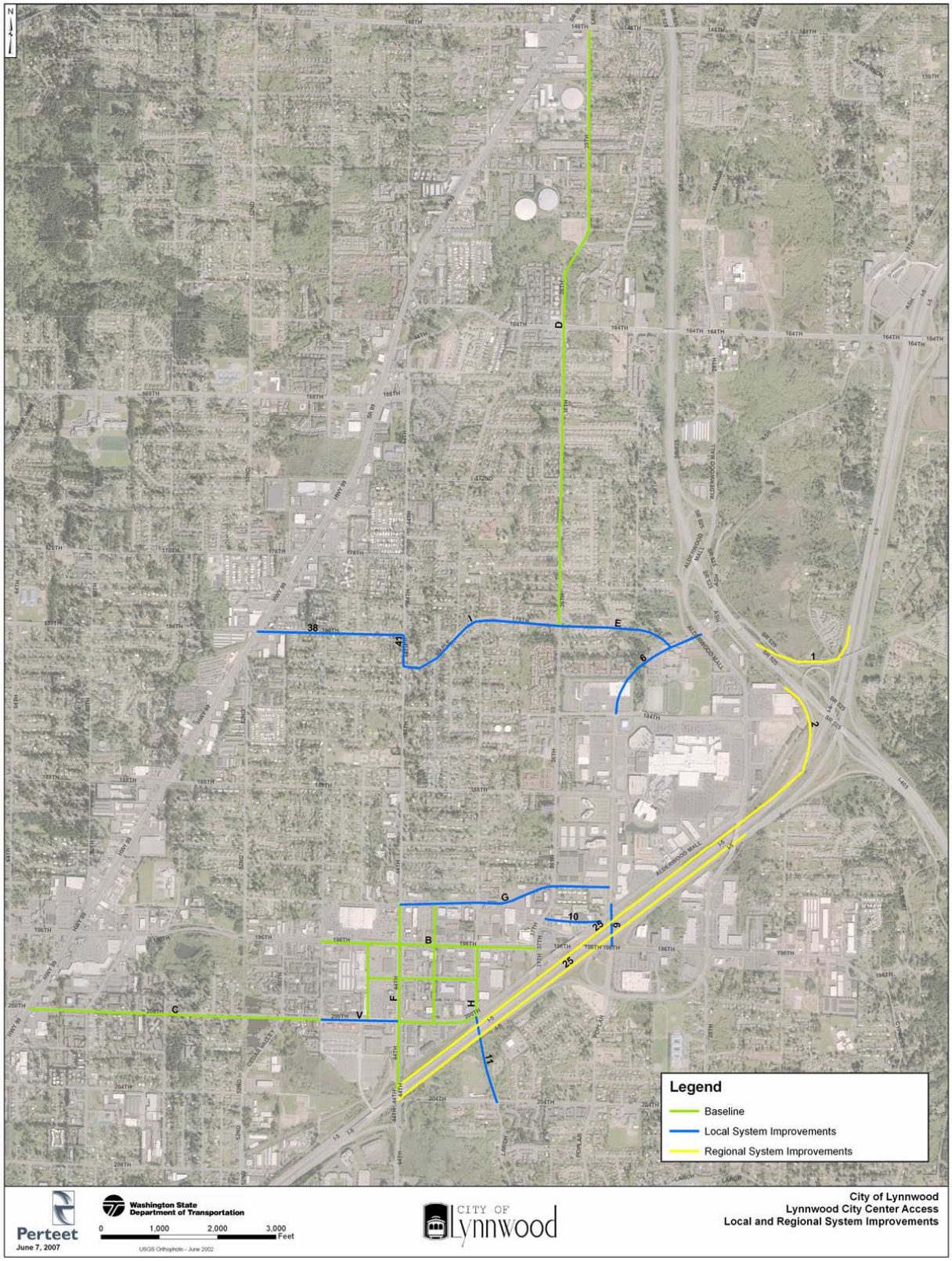
Local and Regional System Improvements

- Local System Improvement concepts listed above
- Concept 25 – Create a north- and southbound collector-distributor (CD) system on I-5 to connect Lynnwood interchanges. Provide southbound off-ramp and northbound on-ramp at 44th Avenue W.
- Concept VI – new ramp from southbound I-5 to Alderwood Mall. This was the concept for which the study funding was originally acquired. Existing ramps in the area will make it difficult to implement a direct connection. It may be possible as part of a CD system such as Concept 25.

Concept VI did not prove to be geometrically feasible. The distance between the diverge from I-5 mainline (near the I-405 underpass) and Alderwood Mall Boulevard is insufficient to achieve the necessary elevation gain. Therefore this concept was dropped from further consideration.

Exhibit 1 depicts the concepts described above.

Exhibit 1 – Local and Regional System Improvements



Preliminary Evaluation of Critical Locations

Changes in travel patterns were reviewed with the concept groupings to identify whether the concepts may relieve congestion at failing intersections (LOS F) and congested freeway locations. This is consistent with the screening method used when reviewing the concepts individually. Ultimately concepts that do not provide at least a 20 percent reduction of volume at an intersection's critical approach or a 10 percent reduction on a congested freeway segment would be screened from further consideration.

Table 1 – 2032 PM Peak Hour (vph) Travel Pattern Changes compared to Baseline

Location	Local System Improvements	Local and Regional System Improvements
I5 SB s/o 164th	298	381
I5 SB n/o 196th	137	659
I5 NB s/o 164th	28	76
I5 NB n/o 196th	59	438
196th e/o 37th EB	-590	-494
196th e/o 37th WB	-320	-471
164th e/o Ash EB	-72	-174
164th e/o Ash WB	-217	-343
SR-99 s/o 200th NB	0	-10
SR-99 s/o 200th SB	-2	-7
SR-99 n/o 168th NB	1	-18
SR-99 n/o 168th SB	-53	-53
196th e/o SR-99 EB	15	50
196th e/o SR-99 WB	18	110
196th e/o 44th EB	-257	-275
196th e/o 44th WB	-46	-273
196th e/o Pkwy EB	-37	-2
196the/o Pkwy WB	-79	-102
44th s/o 200th NB	-699	-219
44th s/o 200th SB	-508	-319
44th s/o 188th NB	8	17
44th s/o 188th SB	-20	-14
200th e/o 44th EB	-346	-493
200th e/o 44th WB	41	-113
200th e/o SR-99 EB	-22	12
200th e/o SR-99 WB	14	-2
36th s/o Maple Rd NB	-603	-623
36th s/o Maple Rd SB	-662	-741
Alderwood Pkwy s/o 184th NB	58	55
Alderwood Pkwy s/o 184th SB	-93	-48

Grouping the concepts into two categories (Local System Improvements, and Local and Regional System Improvements) results in a reduction in traffic at several key locations (particularly along 44th Avenue W and Alderwood Mall Parkway). Since the Local System Improvement and Local and Regional System Improvement groupings meet the screening criteria, detailed operational analysis was performed and is described in the following sections.

Local System Improvement Alternative

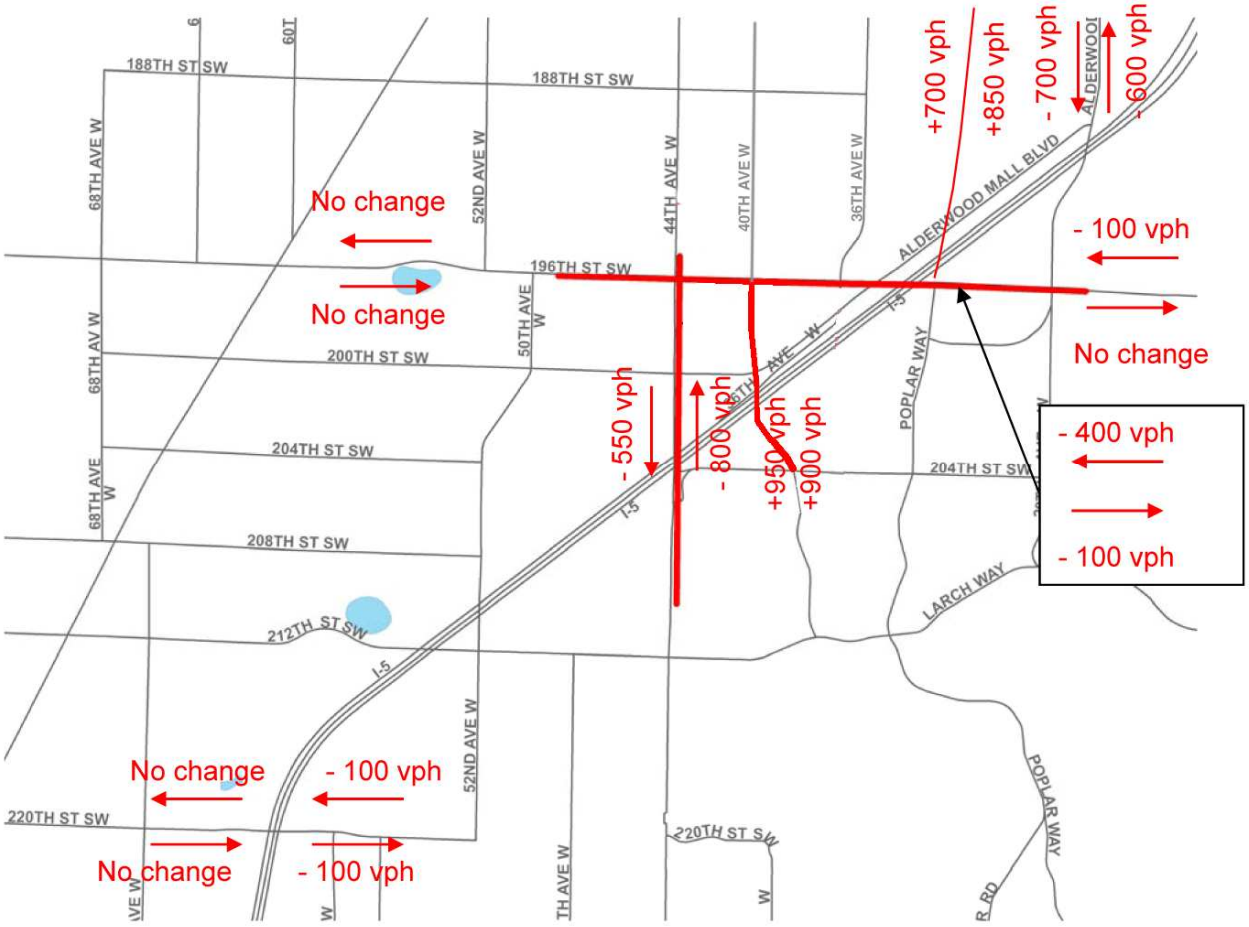
Traffic Forecasts

Changes in traffic distribution are greatest through the downtown core area with the local improvements. The new north-south crossings of I-5 at 40th Avenue W and Poplar Way provide alternate routes and relief to 44th Avenue W and Alderwood Mall Parkway.

Overall traffic volumes on I-5 do not change significantly with the Local System Improvements; however there are some localized traffic patterns changes for northbound I-5 at the 196th interchange. The additional north-south arterial capacity provided by the Poplar Way crossing of I-5 results in an increase in off ramp trips and an increase in on ramp trips at the 196th interchange. The result is a decrease in traffic volume on mainline I-5 between the off and on ramps. There is in no net change south and north of the interchange.

Exhibit 2 summarizes traffic volume changes through some of the greater congested areas.

Exhibit 2 - Local System Improvements, Changes in Travel Pattern



Traffic Operations

Local Intersections

The Study Support Team selected 31 intersections to study. Design Year (2032) Build and Baseline Level of Service (LOS) for the PM peak hour was determined for the study intersections using Synchro (Build 6.14).

In the Baseline alternative, 25 of the 31 intersections operate at LOS E or F. In the Local System Improvements alternative, 21 intersections operate at LOS E or F. The following intersections improve to LOS D or better with the Local System Improvements alternative:

- 128th Street SW/I-5 southbound ramps
- Alderwood Mall Parkway/SR 525 northbound ramps
- Alderwood Mall Parkway/184th Street SW
- 220th Street SW/I-5 northbound ramps

In addition, 20 of the 31 Study intersections experience a decrease in delay with the build alternative.

PM peak hour LOS for the Baseline and Local System Improvement alternatives are shown in Exhibits 3 and 4, respectively.

Exhibit 3 – Design Year (2032) Baseline Alternative, PM Peak Hour Level of Service

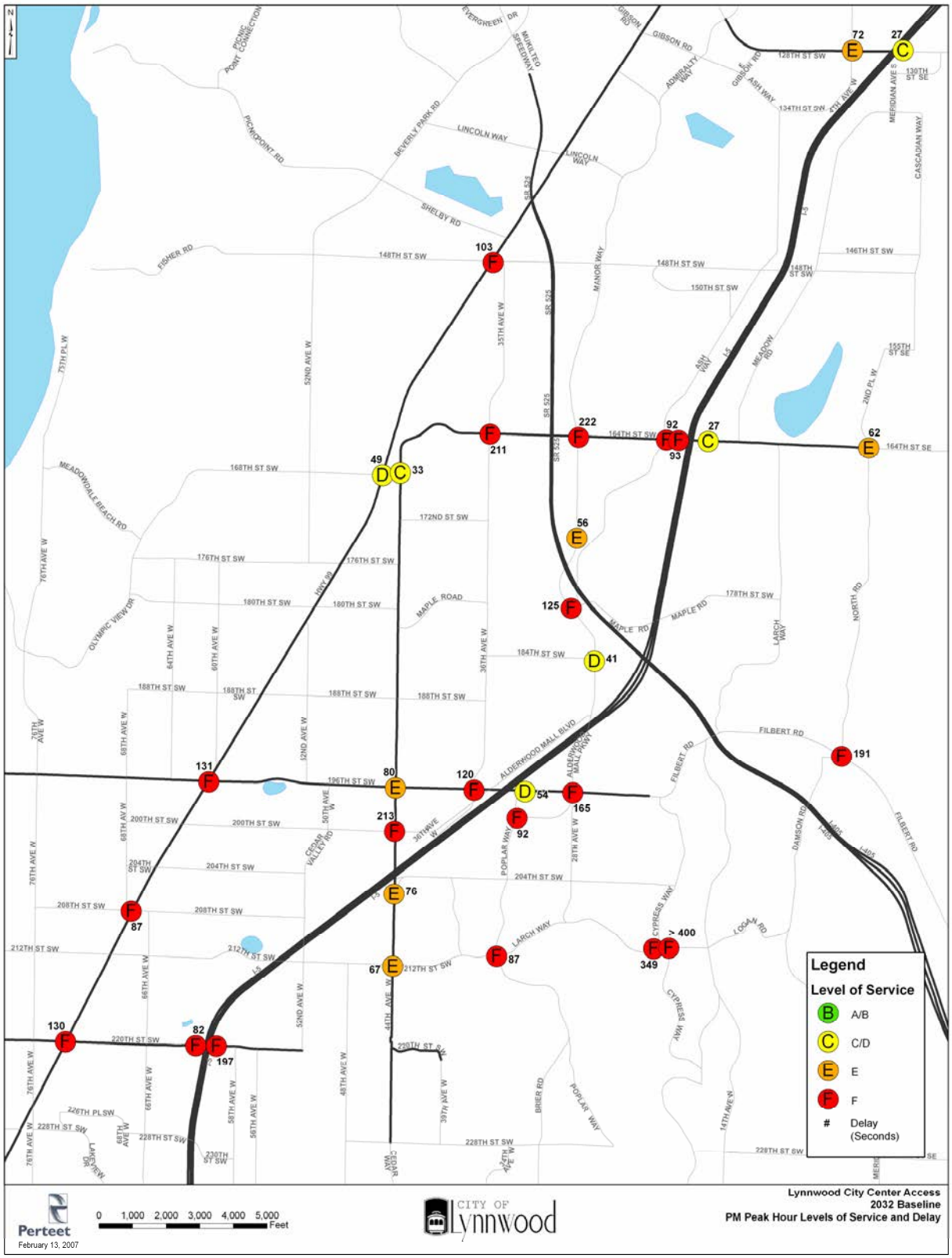
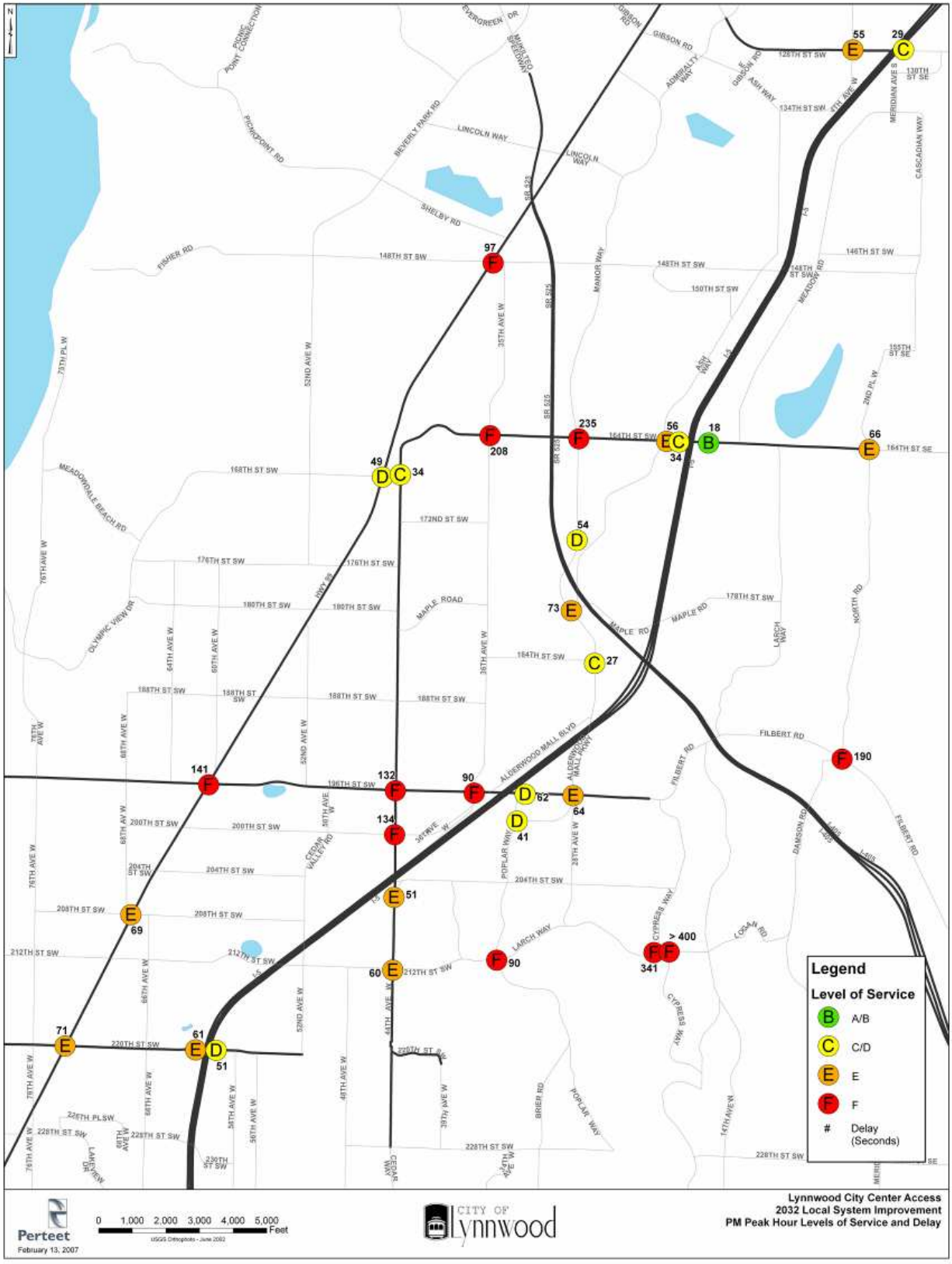


Exhibit 4 – Design Year (2032) Local System Improvement Alternative, PM Peak Hour Level of Service



Freeway

In the year 2032 with the Baseline alternative the travel time between 128th Street SW and 220th Street SW is 7.9 minutes southbound and 9.0 minutes northbound. With the Local System Improvement alternative the operations southbound are similar with a travel time of 8.0 minutes southbound and improve to 8.1 minutes northbound.

Table 2 summarizes the LOS, density, speed, and volume for freeway mainline operations. Table 3 summarizes the LOS, density, speed and volume for freeway merge operations. The traffic volume reported in Tables 2 and 3 is traffic served or throughput. Throughput is less than the demand where congestion exists.

Table 2. Design Year (2032) Local System Improvement Alternative, PM Peak Hour Freeway Mainline Operations

		Baseline				Local Improvements Only			
Freeway Segment	# Lanes	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour
I-5 Southbound									
128th St SW Off to 128th St SW On	4	34	D	52	6,452	30	D	57	6,463
128th St SW On to 164th St SW Off	4	39	E	52	7,410	35	E	57	7,525
164th St SW Off to 164th St SW On	4	31	D	52	5,955	30	D	57	6,388
164th St SW On to I-405 Off	5	27	D	61	7,670	30	D	60	8,295
I-405 Off to I-405 On	4	22	C	61	5,026	25	C	60	5,605
I-405 On to 196th St SW Off	5	26	C	60	7,069	27	D	60	7,506
196th St SW Off to 196th St SW On	4	24	C	60	5,379	25	C	60	5,649
196thSt SW On to 44th Ave W On	4	36	E	48	6,407	33	D	53	6,563
44th Ave W On to 220th St SW Off	4	43	E	48	7,521	38	E	53	7,564
220th St SW Off to 220th St SW On	4	35	E	48	6,263	36	E	47	6,309
I-5 Northbound									
220th St SW Off to 220th St SW On	4	52	F	39	7,514	52	F	39	7,549
220th St SW On to 44th Ave W Off	5	50	F	39	9,031	50	F	39	9,145
44th Ave W Off to 196th St SW Off	4	31	D	60	6,996	33	D	60	7,216
196th St SW Off to Alderwood Mall Pkwy On	4	29	D	60	6,396	27	D	60	6,083
Alderwood Mall Pkwy On to 196th St SW On	5	28	D	60	7,879	26	C	60	7,196
196th St SW On to I-405 Off	5	36	E	53	8,740	27	D	61	7,721
I-405 Off to I-405 NB On	4	32	D	53	6,210	25	C	61	5,539
I-405 On to 164th St SW Off	5	53	F	34	8,304	28	D	59	7,822
164th St SW Off to 164th St SW On	4	53	F	34	6,677	29	D	59	6,374
164th St SW On to 128th St SW Off	4	53	F	38	7,528	34	D	57	7,150
128th St SW Off to 128th St SW On	4	42	E	38	5,971	27	D	57	5,776

Table 3. Design Year (2032) Local System Improvement Alternative, PM Peak Hour Freeway Merge Operations

		Baseline				Local Improvements Only			
Freeway Segment	# Lanes, (mrg or aux)	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour
I-5 Southbound									
128th St SW On	5, M	28	D	52	7,282	34	D	43	7,331
164th St SW On	5, A	27	C	58	7,950	29	D	58	8,298
I-405 On	5, A	25	C	58	7,373	25	C	60	7,489
196th St SW On	5, M	42	E	31	6,580	30	D	43	6,551
44th Ave W On	5, M	84	F	18	7,542	79	F	19	7,551
220th St SW On	5, M	24	C	58	6,879	23	C	59	6,824
I-5 Northbound									
220th St SW On	5, A	52	F	35	9,140	57	F	32	9,132
Alderwood Mall Pkwy On	5, A	27	C	57	7,615	25	C	58	7,146
196th St SW On	6, M	28	C	51	8,477	22	C	57	7,649
I-405 NB On	5, A	31	D	54	8,439	27	C	57	7,802
164th St SW On	5, M	49	F	31	7,641	27	C	53	7,147
128th St SW On	5, M	23	C	59	6,716	22	C	59	6,380

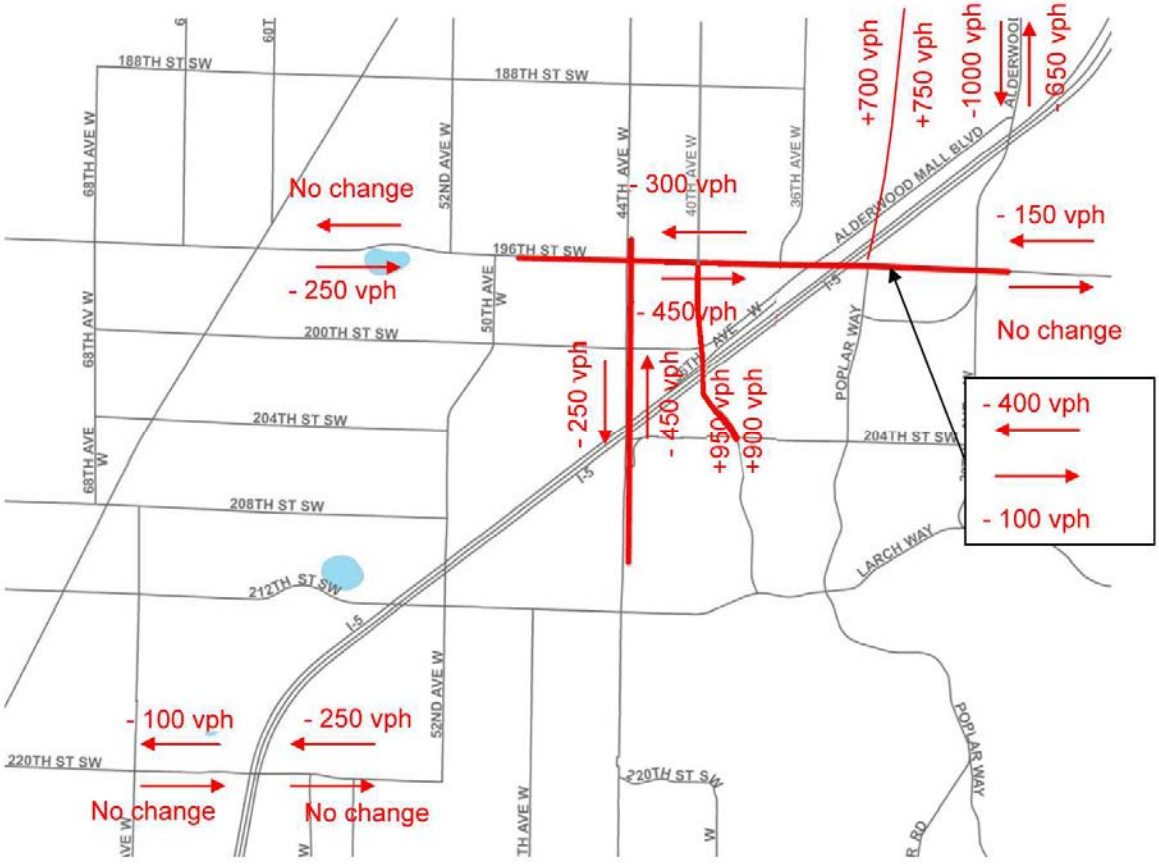
Local and Regional System Improvement Alternative

Traffic Forecasts

The addition of regional improvements, particularly completing the interchange at 44th Avenue W improves access to the Lynnwood City Center area. With southbound access provided at 44th Avenue W from I-5, there is a decrease in vehicular demand exiting I-5 at 164th Street SW, 196th Street SW, and 220th Street SW compared to the Baseline alternative. There is about a 5 percent increase in demand entering at 164th Street SW and I-405/SR525. In the northbound direction with the addition of an on ramp at 44th Avenue W, there is a increase in demand exiting the freeway at I-405 and SR 525. I-5 mainline volume increases between 44th Avenue W and I-405. There is also a decrease in traffic on Alderwood Mall Parkway, likely a result of traffic shifts from the 196th Street SW interchange to 44th Avenue W.

Completing the interchange at 44th Avenue W results in an increase in trips compared to the Local System Improvement alternative; however the volumes are still decreased compared to the Baseline alternative. The PM Peak Hour increase in trips for the Local and Regional System Improvements on 44th Avenue W (650 vph) associated with the new ramps compared to the Local System Improvements. The decrease in trips on 44th Avenue W compared to Baseline is about 700 vph during the PM Peak Hour.

Exhibit 5 - Local and Regional System Improvements, Changes in Travel Pattern



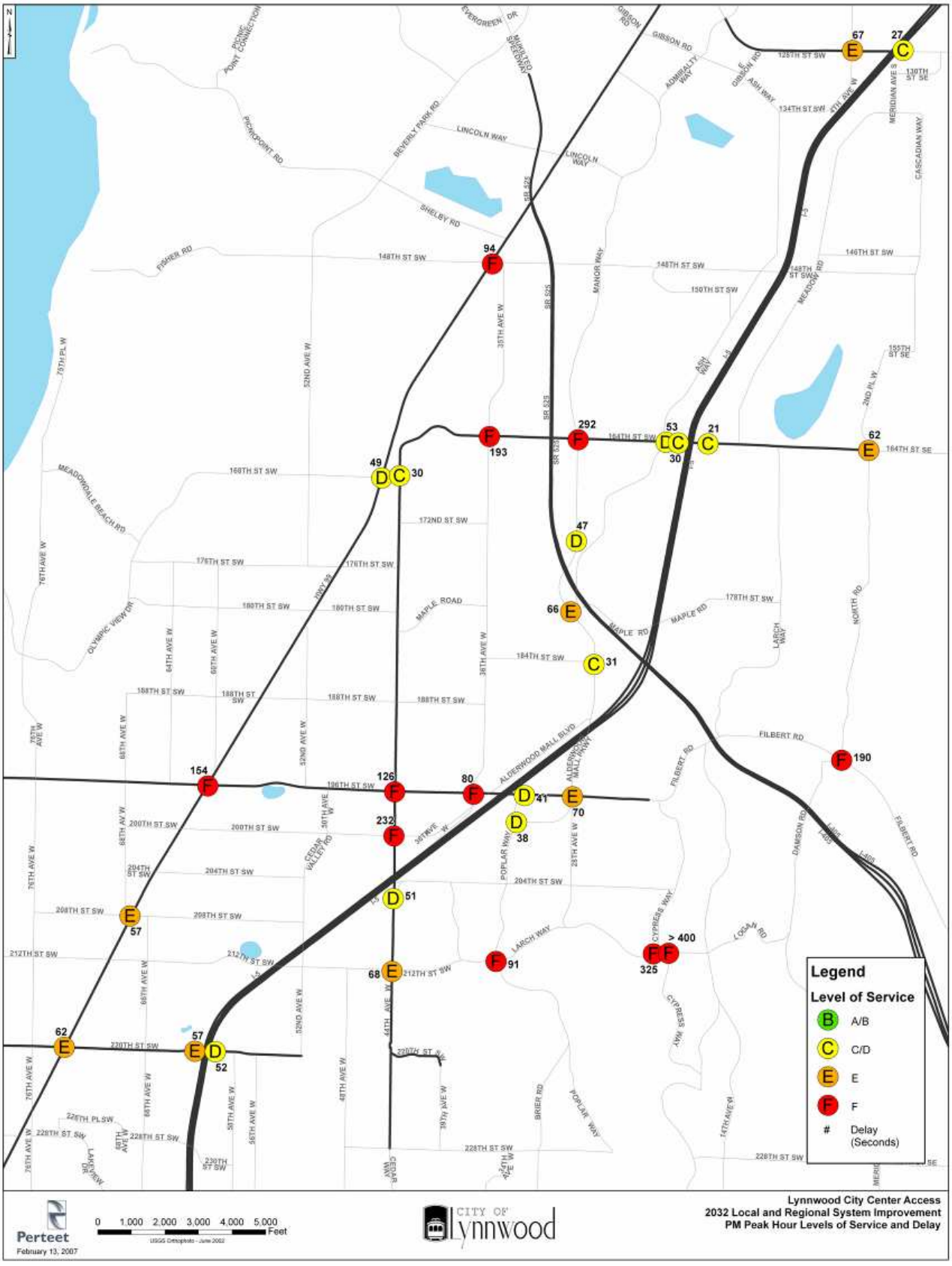
Traffic Operations

Local Intersections

As was done for the Local System Improvements, LOS for the PM peak hour was determined for the study intersections.

In the Baseline option, 25 of the 31 intersections operate at LOS E or F. In the Local and Regional System Improvements option, 19 intersections operate at LOS E or F. The intersections on 164th Street SW at Ash Way and the southbound I-5 off-ramp both show significant improvements over the Baseline option. On 196th Street SW, the intersections with 37th Avenue West, Polar Way, and Alderwood Mall Parkway all have significant reductions in delay. The intersection at the northbound off-ramp at 44th Avenue W also has a significant delay reduction. These improvements are the result of improved traffic distribution to-and-from Lynnwood City Center as the result of the completed I-5/44th Avenue West Interchange, and additional options within the local transportation system. Results of the PM Peak hour LOS analysis are summarized in Exhibit 6.

Exhibit 6 – Local and Regional System Improvement (2032) PM Peak Hour Level of Service



Freeway

Several variations of the regional system improvements were analyzed. For example, one variation includes a CD system that would connect I-405, 196th Street SW, and 44th Avenue W. These variations and their fatal flaws are described following this section.

The option that is included in the Local and Regional System Improvement alternative is one that was determined to be feasible in terms of traffic operations and design. The following briefly describes the changes to the ramp system on I-5 and the resulting operations. The design details are covered in Technical Memorandum 9.

In the southbound direction, a ramp exits to 196th Street SW near the I-405 underpass and traffic from I-405 and SR 525 has access to this ramp. Traffic from I-405 and SR 525 not exiting at 196th Street SW can bypass the ramp and continue to mainline I-5 by crossing over the 196th Street SW off ramp. A new access point is provided to 44th Avenue W from mainline I-5.

In the southbound direction, full access is provided from I-405 and SR 525 to 196th Street SW and 44th Avenue W. Access is not provided between the 196th Street SW on ramp and 44th Avenue W off ramp since these ramps are braided.

In the northbound direction, a ramp exits to 196th Street SW just north of the 44th Avenue W overpass. A new access point is provided from 44th Avenue W to mainline I-5 north of the relocated 196th Street SW off ramp. The 44th Avenue W on ramp and 196th Street SW off ramp are grade separated (braided) with the 44th Avenue W on ramp crossing under the relocated 196th Street SW off ramp. Northbound traffic from 196th Street SW destined to I-405 stays on the ramp systems and does not merge on mainline I-5. A ramp from 196th Street SW ties back into I-5 mainline just south of the I-405 underpass.

In the northbound direction, full access is provided from 44th Avenue W and 196th Street SW to I-405. Access is not provided between 44th Avenue W on ramp and 196th Street SW off ramp since these ramps are braided.

This option eliminates all weave sections in the southbound direction. In the northbound direction, one existing weave section remains between 196th Street SW and I-405, but the weave will take place on the ramp system, rather than I-5. The volume on this weave section is just over 3,000 vph, and a two lane ramp flows freely.

In the year 2032 with the Baseline alternative the travel time between 128th Street SW and 220th Street SW is 7.7 minutes southbound and 9.3 minutes northbound. With the Local and Regional System Improvement alternative the travel time between 128th Street SW and 220th Street SW is 7.6 minutes southbound and 9.1 minutes northbound.

The Local and Regional System Improvement alternative serves 40 percent more vehicles in and out of the City of Lynnwood via I-5 compared to the Baseline alternative. In the Baseline alternative there are 8,120 vph served through the 44th Avenue W and 196th Street SW interchanges. With the added capacity by completing the 44th Avenue W interchange ramps and

additional crossings of I-5, the Local and Regional System Improvement alternative serves 11,360 vph through the I-5 interchange ramps.

Table 4 summarizes the LOS, density, speed, and volume for freeway mainline operations. Table 5 summarizes the LOS, density, speed and volume for the freeway merge operations. The traffic volume reported in Tables 4 and 5 is traffic served or throughput.

Table 4 – Freeway Mainline Operations - 2032 PM Peak Hour Local and Regional System Improvements

		Baseline				Local Improvements + Braided Ramps (6sec)			
Freeway Segment	# Lanes	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour
I-5 Southbound									
128th St SW Off to 128th St SW On	4	34	D	52	6,452	30	D	58	6,580
128th St SW On to 164th St SW Off	4	39	E	52	7,410	35	D	58	7,573
164th St SW Off to 164th St SW On	4	31	D	52	5,955	30	D	58	6,524
164th St SW On to I-405 Off	5	27	D	61	7,670	34	D	53	8,399
I-405 Off to I-405 On	4	22	C	61	5,026	27 23	D C	59 59	5,796 4,954
I-405 On to 196th St SW Off	5	26	C	60	7,069	31	D	59	6,695
196th St SW Off to 196th St SW On	4	24	C	60	5,379	22	C	59	4,794
196thSt SW On to 44th Ave W On	4	36	E	48	6,407	27	D	59	5,969
44th Ave W On to 220th St SW Off	4	43	E	48	7,521	39	E	50	7,204
220th St SW Off to 220th St SW On	4	35	E	48	6,263	33	D	50	6,122
I-5 Northbound									
220th St SW Off to 220th St SW On	4	52	F	39	7,514	44	E	47	7,579
220th St SW On to 44th Ave W Off	5	50	F	39	9,031	42	E	47	9,168
44th Ave W Off to 196th St SW Off	4	31	D	60	6,996	41 26	E C	47 60	7,099 5,832
196th St SW Off to Alderwood Mall Pkwy On	4	29	D	60	6,396	24	C	60	6,609
Alderwood Mall Pkwy On to 196th St SW On	5	28	D	60	7,879				
196th St SW On to I-405 Off	5	36	E	53	8,740	21	C	61	4,811
I-405 Off to I-405 NB On	4	32	D	53	6,210	28	D	61	6,326
I-405 On to 164th St SW Off	5	53	F	34	8,304	39	E	48	8,656
164th St SW Off to 164th St SW On	4	53	F	34	6,677	40	E	48	7,001
164th St SW On to 128th St SW Off	4	53	F	38	7,528	45	E	47	7,714
128th St SW Off to 128th St SW On	4	42	E	38	5,971	37	E	47	6,361

Table 5 - Freeway Merge Operations - 2032 PM Peak Hour Local and Regional System Improvements

Baseline & Local Improvements Only		Baseline				Local Improvements + Braided Ramps (6sec)			
Freeway Segment	# Lanes, (mrg or aux)	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour	Density (pc/mi/ln)	LOS	Speed (mph)	Vehicles Per Hour
I-5 Southbound									
128th St SW On	5, M	28	D	52	7,282	28	D	53	7,429
164th St SW On	5, A	27	C	58	7,950	33	D	51	8,369
I-405 On	5, A	25	C	58	7,373	23	C	57	6,626
196th St SW On	5, M	42	E	31	6,580	21	C	58	5,973
44th Ave W On	5, M	84	F	18	7,542	76	F	19	7,211
220th St SW On	5, M	24	C	58	6,879	23	C	58	6,702
I-5 Northbound									
220th St SW On	5, A	52	F	35	9,140	42	E	44	9,178
						23	C	61	7,113
Alderwood Mall Pkwy On	5, A	27	C	57	7,615	21	C	59	6,268
196th St SW On	6, M	28	C	51	8,477				
I-405 NB On	5, A	31	D	54	8,439	35	D	50	8,678
164th St SW On	5, M	49	F	31	7,641	51	F	30	7,712
128th St SW On	5, M	23	C	59	6,716	27	C	52	6,976

Exhibit 7 – Design Year (2032) PM Peak Hour Freeway Operations, Southbound I-5

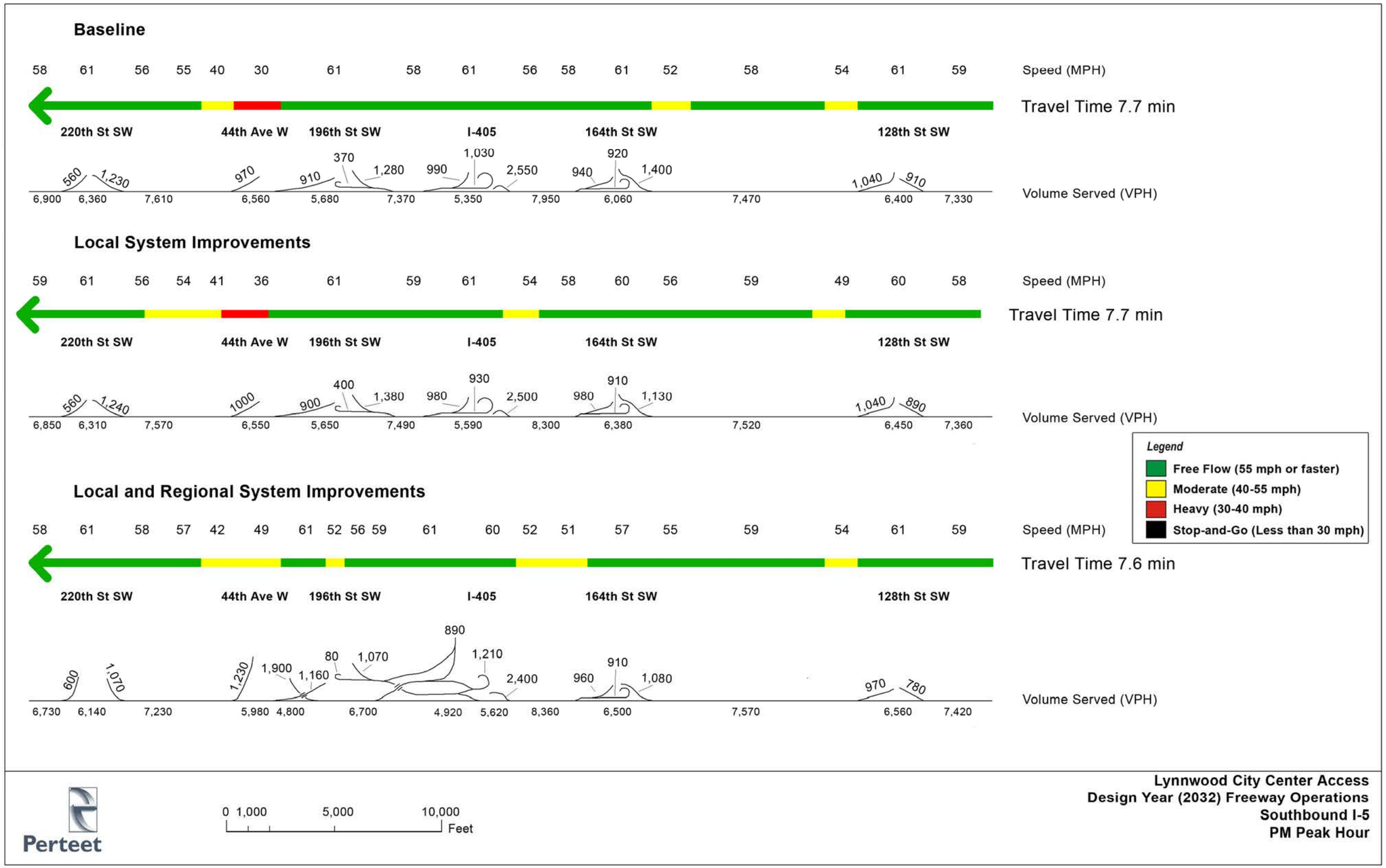
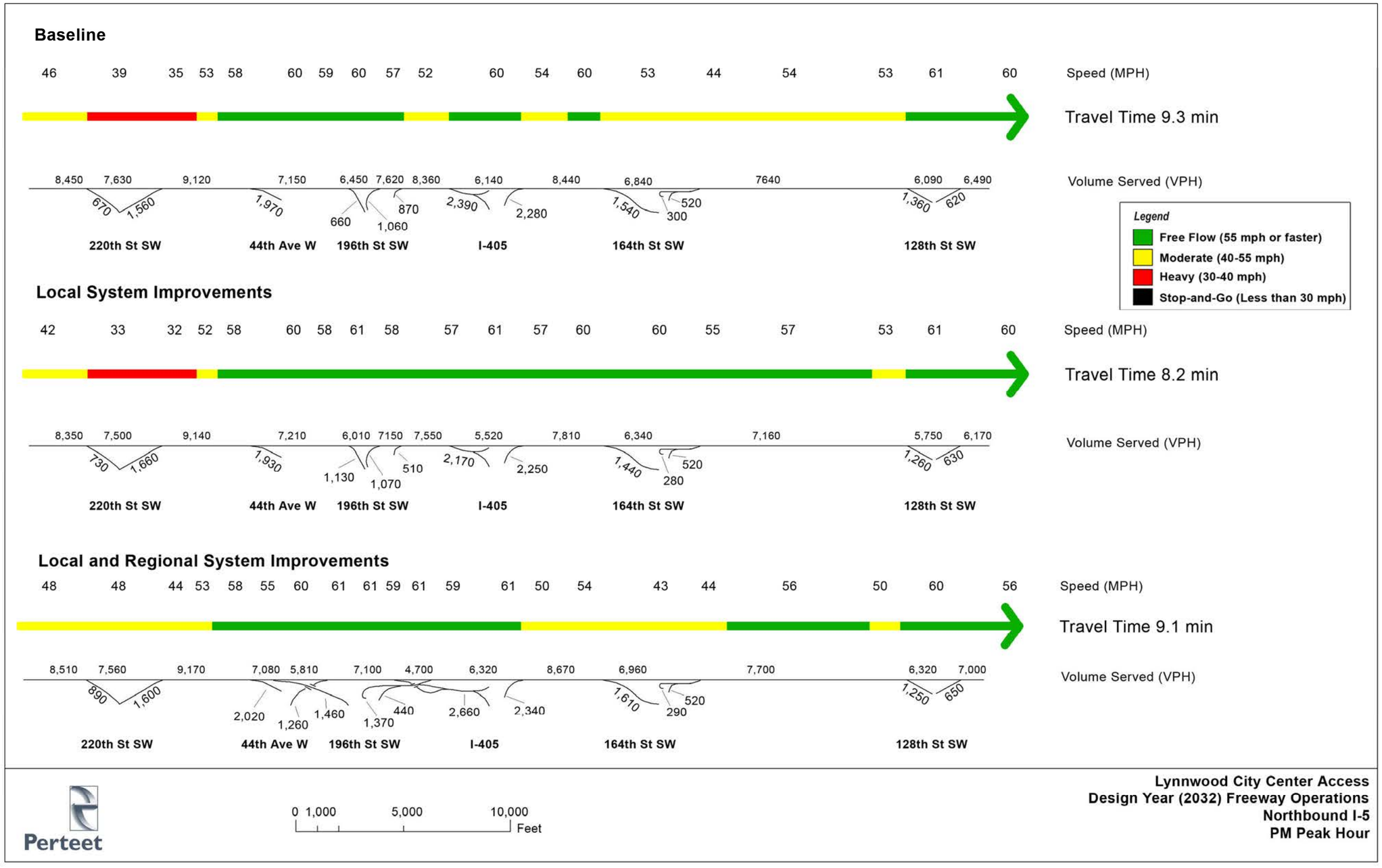


Exhibit 8– Design Year (2032) PM Peak Hour Freeway Operations, Northbound I-5



Other Regional System Improvements Considered

A variety of different configurations were considered for the regional system improvements in Lynnwood. Following is a brief summary of some of those improvements, and why they were not deemed as beneficial as the recommended improvements.

Collector-Distributor for I-405, SR 525, 196th Street SW, and 44th Avenue W

With this first option, SR 525, I-405, 196th Street SW and 44th Avenue W access would be achieved with a CD system both north and southbound.

In the southbound direction, all traffic from I-5 exiting at 196th Street SW and 44th Avenue W would diverge from I-5 onto the CD system. Then, all traffic from SR 525 and I-405 would merge into the CD system. This option also allows traffic entering from 196th Street SW to access the new 44th Avenue W off ramp. After the 44th Avenue W on ramp merges into the CD, the CD would subsequently merge into I-5.

In the northbound direction, all traffic from I-5 exiting to 44th Avenue W, 196th Street SW, SR 525 and I-405 would diverge onto the CD system, and all traffic entering from 44th Avenue W and 196th Street SW would merge into the CD system. After the diverge to SR 525 and I-405, the CD system would merge into I-5.

Two new access points are added with this CD system. In the southbound direction, a new off ramp to 44th Avenue W would provide access from the CD system, and in the northbound direction, a new on ramp from 44th Avenue W would provide access to the CD system. All direct access to and from I-5 between I-405 and 44th Avenue W would be removed, leaving access to the CD system only.

The limited distances available between access points combined with the high volume of traffic attempting to utilize those access points pose some operational issues. In both the south- and northbound directions, between I-405 and 196th Street SW, the CD system would have to support over 5,000 vph. This would require at least four lanes through these sections, and possibly more because of the weaving traffic.

A major design issue with this CD system involves the number of additional lanes needed on I-5 when it passes under I-405. In the northbound direction, the CD would need to merge over 2,800 vph into I-5, which would require a two lane ramp merging onto the mainline. The lanes merge back into mainline I-5 at the I-405 underpass. The existing support columns for I-405 do not leave enough room for the addition of two merge lanes.

The issue with the support columns is similar in the southbound direction where over 2,500 vph would need to access the CD system from mainline I-5, and this would require an additional two lanes to pass under I-405.

While this option removes short weave sections from I-5 providing improved traffic flow without the addition of any new structures, the short weave sections and corresponding high traffic volumes

that previously existed on I-5 have not been eliminated; rather they have been shifted to the CD system.

CD system between 196th and 44th Avenue W, Full access to I-405

In each direction, this option effectively combines the off ramps to 196th Street SW and 44th Avenue W into a single ramp, as well as the on ramps into a single ramp. I-405 and SR 525 can either access these ramps or directly access mainline I-5.

There are two key differences between this option and the previous. The first key difference is that traffic entering from 196th Street SW would not have access to 44th Avenue W and vice versa. The second difference is direct access from I-405 and SR 525 to I-5 would remain, in addition to having access to the CD system, whereas in the previous CD system, direct access from SR 525 and I-405 to mainline I-5 had been removed.

With the exception of SR 525 and I-405, there would be no direct access to I-5. This option does include the new on and off ramps at 44th Avenue W, which would have access to the CD system. By not allowing access from 196th Street SW to 44th Avenue W and vice versa, this option has eliminated the short weave section that existed between them in the previous option. The volume on the CD system between I-405 and 196th Street SW, while less than the previous option, is still at 3,500 vph in the southbound direction and 3,900 vph in the northbound direction. Both would require at least three lanes due to the short distance, and the weaving that would take place.

The design issue of needing an additional two lanes along I-5 in each direction to cross under I-405 still remains.

This option requires the construction of four new structures, but the traffic flow on I-5 is improved and the weave sections between 196th Street SW and 44th Avenue W have been eliminated. The short weave section between 196th Street SW and I-405 remains, as does the issue of requiring the addition of two lanes in each direction to cross under I-405. However, the 3 lane CD system would likely require reconstruction of the 196th Street SW and Alderwood Mall Parkway structures that currently cross I-5.

Conclusions and Recommendations

A combined system of both Local and Regional System Improvements provides the greatest overall benefit to both the local and regional transportation systems versus the Baseline alternative during the PM peak hour in 2032. The following summarizes the key findings of the Local and Regional System Improvement alternative compared to the Baseline alternative.

- Increased access to and from I-5 within the City in the design year (2032) during the PM peak hour.
    - Baseline alternative serves 8,120 vph at the 196th Street SW and 44th Avenue W interchanges
    - Local and Regional System Improvement alternative serves 11,360 vph at the 196th Street SW and 44th Avenue W interchanges

- Improved intersection operations
    - 25 of the 31 study intersections operate at LOS E or F with the Baseline alternative
    - 19 of the 31 study intersections operate at LOS E or F with the Local and Regional System Improvement alternative

- Operations on I-5 mainline improve slightly
    - 7.7 minutes travel time southbound and 9.3 minutes northbound with the Baseline alternative.
    - 7.6 minutes travel time northbound and 9.1 minutes northbound with the Local and Regional System Improvement alternative.

It is recommended that any additional analysis in the area focus on how each of the conceptual improvements can be implemented over time.

Endorsement

The Study Support Team has reviewed this technical memorandum, and concurs with it.

Study Support Team	Initial
FHWA Northwest Washington - ~~Elizabeth Healy~~	
WSDOT NW Region - Rick Mitchell	
WSDOT NW Region Traffic - Shuming Yan	
WSDOT HQ Access & Hearings Manager – Barb De Ste. Croix	
Snohomish County – Jay Larson	
City of Lynnwood - Jeff Elekes	

Technical Memo #9

Lynnwood City Center Access Study
Concept Refinement, Geometric and Configuration Characteristics

TO: **David Mach, P.E., Project Manager, City of Lynnwood**

FROM: **Peter De Boldt, P.E., Project Manager**
Jamie Son, Design Engineer

DATE: **May 4, 2007 (Revised 6-8-07)**

RE: **Concept Refinement, Geometric and Configuration Characteristics**

Summary
The focus of this technical memorandum is on the geometric and configuration characteristics of the different concepts. Technical Memorandum #8 focuses on the traffic operation analysis of each concept. The following concepts were identified in Technical Memo #7 (final revision submitted on November 27, 2006) for further analysis:

Local Transportation System Improvements (estimated between $81 and $103 million in 2007 dollars):

- Concept 6 – Extend 33rd Avenue W to Alderwood Mall Parkway.
- Concept 9 – New link across I-5 between 33rd Avenue W and Poplar Way.
- Concept 11 – New connection across I-5 between 40th Avenue W and Larch Way.
- Concepts 10 and 44 combined – This would create a new east-west corridor along 194th Street SW linking SR99 to Alderwood Mall Boulevard (Concepts 56 and 57 will also be considered as part of this combination and will require further analysis).
- Concept V – Widen 200th Street between 44th to 48th Avenue to 5 lanes.
- Concepts 38, 41 and I combined – This would create a new continuous east-west corridor that would link SR99 to SR 525/Alderwood Mall Boulevard interchange and possibly relieve congestion on 196th Street SW. It would be more effective than just Concepts 31 and I alone originally identified in the October, 2006 SST meeting. This concept was added by the City as worth considering after the SST meeting.

Constructing a new corridor by combining Concepts 38, 41 and I was dropped from further consideration because it would significantly affect a neighborhood of single family homes. There also turned out to be a limited demand for the corridor (about 260 westbound and 380 eastbound during the PM Peak hour in 2032).

Regional Transportation System Improvements:

- Concept 1 – New Ramp – SB I-5 to WB SR 525 (estimated around $17 million for the at-grade alternative and $45 million for the two flyover alternatives based on estimates provided by DMJM).
- Concept 2 – New Braided Ramp – EB SR 525 to SB I-5 (estimated between $13 and $17 million in 2007 dollars).
- Concept 25 – Create NB and SB CD system on I-5 to connect Lynnwood interchanges. Provide SB off-ramp and NB on-ramp at 44th Avenue W.

In addition, based on the analysis, Concept 25 was modified as follows:

- Concept 25a – Create NB and SB braided ramp system on I-5 to connect Lynnwood interchanges. Provide SB off-ramp and NB on-ramp at 44th Avenue W. Provide off-ramp from NB I-5 to the EB I-405/WB SR 525 interchange (estimated between $167 and $213 million in 2007 dollars)

The overall objective of these concepts is to improve access into Lynnwood. This was to be done while keeping local trips on the local transportation system and first looking at improvements to the local transportation system. Then improvements from the regional transportation system (I-5) for regionally oriented trips into the Lynnwood City Center were considered. A desired goal is to reduce congestion along the I-5 interchange arterials, I-5 mainline, and the HAC/HAL locations in the Study Area. As a result, each concept was examined for operational benefits to I-5 and I-5 interchange arterials, as well as for geometric feasibility and potential safety benefits.

The Local Transportation System Improvements Concepts were first evaluated together with Concepts 1 and 2 (both WSDOT Transportation Partnership Account (TPA) projects), but without Concept 25 (CD system along I-5). Concept 25 was to be evaluated only if the access needs of the Lynnwood City Center could not be met strictly with the local system improvements and the two WSDOT TPA projects. Subsequent analysis justified evaluating a CD system but according to the traffic demand models, the CD system had to be three to four lanes wide. Due to traffic capacity requirements, minimum lengths required for weaving, minimum lengths required for ramp spacing, and a constrained amount of area available to fit in the CD system, a braided ramp system was examined as the next alternative (Concept 25a).

As shown in Figure A, Concepts 6 and 9 provides an alternative route to access the west and east sides of Lynnwood across I-5 with a 5- to 6-lane overcrossing near the Alderwood Mall area. The combined concepts link the intersections at 33rd Avenue and Alderwood Mall Blvd to Poplar and Alderwood Mall Pkwy. Currently 196th Street provides a similar connection in that area but Concepts 6 and 9 offer these additional benefits (also listed in Figure A):

- Provide direct access between east Lynnwood and Alderwood Mall Blvd which connects directly to the proposed south end of the City Center area and provides a direct route into the core of the shopping area.
- Provide improved access from Alderwood Mall Blvd to the NB I-5 on-ramp from Alderwood Mall Blvd. Currently there is no direct connection from Alderwood Mall Blvd to NB I-5.

- Provide improved access from NB I-5 to Alderwood Mall Blvd and the shopping area.

In order to accommodate the greater traffic volumes with these concepts, Poplar would be widened in this area with an additional turn lane from 196th Street, an additional northbound through lane going into the proposed overcrossing, and an additional right turn lane going into the existing on-ramp at the intersection with Alderwood Mall Parkway (see Figure A).

Concept 11, shown in Figure B, will create a tunnel extension under I-5 from 204th Street and Larch Way to 40th Avenue and Alderwood Mall Blvd. This will provide an alternative route in addition to 44th Avenue in south Lynnwood to access the proposed eastern side of the City Center area and Alderwood Mall Blvd. The proposed tunnel will be 5-lanes wide and the intersection at Alderwood Mall Blvd and 40th Street will be widened to accommodate the extra movements from the tunnel.

Concepts 10 (shown in Figure C) and 44 will complete the connection along 194th Street to Alderwood Mall Blvd from SR99. Concept 44 would impact a neighborhood of single family homes between 44th Avenue W and SR 99. The concept also would impact Scriber Park. It was determined these impacts were significant so this segment was dropped from further consideration. Concept 10 completes the eastern portion of this connection from 40th Avenue to Alderwood Mall Blvd, which provides new access from the northern portion of the City Center to Alderwood Mall Blvd. This will include a new 2-lane roadway section from 40th Avenue to 33rd Avenue. As shown in Figure C, there are existing commercial and residential buildings between 36th Avenue and 33rd Avenue that will most likely be removed. 33rd Avenue will be widened at the new intersection to accommodate the new roadway and 33rd Avenue will continue down to Alderwood Mall Blvd as a 5-lane section. Alderwood Mall Blvd at 33rd Avenue will also be widened to accommodate the additional traffic and turning movements.

Concept V, shown in Figure B, will widen 200th Street between 44th and 48th Avenue into 5-lanes with an additional westbound left-turn lane on the east side of the 44th Avenue/200th Street intersection. The added westbound left-turn lane on 200th Street (creating a dual-left) will increase capacity coming from the proposed City Center area. Additional improvements to achieve a better LOS at this intersection would be to construct dual left-turn lanes from northbound 44th Avenue to westbound 200th Street. This would benefit the heavy left turn movements at this intersection and relieve congestion at this location. However, it would widen 44th Avenue to a total of 8 lanes, creating a configuration that would not be pedestrian friendly. Early in the development of concepts, the Study Support Team concurred that accommodating pedestrians was important to the future development of the City Center area, and therefore a maximum of 7 lanes was to be considered.

The remainder of this memorandum will describe the process involved in developing Concept 25a from Concept 25.

Description of Concept 25 (See Appendixes A and B)

Concept 25, the CD system, was deemed not as beneficial as the recommended braided ramp system (Concept 25a) that will be discussed in the next section. Concept 25 provides for improved I-5 interchange access within Lynnwood along 44th Avenue, 196th Street, and the I-

405/SR 525 interchange. The existing I-5/44th Avenue interchange in Lynnwood is incomplete and does not provide access to and from the north. At 44th Avenue, a northbound on-ramp and a southbound off-ramp will complete the interchange system at that location. Currently 196th Street is the only complete interchange location in Lynnwood with 164th Street serving as a northern access point.

Ramp designs on the northbound I-5 interchange along 44th Avenue have yet to be selected, although a few options have been shown to work operationally and geometrically. Other factors to consider for the 44th ramp designs are access between 204th Street and 44th Avenue, wetland impacts especially around 204th Street, and a proposed park between 204th Street and 44th Avenue which the City has already purchased property for.

Northbound

The northbound portion of the CD system would have the following connections:

- From 44th to 196th off-ramp – Begin as a one-lane off-ramp from the 44th Avenue interchange and provide access to 196th Street (labeled A1 to A2 in Appendix A).
- From 44th to 196th interchange – A new northbound CD on-ramp from 44th would continue past the 196th interchanges with each of the two on-ramps from 196th Street combining with the CD into 3 lanes (labeled B1 to B5 in Appendixes A and B).
- From 196th to I-405/ SR 525 – The CD eventually splits into a two-lane ramp merging into I-5 and one lane merging into the I-405/SR 525 interchange (labeled C and D in Appendix B, respectively).

The I-405/SR 525 interchange poses the following issues for the proposed CD system:

1. Insufficient distance to weave the projected volume of traffic from the CD onto westbound SR 525 (labeled F in Appendix B).
2. Large bridge span – Prior to merging onto I-5, the two-lane CD ramp would have to cross over the existing I-405/SR 525 interchange. This crossing can only occur past the gore between I-5 and I-405/SR 525 in order for ramp piers to be placed away from the existing travel lanes. Due to the current orientation of the interchange, the new crossing would most likely occur at a higher than desired skew, which would impact the size of the bridge span (labeled G in Appendix B).
3. Existing pier restrictions from I-405/SR 525 overcrossing – To meet vertical clearance and length requirements for the volume of traffic merging onto I-5, the CD lanes would have to extend past the existing I-405/SR 525 structure to the north. The existing piers restrict an additional lane from running adjacent to I-5 unless the I-5 structure was realigned by at least 6 feet. Even if the I-5 structure was realigned, there is only enough width between the piers to fit an extra lane, and shoulder width deviations would be required (labeled H in Appendix B).

Southbound

The southbound portion of the CD system would have the following connections:

- From I-405/SR 525 interchange – Begin CD system north of the I-405/SR 525 interchange as a two-lane I-5 off-ramp to satisfy traffic demand requirements. Piers on the I-405/SR 525 structure would not allow room for extra lanes so the I-5 structure would have to be realigned by at least 3 feet. Ramps from westbound and eastbound SR

525 would combine with the CD into 4 lanes and then merge eventually into 2 lanes (labeled I in Appendix B).

- From I-405/SR 525 to 196th to 44th interchanges – One lane of the CD would exit off 196th Street and the other off 44th Avenue (labeled J1 to J4 in Appendix A).
- From 196th on-ramp to 44th to 220th – The southbound on-ramp from 196th Street would run past 44th Avenue with the on-ramp from 44th merging into the new CD and extending as an auxiliary lane down to the 220th Street exit (labeled K1 to K4 in Appendix A).

Description of Concept 25a (See Figures D and E)

As discussed above, a CD system to meet the traffic demand needs in Lynnwood would require three to four lanes of travel in some locations. Additionally, the amount of space available in the area limits the kind of improvements that can be reasonably designed for. To accommodate the amount of traffic expected on the CD system, both the northbound and southbound CD systems would have to extend north of the I-405/SR 525 bridge crossing. Bridge piers restrict the number of lanes that can be added next to I-5 in this area. In order to avoid realigning the I-5 structure in this area and reduce the number of lanes, the amount of volume on the CD system was reduced by terminating the CD interchange connections earlier. On the northbound side, rather than collecting traffic from 44th through the 196th interchanges, the CD system was truncated to remove traffic coming from 44th and a new northbound 44th I-5 on-ramp was put in place instead. The southbound CD system terminated on the 196th interchanges rather than continuing down to 44th Avenue for the same reason. A new off-ramp was proposed instead from I-5 to 44th Avenue.

Additionally, the northbound connection back onto the I-405/ SR 525 interchange posed several issues due to insufficient space available to weave the projected volume of traffic from the CD system across the I-405/SR 525 interchange. Furthermore, a bridge over the existing entrance into I-405/ SR 525 would require a wide span. To resolve these challenges, realigning the existing I-5 access onto I-405/ SR 525 as a possible off-ramp from I-5 was explored. Based on these changes, the CD system was modified into a braided ramp system.

<u>Northbound</u>

From 44th to the 196th interchange, the northbound portion of the braided ramp system is estimated to cost between $50 and $64 million in 2007 dollars. From 196th to the I-405/SR 525 and I-5 on-connections, the estimated cost is between $34 and $44 million.

The northbound portion of the braided ramp system would have the following connections:

- From 44th to 196th – Begin with an I-5 off-ramp to 196th (labeled A1 and A2 in Figure D) and a new on-ramp from 44th Avenue (labeled B in Figure D). The new off-ramp to 196th will begin further south than the existing 196th off-ramp in order to meet vertical clearance requirements going over the proposed on-ramp from 44th.
- From I-5 to I-405/SR 525 – The new on-ramp from 44th will form a new auxiliary lane (labeled C1 in Figure D) along I-5 northbound which will also serve as an exit lane onto I-405/SR 525. Existing piers on the 196th structure run within the proposed auxiliary lane so that the mainline would have to be shifted west by approximately 2 to 5 feet, depending on what type of shoulder deviations would be accepted.

- From 196th to I-405/ SR 525 – The two 196th on-ramps will run as two lanes and merge onto I-5 as a two-lane on-ramp (labeled D1 to D3 in Figures D and E) and one lane will also have an exit to I-405/SR 525 (labeled C2 in Figure E).

In order to resolve the geometric challenge of crossing over the existing exit for the I-405/SR 525 interchange, a new I-5 off-ramp for this interchange will begin prior to the 196th structure. This will allow for enough distance for the off-ramp to cross over the ramps from 196th and cross under the structure at Alderwood Mall Parkway before connecting as two-lanes onto I-405 and two lanes onto SR 525. In order to avoid piers under Alderwood Mall Parkway, there would only be enough room for a 2 foot shoulder for the lanes merging into I-5 and those merging into I-405/SR 525. A barrier would run between these lanes to prevent vehicles from weaving across I-5 through the braided ramp system and onto I-405/SR 525. The northbound existing on-ramps from 196th will also need to be realigned to accommodate the new I-5 off-ramp to I-405/SR 525.

Southbound

From the I-5 off-ramp at the I-405/SR 525 interchange to the 196th interchange, the southbound portion of the braided ramp system is estimated to cost between $50 and $64 million in 2007 dollars. From 196th to the 220th off-ramp, the estimated cost is between $45 and $58 million.

The southbound portion of the braided ramp system would have the following connections:

- From I-405/SR 525 interchange – Begin as a one-lane off-ramp from I-5 (labeled E1 in Figure E) just south of the I-405/SR 525 interchange. Unlike the CD system, a one-lane ramp would avoid the piers on the I-405/SR 525 structure and would avoid having to realign this structure. Ramps from westbound and eastbound SR 525 would combine with the new braided ramp system into 3 lanes and then merge into 2 lanes (labeled E2 in Figure E).
- From I-405/SR 525 to 196th – One lane of the braid would exit off each of the 196th off-ramps (labeled E3 to E4 in Figure D).
- From 196th on-ramp to 44th to 220th – The southbound on-ramp from 196th Street would run past 44th Avenue with the on-ramp from 44th merging into the new braided ramp system and extend as an auxiliary lane down to the 220th Street exit, similar to the CD system (labeled F1 to F4 in Figure D).
- From I-5 to 44th Off-ramp – A new off-ramp onto 44th Avenue will complete the interchange at this location (labeled G in Figure D).

To summarize the above, due to traffic demand requirements, the proposed Concept 25 of a 3- to 4-lane CD system required greater space than available within the I-5/Lynnwood corridor. Therefore, a braided ramp system (Concept 25a) was examined as an improved alternative to connect interchanges along Lynnwood and meet the access needs for the Lynnwood City Center. A new I-5 braided off-ramp to the I-405/SR 525 interchange was also added to Concept 25a in order to fit the connection from the braided ramp system back onto NB I-5 prior to the I-405/SR 525 structure.

Conclusions and Recommendations

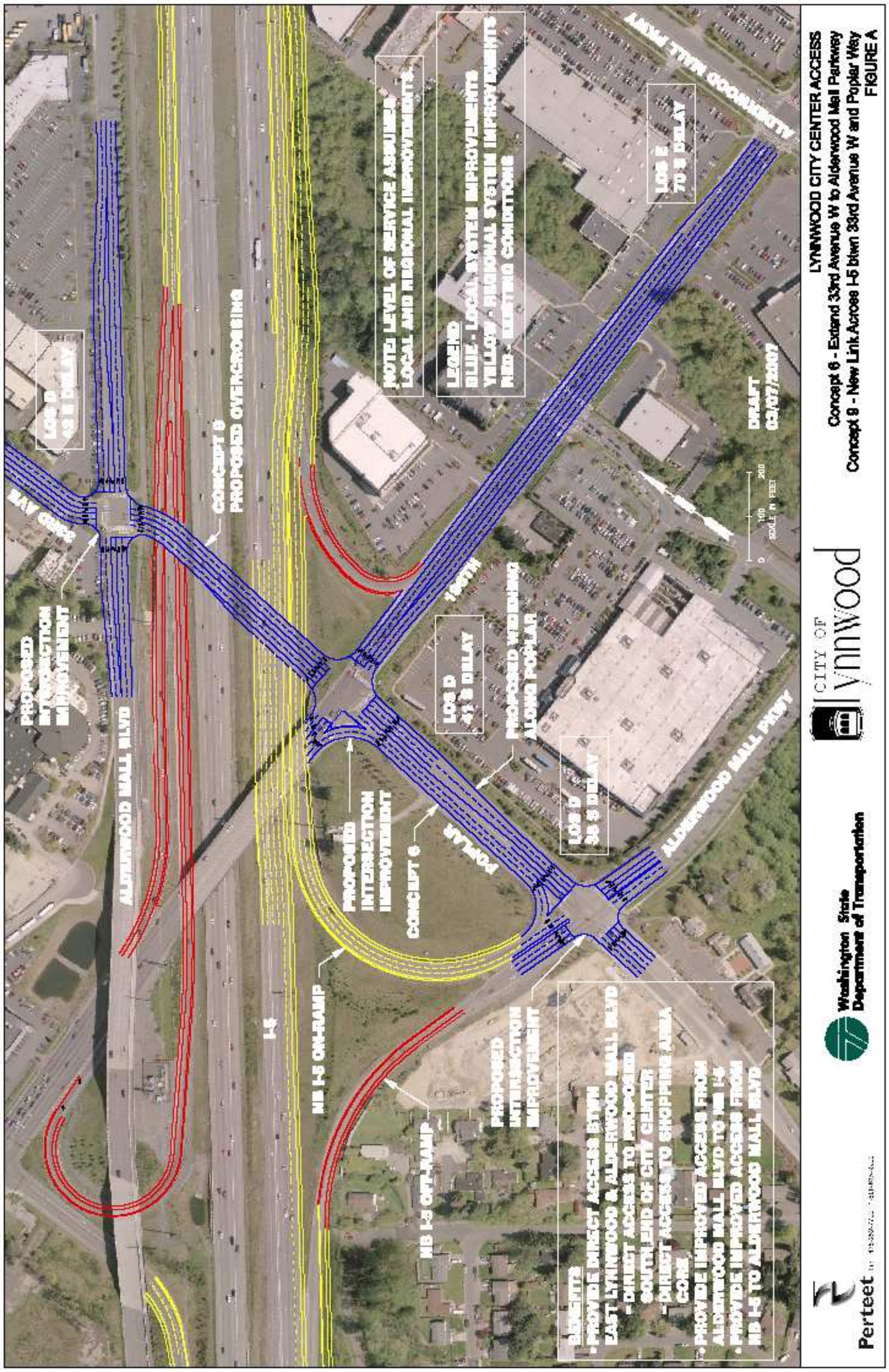
A combined system of both Local and Regional System Improvements provides the greatest overall traffic operations benefit to both the local and regional transportation systems versus the Baseline alternative during the PM peak hour in 2032. This was described in Technical Memorandum #8. The concepts described in this Technical Memorandum are all technically feasible, and based on the level of concept design conducted thus far are geometrically feasible.

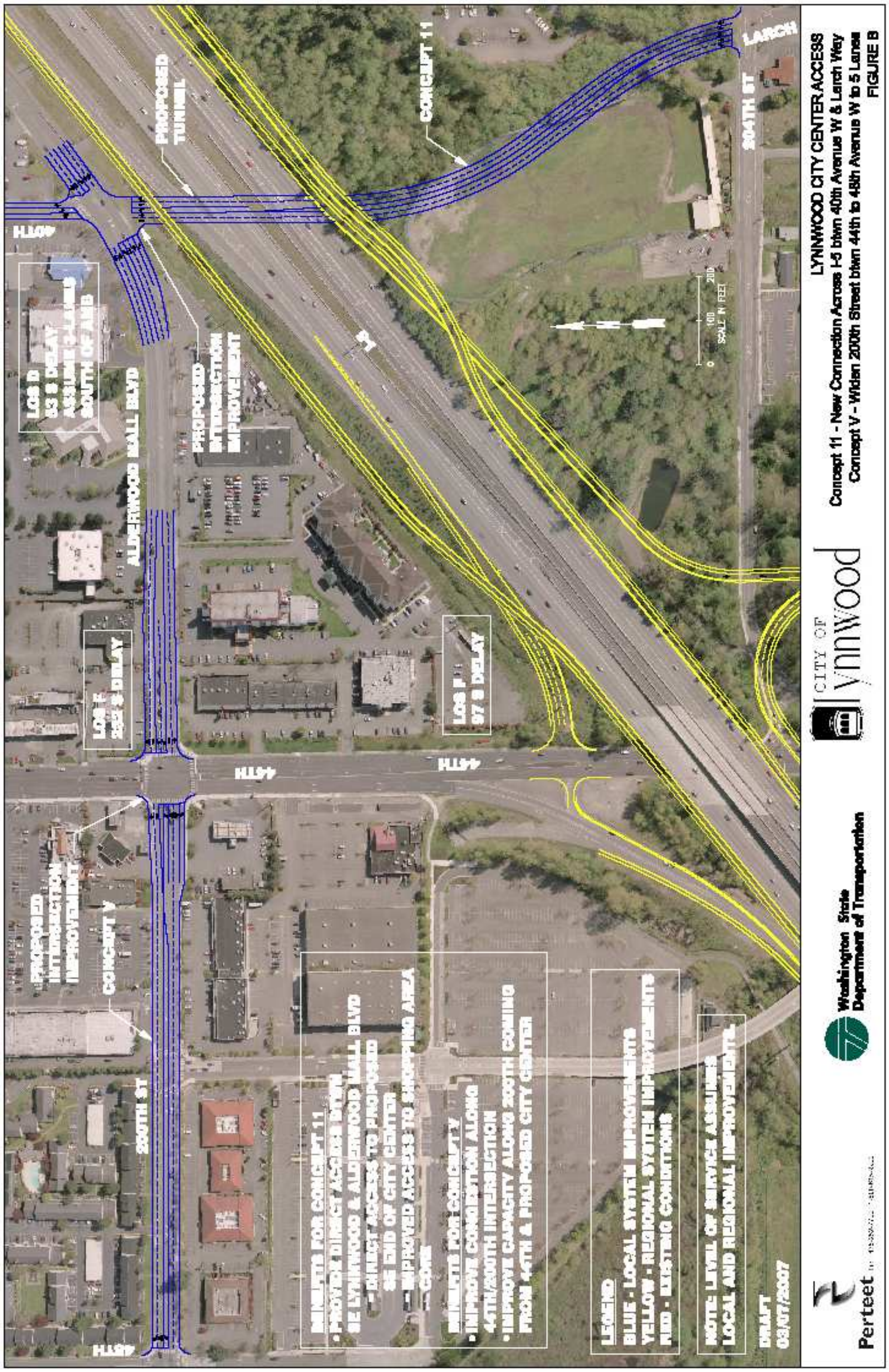
It is recommended that any additional analysis in the area focus on how each of the conceptual improvements can be implemented over time to accommodate funding as it becomes available.

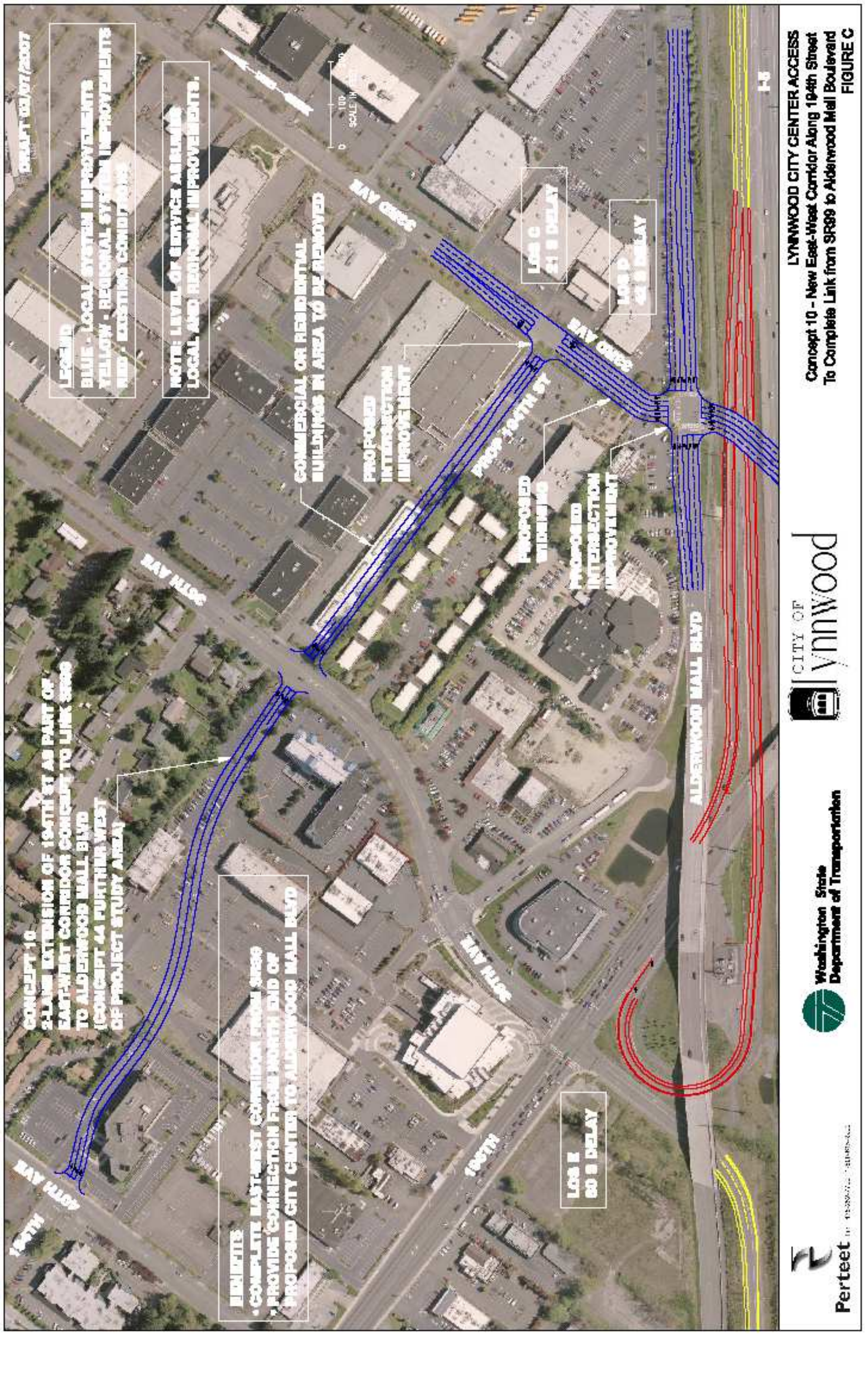
Endorsement

The Study Support Team has reviewed this technical memorandum, and concurs with it.

Study Support Team	Initial
FHWA Northwest Washington - ~~Elizabeth Healy~~ Steve Saxton	
WSDOT NW Region - Rick Mitchell	
WSDOT NW Region Traffic - Shuming Yan	
WSDOT HQ Access & Hearings Manager – Barb De Ste. Croix	
Snohomish County – Jay Larson	
City of Lynnwood - Jeff Elekes	


LYNNWOOD CITY CENTER ACCESS
Concept 6 - Extend 33rd Avenue W to Alderwood Mall Parkway
Concept 9 - New Link Across I-5 btwn 33rd Avenue W and Poplar Way
FIGURE A


LYNNWOOD CITY CENTER ACCESS
Concept 11 - New Connection Across I-5 btwn 40th Avenue W & Larch Way
Concept V - Widen 200th Street btwn 44th to 48th Avenue W to 5 Lanes
FIGURE B
CONCEPT 11
PROPOSED TUNNEL
LARCH
204TH ST
ALDERWOOD MALL BLVD
200TH ST
44TH
40TH
48TH
CONCEPT V
PROPOSED INTERSECTION IMPROVEMENT
LOS F 97 S DELAY
LOS D 53 S DELAY
DRAFT
03/07/2007
Perteet
Washington State Department of Transportation
CITY OF lynnwood


LYNNWOOD CITY CENTER ACCESS
Concept 10 - New East-West Corridor Along 194th Street
To Complete Link from SR99 to Alderwood Mall Boulevard
FIGURE C
ALDERWOOD MALL BLVD
I-5
CITY OF Lynnwood
Washington State Department of Transportation
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