MITIGATION STRATEGIES

The mitigation strategies outlined below address three different aspects of the view issue. The first concerns the potential blockage of existing views—for the most part views of natural features that can currently be seen from areas within or adjacent to Downtown. The second addresses the Downtown skyline as a view object, focusing on enhancing the quality of this view as it evolves over time. The third addresses views of protected landmark structures.

REQUIRED/PROPOSED MITIGATION STRATEGIES

Given the type and magnitude of impacts discussed in this section, no mitigation measures or strategies are required or proposed to be mandatory actions accompanying approval of any of the alternatives studied in this EIS.

OTHER POSSIBLE MITIGATION STRATEGIES

View Obstruction

Comprehensive assessment of view conditions, view preservation strategy, and clarification of SEPA policies. An effective strategy for view protection would likely incorporate a variety of actions tailored to address specific conditions and accomplish particular objectives. Implementing such a strategy would require an initial comprehensive assessment of view conditions that would ultimately identify specific views to be protected, as well as measures to protect them. This strategy should acknowledge reasonable limitations on the level of view protection that can realistically be achieved for the Downtown area and surroundings, if other policy objectives for Downtown are to be realized. Consequently, SEPA policies related to Downtown should be clarified and narrowed to focus protection on a limited number of views that are agreed to have the highest priority for protection.

Potential tools that could be incorporated into a comprehensive view preservation strategy might include:

- Designate additional view corridors along streets providing critical views and establish appropriate development standards for maintaining desired view conditions, such as setbacks for upper floors.
- Consider opportunities for promoting view protection in the siting of public open space and other public facilities.
- Consider lower height limits in some locations to maintain critical view corridors. Selective designation of views with height limits carefully detailed to protect those views would be a means of mitigating the view blockage potential.
- Examine potential use of the transfer of development rights or the purchase of view easements from properties that may be severely constrained by measures to protect views.
- Identify opportunities for off-site mitigation. Within an identified viewshed area, require development contributing to the overall loss of views to mitigate this loss by contributing to the preservation of a specified view corridor within the area.
- Provide stronger guidance in street and alley vacation policies to address conditions related to view impacts of development on larger sites. Large sites created by alley vacations promote taller, bulkier structures that can potentially have a greater impact on views. Identify areas that are especially view-sensitive where alley vacations would either be prohibited or considered only with impact-mitigating measures.
- Map selected view corridors to emphasize consideration of view issues in SEPA project review and promote better coordination with City Design Review process in addressing view issues.
- In designated view-sensitive areas, restrict development above base height and density limits unless view blockage issues are addressed.

- Require minimum site sizes and/or coverage limits for tower development in view-sensitive locations to enable massing solutions that minimize obstruction of specified protected views.
- Provide additional development standards or incentives related to building bulk (tower spacing provisions, maximum wall dimensions, maximum floor sizes, etc.) to encourage conditions that allow more opportunities for views in areas designated as view sensitive.

Exempt Downtown from SEPA view protection policies. This alternative mitigation measure assumes that there is an inherent conflict between the broad application of the existing SEPA view protection measures in an area where public policy promotes concentrated high-density development. To reinforce growth policies, development within Downtown would not be subject to any additional consideration of potential view impacts through SEPA. This exemption is further supported by the assumption that view protection Downtown is appropriately and adequately addressed through the policy decisions that established the height limits, view corridor designations and related setbacks, design guidelines related to views, and other existing or future provisions that specifically apply to view protection.

Skyline Appearance

Possible strategies to avoid or minimize impacts on skyline appearance could include:

- Maintain variable height limits across Downtown that continue to ensure the "stepping up" of Downtown development from the periphery to the core and provide transition or contrast with development heights in adjacent areas.
- Define requirements or incentives that require the tapering of towers with increased height. The tapering tower form appears less bulky to the observer and promotes greater architectural interest and distinction to new towers. Granting additional height and density above current limits could be conditioned on measures to reduce the bulky appearance of structures and add architectural interest.
- Require or incentivize special architectural treatment of building tops to add interest to the portion of the structure that is the most visible addition to the skyline.
- Establish additional controls on the overall bulk of development through provisions that address spacing between towers, maximum tower dimensions, and other characteristics of large buildings. This could help avoid or minimize visual perceptions of “solid walls” of development due to the massing of bulky buildings in an area.
- Provide stronger guidance in street and alley vacation policies. Identify areas that are especially view-sensitive where alley vacations would either be prohibited or considered only if measures addressing skyline impacts are taken.
- Promote design treatments through project permit and design review processes that offset the bulky appearance of large structures and increase visual interest, including variations of facade materials, lighting, façade modulation and setbacks to interrupt continuous horizontal and vertical surfaces, color, lighting, fenestration treatment and other design details.

Views Toward Protected Landmarks

Possible strategies to better address views toward protected landmarks could include:

- Identify landmark structures worthy of greater view protection and consider what views would be protected and how. These could include prominent structures visible beyond their immediate surroundings, such as Pac-Med Hospital and Queen Anne High School.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

Additional height and bulk enabled by proposed zoning changes would add incrementally to the potential future impairment or blockage of views from some areas, predominantly portions of the Capitol Hill (south of Denny Way), Pike/Pine and First Hill neighborhoods.

CLIMATE—SHADOWS AND WIND

AFFECTED ENVIRONMENT

Shadows and Sun

The relative amount of shadow and sun available at the pedestrian level depends upon the landform, climate, vegetation, surrounding buildings, signs and bridges. In general, the land slopes downward to the southwest or west throughout much of Downtown, maximizing the potential sunlight during the midday and afternoon hours. Shadows cast by buildings create a mixed pattern of sunny and shady areas at street level, changing throughout the day and varying with the season. In the winter, portions of the retail and office cores are in the natural shadows of hills to the east until mid-morning. Although long periods of sunny weather are not uncommon, a clear day or two frequently provides a pleasant break after several continuous weeks of overcast skies, which can occur during any season.

The changing orientation of the street grid divides Downtown into three sectors. During daylight savings time, the heavily pedestrian-traveled avenues in the intensely developed central sector are exposed to full sunlight for a brief period around noon, while the east/west-oriented streets receive full sunlight later in the afternoon. These same changes occur roughly an hour earlier in the northern sector, and later in the southern sector. At other times of the day, both streets and avenues are affected, to varying degrees, by shadows from buildings. Building heights and widths are the primary factors affecting the amount of shadow, but other characteristics such as street level or upper level setbacks, locations of towers within a block, gaps between buildings, recessed plazas, roof overhangs, and marquees can modify the total amount and pattern of sun and shadow on the streetscape.

Although pedestrians tend to move to the shady side of the street on hot days, the more frequent choice is to walk in available sunlight along a route. Even on the hottest days, the sunniest parks and open spaces attract the most people. In a climate that is frequently gray and cloudy, sunshine provides a psychological lift, and the availability of sunlight at the street level Downtown is considered a valuable resource.

Relationship to building height and bulk. Very generally, higher building heights extend the *length* of the shadow cast, and increased bulk (or cross-section width) *widens* the shadow cast by a building. While the longer shadows may mean they are noticed farther from a building, their effects on more distant locations are briefer, because the sun's motion translates into faster movement of the shadow over the ground. Buildings with increasing amounts of bulk will generally result in wider shadows and an increased amount of shadowed area. The amount and impact of shadows cast by a group of buildings depends upon the spacing, orientation and relative locations of those buildings (e.g., some building arrangements may result in overlapping shadows, or cast shadows in patterns that are not detrimental to public areas where solar access is desirable). Effectively planning the spacing, orientation and relative locations of new buildings within a group of buildings can sometimes result in benefits, such as lesser area in shadow, or retention of good solar access in favored areas. Conceptually, taller and narrower towers with wide spacing may result in shadow impacts and light conditions that are more transitory and less objectionable than conditions resulting from lower and more bulky buildings set close together.

Wind

The onshore winds over coastal areas give Seattle a milder and moister climate than if winds were from the interior of the continent. The prevailing winds in Downtown Seattle blow from the south and south-southwest (about 22 percent of the time). In the summer months, prevailing winds are also experienced from the northwest (about 20 percent of the time).

Ground-level wind speeds can be significantly higher than speeds of prevailing winds. For example, a study conducted at 1001 Fourth Avenue Plaza (formerly the SeaFirst Tower) in 1978 recorded winds at the base of the building that were twice the velocity of prevailing winds. The increase in wind velocity near the ground can be caused by groupings of buildings that create corridors channeling winds, as well as by the shape, size, and position of the buildings.

In general, taller buildings with large, flat sides perpendicular to prevailing winds cause "downwash" currents that travel down the face of the structure. Downwash velocity may be greater than prevailing wind speeds. Round buildings or buildings at a 45-degree angle to the wind direction tend to reduce downwash. The Westin Hotel is an example of a design that helps to mitigate this downwash effect.

The orientation of the street grid relative to the prevailing winds influences street-level wind conditions when building walls parallel the grid. The grid orientation varies throughout Downtown, producing different wind conditions on the same day. The northern portion of Downtown between Denny Way and Stewart Street is oriented at a 49-degree angle west of north, with the long side of the blocks running from northwest to southeast. Prevailing summer winds from the northwest parallel these streets, while winter winds from the south form an acute angle with the long side of the block. This sector is least likely to experience the downwash effect during the summer months.

The vicinity between Stewart Street and Yesler Way is oriented with the long side of the blocks running from the north-northwest (32 degrees) to south-southeast. Both prevailing summer and winter winds form acute angles with the long block face. This sector is more likely than the north sector to experience the downwash effect throughout the year. South of Yesler Way to Royal Brougham Way, the street grid is oriented north/south. Winter winds blow parallel to the north/south streets. Prevailing summer winds form an acute angle with the street grid. Downwash effects would be similar to the north sector except the impacts would occur during the summer months.

Wind at the pedestrian level is accompanied by turbulence such as varying velocities, gusts and eddies. Researchers have established a relationship between ground-level wind effects on people and wind speed standards for pedestrian comfort. Each site and building project may have different effects on human comfort. Other nearby building developments may also influence particular wind effects at a given site. For some building types, the patterns of at-grade winds are predictable, by investigating relationships between climate, the site, the building form, and the resulting comfort and safety. As a result, it is possible to avoid creation of severe wind velocities from new development in urban areas.

At the pedestrian level, the building form, planting, and contours of the site often affect winds. Three general types of wind patterns affect wind flows at pedestrian levels: downwash wind flows from exterior walls to the base of a building; abrupt changes in wind speeds caused by differences in pressure between exposed and sheltered areas; and winds concentrated through openings such as passageways or arcades.

Relationship to building height and bulk. Tall buildings and structures can notably affect the wind environment for pedestrians. In cities, groups of structures tend to slow the winds near ground level, due to the friction and drag of the structures themselves. However, buildings that are much taller than the surrounding buildings intercept and redirect winds that might otherwise flow overhead, and bring them down the vertical faces of the building to ground level, where they can create ground-level wind and turbulence. These redirected winds can be relatively strong and also relatively turbulent, which can be incompatible with the intended uses of nearby ground-level spaces, or even hazardous.

Generally, the taller the high-rise building, the stronger the winds it encounters. These stronger winds are redirected down the face of the building. These redirected winds can be especially strong when the upwind buildings are much shorter, and can be diminished when the upwind buildings' heights are similar to the height of the subject building. If, in addition, the building provides a wide face to the wind, more wind will be directed down that face of the building toward ground level. Thus, both height and bulk can increase wind effects. However, these wind effects on the ground level usually can be controlled by design features that redirect those winds away from pedestrian areas. Typically, it is sufficient to provide a horizontal deflecting structure near the base of a building so that winds coming down the building face are redirected horizontally above the ground level. This is an effective design strategy for both taller towers and lower, bulkier buildings.

IMPACTS

Alternative 1 – High End Height and Density Increase

Consideration of shadow impacts under the City's SEPA Ordinance is limited to certain open space resources in Downtown, as well as certain other locations such as schoolyards. Some regulatory guidance on control of wind effects is provided by City codes and design review processes. The following is intended as a qualitative discussion of adverse effects on the comfort of the urban setting, and is not meant to extend SEPA or regulatory protection to these topics beyond that currently afforded by City codes and ordinances.

The potential shadow and wind effects due to future development under Alternative 1 are summarized in Table 38 below.

Table 38
Shadow and Wind Effects of Alternative 1

Potential Shadow Effects	Potential Wind Effects
• Future developments in the DOC 1 office core may add to total extent of shading of city streets, although existing buildings already result in considerable shading. • Taller buildings in all of Denny Triangle would add to shading of city streets. • Taller buildings in 1st/Western Ave. vicinity and edge of Belltown would add to shading of city streets. • Additional shading of Downtown SEPA-identified parks not likely to occur due to zoning changes. • Additional building heights near Denny Park at Denny Way create slightly greater potential for shading impacts on the park.	• Future new buildings in the office core and some peripheral areas would create the potential for additional wind effects near street level. However, interspersing of new buildings with existing buildings may help protect them from some wind exposure. • The additional bulk and distribution of future development in the Denny Triangle may provide some additional buffering of winds from the north. However, the new buildings at the northern periphery would be exposed to those winds and their effects. • Site design and architectural features can help avoid or reduce potential adverse wind effects at street level.

Alternative 2 – Concentrated Office Core

The potential shadow and wind effects due to future development under Alternative 2 are summarized in Table 39 below.

Table 39
Shadow and Wind Effects of Alternative 2

Potential Shadow Effects	Potential Wind Effects
• Potential shadow effects in DOC 1 office core would be nearly the same as for Alternative 1. • No zone changes in peripheral areas of Denny Triangle would result in somewhat less potential for shading of city streets. • No zone changes in 1st Ave./ Western Ave. vicinity or edge of Belltown would avoid additional shading effects. • Similar to Alternative 1, additional shading of Downtown SEPA-identified parks is not likely. • No zone changes near Denny Way would avoid additional shading effects on Denny Park.	• Potential wind effects in the office core would be nearly the same as for Alternative 1. • Due to somewhat less height and bulk of future buildings in the Denny Triangle and peripheral areas, potential wind effects would be somewhat less than for Alternative 1. • As with Alternative 1, site design and architectural features can be used to avoid or reduce potential adverse wind effects at street level.

Alternative 3 – Residential Emphasis

The potential shadow and wind effects due to future development under Alternative 3 are summarized in Table 40 below.

Table 40
Shadow and Wind Effects of Alternative 3

Potential Shadow Effects	Potential Wind Effects
• Potential shadow effects in DOC 1 office core would be nearly the same as for Alternative 1. • Less intensive zoning in peripheral areas of Denny Triangle, edge of Belltown and 1st Ave./Western Ave. vicinities would result in less potential for shading of city streets than Alternatives 1 or 2. • Similar to Alternative 1, additional shading of Downtown SEPA-identified parks is not likely. • Changes would not affect zoned height/density near Denny Way, thus avoiding additional shading effects on Denny Park.	• Potential wind effects in the office core would be slightly less than for Alternatives 1 or 2. • Due to somewhat less height and bulk of future buildings in the Denny Triangle and peripheral areas, potential wind effects would be somewhat less than for Alternatives 1 or 2. • As with the other alternatives, site design and architectural features can aid in avoiding wind effects at street level.

Alternative 4 – No Action

SHADOWS, SUN AND WIND

The potential shadow and wind effects due to future development under Alternative 4 are summarized in Table 41 below.

Table 41
Shadow and Wind Effects of Alternative 4

Potential Shadow Effects	Potential Wind Effects
• No zone changes, but future developments under existing height/density limits could add to total extent of shading of city streets. • No zone changes, but future developments under existing height/density limits could add to shading of city streets in Denny Triangle and other peripheral areas of Downtown. However, existing bulk and site coverage regulations provide some benefits in avoiding shading from upper level bulk. • No impact on Downtown SEPA-identified parks, but future development closer to protected parks could possibly trigger the need to use SEPA protections.	• No impacts. However, due to less potential for height and bulk in future development, potential wind effects in the office core would be slightly less than for Alternatives 1, 2 or 3. • No impacts. However, due to somewhat less height and bulk of future buildings in the Denny Triangle and peripheral areas, potential wind effects would be slightly less than for Alternatives 1, 2 or 3. • Existing bulk and site coverage regulations provide some benefits in avoiding wind effects. • As with the other alternatives, site design and architectural features can aid in avoiding wind effects at street level.

MITIGATION STRATEGIES

Possible Mitigation Strategies

Given the current regulations, including the City's SEPA Ordinance, none of the alternatives are expected to generate significant adverse shadowing or wind impacts. Therefore, no SEPA mitigation measures are required to be implemented. However, the City may wish to explore a few strategies over the long term to improve overall consideration of shadowing and wind effects of future development.

- The City could review existing regulations and guidelines pertaining to control of wind effects. Additional quantitative criteria on acceptable wind speeds and/or design criteria for avoiding adverse wind conditions at the street level of structures could be provided. If identified, inconsistencies in Code requirements and guidelines could be remedied. This could aid City reviewers in evaluating the performance of proposals with regard to wind abatement.
- The City could consider additional design guidelines or regulatory requirements to assure that important public open spaces continue to have solar access. This could mean considering additional locations for SEPA protection against possible shadow impacts, and/or other measures.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

None are identified.

TRANSPORTATION

AFFECTED ENVIRONMENT

Travel Characteristics

Pertinent facts about existing Downtown travel characteristics include:

Average weekday trips with an origin or destination in Downtown:

- 815,000 person trips per day
- 519,400 vehicle trips per day

Percent of Downtown-oriented trips made by transit: 20%

Average automobile occupancy: 1.26 persons per vehicle.

EXISTING AM AND PM PEAK HOUR TRAFFIC CONDITIONS

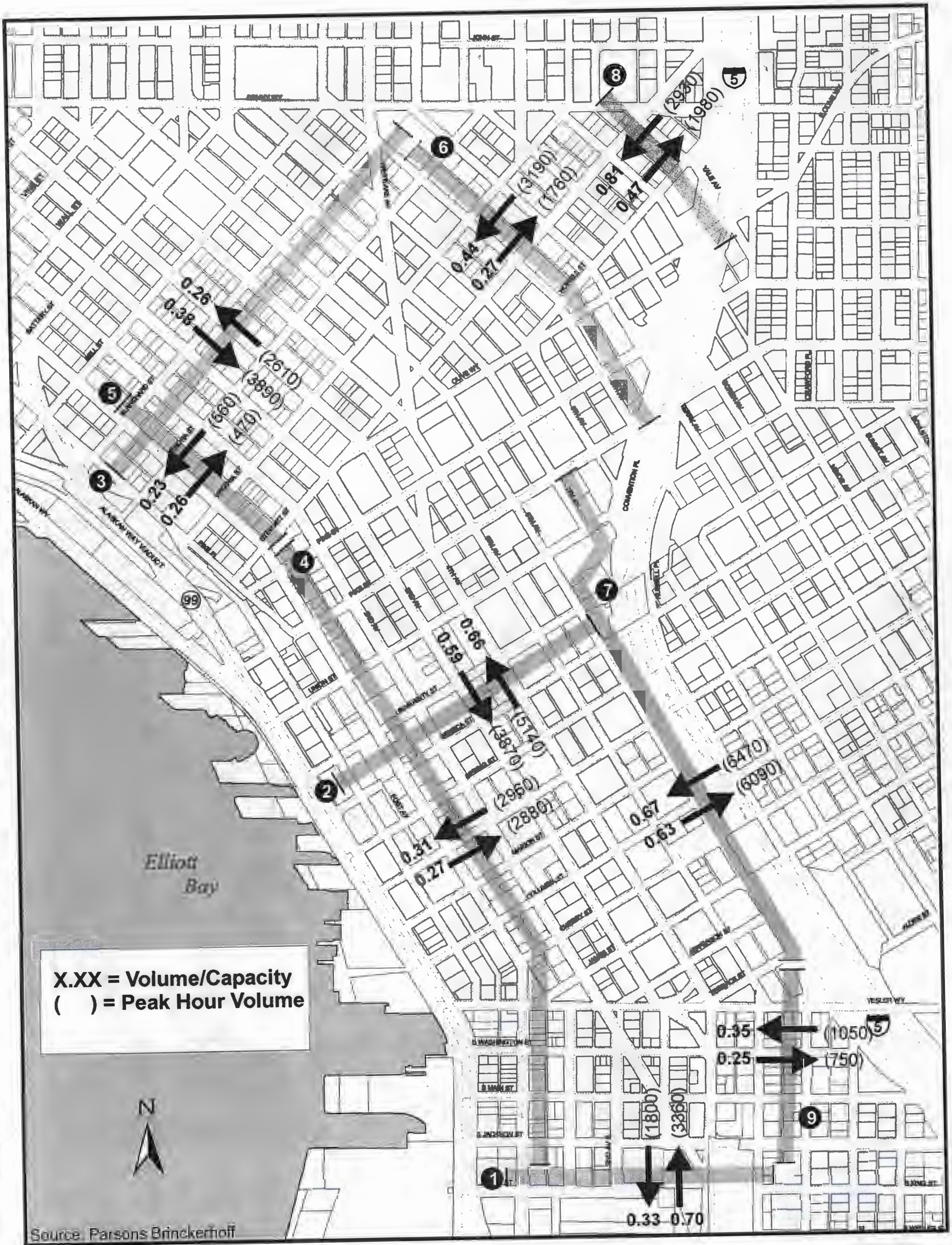
Travel patterns within and through Downtown can be interpreted using "screenlines" that measure traffic volumes and capacities on multiple streets carrying traffic in the same general direction. For this EIS, nine screenlines are defined to capture traffic entering and leaving Downtown from all directions, as well as locations within Downtown. This study examines traffic conditions during the AM and PM "peak hours," which represent the most congested conditions during the morning and evening commute periods. Typical AM and PM peak hours are 7-8 AM and 5:30-6:30 PM. Figures 31 and 32 illustrate existing AM and PM peak hour traffic volumes across the nine screenlines.

For each screenline, the existing traffic volumes are summed for travel in each direction, and a "volume-to-capacity ratio" (v/c ratio) is calculated. Typical street capacities are used for these calculations, but because the capacity of a roadway is not a hard-and-fast value, typical capacities can be exceeded.[1] In this study, a v/c ratio of 1.20 for a screenline indicates that streets crossing this screenline are at or near their ultimate capacity. A v/c ratio between 0.80 and 1.00 indicates moderately congested operating conditions, and a ratio between 1.00 and 1.20 indicates more-than-moderately congested conditions. The City's arterial level of service standard for these areas of Downtown is a screenline v/c ratio of 1.20 or less. Figures 31 and 32 show the peak hour traffic volumes and v/c ratios for each of the screenlines. Table 42 also summarizes that information.

Notable Findings

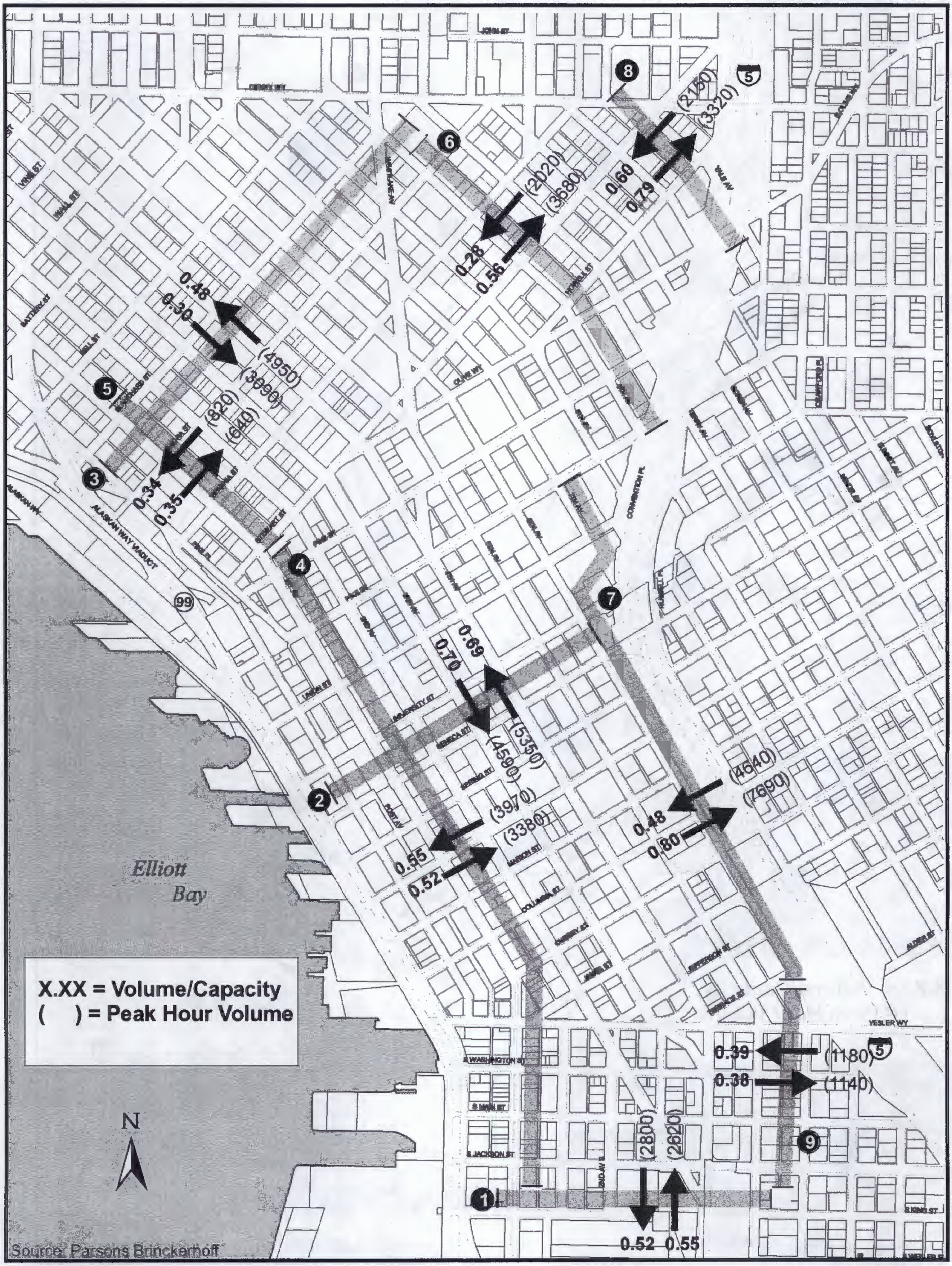
- As expected, inbound traffic volumes are greater during the AM peak hour, and outbound traffic volumes are greater during the PM peak hour.
- Traffic volumes across the studied screenlines during the PM peak hour are approximately 12% higher than screenline volumes during the AM peak hour.
- Outbound traffic during the PM peak hour represents 59% of traffic at screenlines (41% is inbound). During the AM peak hour, the inbound traffic represents 57% of traffic at screenlines (43% is outbound).
- Only two screenlines have v/c ratios of 0.80 or higher—Screenline 7 (east of Sixth Avenue, Pike St. to Yesler Way) eastbound during the PM peak hour; and Screenline 8 (east of Minor Avenue, Denny Way to Olive Way) westbound during the AM peak hour. These reflect the most heavily used commuting routes to/from Interstate 5 (via Stewart Street, Howell Street and Olive Way) as well as east-west traffic on Denny Way.

[1] For this study, the assumed street capacity is 600 vehicles per hour per lane.



Downtown Height & Density EIS

FIGURE 31
Existing Screenline Volumes and V/C Ratios
AM Peak Hour



Downtown Height & Density EIS

FIGURE 32
Existing Screenline Volumes and V/C Ratios
PM Peak Hour

Table 42
Existing Peak Hour Traffic Volumes and V/C Ratios Across Screenlines

Screenline	Map Key	AM Peak Hour		PM Peak Hour	
		Volume	V/C Ratio	Volume	V/C Ratio
S. King St., First Ave. S. to Sixth Ave. S.	1				
Northbound Total		3,360	0.70	2,620	0.55
Southbound Total		1,800	0.33	2,800	0.52
North of Seneca St., Western Ave. to Sixth Ave.	2				
Northbound Total		5,140	0.66	5,350	0.69
Southbound Total		3,870	0.59	4,590	0.70
South of Blanchard St., Elliott Ave. to Ninth Ave.	3				
Northbound Total		2,610	0.26	4,950	0.48
Southbound Total		3,890	0.38	3,090	0.30
1st Ave/Office Core, East of First Ave., S. Jackson St. to Pine St.	4				
Westbound Total		2,960	0.31	3,970	0.55
Eastbound Total		2,880	0.27	3,380	0.52
1st Ave/Belltown, East of First Ave., Stewart St. to Blanchard St.	5				
Westbound Total		560	0.23	820	0.34
Eastbound Total		470	0.26	640	0.35
9th Ave/Denny Triangle, East of Ninth Ave., Lenora St. to Pike St.	6				
Westbound Total		3,190	0.44	2,020	0.28
Eastbound Total		1,760	0.27	3,680	0.56
6th Ave/Office Core, East of Sixth Ave., Union St. to S. Jackson St.	7				
Westbound Total		6,470	0.67	4,640	0.48
Eastbound Total		6,090	0.63	7,690	0.80
NE Denny Triangle, East of Minor Ave., Denny Way to Olive Way.	8				
Westbound Total		2,930	0.81	2,150	0.60
Eastbound Total		1,980	0.47	3,320	0.79
Yesler – Jackson, West of Sixth Ave.	9				
Westbound Total		1,050	0.35	1,180	0.39
Eastbound Total		750	0.25	1,140	0.38

Source: Parsons Brinckerhoff, 2002

- While Interstate 5 is the dominant origin and destination of commuting traffic, Aurora Avenue (SR 99) also is a frequent origin and destination. Screenline 3 captures traffic that arrives and departs Downtown via surface streets, to/from northern locations. Screenline 3 v/c ratios are approximately 0.38 for inbound traffic during the AM peak hour, and 0.48 for outbound traffic during the PM peak hour.
- Screenline 2 (north of Seneca Street) captures traffic moving north and south in the heart of Downtown. The v/c ratios ranging between 0.59 and 0.70 during the AM and PM peak hours reflect the moderately congested conditions observed in this area during peak commuting periods.

Traffic Circulation

The quality of traffic circulation on an arterial street system is generally the result of operating conditions at signalized intersections, since these are the locations where roadway capacity is shared by vehicles moving in conflicting directions. Operating conditions at key intersections along selected critical corridors serving the Downtown area were examined using a traffic model known as SYNCHRO. This tool simulates traffic operations at both a corridor and intersection level, and can indicate how operations at one intersection may affect those at nearby intersections. The results of the analysis are expressed in terms of "level of service"[2] and travel times through the corridors. Queuing conditions, referring to line-ups or back-ups of vehicles, are also evaluated, because back-ups may affect the operations of nearby intersections.

The studied corridors are the Denny Way corridor and the combined corridors of Stewart Street, Howell Street and Olive Way. Within these corridors, 38 intersections were analyzed—12 along Denny Way and 26 along the Stewart/Howell/Olive corridors. Table 43 and Figure 33 summarize current operating conditions for these corridors.

The analysis indicates that in the AM peak hour, only 2 intersections in the studied corridors operate at LOS F: Stewart St./Denny Way, and Stewart St./5th Avenue.

Operations in the PM peak hour are generally more congested than the morning peak hour, with 4 intersections experiencing operating conditions of LOS F: Stewart St./Yale Avenue, Howell St./Minor Avenue, Olive Way/Boren Avenue, and Stewart St./Denny Way. Denny Way/6th Avenue operates at LOS E. These findings are consistent with field observations.

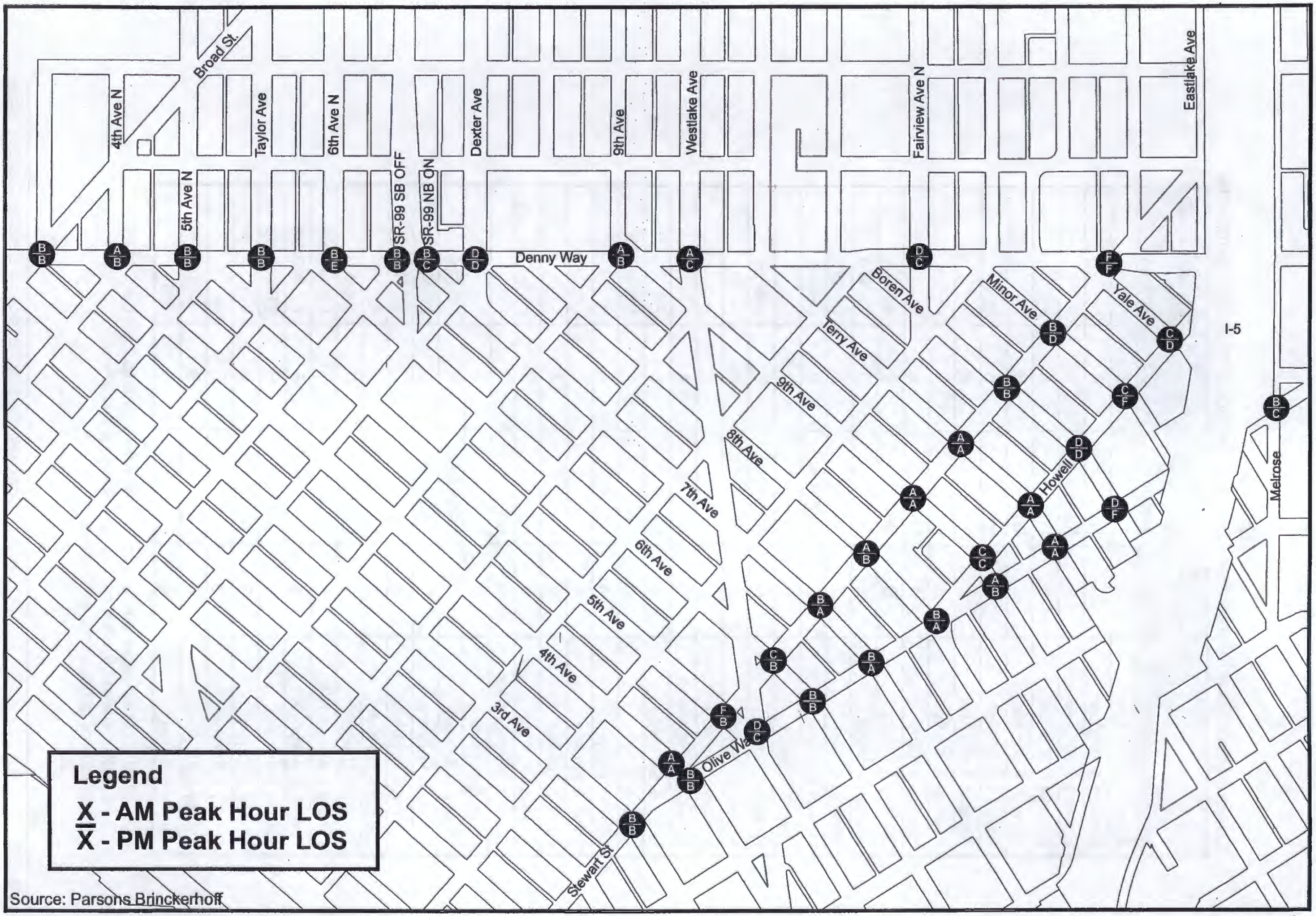
While other studied intersections operate at LOS D or better, several of them still experience queuing problems on one or more approaches, such that queue back-ups may affect operations at nearby intersections (see Table 43). This is evident along Stewart Street in the westbound direction and along Denny Way in both directions between Stewart Street and 6th Avenue, in the AM peak hour. During the PM peak hour, queuing problems are additionally noted along Howell Street between Boren and Yale Avenues.

[2] Level of service is a measure defined by the Highway Capacity Manual that ranges from excellent conditions (LOS A) to overloaded conditions (LOS F). Average vehicle delay for LOS A is 10 seconds or less, and for LOS F is greater than 80 seconds. These level of service measures are not directly related to the City's Arterial Level of Service Standard required by the Growth Management Act. The Arterial Level of Service Standard designated by the City is an areawide v/c ratio measured against all the arterials crossing certain specifically-defined screenlines.

Table 43
Current Peak Hour Intersection Levels of Service and Queuing Impacts

Intersection	AM Peak Hour		PM Peak Hour	
	LOS	Queuing Impacts*	LOS	Queuing Impacts*
Stewart & 3rd Ave	B	---	B	---
Stewart & 4th Ave	A	WB	A	---
Stewart & 5th Ave	F	SB/WB	B	---
Stewart & Westlake	B	WB	A	---
Stewart & 6th Ave	C	WB	B	---
Stewart & 7th Ave	B	---	A	---
Stewart & 8th Ave	A	---	B	---
Stewart & 9th Ave	A	---	A	---
Stewart & Terry	A	WB	A	---
Stewart & Boren	B	SB	B	SB
Stewart & Minor	B	---	D	SB/WB
Stewart & Yale	B	SB/WB	F	SB/WB
Howell & Yale	C	SB/EB/WB	D	SB/EB
Howell & Minor	C	WB	F	SB
Howell & Boren	D	NB/WB	D	NB/EB
Howell & Terry	A	---	A	---
Howell & 9th Ave	C	---	C	---
Howell & 8th/Olive	B	---	A	---
Olive & Melrose	B	EB	C	EB
Olive & Boren	D	NB	F	EB/NB/SB
Olive & Terry	A	---	A	---
Olive & 9th Ave	A	---	B	---
Olive & 7th Ave	B	---	A	---
Olive & 6th Ave	B	---	B	---
Olive & 5th/Westlake	D	SB	C	---
Olive & 4th Ave	B	---	B	---
Denny & Stewart	F	EB/WB/SW	F	EB/SW
Denny & Fairview	D	EB/WB/NB	C	EB/WB/NB
Denny & Westlake	A	---	C	EB/NB
Denny & 9th Ave	A	EB/SB	B	EB/SB
Denny & Dexter	D	EB/WB	D	EB/WB
Denny & Aurora NB	B	EB/WB	C	EB/WB/NB
Denny & Aurora SB	B	EB/WB/SB	B	EB/WB/SB
Denny & 6th Ave	B	WB	E	EB/WB/NB
Denny & Taylor	B	WB	B	---
Denny & 5th Ave	B	---	B	---
Denny & 4th Ave	A	---	B	---
Denny & Broad	B	---	B	WB

* Direction(s) indicated are for approaches where queues from the specified intersection are calculated to back up and affect operations at adjacent intersections.



Seattle Height & Density EIS

FIGURE 33
Existing AM & PM Peak Hour Intersection Levels of Service

Travel Times

Table 44 shows current average AM and PM peak hour travel time summaries for the studied corridors. Travel time is frequently used as a measure of effectiveness for comparing transportation alternatives. These findings were developed based on output from the SYNCHRO model. The longer travel times along Stewart Street in the PM peak hour may be due to less advantageous signal timings compared to the morning commute when signals are better set to facilitate inbound volumes.

Table 44
Current Average Peak Hour Corridor Travel Time Summaries

Corridor	AM Peak Hour (minutes)	PM Peak Hour (minutes)
Denny Way Eastbound	5.5	5.9
Denny Way Westbound	5.9	6.3
Olive Way Eastbound	3.8	3.4
Stewart Street Westbound	4.0	8.5

Source: Parsons Brinckerhoff, 2002
Assumptions:
* Stewart Street corridor evaluated from Yale Ave to 3rd Ave.
* Olive Way corridor evaluated from 3rd Ave to Boren Ave.
* Denny Corridor (both directions) evaluated from Broad St to Stewart St.
* Average travel speed of 20 mph is assumed for all arterial segments

Transit Service

Transit Operations

The transit analysis considers two corridors and two transit screenlines to measure bus service. The two corridors—Stewart Street from Yale to 3rd Avenue, and Olive Way from 3rd Avenue to Boren Avenue—were chosen because they each carry relatively high transit volumes, and because peak hour traffic modeling was conducted on them. For the two corridors, the analysis applies transit volumes to the respective travel times to develop a combined aggregate bus travel time value for the corridors. The two transit screenlines are: 1st to 5th Avenue north of Seneca Street, and Denny Way between Broad Street and Stewart Street. These screenlines capture north-south routes through the commercial core and to/from the north. See Appendix N for additional details, including tables documenting transit volumes.

Stewart St./Olive Way Corridors. This screenline helps measure the relationship to regional transit service providers. Stewart Street and Olive Way are the principal transit access routes to/from Interstate 5 in the study area. A total of 149 buses use the corridor in the AM peak hour and 115 buses in the PM peak hour. Stewart Street and Olive Way experience significant transit volumes entering Downtown in the AM peak hour; Stewart Street's volumes are partly attributable to the volumes of Community Transit buses. Service on Olive Way does not show a directional peak and has fairly balanced volumes in both the AM and PM peak hours due to a large number of Sound Transit buses returning to Interstate 5. The overall cumulative peak-hour travel times weighted by bus volumes for the combined Stewart/Olive corridors is 572 bus-minutes in the AM peak hour and 651 bus-minutes in the PM peak hour.

North of Seneca Transit Screenline. This screenline measures the major transit spine on surface streets through the Downtown core. Approximately 421 buses move through the corridor in the AM peak hour and 414 buses in the PM peak hour, representing approximately 5 percent of the traffic stream. These bus volumes do not include transit tunnel buses. The transit volumes are roughly equivalent northbound and southbound during the peak hours. Fourth and Second Avenue carry the highest transit volumes. Community Transit and Sound Transit bus service is focused exclusively on Fourth and Second Avenue.

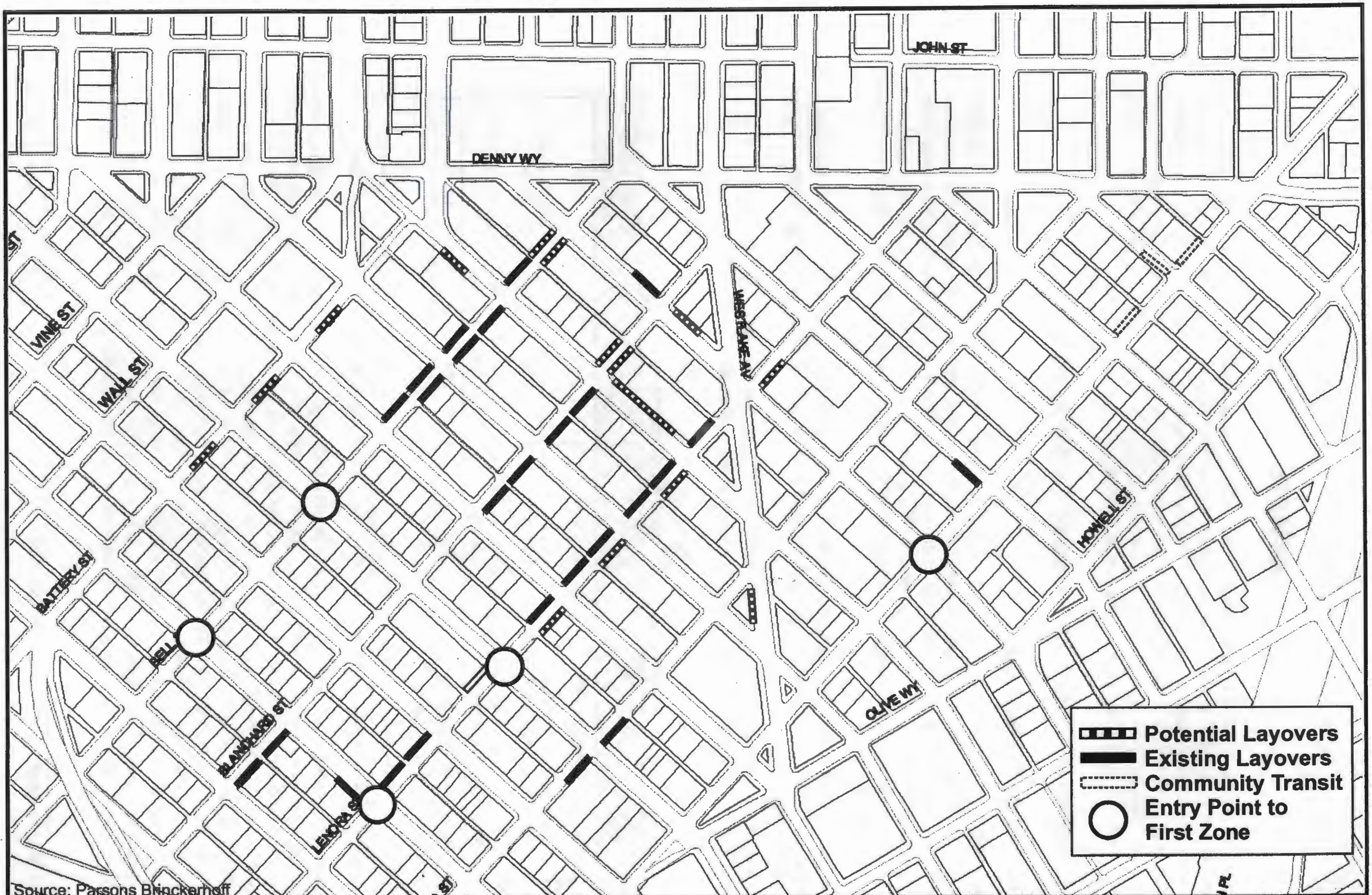
Denny Way Transit Screenline. This screenline captures more local-bound service than the Stewart/ Olive screenline, generally to/from northern and northwestern portions of the city. Approximately 169 buses cross Denny Way in both directions during the AM and PM peak hours. This includes 81 buses in the AM peak hour and 88 in the PM peak hour. The existing cumulative peak-hour sum of delay for buses crossing Denny Way is estimated at 29 minutes in the AM peak hour and 40 minutes in the PM peak hour. Dexter Avenue experiences the highest delays crossing Denny Way, due to large numbers of buses using the street coupled with high average traffic delay at the Denny/Dexter intersection. Aurora Avenue and Fifth Avenue (near Seattle Center) have a large number of buses using the street but fairly modest delays, resulting in moderate levels of overall delay. Fourth, Ninth and Westlake Avenues carry relatively few buses compared to the other streets crossing the Denny Way screenline, and have low levels of delay.

Transit Layover

A layover space is a designated stopover location for a transit vehicle at or near one end of a route, or at a turn-back point. Layover is a critical element in transit service planning and has direct implications on operating costs and levels of service provided. King County Metro has a total of 25 existing layover spaces in the study area, and 17 other identified potential layover spaces (see Figure 34). Community Transit has four layover spaces in the study area. These layover spaces are all within the northern portion of Downtown in the Belltown and Denny Triangle neighborhoods, and are concentrated mostly on Blanchard, Bell and Lenora Streets. They accommodate buses that originate in this area and move through Downtown heading to the Eastside and southern destinations.

Potential layover spaces are those that King County Metro considers feasible based on compatible adjacent land uses and proximity to route origins. The potential layover spaces are intended to provide alternative sites if development displaces existing spaces, and/or to accommodate projected growth in service that increases the need for layover spaces. Typically, layovers are located adjacent to vacant lots, parking lots or buildings with blank walls. It is considered undesirable to have layover buses parked next to residential or commercial uses, due to potential noise and diesel fume issues.

Green Street designations on Bell and Blanchard Streets and Ninth Avenue correspond with some existing layover spaces, and will likely reduce the number of potential layover sites in the study area. Though not explicitly stated in codes, the desired character of Green Streets may be incompatible with bus layover spaces.



Downtown Height & Density EIS

FIGURE 34
Potential Future On-Street Layovers

IMPACTS

This impact section summarizes the findings of the transportation impact analysis (see Appendix N for additional detailed information). This section first presents the baseline condition for the year 2020, based on the future growth assumptions of this EIS. This baseline condition corresponds to the EIS Alternative 4 – No Action condition, because it shows what is projected to occur if none of the proposed zone changes occur. The 2020 baseline condition represents the impacts of Alternative 4, and also serves as a benchmark against which to compare the impacts of Alternatives 1, 2 and 3.

2020 Baseline Condition (Alternative 4 – No Action)

TRAVEL CHARACTERISTICS

The transportation impact modeling is based on: the high-end growth assumptions made for this EIS; forecasts from the City of Seattle's travel demand forecasting model; and travel "mode share" information from the Puget Sound Regional Council's travel demand model. Traffic growth rates were obtained from the City's model and applied to actual ground traffic counts to develop the future volumes used for analysis. Table 45 summarizes differences between existing conditions and 2020 travel assumptions. The highlights for 2020 include:

- a forecasted 58% increase in the number of person-trips to or from Downtown (including internal trips);
- an increase in the share of person-trips made by transit from 20% to 33%, translating to considerably more transit ridership;
- a 5.5% increase in average auto occupancy to 1.33 persons per vehicle; and
- an approximate 13% decrease in the share of person-trips made by automobiles.

Table 45
Comparison of Travel Characteristics

	Existing Condition	2020 Condition	% Change to Year 2020
Average person-trips/weekday to/from Downtown	815,000	1,285,000	58%
Average vehicle trips/weekday to/from Downtown	519,400	645,900	24%
Percent of person-trips made by transit	20%	33%	--
Daily person-trips made by transit	163,000	424,000	160%
Percent of person-trips made by automobile	80%	67%	--
Average auto occupancy	1.26 persons	1.33 persons	6%

The mode choice modeling assumed the presence of monorail, light rail from SeaTac to Northgate, and some growth in transit service. The transportation network for the traffic forecasting analysis assumed the existing capacity and function of SR 99, and no specific changes to the Mercer corridor. The Washington State Department of Transportation and the City of Seattle are analyzing replacement alternatives for the Alaskan Way Viaduct in an EIS. Some of the alternatives under consideration in that study would change how traffic accesses Downtown from SR 99, especially from the south. The City has also been studying alternatives for the Mercer Corridor, and will begin an EIS in the Fall of 2003. Options under consideration could have some impact on traffic volumes on Denny Way, but the extent of this impact has not yet been determined. Additionally, the following impact analysis does not analyze potential traffic operational impacts from monorail alignments because it is a programmatic study and sufficient detail was not available at the time of study. However, the September 2003 Draft EIS for the monorail now identifies traffic impacts of the monorail alignment.

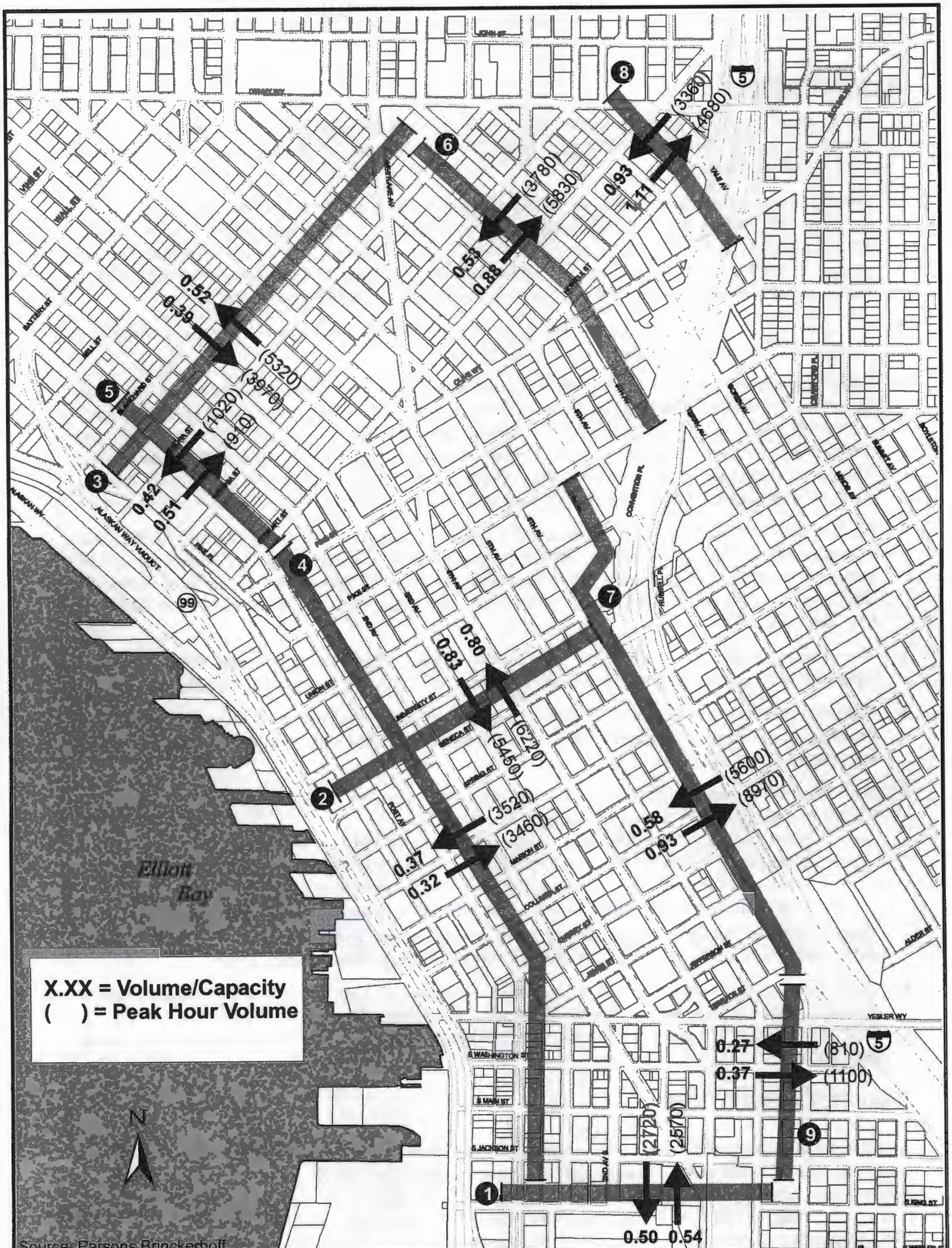
The 2020 analysis uses the same nine screenlines discussed for existing conditions. Table 46 shows 2020 peak hour traffic volumes and v/c (volume-to-capacity) ratios across the screenlines, for the AM and PM peak hour. The volumes shown are the summation of volumes on all individual streets crossing the screenline. Figures 35 and 36 portray these results graphically.

Table 46
Existing and 2020 No Action Peak Hour Traffic Volumes and Volume/Capacity Ratios

Screenline	Map Key	AM Peak Hour					PM Peak Hour				
		Existing		2020 No Action			Existing		2020 No Action		
		Volume	V/C Ratio	Volume	V/C Ratio	% Vol Chg.	Volume	V/C Ratio	Volume	V/C Ratio	% Vol Chg.
S. King St., 1st Ave. S. to 6th Ave. S.	1										
Northbound Total		3,360	0.70	2,920	0.61	-13.1	2,620	0.55	2,570	0.54	-1.9
Southbound Total		1,800	0.33	1,340	0.25	-25.6	2,800	0.52	2,720	0.50	-2.9
North of Seneca St., Western Ave. to 6th Ave.	2										
Northbound Total		5,140	0.66	4,950	0.63	-3.7	5,350	0.69	6,220	0.80	16.3
Southbound Total		3,870	0.59	3,760	0.57	-2.8	4,590	0.70	5,450	0.83	18.7
South of Blanchard St., Elliott Ave. to 9th Ave.	3										
Northbound Total		2,610	0.26	2,490	0.24	-4.6	4,950	0.48	5,320	0.52	7.5
Southbound Total		3,890	0.38	4,100	0.40	5.4	3,090	0.30	3,970	0.39	28.5
1st Ave/Office Core, East of 1st Ave., S. Jackson St. to Pine St.	4										
Westbound Total		2,960	0.31	2,560	0.27	-13.5	3,970	0.55	3,520	0.37	-11.3
Eastbound Total		2,880	0.27	2,820	0.26	-2.1	3,380	0.52	3,460	0.32	2.4
1st Ave/Belltown, East of 1st Ave., Stewart St. to Blanchard St.	5										
Westbound Total		560	0.23	900	0.38	60.7	820	0.34	1,020	0.42	24.4
Eastbound Total		470	0.26	610	0.34	29.8	640	0.35	910	0.51	42.2
9th Ave/Denny Triangle, East of 9th Ave., Lenora St. to Pike St.	6										
Westbound Total		3,190	0.44	3,640	0.51	14.1	2,020	0.28	3,780	0.53	87.1
Eastbound Total		1,760	0.27	4,380	0.66	148.9	3,680	0.56	5,830	0.88	58.4
6th Ave/Office Core, East of 6th Ave., Union St. to Jefferson St.	7										
Westbound Total		6,470	0.67	6,740	0.70	4.2	4,640	0.48	5,600	0.58	20.7
Eastbound Total		6,090	0.63	6,250	0.65	2.6	7,690	0.80	8,970	0.93	16.6
NE Denny Triangle: E. of Minor Ave., Denny Way to Olive Way	8										
Westbound Total		2,930	0.81	3,380	0.94	15.4	2,150	0.60	3,360	0.93	56.3
Eastbound Total		1,980	0.47	4,280	1.02	116.2	3,320	0.79	4,680	1.11	41.0
Yesler – Jackson, West of 6th Ave., Yesler Wy to S. Jackson St	9										
Westbound Total		1,050	0.35	860	0.29	-18.1	1,180	0.39	810	0.27	-31.4
Eastbound Total		750	0.25	650	0.22	-13.3	1,140	0.38	1,100	0.37	-3.5
Grand Totals		**57,700**		**65,470**		**13.5**	**63,370**		**76,580**		**20.8**

Source: Parsons Brinckerhoff, 2002

FIGURE 35
Year 2020 No Action Screenline Volumes and V/C Ratios - AM Peak Hour



Downtown Height & Density EIS

FIGURE 36
Year 2020 No Action Screenline Volumes and V/C Ratios
PM Peak Hour

Notable Findings

- On an aggregate basis, volumes across all screenlines are projected to increase by 9.4% in the AM peak hour, and by 19.4% in the PM peak hour. This level of increase would be generally consistent with overall regional growth.
- Some individual screenlines are predicted to experience more significant percentage traffic growth, including Screenlines 6 and 8 measuring east-west traffic and I-5 accessing traffic in the Denny Triangle, and Screenline 5 measuring east-west traffic near 1st Avenue in Belltown. For example, PM peak hour traffic volumes across Screenline 6 would increase almost 70 percent, across Screenline 8 would increase 47 percent, and across Screenline 5 would increase 33 percent by 2020.
- PM peak hour traffic volumes across Screenline 7 (including access to/from I-5 at the Commercial Core) would increase approximately 18 percent by 2020.
- Three screenlines are forecast to experience modest decreases in peak hour volumes by 2020, including Screenline 1 measuring north-south traffic near S. King Street, Screenline 4 measuring east-west traffic for Downtown areas near 1st Avenue between Pine Street and Pioneer Square, and Screenline 9 measuring east-west traffic near 6th Avenue between Yesler Way and Jackson Street. These decreases may be attributable to the addition of the SR 519 connection between I-5 and the Alaskan Way viaduct by 2020, which may alter traffic flow patterns measured by these screenlines.
- For the 2020 AM peak hour, probable increases in housing supply in the study area will likely result in more traffic departing Downtown. This outbound traffic will likely account for 48 percent of AM peak hour screenline volumes rather than the current 44 percent. This pattern will be most evident in the Denny Triangle area, where the two screenlines show large percentage increases in this AM peak hour outbound traffic.
- The directional split in the PM peak hour traffic will stay about the same, with outbound traffic representing 58 percent of the total screenline volumes, and inbound representing 42 percent.
- PM peak hour traffic is expected to grow at a faster rate than AM peak hour traffic. By 2020, PM peak hour traffic is projected to be over 22 percent greater than AM peak hour traffic, when summing up volumes across all screenlines.
- By 2020, four screenlines (two more than existing conditions) are anticipated to have v/c ratios of 0.80 or higher, indicating potentially congested operations:
  - Screenline 2, north of Seneca St., both directions in the PM peak hour
  - Screenline 6, east of 9th Avenue, eastbound in the PM peak hour
  - Screenline 7, east of 6th Avenue, eastbound in the PM peak hour
  - Screenline 8, north of Minor Avenue, both directions in the AM and PM peak hours.

  These results are consistent with expected traffic growth patterns and orientation of a large portion of traffic either to/from the east (e.g., Interstate 5) or to/from the north via surface streets.
- None of the screenlines are projected to exceed a v/c ratio of 1.20. At Screenline 8 east of Minor Avenue, eastbound volumes are expected to reach a v/c ratio of 1.01 in the AM peak hour and 1.11 in the PM peak hour. These ratios in excess of 1.0 indicate a relatively high level of congestion in both peak hours.

TRAFFIC CIRCULATION

As noted for Existing Conditions, traffic operating conditions were analyzed for two arterial corridors—the Denny Way corridor and the Stewart/Howell/Olive Way corridor. The SYNCHRO model assessed 38 intersections along these corridors for the 2020 AM and PM peak hours. For this analysis, the signal phasing and timing were held constant for both the existing conditions and 2020 period, to provide a consistent basis for comparing the impacts of the alternatives.

Table 48 shows projected 2020 peak hour levels of service as compared to existing levels for the identified corridors.[3] The table also identifies intersections with specific queuing problems. Figure 37 shows the results graphically for both the AM and PM peak hours.

2020 Baseline, AM Peak Hour

The analysis indicates that AM peak hour operations are expected to significantly worsen by 2020. Eleven of the 38 intersections analyzed are projected to operate at levels of service LOS E or worse, compared to only two intersections in Existing Conditions. These include two intersections each along Stewart and Howell Streets, three on Olive Way and four along Denny Way. Nine of these eleven intersection levels of service would be LOS F, and only two would be LOS E.

Although several intersections analyzed are expected to operate at LOS D or better in the AM peak hour, many of these are expected to experience queuing problems on one or more approaches such that queues will back up and affect operations at nearby intersections. Eight of the 12 intersections on Stewart Street would experience this for the westbound (inbound) direction during the AM peak hour. All 12 Denny Way intersections would experience queuing problems in the eastbound direction. These results indicate these travel directions for these two corridors in particular will experience significant congestion by 2020, even if no zoning changes occur.

Along Howell Street and Olive Way, nearly half of the intersections in the AM peak hour are also projected to experience queuing problems in the eastbound or outbound direction. This is a noticeable increase from existing conditions indicating that by 2020, outbound traffic from Downtown is expected to increase significantly in the AM peak hour.

2020 Baseline, PM Peak Hour

Similar to existing conditions, the 2020 PM peak hour traffic operating conditions are projected to be generally worse than AM peak hour conditions. The biggest change in operating conditions is projected to occur at the northeastern ends of Stewart Street, Howell Street, and Olive Way. Denny Way is expected to experience significant increases in congestion throughout the corridor, with a slightly higher predominance of congestion toward the western end. Between Dexter Avenue and Broad Street, all but two intersections are projected to operate at LOS E or F. Overall, 17 of the 38 intersections analyzed (45%), are projected to operate at LOS E or worse by the 2020 PM peak hour, up from 5 today, and 15 of those will operate at LOS F. A summarized comparison of performance is shown in Table 47.

Table 47
Performance Summary for 2020 Baseline PM Peak Hour

	Number of Intersections Operating at LOS E or F	
	Existing Conditions	2020 Baseline
Stewart Street	1 of 12	5 of 12
Olive/Howell	2 of 14	5 of 14
Denny Way	2 of 12	7 of 12

Source: SPO, Parsons Brinckerhoff, 2002

[3] Direction(s) indicated in Table 48 below are for those approaches where queues from the specified intersection are expected to back up and affect operations at adjacent intersections.

Table 48
Existing and 2020 No Action Peak Hour Intersection Levels of Service and Queuing Impacts

Intersection	AM Peak Hour				PM Peak Hour			
	Existing Conditions		2020 No-Action		Existing Conditions		2020 No-Action	
	LOS	*Queuing Impacts*	*LOS*	*Queuing Impacts*	*LOS*	*Queuing Impacts*	*LOS*	*Queuing Impacts*
Stewart & 3rd Ave	B	---	B	---	B	---	B	---
Stewart & 4th Ave	A	WB	B	NB/WB	A	---	A	NB/WB
Stewart & 5th Ave	F	SB/WB	F	SB/WB	B	---	C	SB/WB
Stewart & Westlake	B	WB	B	WB	A	---	B	---
Stewart & 6th Ave	C	WB	C	WB	B	---	C	WB
Stewart & 7th Ave	B	---	B	SB/WB	A	---	F	SB/WB
Stewart & 8th Ave	A	---	A	---	B	---	B	---
Stewart & 9th Ave	A	---	A	---	A	---	F	SB/WB
Stewart & Terry	A	WB	B	WB	A	---	A	---
Stewart & Boren	B	SB	D	SB/WB	B	SB	F	SB/WB
Stewart & Minor	B	---	B	---	D	SB/WB	F	SB/WB
Stewart & Yale	B	SB/WB	F	SB/WB	F	SB/WB	F	SB/WB
Howell & Yale	C	SB/EB/WB	F	SB/EB/WB	D	SB/EB	C	SB/EB
Howell & Minor	C	WB	C	WB	F	SB	F	SB/WB
Howell & Boren	D	NB/WB	E	NB/EB/WB	D	NB/EB	E	---
Howell & Terry	A	---	B	---	A	---	A	---
Howell & 9th Ave	C	---	D	---	C	---	F	SB
Howell & 8th/Olive	B	---	C	EB	A	---	B	EB
Olive & Melrose	B	EB	F	EB/NB	C	EB	F	EB/NB
Olive & Boren	D	NB	F	EB/NB	F	EB/NB/SB	F	EB/NB/SB
Olive & Terry	A	---	E	EB	A	---	D	EB
Olive & 9th Ave	A	---	D	EB	B	---	C	EB/SB
Olive & 7th Ave	B	---	C	---	A	---	D	SB
Olive & 6th Ave	B	---	B	---	B	---	B	NB
Olive & 5th/Westlake	D	SB	C	SB	C	---	D	EB/SB
Olive & 4th Ave	B	---	B	---	B	---	B	---
Denny & Stewart	F	EB/WB/SW	F	EB/WB/SW	F	EB/SW	F	EB/WB/SW
Denny & Fairview	D	EB/WB/NB	F	EB/WB/NB	C	EB/WB/NB	D	EB/WB/NB
Denny & Westlake	A	---	D	EB	C	EB/NB	B	EB/NB
Denny & 9th Ave	A	EB/SB	F	EB/SB	B	EB/SB	B	EB/SB
Denny & Dexter	D	EB/WB	F	EB	D	EB/WB	F	EB/WB/NB
Denny & Aurora NB	B	EB/WB	C	EB/WB	C	EB/WB/NB	F	EB/WB/NB
Denny & Aurora SB	B	EB/WB/SB	B	EB/WB/SB	B	EB/WB/SB	B	EB/WB/SB
Denny & 6th Ave	B	WB	C	EB/WB/NB	E	EB/WB/NB	F	EB/NB
Denny & Taylor	B	WB	C	EB	B	---	D	EB
Denny & 5th Ave	B	---	C	EB	B	---	E	EB/WB
Denny & 4th Ave	A	---	B	EB	B	---	F	EB
Denny & Broad	B	---	C	EB	B	WB	F	EB/WB/NE

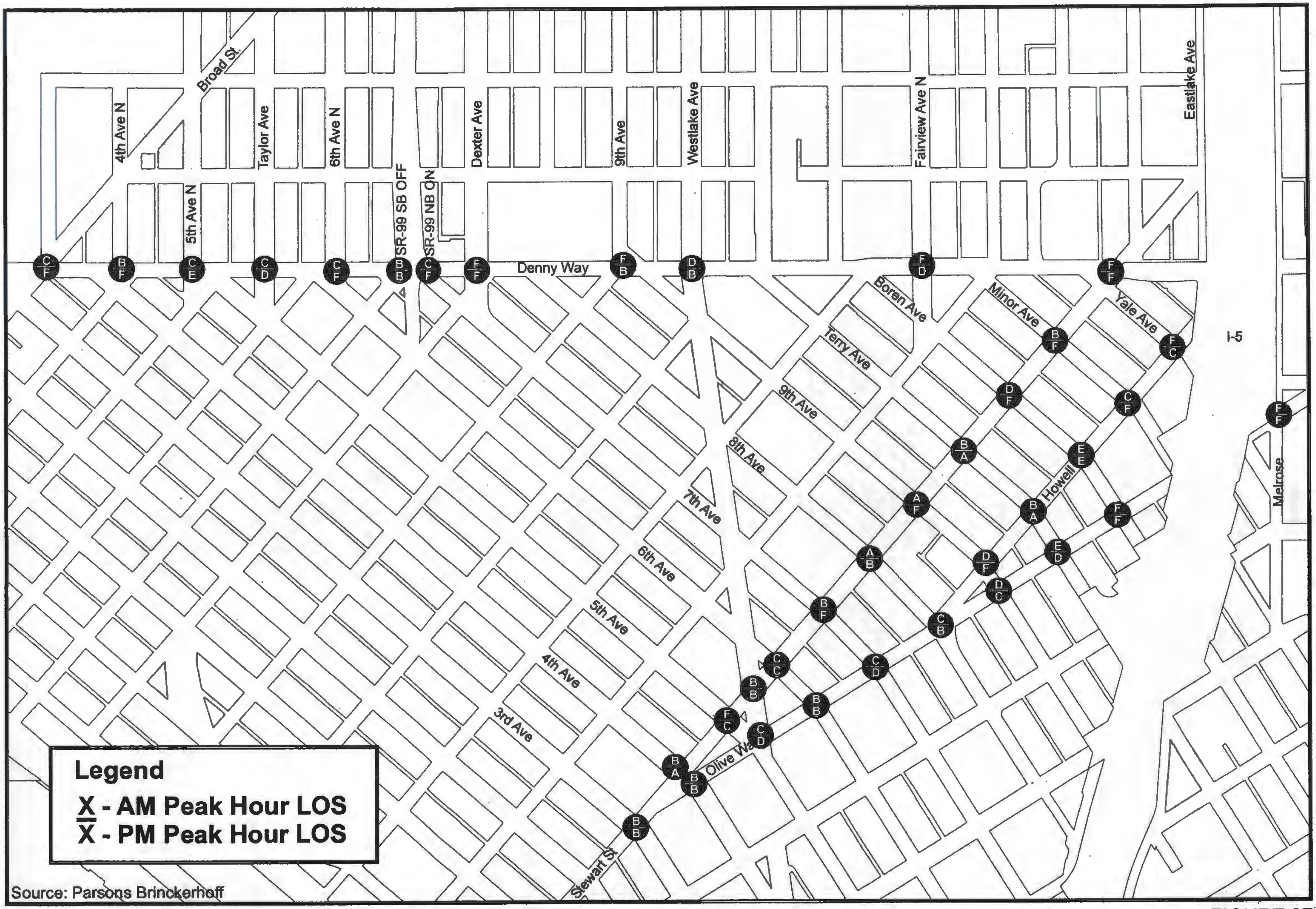


FIGURE 37
Year 2020 No Action
AM & PM Peak Hour Intersection Levels of Service

The queuing analysis for the PM peak hour indicates that by 2020, most of the corridors analyzed are expected to experience corridor-wide congestion. Eight of the 12 intersections along Stewart Street would likely experience queues in the westbound direction that would back up into adjacent intersections, compared to 2 in the existing condition. Along Denny Way, every intersection in the eastbound direction, and over half in the westbound direction, are expected to experience queuing problems. While not dramatically different from current conditions, this does indicate that congested conditions will be exacerbated in the future.

Travel Time

Table 49 shows projected 2020 average AM and PM peak hour travel time summaries for the studied corridors. The results indicate that all corridors are expected to experience significant increases in travel time by the 2020 baseline condition.

Table 49
Existing and 2020 No Action Peak Hour Corridor Travel Time Summaries

Corridor	AM Peak Hour (minutes)			PM Peak Hour (minutes)		
	Existing	2020	% Change	Existing	2020	% Change
Denny Way Eastbound	5.5	12.7	133%	5.9	19.7	232%
Denny Way Westbound	5.9	14.7	147%	6.3	10.6	68%
Olive Way Eastbound	3.8	6.6	75%	3.4	5.3	55%
Stewart Street Westbound	4.0	4.4	11%	8.5	11.9	40%

Source: Parsons Brinckerhoff, 2002
Assumptions:
* Stewart Street corridor evaluated from Yale Avenue to 3rd Avenue
* Olive Way corridor evaluated from 3rd Avenue to Boren Avenue
* Denny Corridor (both directions) evaluated from Broad Street to Stewart Street.
* Average travel speed of 20 mph is assumed from all arterial segments

TRANSIT SERVICE

Transit Operations

Assumed transit facilities in 2020 include Link Light Rail in its Locally Preferred Alternative alignment from Northgate to SeaTac. In addition, some joint bus/rail operations are projected to occur in the tunnel. Also, the presence of monorail is factored into the PSRC's mode share modeling.

North of Seneca Street Screenline. The 2020 AM peak hour conditions (baseline) would be nearly the same or slightly improved over existing conditions, meaning no adverse effects on transit operations in the Commercial Core. The PM peak hour traffic conditions are projected to worsen from a v/c ratio of 0.69 to 0.80 (northbound) and from 0.70 to 0.83 (southbound), which could mean a proportional increase in transit delay. Due to its southbound emphasis in the PM peak hour, transit service on 2nd Avenue will likely experience the greatest increase in delay. Transit traffic on 3rd and 4th Avenue will also experience increases in delay.

Stewart/Olive Corridors. By 2020, the cumulative amount of travel time spent by transit vehicles in the Stewart Street and Olive Way corridors is projected to increase by approximately 40% in the AM peak hour and 45% in the PM peak hour (see Table 50).

Table 50
Comparison of Existing and 2020 No Action
Cumulative Transit Travel Time – Olive/Stewart Corridors

Peak Hour	Total Bus-Minutes		% Change
	Existing	2020 No-Action	
AM	572	801	40%
PM	651	942	45%
Total, AM and PM	1223	1743	43%

Source: Parsons Brinckerhoff, 2002

Denny Way Screenline. Table 51 summarizes total minutes of delay incurred by buses crossing the Denny Way transit screenline in the 2020 baseline condition. Total minutes of delay are projected to increase from 29 minutes to 63 minutes in the AM peak hour, and from 40 minutes to 108 minutes in the PM peak hour. Denny Way's intersections with Dexter, Aurora, Fourth and Fifth Avenues (and Fairview Avenue in the AM peak hour) show the greatest predicted increase in transit delay.

Table 51
Comparison of Existing and 2020 No Action
Cumulative Bus Delay in Minutes Crossing Denny Way

	Bus-Minutes of Delay					
Crossing	Existing		2020 No-Action		% Change	
	AM	PM	AM	PM	AM	PM
Fourth Avenue	0.5	2.9	0.9	13.6	91%	368%
Fifth Avenue	6.0	6.1	8.8	27.4	46%	348%
Aurora Avenue	9.1	11.9	11.0	31.0	22%	161%
Dexter Avenue	6.4	11.7	15.0	26.7	134%	129%
Ninth Avenue	0.9	0.5	8.4	0.7	809%	24%
Westlake Avenue	0.6	2.1	3.5	1.6	496%	-25%
Fairview Avenue	5.7	5.2	15.0	7.4	165%	42%
Totals	29	40	63	108	115%	168%
AM and PM Totals	70 minutes		171 minutes		146%	

Source: Parsons Brinckerhoff, 2002

Transit Layover

The analysis conservatively assumes that redevelopment projects adjacent to layover locations would displace the layover spaces, as a worst-case impact. With this assumption, future development in the 2020 baseline condition may displace 10 existing and 7 potential Metro layover locations. No Community Transit layover locations would be affected. If these existing and potential layover locations are lost over time, it may be challenging to locate a sufficient number of additional replacement layover locations.

Alternative 1 – High End Height and Density Increase

Travel Characteristics

While substantial changes from existing conditions are projected for the 2020 Baseline Condition, there are relatively limited differences between Alternatives 1, 2 and 3 and the Baseline Condition (Alternative 4). Tables 52 and 53 summarize the differences between the Alternatives and the 2020 Baseline Condition for the PM peak hour at the nine screenlines, in terms of volumes, percent difference from the Baseline

Condition, and volume-to-capacity (v/c) ratio[4]. Table 52 illustrates that essentially all screenlines except Screenline 8 (East of Minor Avenue, Denny Way to Olive Way) would experience the same relative capacity conditions, as measured by v/c ratios. Given the nature of travel demand forecasting, differences of 5 percent or less are generally considered to be insignificant due to modeling accuracy limits.

Table 52
Comparison of 2020 PM Peak Hour Screenline Volumes to Baseline Condition

	2020 No Action	Alt. 1	Alt. 2	Alt. 3
Screenline	**PM peak hr. total volume**	**Percent difference**	**Percent difference**	**Percent difference**
1. S. King St.				
Northbound	2,570	0.8%	0.4%	0.0%
Southbound	2,720	1.5%	0.0%	1.5%
2. Seneca St.				
Northbound	6,220	1.1%	0.8%	0.2%
Southbound	5,450	1.3%	0.0%	0.4%
3. Blanchard St.				
Northbound	5,320	1.7%	1.1%	-0.2%
Southbound	3,970	1.0%	-0.3%	-0.5%
4. 1st Ave/Office Core				
Westbound	3,520	1.4%	0.9%	-0.3%
Eastbound	3,460	-3.2%	-2.3%	-2.3%
5. 1st Ave./Belltown				
Westbound	1,020	2.9%	4.9% (1,070)	8.8% (1,110)
Eastbound	910	0.0%	-2.2%	-3.3%
6. 9th Ave./Denny Triangle				
Westbound	3,780	4.2%	-0.5%	1.6%
Eastbound	5,830	2.4%	2.7%	2.2%
7. 6th Ave./Office Core				
Westbound	5,600	0.4%	0.2%	0.4%
Eastbound	8,970	-0.4%	-0.4%	0.0%
8. NE Denny Triangle				
Westbound	3,360	-3.6%	-3.3%	9.5% (3,680)
Eastbound	4,680	7.9% (5,050)	1.3%	0.0%
9. Yesler – Jackson				
Westbound	810	1.2%	1.2%	1.2%
Eastbound	1,100	0.0%	0.0%	-0.9%

Source: SPO, Parsons Brinckerhoff, 2002
Note: Numbers in parentheses are 2020 PM peak hour screenline traffic volumes under the alternatives.

At Screenline 8, eastbound PM peak hour traffic under Alternative 1 is projected to be approximately 8 percent greater than projected for the 2020 Baseline Condition (refer to Table 52). This additional traffic could be related to slightly greater concentration of future development in the Denny Triangle vicinity under Alternative 1 than for the No Action Alternative. With this additional traffic, the predicted v/c ratio at Screenline 8 for eastbound PM peak hour traffic would reach 1.20 by 2020, the highest v/c ratio for any alternative or screenline in this study (see Table 53). This would be right at the 1.20 threshold defined as the City's maximum arterial level of service standard[5]. This screenline covers a relatively small number of routes (Stewart Street, Howell Street, Denny Way, Olive Way) that are intensively used by commuters to enter and leave Downtown during peak hours. Other screenlines anticipated to experience v/c ratios of

[4] AM peak hour information is provided in the technical analysis prepared by Parsons Brinckerhoff (see Appendix N).
[5] Because Screenline 8 is not an official concurrency screenline, the 1.20 threshold is relevant only for general comparison purposes.

0.80 or higher for one or both travel directions include Screenlines 2, 6 and 7, in a manner similar to the Baseline Condition (see Table 53). Figures 38 and 39 illustrate the anticipated AM and PM peak hour volumes and v/c ratios across the studied screenlines.

Table 53
Comparison of 2020 Volume-to-Capacity Ratios to Baseline Condition

	2020 No Action	Alt. 1	Alt. 2	Alt. 3
Screenline	PM peak hr. v/c ratio	PM peak hr. v/c ratio	PM peak hr. v/c ratio	PM peak hr. v/c ratio
1. S. King St.				
Northbound	0.54	0.54	0.54	0.53
Southbound	0.50	0.51	0.50	0.51
2. Seneca St.				
Northbound	0.80	0.81	0.80	0.80
Southbound	0.83	0.84	0.83	0.83
3. Blanchard St.				
Northbound	0.59	0.60	0.60	0.59
Southbound	0.44	0.45	0.44	0.44
4. 1st Ave/Office Core				
Westbound	0.37	0.37	0.37	0.37
Eastbound	0.32	0.31	0.31	0.31
5. 1st Ave./Belltown				
Westbound	0.42	0.44	0.44	0.46
Eastbound	0.51	0.51	0.49	0.49
6. 9th Ave./D. Triangle				
Westbound	0.53	0.55	0.52	0.53
Eastbound	0.88	0.90	0.91	0.90
7. 6th Ave./Off. Core				
Westbound	0.58	0.59	0.58	0.59
Eastbound	0.93	0.93	0.93	0.93
8. NE Denny Triangle				
Westbound	0.93	0.90	0.90	1.02
Eastbound	1.11	1.20	1.13	1.12
9. Yesler – Jackson				
Westbound	0.27	0.27	0.27	0.27
Eastbound	0.37	0.37	0.36	0.37

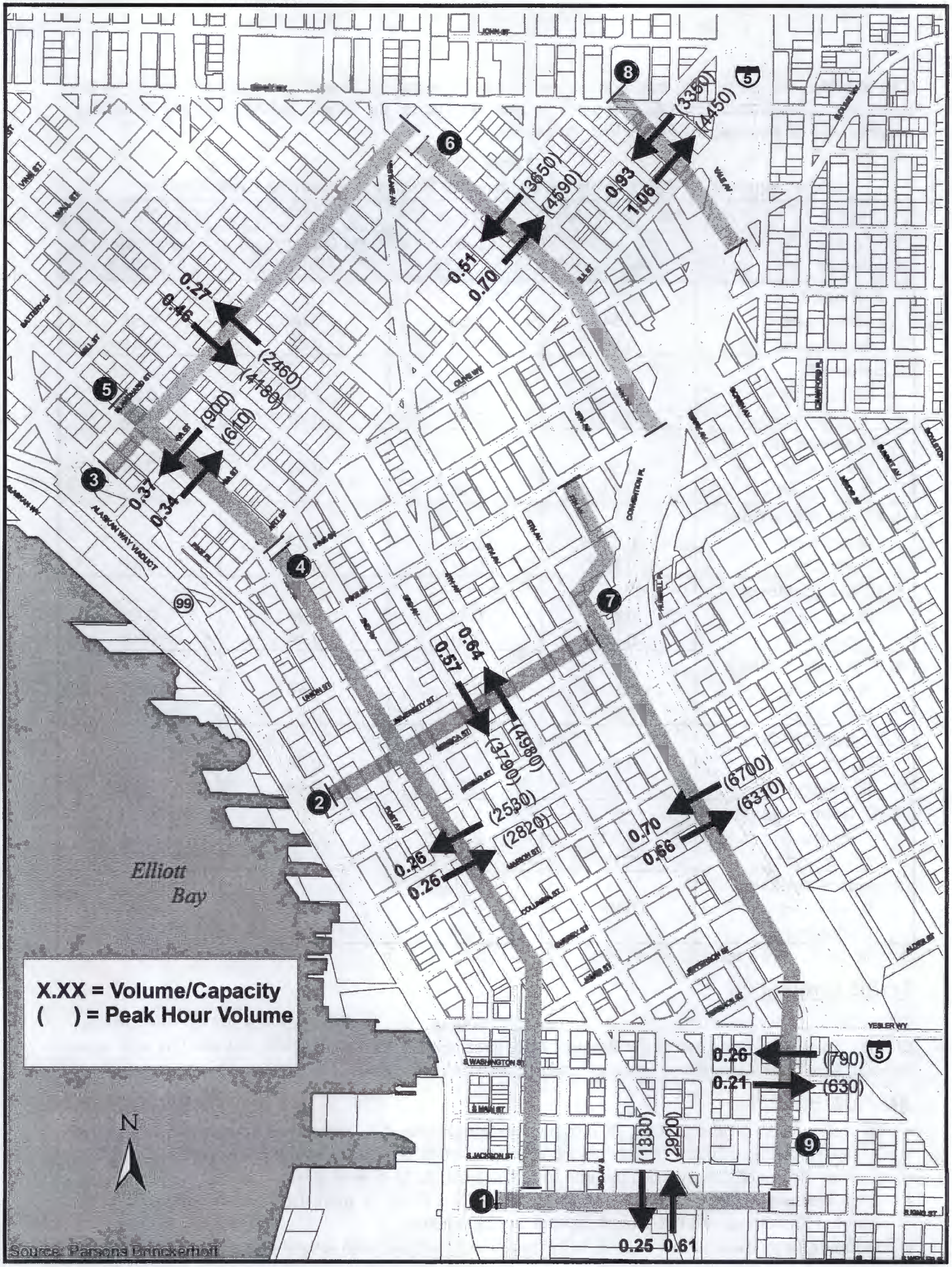
Source: SPO, Parsons Brinckerhoff, 2002

Traffic Circulation

Tables 54 and 55 show 2020 AM and PM peak hour intersection levels of service and queuing impacts for the alternatives, compared to the Baseline Condition. Figure 40 illustrates the AM and PM peak hour levels of service at intersections in the studied corridors.

AM Peak Hour

- In the studied corridors, 14 of 38 intersections are projected to experience operating conditions at LOS E or worse in 2020, 3 more than the Baseline Condition. Operational levels would decline along Stewart Street and Denny Way, but improve somewhat along Howell Street.
- Five intersections would decrease in level of service by two or more LOS levels compared to the Baseline Condition, and two would improve by that amount.
- **Queuing impacts:** generally similar to the Baseline Condition, with several noted problem areas.



Downtown Height & Density EIS

FIGURE 38
Screenline Volumes and V/C Ratios for Alternative 1
AM Peak Hour

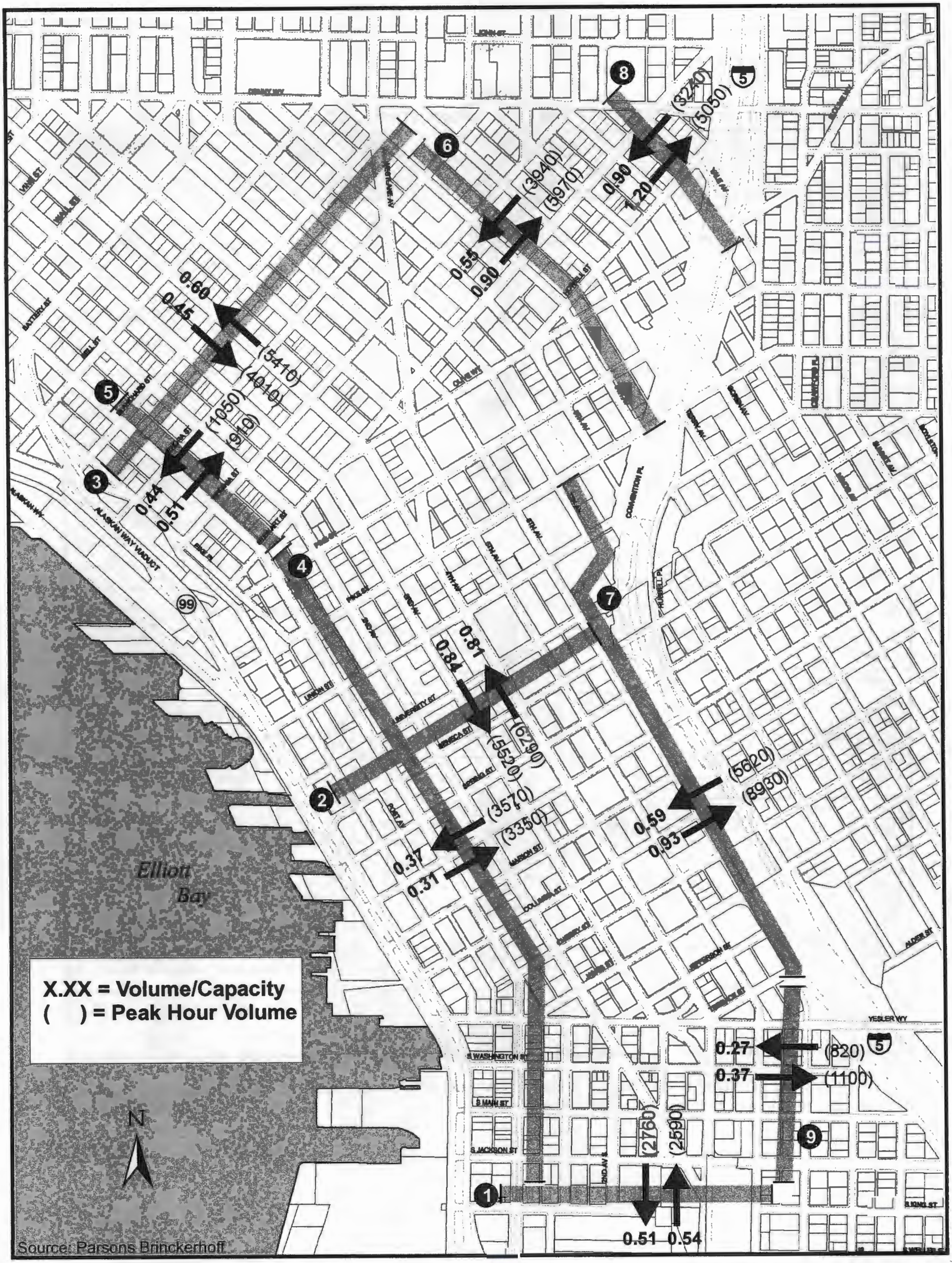


FIGURE 39
Screenline Volumes and V/C Ratios for Alternative 1
PM Peak Hour

Table 54
Comparison of Year 2020 AM Peak Hour Intersection LOS and Queuing Impacts

Intersection	2020 No-Action		2020 Alternative 1		2020 Alternative 2		2020 Alternative 3	
	LOS	*Queuing Impacts**	*LOS*	*Queuing Impacts**	*LOS*	*Queuing Impacts**	*LOS*	*Queuing Impacts**
Stewart & 3rd Ave	B	---	A	---	A	---	B	---
Stewart & 4th Ave	B	NB/WB	B	NB/WB	B	NB	B	NB/WB
Stewart & 5th Ave	F	SB/WB	F	SB/WB	F	SB/WB	F	SB/WB
Stewart & Westlake	B	WB	C	WB	B	WB	B	WB
Stewart & 6th Ave	C	WB	D	WB	D	WB	D	WB
Stewart & 7th Ave	B	SB/WB	E	SB/WB	C	WB	E	SB/WB
Stewart & 8th Ave	A	---	B	---	A	---	B	WB
Stewart & 9th Ave	A	---	A	---	A	---	B	---
Stewart & Terry	B	WB	B	WB	B	WB	B	WB
Stewart & Boren	D	SB/WB	F	SB/WB	D	SB/WB	E	SB/WB
Stewart & Minor	B	---	B	---	B	---	B	WB
Howell & Yale	F	SB/EB/WB	C	SB/WB	D	SB/WB	C	SB/WB
Howell & Minor	C	WB	C	WB	D	WB	B	WB
Howell & Boren	E	NB/EB/WB	D	NB/EB/WB	D	NB/EB/WB	F	NB/EB/WB
Howell & Terry	B	---	B	---	B	---	D	---
Howell & 9th Ave	D	---	C	---	D	---	C	---
Howell & 8th/Olive	C	EB	D	EB	B	---	A	---
Olive & Melrose	F	EB/NB	F	EB/NB	B	EB	F	EB/NB
Olive & Boren	F	EB/NB	E	EB/NB	C	EB	C	EB/NB
Olive & Terry	E	EB	E	EB	F	EB	C	EB
Olive & 9th Ave	D	EB	F	EB	C	EB	B	---
Olive & 7th Ave	C	---	C	---	B	---	B	---
Olive & 6th Ave	B	---	B	---	D	NB	B	---
Olive & 5th/Westlake	C	SB	C	SB	C	SB	D	SB
Olive & 4th Ave	B	---	B	---	B	---	B	---
Denny & Stewart	F	EB/WB/SW	F	EB/WB/SW	F	EB/WB/SW	F	EB/WB/SW
Denny & Fairview	F	EB/WB/NB	F	EB/WB/NB	F	EB/WB/NB	F	EB/WB/NB
Denny & Westlake	D	EB	B	EB	B	---	B	EB
Denny & 9th Ave	F	EB/SB	F	EB/SB	B	SB	B	EB/SB
Denny & Dexter	F	EB	F	EB	F	EB/WB	F	EB
Denny & Aurora NB	C	EB/WB	C	EB/WB	E	EB/WB	C	EB/WB
Denny & Aurora SB	B	EB/WB/SB	B	EB/WB/SB	B	EB/WB/SB	B	EB/WB/SB
Denny & 6th Ave	C	EB/WB/NB	D	EB/WB/NB	D	EB/WB/NB	B	EB/NB
Denny & Taylor	C	EB	F	EB	F	EB	B	---
Denny & 5th Ave	C	EB	C	EB	D	EB	A	EB
Denny & 4th Ave	B	EB	E	EB	D	EB	B	EB
Denny & Broad	C	EB	D	EB/WB	E	EB/WB	C	WB

Source: Parsons Brinckerhoff, 2002

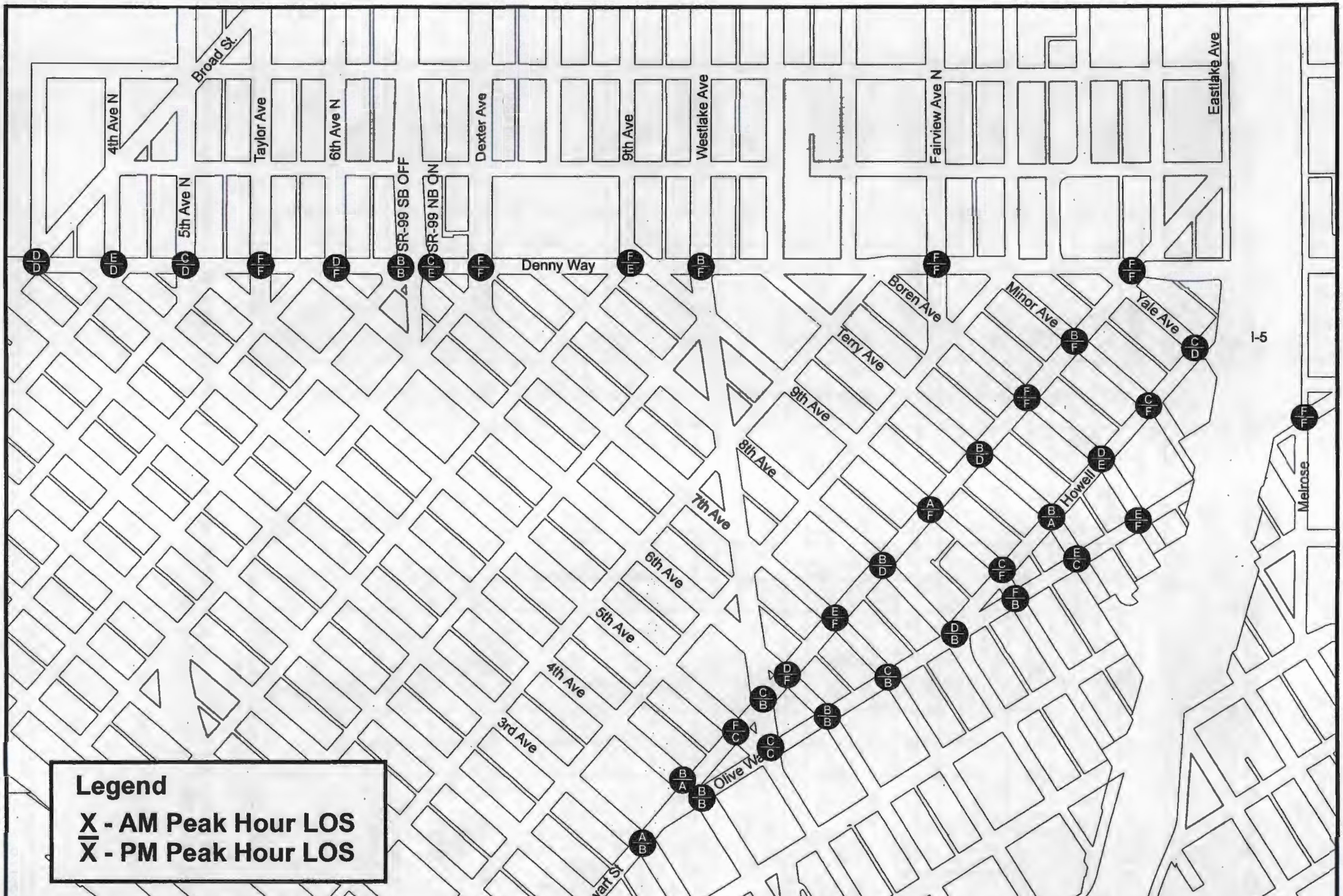
* Direction(s) indicated are for those approaches where queues from the specified intersection are expected to back up and affect operations at adjacent intersections.

Table 55
Comparison of Year 2020 PM Peak Hour Intersection LOS and Queuing Impacts

Intersection	2020 No-Action		2020 Alternative 1		2020 Alternative 2		2020 Alternative 3	
	LOS	Queuing Impacts*	LOS	Queuing Impacts*	LOS	Queuing Impacts*	LOS	Queuing Impacts*
Stewart & 3rd Ave	B	---	B	---	B	---	B	---
Stewart & 4th Ave	A	NB/WB	A	NB	A	NB/WB	A	NB/WB
Stewart & 5th Ave	C	SB/WB	C	SB/WB	C	SB/WB	C	SB/WB
Stewart & Westlake	B	---	B	---	B	---	B	---
Stewart & 6th Ave	C	WB	F	WB	D	WB	C	WB
Stewart & 7th Ave	F	SB/WB	F	SB/WB	E	SB	F	SB/WB
Stewart & 8th Ave	B	---	D	WB	B	---	B	---
Stewart & 9th Ave	F	SB/WB	F	SB/WB	F	SB/WB	F	SB/WB
Stewart & Terry	A	---	D	WB	B	---	B	---
Stewart & Boren	F	SB/WB	F	SB/WB	F	SB/WB	F	SB/WB
Stewart & Minor	F	SB/WB	F	---	E	SB/WB	F	SB/WB
Stewart & Yale	F	SB/WB	F	SB/WB	F	SB/WB	F	SB/WB
Howell & Yale	C	SB/EB	D	SB/EB	D	SB/EB	C	SB/EB
Howell & Minor	F	SB/WB	F	SB/WB	F	SB/WB	F	NB/SB/WB
Howell & Boren	E	---	E	NB/SB/EB	E	NB/SB/EB	E	NB/SB/EB
Howell & Terry	A	---	A	---	A	---	A	---
Howell & 9th Ave	F	SB	F	---	F	SB	F	SB
Howell & 8th/Olive	B	EB	B	---	B	---	D	EB/NB
Olive & Melrose	F	EB/NB	F	EB/NB	F	EB/NB	F	EB/NB
Olive & Boren	F	EB/NB/SB	F	EB/NB/SB	F	EB/NB/SB	F	EB/NB/SB
Olive & Terry	D	EB	C	EB	C	EB	E	EB
Olive & 9th Ave	C	EB/SB	B	EB	B	---	D	EB/SB
Olive & 7th Ave	D	SB	B	---	C	SB	F	EB/SB
Olive & 6th Ave	B	NB	B	NB	B	NB	F	EB/NB
Olive & 5th/Westlake	D	EB/SB	C	SB	C	SB	C	SB
Olive & 4th Ave	B	---	B	---	B	---	B	---
Denny & Stewart	F	EB/WB/SW	F	EB/WB/SW	F	EB/SW	F	EB/WB/SW
Denny & Fairview	D	EB/WB/NB	F	EB/WB/NB	F	EB/WB/NB	F	EB/WB/NB
Denny & Westlake	B	EB/NB	F	EB/NB	F	EB/NB	F	EB/NB
Denny & 9th Ave	B	EB/SB	E	EB/SB	C	EB/SB	D	EB/SB
Denny & Dexter	F	EB/WB/NB	F	EB/WB/NB	F	EB/WB/NB	F	EB/NB
Denny & Aurora NB	F	EB/WB/NB	E	EB/WB/NB	F	EB/WB/NB	F	EB/WB/NB
Denny & Aurora SB	B	EB/WB/SB	B	EB/WB/SB	B	EB/WB/SB	B	EB/WB/SB
Denny & 6th Ave	F	EB/NB	F	EB/NB	F	EB/NB	F	EB/NB
Denny & Taylor	D	EB	F	EB	D	EB	D	EB
Denny & 5th Ave	E	EB/WB	D	EB/NB	E	EB/NB	E	EB/WB/NB
Denny & 4th Ave	F	EB	D	EB	F	EB	F	EB
Denny & Broad	F	EB/WB/NE	D	EB/WB	F	EB/WB/NE	F	EB/WB/NE

Source: Parsons Brinckerhoff, 2002

* Direction(s) indicated are for those approaches where queues from the specified intersection are expected to back up and affect operations at adjacent intersections.



Source: Parsons Brinckerhoff

FIGURE 40
Year 2020 Peak Hour Intersection LOS for Alternative 1

PM Peak Hour

- In the studied corridors, 19 of 38 intersections are projected to experience operating conditions at LOS E or worse in 2020, 2 more than the Baseline Condition. Operational levels would decline along Stewart Street and Denny Way.
- Seven intersections would decrease in level of service by two or more LOS levels compared to the Baseline Condition.
- **Queuing impacts:** generally similar to the Baseline Condition, with several noted problem areas. Additional queuing impacts predicted at two locations westbound on Stewart Street (at 8th and at Terry), and in multiple directions at Boren Avenue/Howell Street. Queuing impacts appear to lessen on Olive Way eastbound, compared to the Baseline Condition.

Table 56 further summarizes intersection performance of the alternatives in the PM peak hour.

Table 56
Intersection Performance Summary for 2020 PM Peak Hour (Without Mitigation)

	Number of Intersections Operating at LOS E or F				
	Existing Conditions	2020 Baseline	Alt. 1	Alt. 2	Alt. 3
Stewart St.	1 of 12	5 of 12	6 of 12	5 of 12	5 of 12
Olive/Howell	2 of 14	5 of 14	5 of 14	5 of 14	8 of 14
Denny Way	2 of 12	7 of 12	8 of 12	9 of 12	9 of 12
Totals	5 of 38	17 of 38	19 of 38	19 of 38	22 of 38

Source: SPO, 2002

Travel Time

Table 57 summarizes the PM peak hour corridor travel times by alternative (see Table 22 in Appendix N for AM peak hour travel times).

Table 57
Comparison of Corridor Travel Time Summaries by Alternative—PM Peak Hour

	No Action	Alternative 1		Alternative 2		Alternative 3	
	Time (minutes)	Time (minutes)	% Change from No Action	Time (minutes)	% Change from No Action	Time (minutes)	% Change from No Action
Denny Way Eastbound	19.7	16.6	-16%	14.4	-27%	24.5	24%
Denny Way Westbound	10.6	10.4	-2%	10.1	-5%	10.3	-3%
Olive Way Eastbound	5.3	4.0	-24%	3.5	-34%	6.4	23%
Stewart Street Westbound	11.9	17.8	50%	11.3	-5%	15.0	26%

Source: Parsons Brinckerhoff, 2002

Transit Service

North of Seneca Street Screenline. For the AM and PM peak hour, Alternative 1's v/c ratios are similar to the Baseline Condition, indicating no substantial differences in transit service impacts.

Olive/Stewart Corridors. Under Alternative 1, the cumulative amount of travel time spent by transit vehicles in the Olive and Stewart corridors would increase by approximately 10% in the AM peak hour and 24% in the PM peak hour, compared to the Baseline Condition. The sum of delay in both peak hours

(300 additional minutes) would represent an approximately 17% increase in transit travel time compared to the Baseline Condition.

Denny Way Screenline. Under Alternative 1, the cumulative additional delay for transit routes crossing the Denny Way screenline would be relatively similar to the Baseline Condition for both AM and PM peak hours, summing to an overall 2% improvement under Alternative 1. Aurora, Dexter, Fairview and 5^{th} Avenues would experience relatively high amounts of delay.

Transit Layover

Alternative 1 would concentrate the projected future employment and housing growth into fewer overall properties than the other alternatives. Alternative 4, the Baseline Condition, would result in the greatest spread of future development across more properties than the other alternatives. Overall, with only 5 existing layover locations potentially displaced (compared to 10 in the 2020 Baseline), Alternative 1's impact on transit layover locations can be categorized as slightly less than the Baseline Condition.

Alternative 2 – Concentrated Office Core

Travel Characteristics

Table 53 earlier in this section shows the difference between Alternative 2 and the 2020 Baseline Condition for the PM peak hour at the nine screenlines. At Screenline 8, eastbound PM peak hour traffic under Alternative 2 is predicted to be approximately 1.3% greater than predicted for the Baseline Condition. This additional traffic could be related to slightly greater concentration of future development in the Denny Triangle vicinity under Alternative 2 than for the No Action Alternative. With this additional traffic, the predicted v/c ratio at Screenline 8 for eastbound traffic would reach 1.13, nearly the same as the Baseline Condition and less than Alternative 1 (refer to Table 53). This would be less than the 1.20 threshold defined as the City's maximum arterial level of service standard. Other screenlines anticipated to experience v/c ratios of 0.80 or higher for one or both travel directions include Screenlines 2, 6 and 7, in a manner similar to the Baseline Condition (refer to Table 53). Figures 41 and 42 illustrate the anticipated AM and PM peak hour volumes and v/c ratios across the studied screenlines.

Traffic Circulation

Tables 54 and 55 above show 2020 AM and PM peak hour intersection levels of service and queuing impacts for the alternatives, compared to the Baseline Condition. Figure 43 illustrates the AM and PM peak hour levels of service at intersections in the studied corridors for Alternative 2.

AM Peak Hour

- In the studied corridors, 9 of 38 intersections are projected to experience operating conditions at LOS E or worse in 2020, 2 less than the Baseline Condition. Operational levels would decline along Denny Way, but improve along Olive Way and Howell Street.
- Five intersections would decrease in level of service by two or more LOS levels compared to the Baseline Condition, and five would improve by that amount. Four of these declining intersections would be along Denny Way.
- **Queuing impacts:** Queuing impacts would be somewhat less than for the 2020 Baseline Condition, with some improvement along Stewart, Howell, Olive Way, and eastbound Denny Way (refer to Table 54). Some degradation would occur for westbound Denny Way.

PM Peak Hour

- In the studied corridors, 19 of 38 intersections are projected to experience operating conditions at LOS E or worse in 2020, 2 more than the Baseline Condition. Operational levels would decline along Denny Way and Stewart Street.

FIGURE 41
Screenline Volumes and V/C Ratios for Alternative 2
AM Peak Hour

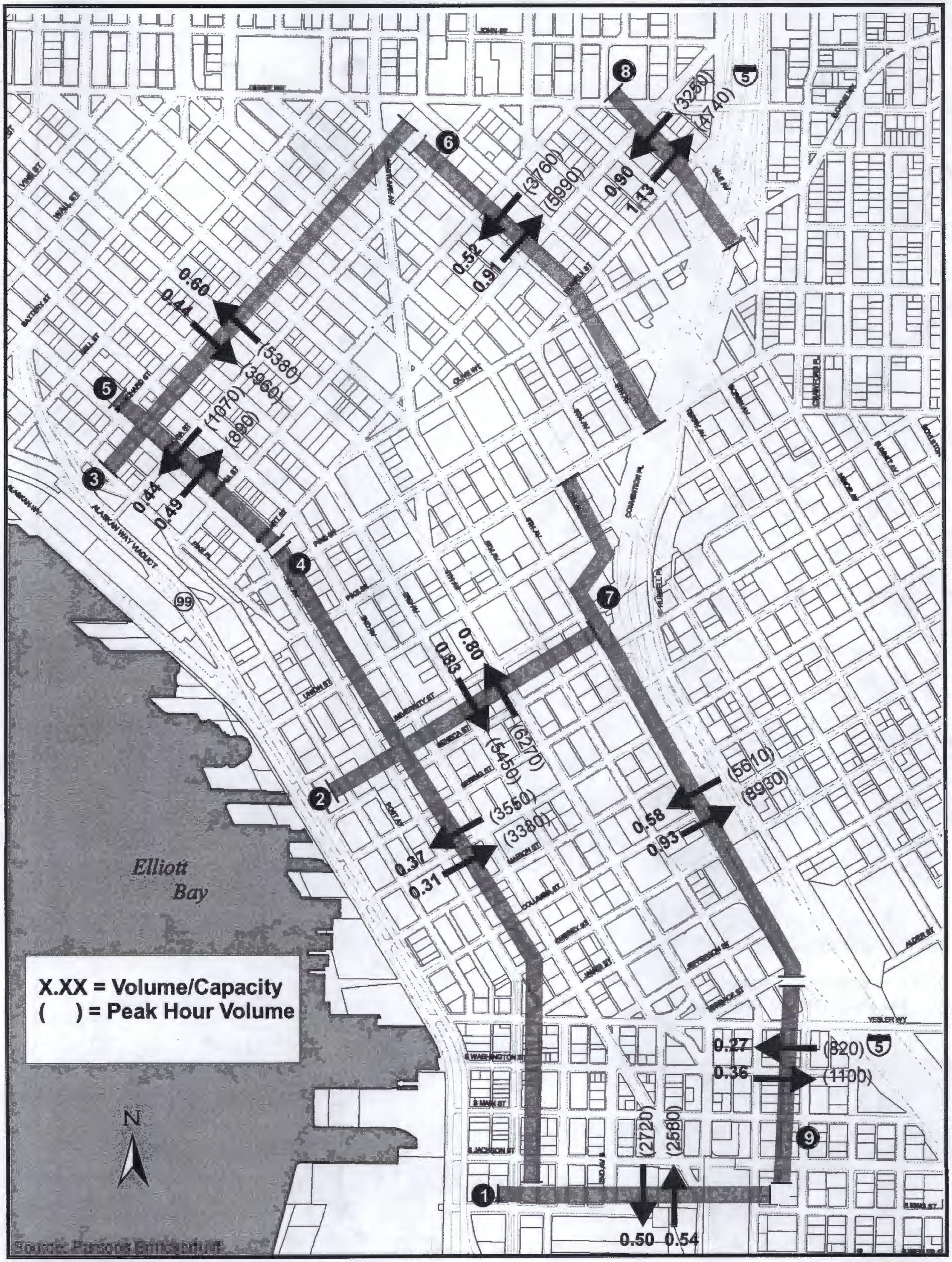
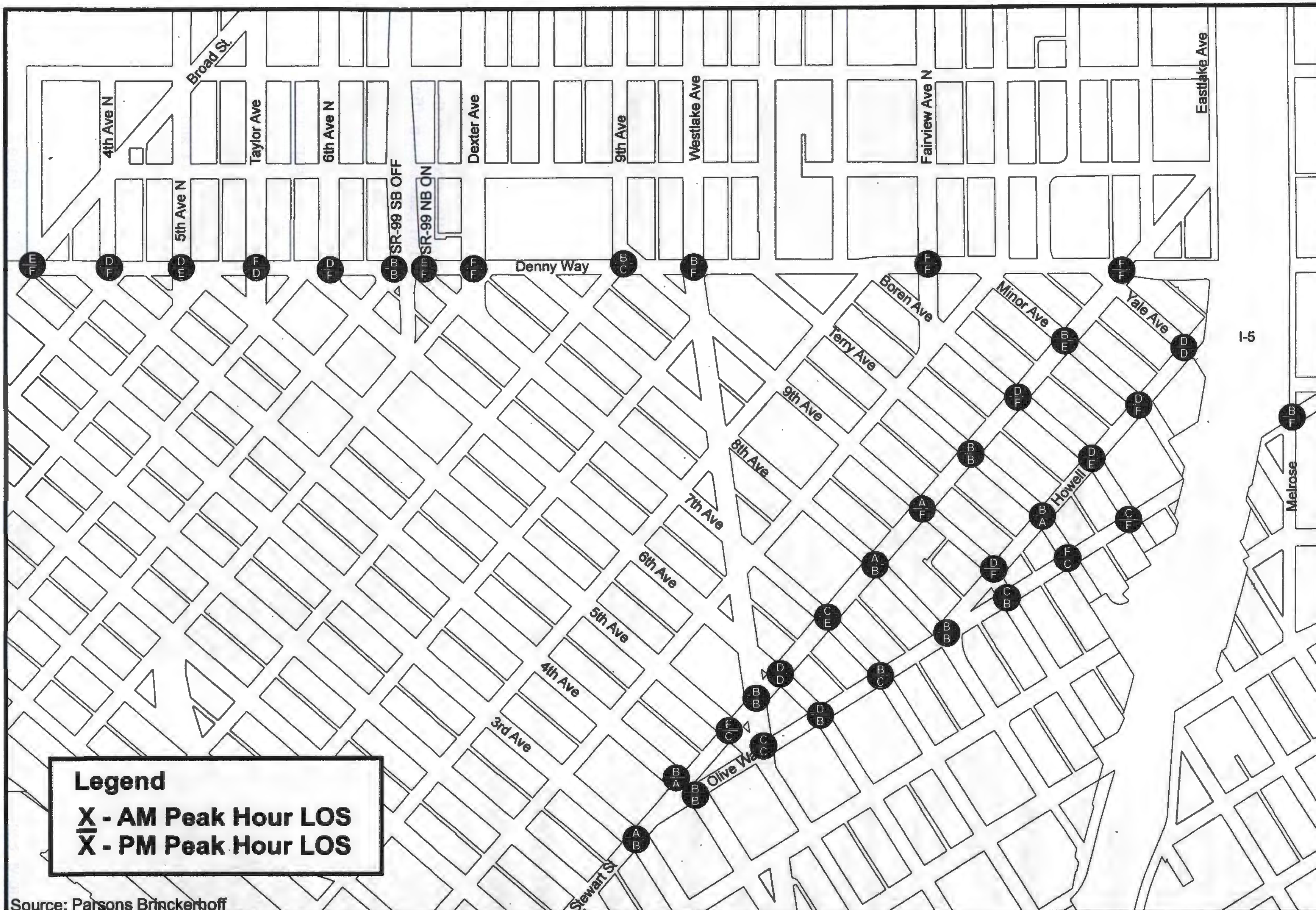


FIGURE 42
Screenline Volumes and V/C Ratios for Alternative 2
PM Peak Hour



Seattle Height & Density EIS

FIGURE 43
Year 2020 Peak Hour Intersection LOS for Alternative 2

- Two intersections would worsen in level of service by two or more LOS levels compared to the Baseline Condition.
- **Queuing impacts:** generally similar to the Baseline Condition, with several noted problem areas (refer to Table 55). There would be fewer queuing impacts on Olive Way than the Baseline Condition or Alternative 1.

Travel Time

Refer to Table 57 earlier in this section for a comparison of corridor travel times.

Transit Service

North of Seneca Street Screenline. For the AM and PM peak hour, Alternative 2's v/c ratios are similar to the Baseline Condition, indicating no substantial differences in transit service impacts.

Olive/Stewart Corridors. Under Alternative 2, the cumulative amount of travel time spent by transit vehicles in the Olive and Stewart corridors would improve by approximately 1% in the AM peak hour and 15% in the PM peak hour, compared to the Baseline Condition. The sum of delay in both peak hours (149 fewer minutes) would represent an approximately 9% improvement in transit travel time compared to the Baseline Condition.

Denny Way Screenline. Transit delay for routes across the Denny Way Screenline would be notably greater than the Baseline Condition for both AM and PM peak hours, summing to an overall 21% greater level of delay under Alternative 2. Aurora, Dexter, Fairview and 5th Avenues would experience relatively high amounts of delay.

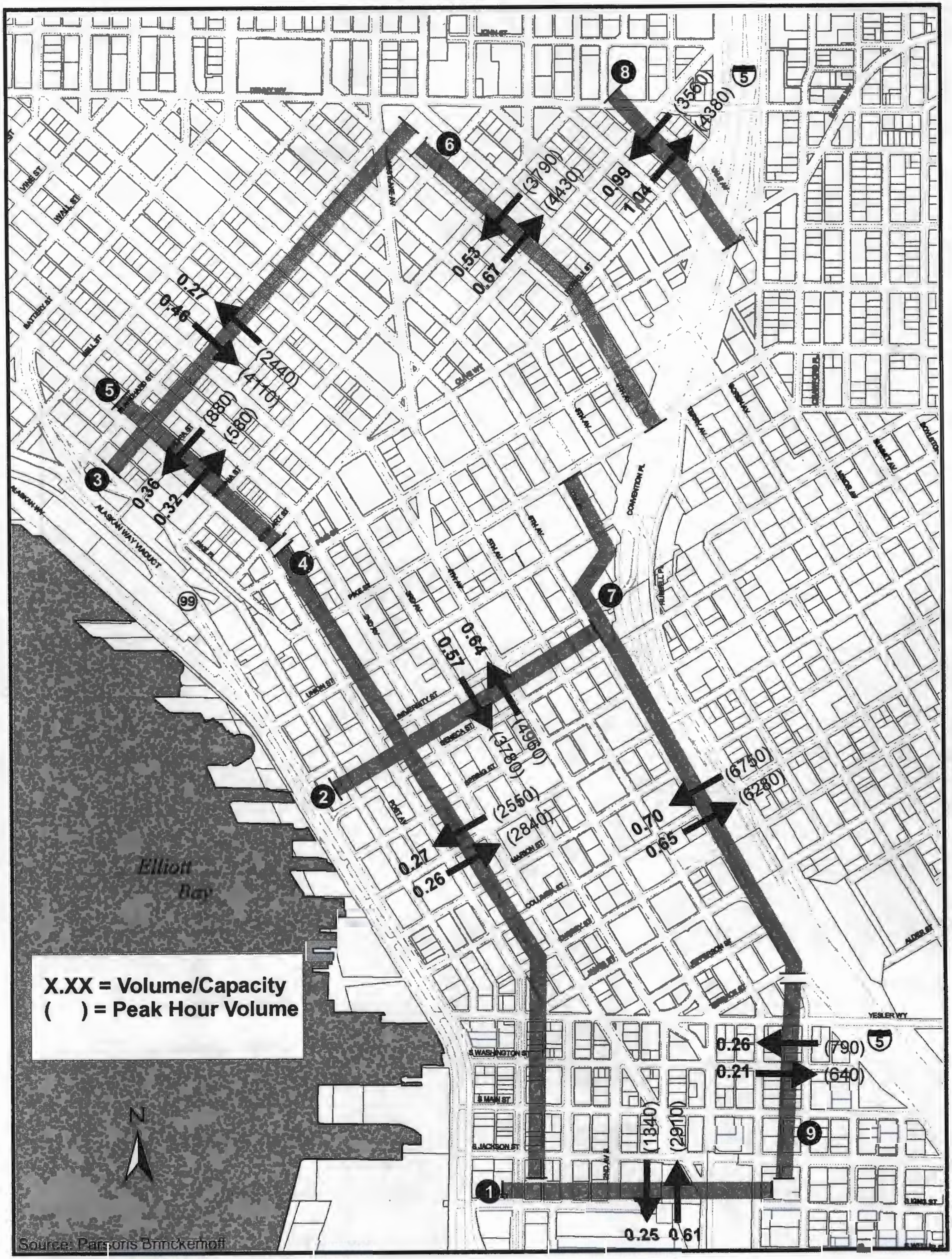
Transit Layover

Alternative 2 would concentrate the projected future employment and housing growth into fewer overall properties than Alternatives 3 or 4. Alternative 4, the Baseline Condition, would result in the greatest spread of future development across more properties than the other alternatives. Overall, Alternative 2's impact on transit layover locations can be categorized as slightly less than the Baseline Condition.

Alternative 3 – Residential Emphasis

Travel Characteristics

Table 53 earlier in this section shows the difference between Alternative 3 and the 2020 Baseline Condition for the PM peak hour at the nine screenlines, in terms of volumes, percent difference from the Baseline Condition, and volume-to-capacity (v/c) ratio. At Screenline 8, westbound PM peak hour traffic under Alternative 3 is predicted to be approximately 9.5% greater than predicted for the Baseline Condition. This is probably due to the higher amount of residential use in the Denny Triangle vicinity under Alternative 3. With this additional traffic, the predicted v/c ratio at Screenline 8 for westbound traffic would reach 1.02 (refer to Table 53). This would be approximately 10% greater than the westbound v/c ratio for the other alternatives in this location. Other screenlines anticipated to experience v/c ratios of 0.80 or higher for one or both travel directions include Screenlines 2, 6 and 7, in a manner similar to the Baseline Condition (refer to Table 53). Another finding particular to Alternative 3 is a projected 8.8% increase over the Baseline Condition in westbound PM peak hour traffic at Screenline 5 (just east of 1st Avenue in Belltown). This might relate to traffic generated by projected employment and residential development in the 1st Avenue/Western Avenue and Belltown vicinities. Figures 44 and 45 illustrate the anticipated AM and PM peak hour volumes and v/c ratios across the studied screenlines.



Downtown Height & Density EIS

FIGURE 44
Screenline Volumes and V/C Ratios for Alternative 3
AM Peak Hour

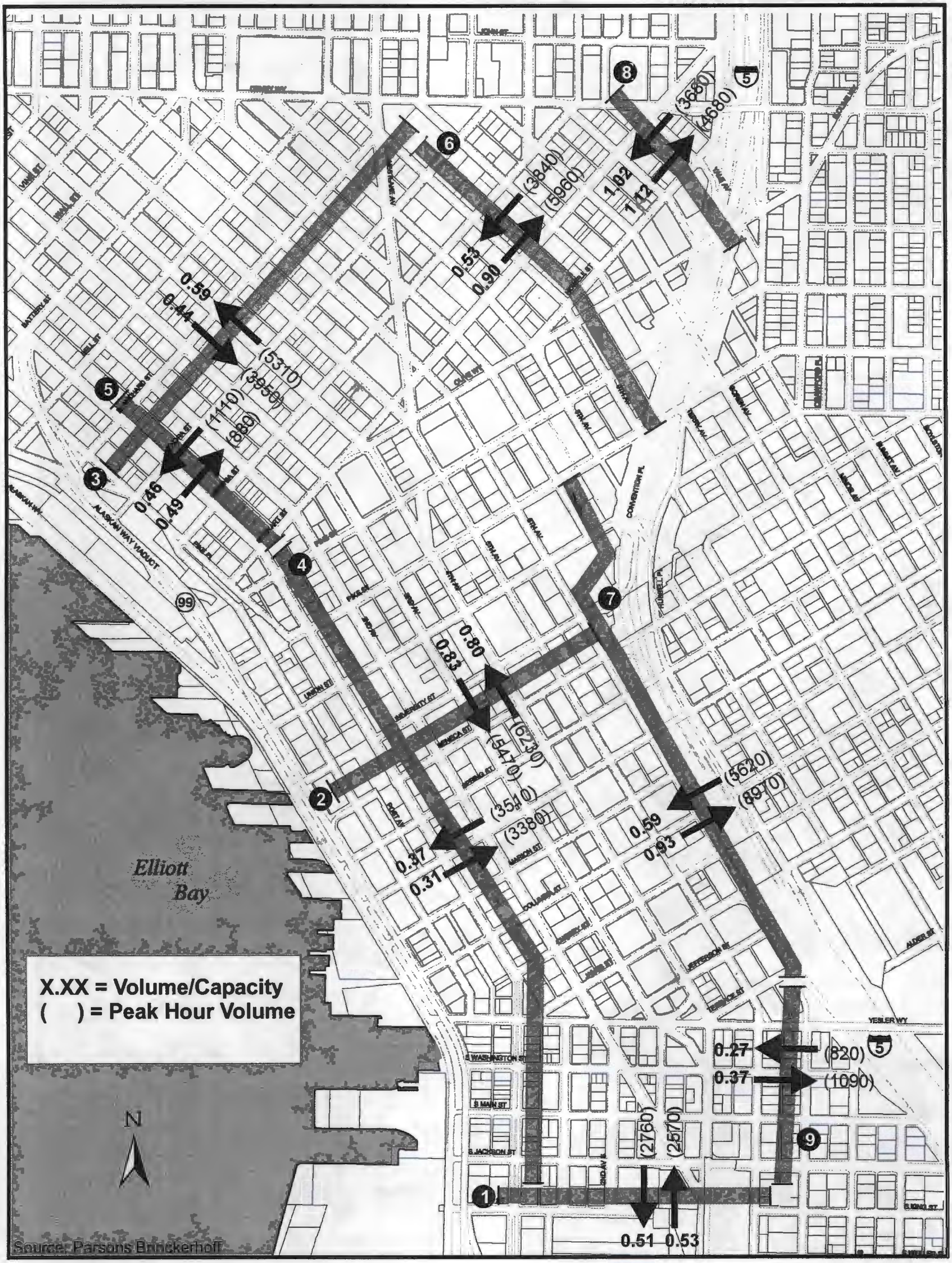


FIGURE 45
Screenline Volumes and V/C Ratios for Alternative 3
PM Peak Hour

Traffic Circulation

Tables 54 and 55 earlier in this section show 2020 AM and PM peak hour intersection levels of service and queuing impacts for the alternatives, compared to the Baseline Condition. Figure 46 illustrates the AM and PM peak hour levels of service at intersections in the studied corridors.

AM Peak Hour

- In the studied corridors, 9 of 38 intersections are projected to experience operating conditions at LOS E or worse in 2020, two fewer than the Baseline Condition. Operational levels would decline along Stewart Street, but improve somewhat along Denny Way, Olive Way and Howell Street compared to the Baseline Condition.
- Two intersections would decrease in level of service by two or more LOS levels compared to the Baseline Condition, and eight intersections would improve by that amount.
- **Queuing impacts:** generally similar to the Baseline Condition, with several noted problem areas (refer to Table 54). However, conditions would be slightly worse along Stewart Street and improve somewhat along Denny Way, Olive Way and Howell Street.

PM Peak Hour

- In the studied corridors, 22 of 38 intersections are projected to experience operating conditions at LOS E or worse in 2020, 5 more than the Baseline Condition. Operational levels would decline along Olive Way and Denny Way.
- Six intersections would decrease in level of service by two or more LOS levels compared to the Baseline Condition, and none would improve by that amount.
- **Queuing impacts:** generally similar to the Baseline Condition, with several noted problem areas (refer to Table 55). Queuing impacts appear to slightly increase along Stewart Street, and lessen on Olive Way, Howell Street and Denny Way compared to the Baseline Condition.

Travel Time

Refer to Table 57 earlier in this section for a comparison of corridor travel times.

Transit Service

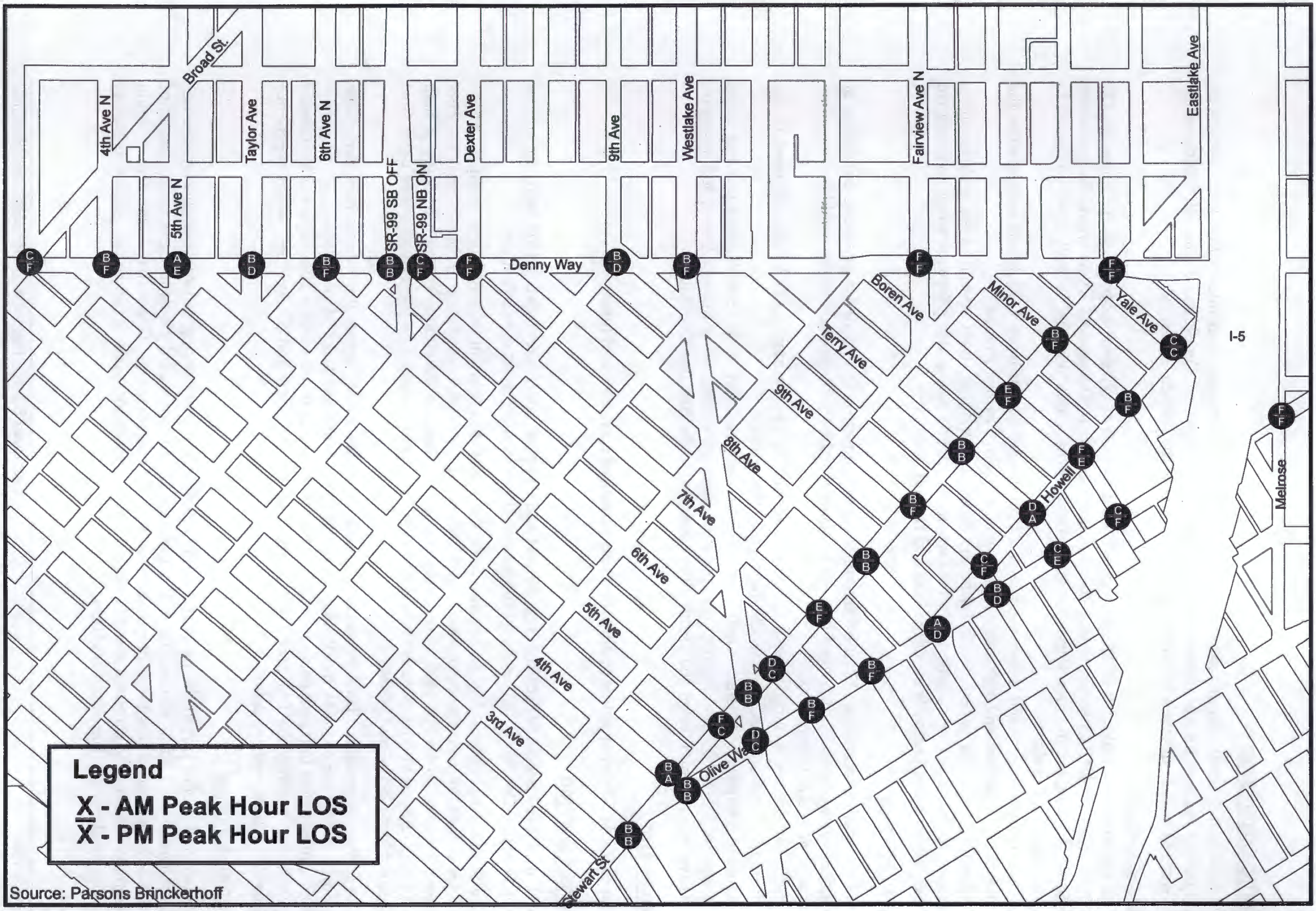
North of Seneca Street Screenline. For the AM and PM peak hour, Alternative 3's v/c ratios are similar to the Baseline Condition, indicating no substantial differences in transit service impacts.

Olive/Stewart Corridors. Under Alternative 3, the cumulative amount of travel time spent by transit vehicles in the Olive and Stewart corridors would decrease by approximately 4% in the AM peak hour but increase by 25% in the PM peak hour, compared to the Baseline Condition. The sum of delay in both peak hours (204 additional minutes) would represent an approximately 12% increase in transit travel time compared to the Baseline Condition.

Denny Way Screenline. Total cumulative transit delay for routes across the Denny Way Screenline would be nearly the same as the Baseline Condition for both AM and PM peak hours. An 18-minute (28%) improvement in transit delay for the AM peak hour would be offset by a 20-minute (18%) increase in transit delay during the PM peak hour. Aurora, Dexter, Fairview and 5th Avenues would experience relatively high amounts of delay.

Transit Layover

Alternative 3 would spread the projected future employment and housing growth over more properties than Alternatives 1 or 2. Alternative 4, the Baseline Condition, would result in the greatest spread of future development across more properties than the other alternatives. Given that Alternative 3 would potentially displace the same number of existing transit layover locations, it can be categorized as having impacts similar to the Baseline Condition.



Seattle Height & Density EIS

FIGURE 46

Year 2020 Peak Hour Intersection LOS for Alternative 3

Relationship to Transportation Plans and Policies

All of the alternatives studied in this EIS are generally consistent with the objectives of regional and local transportation-related plans and policies, although they are neutral with respect to certain topics such as pedestrian and bicycle travel modes. The concept of accommodating additional employment and residential growth within the Downtown Urban Center (the largest urban center in the region) is generally consistent with growth management objectives. Such a pattern should encourage greater transit use and more efficient investments in transportation improvements, compared to more typical suburbanized growth patterns. With future growth under any alternative, long-term transportation planning needs to promote improvements that will maintain the overall functionality of the system. See Appendix P for description of relevant plans and policies and additional discussion of the relationship of the alternatives.

MITIGATION STRATEGIES

Proposed Mitigation Strategies

With or without zone changes, the study area is likely to experience adverse impacts to travel conditions by 2020 with projected increases in levels of congestion and delay for all vehicles using Downtown streets, compared to today. For most studied locations, the projected traffic volumes for the three land use alternatives would be within 5% percent of the 2020 Baseline Condition. The biggest exception is in the northeast corner of the Denny Triangle (screenline #8) under Alternative 1, which would generate approximately 8% more traffic in the PM peak hour (peak direction) than the 2020 Baseline Condition. Data from other studied screenlines (#2, 6 and 7) indicate that PM peak hour traffic in 2020 will use a large portion of the available road capacity in the Downtown Commercial Core and Denny Triangle.

In order to alleviate future adverse impacts to traffic conditions as identified in this study, a combination of mitigation strategies should be implemented over time. The mix of mitigation strategies should be flexible and responsive to the magnitude and timing of significant adverse impacts experienced (or likely to be experienced) in the future. Because this is a programmatic EIS, the mitigation strategies are discussed at a somewhat generalized level of detail.

Demand Reduction Strategies

TRANSPORTATION DEMAND MANAGEMENT STRATEGIES

Over the past several years, transportation demand management (TDM) strategies have helped reduce the percentage of workers driving alone to Downtown. King County and other government agencies continue to enhance TDM strategies and programs over time. King County's Downtown Seattle Access Project is a federally funded demonstration project that seeks to reduce the single-occupant vehicle (SOV) parking supply and promote alternative transportation modes.

Continuing and strengthening the use of TDM strategies is proposed as a primary mitigation strategy to address projected significant adverse impacts.

- The current method of requiring transportation management plans (TMPs) for new development should be continued and improved as possible.
- The City should seek to include the most advanced and effective TDM strategies in TMPs for new developments.
- The City and other public agencies should continue to promote (and require as possible) greater implementation of TDM strategies, coordinated through worksites. The following TDM strategies should be promoted:
  - ♦ Discounted transit passes (e.g., Flex Pass)

- Promotion of other alternative modes (walking, biking)
- Increased telecommuting
- Business use of vans
- Carsharing
- Preferential parking for carpools/vanpools
- Guaranteed ride home
- Enhanced computerized ridematching database and mapping services
- Parking cashout (discontinuing parking subsidies and providing incentives for alternative modes)
- Enhanced real-time transit information via Internet and on-street kiosks.

- **Residential-oriented TDM programs.** The City should pursue the implementation of residential-oriented TDM programs Downtown to reduce vehicle trip generation by encouraging alternatives to automobile ownership. These programs should explore options such as FlexCar and bus pass incentives.
- **Transportation Management Association (TMA).** The City should promote formation of a TMA by Downtown stakeholders to aid in future TDM planning activities.

REDUCE TRIP GENERATION THROUGH AREA-SPECIFIC REZONES.

The City could pursue area-specific rezones that would govern the size and type of development, and its associated potential to generate trips in particularly congested areas. For example, future development of residential uses might generate fewer overall vehicle trips than office development on the same properties. Specific zoning could be targeted to certain locations where high traffic volumes might otherwise generate significant adverse impacts on traffic operations.

Mitigation Funding Strategies

CREATE A TRANSPORTATION MITIGATION PROGRAM FOR DOWNTOWN OR PORTIONS OF DOWNTOWN.

The City should develop a comprehensive approach to defining transportation mitigation requirements for projects in Downtown or portions of Downtown. The City is studying such an approach in analyses for the University District and South Lake Union neighborhoods. A transportation mitigation program could include defining a set of improvements to address significant adverse impacts, and a mechanism by which new development and redevelopment would contribute a fair share toward transportation system improvements. These improvements could address impacts to all mode choices, including roads, transit facilities, bicycle, pedestrian and ride-sharing programs. A transportation mitigation program could provide more certainty and clarity for Downtown property owners and developers, and greater certainty that significant transportation impacts would be remedied over the long term.

Mobility Strategies

A combination of strategies should be pursued to improve overall mobility of people and vehicles in the study area over the long term. The following discussion provides several possible options for mitigation strategies that could be pursued at the discretion of the decisionmakers.

DEFINE PHYSICAL IMPROVEMENT OPTIONS THAT SHOULD BE PLANNED AND IMPLEMENTED TO ENHANCE THE CAPACITY OF THE TRANSPORTATION NETWORK.

A comprehensive set of physical improvement options or specific improvement projects could be identified, and related to a transportation mitigation program. This could include previously-identified capital improvement projects, new capital improvements and/or changes (such as lane restriping or designation changes) that would make better use of existing rights-of-way. It could also include projects needing additional right-of-way, such as adding travel lanes or turn lanes to streets, and/or pedestrian/bicycle-oriented improvements, transit facilities, and improvements such as grade-separation of selected intersections. Lane modifications could also include changes to better accommodate transit vehicles and reduce transit delay. The following improvement strategies are suggested as options by the transportation consultant:

Options for Stewart Street

- *Restripe Stewart Street between Yale and Sixth Avenue to allow for four 12-foot travel lanes, with no on-street parking during the AM or PM peak periods; or,*
- *Restripe Stewart Street between Yale and Sixth Avenue to allow for four ten-foot travel lanes and (along most segments) an eight-foot parking lane; and/or,*
- *Restripe Stewart Street to accommodate a right-side peak-period transit-only lane.*
- *Construct a grade-separated intersection of Stewart Street with Denny Way.*

  Grade-separating this intersection could provide significant relief to both the Denny Way and Stewart Street corridors. Before serious consideration is given to this measure, a more thorough analysis of its impacts, constructibility and costs would need to be undertaken.
- *Stewart Street configuration adjustments to discourage diversion of I-5 traffic.*

  It has been observed that a significant volume of traffic in the AM peak period exits the express lanes southbound onto Stewart Street and re-enters I-5 southbound at Yale Avenue in order to exit at later Downtown exits or continue south on the mainline. Modifications to the street system to discourage this movement could provide benefits to Stewart Street traffic operations in the AM peak hour. One possible reconfiguration would incorporate a left-turn only lane from Stewart Street onto Denny Way, to alter lane choices made by drivers seeking to turn left from Stewart Street to Yale Avenue.

Options for Olive Way and Howell Street

- *Restripe Olive Way between Fourth and Eighth Avenue to allow for four travel lanes during both the AM and PM peak periods.*
- *Restripe Olive Way to accommodate a right-side peak-period transit-only lane.*
- *Convert westbound contra-flow lane on Howell Street to eastbound direction.*

Options for Denny Way

- *Construct a grade-separated intersection of Stewart Street with Denny Way.*

  Same as discussed above.
- *Locate transit queue jumps at intersections with significant queues.*

  Under all of the alternatives, Fairview Avenue North would experience the longest queues and would likely benefit the most from a signal queue jump for transit vehicles. Other streets crossing Denny Way with significant delays and transit volumes that could also benefit from transit signal queue jumps include Fifth Avenue North, the Aurora Avenue North ramps, and Dexter Avenue North.
- *Potential benefit from restoring street grid over Aurora Avenue north of Denny Way.*

  This type of improvement is being considered as part of the Alaskan Way Viaduct Project. Reconnection of several east/west arterial streets currently severed by Aurora Avenue north of Denny Way would allow for more east/west traffic capacity, and potentially reduce the amount of traffic using Denny Way (particularly in the western portion of the corridor). Although assessment of these impacts to Denny Way is beyond the scope of this study, separate studies analyzing the overall impacts of these improvements are currently underway.

CURB LANE MANAGEMENT

- Truck loading and passenger loading in curb lanes can significantly affect capacity, as can driveway access points. Controls (development standards or conditions) could be placed on future development to require them to locate loading zones in alleys or on side streets, and locate access drives (preferably right-in and right-out only) on side streets rather than key arterials.
- Where loading zones and passenger pick-up/drop-off zones already exist, or are not possible to locate off-street or on a minor street, the City could consider time-of-day restrictions on use of loading zones and pick-up/drop-off zones to avoid peak hour conflicts.

RETIMING TRAFFIC SIGNALS TO OPTIMIZE CORRIDOR TRAFFIC FLOW

Retiming or re-synchronizing signals is a long-term operational strategy best implemented within the context of the entire Downtown street network, and on an ongoing periodic basis as actual changes in traffic volumes and patterns are experienced. More funding would allow more frequent updates to signal timing to better meet changing demands and travel patterns.

FUNDING FOR ADDITIONAL STAFFING OF CITY'S TRAFFIC MANAGEMENT CENTER

With additional funding for more staffing, the City's Traffic Management Center would be able to improve management of Downtown's traffic signal systems. More funding would allow the City to increase staffing and better utilize the capabilities of its traffic management center, including providing quicker signal timing responses to incidents, special events or other fluctuations in day-to-day traffic flows. More staffing would also allow more frequent updates of signal timing and coordination plans. This strategy would benefit traffic conditions throughout the Downtown street network.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

Without mitigation, future development through the year 2020 would generate additional traffic volumes and increase congestion in portions of Downtown, most notably in the Denny Triangle area. Much of this impact would occur with or without zoning changes. However, if Alternative 1 or Alternative 3 is implemented, congestion in the northeastern Denny Triangle could be approximately 5-10 percent worse than under the other alternatives, including the 2020 baseline condition (Alternative 4 - No Action). Under all the alternatives considered, additional congestion will likely increase overall travel times on Denny Way, Stewart Street and Olive Way, including transit travel time. Implementation of mitigation strategies, at the City's discretion, would likely improve overall transportation conditions, so that a portion of the impacts of traffic congestion could be avoided.

PARKING

AFFECTED ENVIRONMENT

The study area for this analysis includes the portion of Downtown Seattle bordered by Denny Way on the north, I-5 on the east, Yesler Way on the south and Alaskan Way on the west, omitting Pioneer Square and the International District. This study generally characterizes the area south of Olive Way as part of the Commercial Core neighborhood, and areas north of Olive Way (and Stewart Street west of 3rd Avenue) as the Denny Triangle and Belltown neighborhoods.

Parking Supply and Utilization

OFF-STREET PARKING SUPPLY

Sources for off-street parking supply information include the 1999 PSRC *Parking Inventory for Seattle and Bellevue,* 2002 PSRC *Parking Inventory for the Central Puget Sound Region,* and supplemental data from the City of Seattle. In 1999, the Downtown EIS study area contained roughly 48,000 off-street parking spaces in 540 lots and garages. The types of spaces were approximately as follows:

- 38,000 spaces, general public paid parking
- 3,200 spaces, residential parking
- 5,600 spaces, employee parking
- 1,000 spaces, short-term free parking

As of 1999, approximately 19,220 parking spaces, or about 40 percent of the total inventory, were located north of Olive Way, while approximately 28,000 parking spaces (60 percent of the total) were located south of Olive Way. An additional 700 parking spaces were located in unspecified newer developments throughout the study area. The data indicate that parking facilities in the commercial core area south of Olive Way tend to be larger than facilities north of Olive Way. However, there are a greater number of off-street facilities (likely smaller surface parking lots) in areas north of Olive Way.

Data in the 2002 *Inventory* suggest that overall parking supply increased by approximately 3,000 parking spaces in the EIS study area since 1999, representing a 4-6% increase to approximately 50,000 total parking spaces. Due to a change in methodology in the 2002 *Inventory,* trends in types of parking since 1999 are not interpreted for the EIS study area.

OFF-STREET PARKING UTILIZATION

Average weekday utilization of off-street parking is available from 1999 PSRC data for the study area as a whole and for areas north and south of Olive Way (see Table 58). Average weekday morning parking utilization for the entire study area in 1999 was approximately 81 percent, and average afternoon parking utilization was approximately 77 percent. The subarea data indicate that off-street parking in areas south of Olive Way were slightly more occupied on average than areas north of Olive Way. This is generally consistent with the greater employment density and commercial activity in the commercial core area. These parking utilization rates indicate that a modest amount of off-street parking capacity is available on an average day, if the user is willing to pay. Parking rates are generally highest in the central part of the commercial core, easing gradually with greater distance to the north and south.

The 2002 PSRC data indicate that occupancy rates have dropped noticeably since 1999. In the entire PSRC Downtown study area, average occupancy dropped about 15% to about 63% in 2002. Only the waterfront vicinity experienced a slight increase in average occupancy. The overall drop in average occupancy could be due to a combination of increased parking supply and the effects of the economic downturn.

Table 58
Average Weekday Off-Street Parking Utilization, 1999

	Max. Capacity (see note)	Average Weekday Utilization			
		Morning (9-11:30 am)		Afternoon (1-3:30 pm)	
Total Study Area	47,230	38,380	*81%*	36,450	*77%*
N/of Stewart/Olive	19,220	15,090	*79%*	14,545	*76%*
S/of Stewart/Olive	28,010	23,290	*83%*	21,905	*78%*

Source: PSRC data compiled by Parsons Brinckerhoff.

Note: The maximum capacity for the total study area (47,230) does not include 700 parking spaces at new developments. Utilization data was not available for parking at these new developments.

Historical Trends in Parking Utilization, Supply, and Price

The PSRC's inventories of off-street parking in Downtown Seattle include a count of total parking stalls, occupancy and cost. Table 59 below summarizes the 1999 parking information for Downtown Seattle.

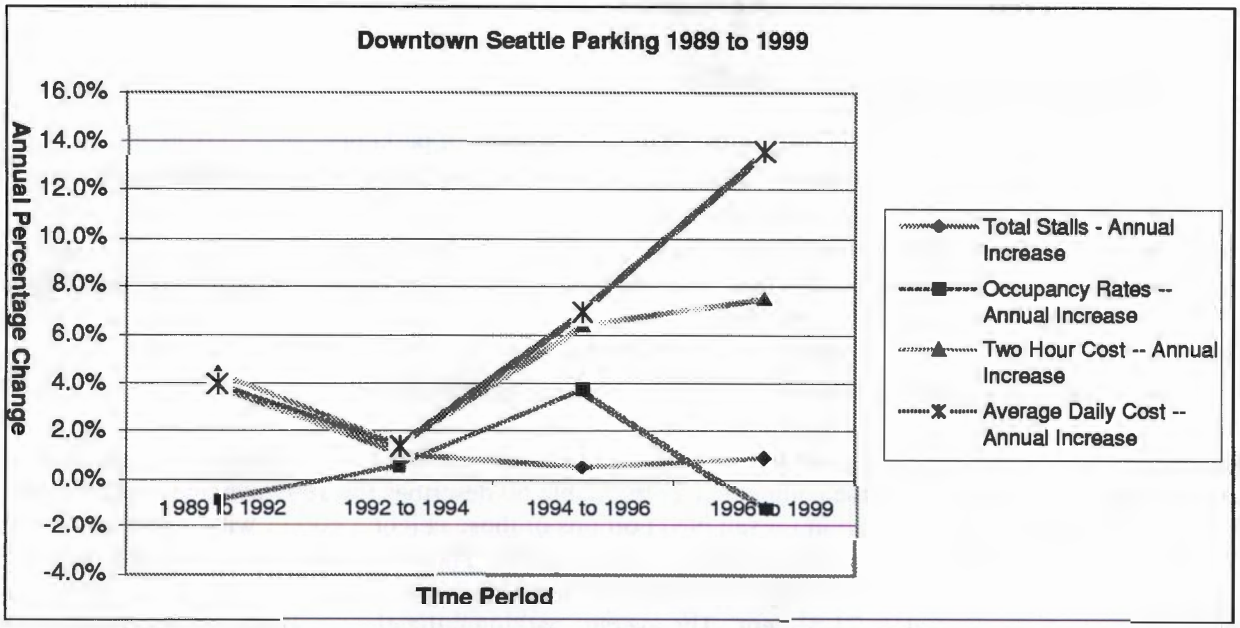
The relationships between parking supply, demand (represented as occupancy) and cost are complex. As shown in Table 59, from 1989 to 1999, the cost of parking increased faster than the demand or supply of parking changed. Between 1989 and 1999, parking supply increased by an annual average of 1.8%. During this same time period, the average daily cost increased by an annual average of 6.8%. The demand, expressed as occupancy, has at times increased, and at other times decreased. It decreased between 1989 and 1992, possibly because of an increase in parking supply during this same period of more than 5,000 spaces. As shown in Figure 47, occupancy decreased between 1996 and 1999. During this period the cost of daily parking jumped considerably, while the supply of parking increased only modestly. Parking supply increased by only about 900 spaces, but the daily cost of parking increased by about $4.50, or over 13 percent. This suggests that between 1996 and 1999, the demand for parking decreased partially because it became too expensive for some to park.

As of 2002, total stalls in PSRC's Downtown study area (including Pioneer Square and the International District) increased to approximately 58,538 stalls, representing a slightly higher rate of growth in parking supply than in past years. Between 1999 and 2002, the average cost for two-hour parking rose about 5% annually to $7.20, mirroring the past trend. However, the average cost for daily parking remained nearly unchanged for the past three years, at $14.52. Over time, market forces will continue to influence the supply of parking, the demand for it, and the cost. More detailed information about parking inventories can be found at the PSRC website, (www.psrc.org).

Table 59
Summary of Parking in Downtown Seattle, 1989–1999

Parking Data	1989	1992	1994	1996	1999	Avg. Annual % Change
Total Stalls	45,389	50,863	52,596	53,164	54,063	
Total Stalls -- Annual Percent Change	--	3.9%	1.1%	0.5%	0.9%	1.8%
Occupancy Rates	75.4%	73.3%	74.6%	80.3%	78.2%	
Occupancy Rates -- Annual Percent Change	--	-0.9%	0.6%	3.7%	-1.3%	0.4%
Two Hour Cost	$3.76	$4.28	$4.41	$4.99	$6.20	
Two Hour Cost -- Annual Percent Change	--	4.4%	1.5%	6.4%	7.5%	5.1%
Average Daily Cost	$7.45	$8.37	$8.60	$9.83	$14.39	
Average Daily Cost -- Annual Percent Change	--	4.0%	1.4%	6.9%	13.6%	6.8%

Figure 47
Summary of Parking Changes in Downtown Seattle, 1989–1999



On-Street Parking Supply

Although much of the Downtown study area's on-street parking supply primarily consists of parallel curb parking controlled by parking meters, the different subareas have different mixes of on-street parking resources, as described below.

<u>Commercial Core (south of Olive Way)</u>
Office core and retail core vicinity

- Metered parallel parking typically present on east-west streets, but more limited on portions of the north-south avenues such as 3rd, 4th, 5th and 1st Avenues. Typical metering is 2-hours, with some meters 30-minutes or less.

- Commercial vehicle parking zones and pickup/drop-off zones
- Selected areas reserved for government vehicles near public facilities
- Limited carpool parking on some blocks, primarily in peripheral areas
- Curb parking frequently interrupted by bus stop zones and curb cuts

Western Avenue vicinity

- Metered parallel parking in a majority of locations, 2-hour and short-term
- Metered angle parking beneath adjacent Alaskan Way Viaduct
- Commercial vehicle parking zones and pickup/drop-off zones

Belltown

- Metered parallel parking in majority of area, majority with 2-hour term

Denny Triangle (north of Olive Way)

- Metered parallel parking in majority of area, majority with 2-hour term
- Limited number of streets with no curb parking
- Limited carpool parking on a few blocks, primarily in northern vicinity
- Angled parking available in some non-arterial blocks
- Free short-term curb parking available
- Curb parking occasionally interrupted by bus stop zones and curb cuts
- Bus layover zones defined in a few blocks

Nearby Areas Outside Denny Triangle

South Lake Union vicinity

- Other than Denny and Valley, most streets offer plenty of parking
- Most parking is free parallel parking with a time limit of 2 hours or no time limit at all.
- Metered parking is mainly limited to 2 hours.
- In the Seattle Times area, metered parking is limited to 15 minutes.
- In the Denny/Harrison/Westlake area, there is a mix of angled parking with parallel, with a couple of blocks limiting parking to 4 hours
- Commercial vehicle parking zones and pickup/drop-off zones
- Curb parking is frequently interrupted by bus stop zones and curb cuts

On-street parking utilization data from 1999 are available for portions of the Belltown and Denny Triangle neighborhoods, but not the commercial core. Table 60 describes the 1999 average weekday and peak hour on-street parking utilization for sampled portions of those neighborhoods, with a comparison to the Pike-Pine neighborhood, adjacent and east of Downtown. The 1999 peak hour on-street parking utilization in Belltown was approximately 87 percent, considerably higher than the Denny Triangle's peak hour utilization of approximately 71 percent. The average parking utilization for both neighborhoods was approximately the same at 61-62 percent.[1] In an everyday operational sense, on-street parking is generally perceived to be near capacity when rates reach 80 to 85 percent. The perception of low parking availability at these rates can occur because, while turnover may be relatively high, the available spaces are dispersed infrequently within the entire street network, making them difficult to find. The somewhat lower rate of utilization in the Denny Triangle may reflect the tendency for lower parking utilization in peripheral locations and greater utilization closer to the retail core and commercial core.

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[1] These utilization figures are based on a sample of the on-street parking inventory, including 210 spaces in Denny Triangle and 360 spaces in the Belltown neighborhood.

As a comparison, the Pike-Pine neighborhood adjacent to Downtown had an average utilization of 84 percent and a peak hour utilization of 91 percent in 1999, higher than both of the studied Downtown neighborhoods. This high utilization was likely due to the combination of dense residential use and growing commercial uses in that neighborhood.

Table 60
On-Street Parking Utilization in Selected Neighborhoods, 1999

	On-Street	
Sub-Area	**Average Utilization**	**Peak Hour Utilization**
Denny Triangle	*61%*	*71%*
Belltown	*62%*	*87%*
Pike-Pine	*84%*	*91%*

ource: PSRC and City of Seattle data compiled by Parsons Brinckerhoff.

A considerable amount of on-street parking is available in or near the south end of the study area, serving Pioneer Square, the International District, and the baseball and football stadiums. Within a ten-minute walk of the stadiums (about 5 or 6 blocks largely in the Pioneer Square and International District areas), approximately 1,830 on-street parking spaces are available.[2]

IMPACTS

Alternative 4 – No Action

Future projected growth and redevelopment in the Downtown study area will result in changes to parking supply and demand conditions, with or without any changes to zoning. This discussion first addresses conditions in 2020 for Alternative 4 - the No Action Alternative.

OFF-STREET PARKING

Future residential and employment growth throughout the study area would increase overall demand for parking. Table 61 compares predicted parking supply and demand conditions in 2020 for all of the alternatives. Parking supply estimates in Table 61 assume that minimum parking requirements for commercial uses would be met, and that residential development (which has no minimum parking requirement) would provide 0.63 parking spaces per residential unit[3].

As shown in Table 61, the predicted amount of off-street parking supply provided with future development would be approximately 16,991 spaces, including approximately 12,200 commercial (e.g., office/retail) parking spaces and approximately 4,800 residential spaces. Since the commercial parking calculations are based on minimum requirements, they may be lower than the amount actually provided with future development. The residential parking calculation could also be low, at 0.63 parking spaces per residential unit (based on the most current census data available for vehicle ownership per household in Downtown Seattle). Residential developers could provide more parking. If one parking space per

[2] Source: SR 519 Operational Analysis Team-*SR 519 - Operational Analysis Weekday Event*, May 1998.
[3] The value 0.63 is a low-end estimate based on 1990 census data for auto ownership per household in Downtown Seattle census tracts.

residential unit is provided for all future residential development, the residential parking supply would be approximately 2,800 spaces greater than shown in Table 61.

Table 61 shows parking demands for 2020 under two scenarios: one with "moderate" implementation of TDM measures, and one with more aggressive implementation of TDM measures. The 2020 estimated parking demand with moderate TDM is for approximately 23,837 spaces, while estimated parking demand with more aggressive TDM is for approximately 19,598 spaces. This suggests that future development could generate more parking demand than the minimum supply provided, by approximately 2,600 to 6,850 spaces. However, developers could choose to provide more than the minimum parking, if market conditions warrant.

Future development under Alternative 4 would displace approximately 7,550 existing off-street parking spaces by 2020, of which approximately one-half would be from existing principal-use parking lots/garages and one-half would be from parking that is accessory to other land uses. A large majority of the displaced off-street parking will be concentrated into three areas Downtown (see Figure 48). In Area 1 (between 9th Avenue and 6th Avenue, from Pine Street to Denny Way) approximately 1,900 parking spaces from lots and garages are likely to be displaced by future development. In Area 2 (from Lenora Street to Stewart Street, between 5th Avenue and 1st Avenue), approximately 373 parking spaces from lots or garages are likely to be displaced by future development. In Area 3 (one block between 4th and 5th Avenues, Seneca and Spring Streets), a 700-space parking garage is projected to be displaced by future development.

Table 61
Parking Supply and Demand Changes, by Alternative

2020 PARKING SUPPLY				
	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Parking Spaces Displaced From Principal-Use Parking Lots/Garages	3,481	3,481	3,661	3,775
Other Displaced Parking (accessory to other existing uses)	3,656	3,656	3,656	3,774
Total Displaced	7,137	7,137	7,317	7,549
Parking Spaces Added by Future Comm. Development (minimum req.)	12,357	12,178	12,201	12,187
Parking Spaces Added by Residential Development (assumption)	4,648	4,811	4,696	4,804
Total Added	17,005	16,989	16,897	16,991
2020 PARKING DEMAND (with "moderate" TDM measures)				
	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Parking Spaces to Meet Demand				
Commercial Parking	19,113	18,942	18,983	19,034
Residential Parking	4,648	4,811	4,696	4,803
Total Demand	23,762	23,752	23,678	23,837
2020 PARKING DEMAND (with more aggressive TDM measures)				
Parking Spaces to Meet Demand				
Commercial Parking	14,857	14,723	14,755	14,795
Residential Parking	4,648	4,811	4,696	4,803
Total Demand	19,505	19,534	19,451	19,598

Source: Parsons Brinckerhoff, 2002

One consequence of parking demand unmet by off-street parking supply would be increased demand for other off-street and on-street parking resources. Competition would likely increase for on-street parking in a greater portion of the study area, and prices for off-street parking could increase. Higher parking prices could potentially affect shoppers' interest in patronizing Downtown businesses, but detailed analysis of this topic is beyond the scope of this EIS. The City could consider adjusting its minimum parking requirements to increase the supply of parking provided with future redevelopment. However, given City policies to promote alternative transportation modes, a higher parking requirement is not likely to be a City priority.

ON-STREET PARKING

As noted above, increased overall parking demand from future development would likely lead to increased competition for on-street parking resources. This trend would be gradual and occur in response to the amount of additional development in a particular area. However, given that the largest concentration of future development would occur in the Denny Triangle neighborhood, the increased competition would most strongly occur in the Denny Triangle and nearby surrounding areas. More specifically, the areas most impacted by increased competition for on-street parking are the same three areas shown in Figure 48.

In addition, as future development occurs, some displacement of on-street parking resources would likely occur due to the need for garage access points and possibly additional commercial vehicle parking spaces or other specialized types of parking or curb uses.

Alternative 1 – High End Height and Density Increase

OFF-STREET PARKING

Future residential and employment growth throughout the study area would increase overall demand for parking. As shown in Table 61, the predicted amount of off-street parking supply provided with future development would be approximately 17,005 spaces, including approximately 12,357 commercial (e.g., office/retail) parking spaces and approximately 4,648 residential spaces. This would be nearly the same parking supply as under Alternative 4 – the No Action Alternative.

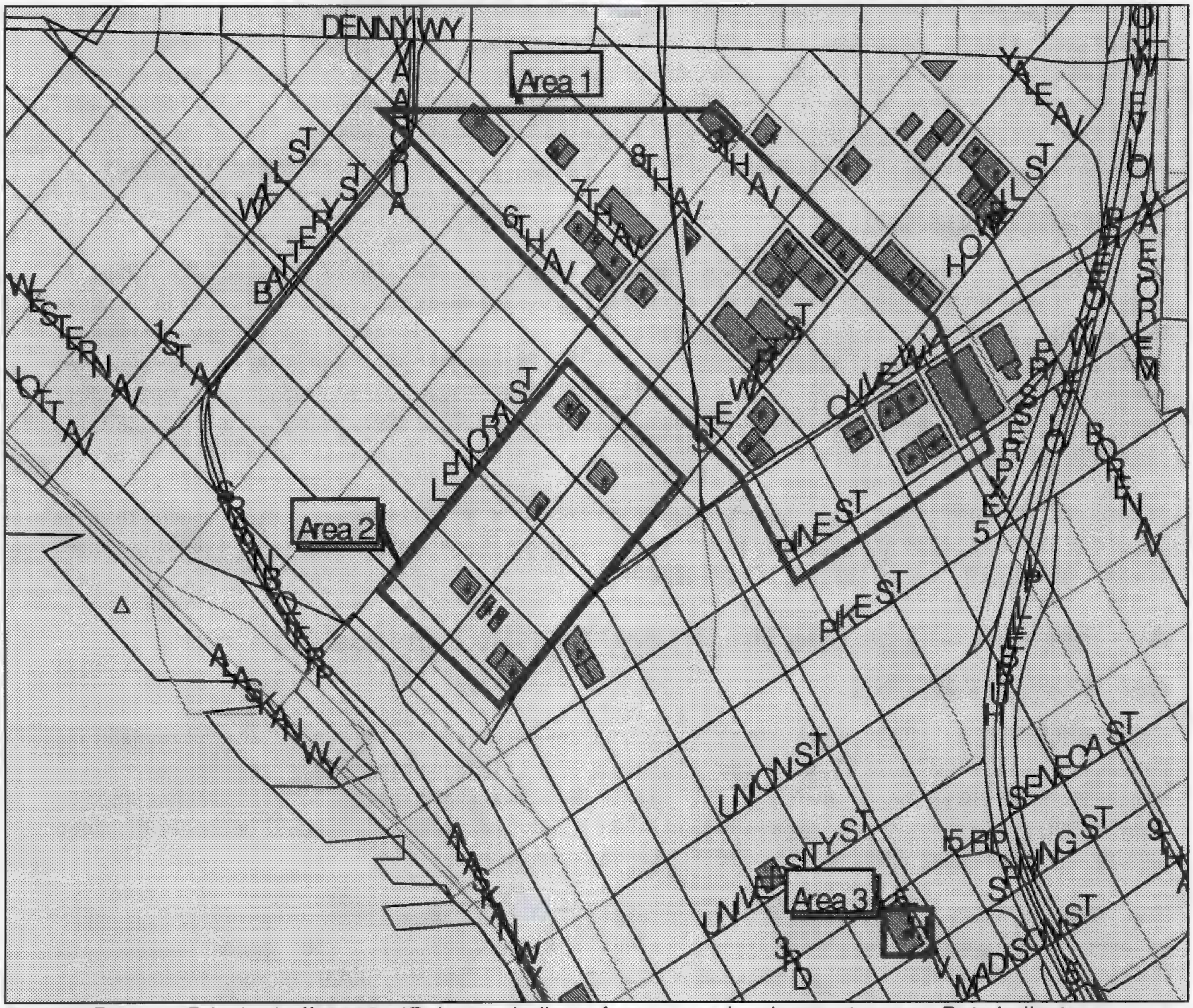
The 2020 estimated parking demand with moderate TDM is for approximately 23,762 spaces, while estimated parking demand with more aggressive TDM is for approximately 19,505 spaces. This suggests that future development could generate more parking demand than the minimum supply provided by approximately 2,500 to 6,750 spaces. However, developers could choose to provide more than the minimum parking, if market conditions warrant. This level of parking demand would nearly the same as under Alternative 4 – the No Action Alternative.

Future development under Alternative 1 would displace approximately 7,137 existing off-street parking spaces by 2020, approximately 400 fewer displaced spaces than under Alternative 4 – the No Action Alternative. Most of the displaced off-street parking would occur in the three areas shown in Figure 48.

ON-STREET PARKING

Alternative 1 would likely generate increased competition for on-street parking in a greater portion of the study area, and increased prices for off-street parking, in a manner similar to Alternative 4. However, with future development spreading across fewer blocks under Alternative 1, displacement of off-street and on-street parking resources would likely be slightly less than under Alternative 4.

Figure 48
Three Areas Most Affected by Displacement of Parking Garages*



Source: Parsons Brinckerhoff, 2002. *Polygons indicate future new development areas. Dots indicate displaced off-street parking lots/garages

Alternative 2 – Concentrated Office Core

OFF-STREET PARKING

Future residential and employment growth throughout the study area would increase overall demand for parking, in a manner similar to Alternative 1 and 4 (refer to Table 61 for details).

ON-STREET PARKING

Alternative 2 would likely generate increased competition for on-street parking in a greater portion of the study area, and increased prices for off-street parking, in a manner similar to Alternative 1.

Alternative 3 – Residential Emphasis

OFF-STREET PARKING

Future residential and employment growth throughout the study area would increase overall demand for parking. Overall impacts on off-street parking would be between those of Alternatives 1 and 4 (refer to Table 61 for details).

ON-STREET PARKING

Alternative 2 would likely generate increased competition for on-street parking in a greater portion of the study area, and increased prices for off-street parking. Overall on-street parking impacts would be between those of Alternatives 1 and 4.

Relationship of Alternatives to Parking Policies

The Comprehensive Plan's parking policies support the provision of adequate parking for economic viability of commercial areas while discouraging single-occupant-vehicle commuting by employees. The policies also seek to make best use of the City's limited street space, a balance among competing uses, and protection of neighborhoods from overflow parking. The Downtown Urban Center Goals and Policies are generally similar in intent, and promote incentives for use of transit, vanpools, carpools and bicycles as alternatives to single-occupant-vehicle commuting.

All of the alternatives, including No Action, are likely to displace several existing off-street parking lots and garages. Some of these are in proximity to the retail core, and a portion of their use is likely attributable to customers of the retail core and immediate vicinity. However, a substantial portion of existing parking demand in these off-street locations is likely due to commuter employees, mostly single-occupant vehicle drivers. The continuing availability of such parking encourages travel choices that foster traffic congestion and are less energy-efficient.

Placing greater restrictions on parking supply is a demand-reduction strategy that would discourage single-occupant-vehicle commuting and help (to some degree) avoid adverse traffic impacts. Given the potential severity of traffic impacts identified in this EIS for all of the alternatives, an aggressive approach to managing parking supply may be warranted.

Due to the projected high traffic volumes and congestion with or without zoning changes, it will likely be necessary over time to increase the efficiency of existing street use, which may mean removing some on-street parking lanes on some streets to optimize their capacities.

MITIGATION STRATEGIES

Proposed Mitigation Strategies

<u>Demand Reduction Strategies (TDM Programs)</u>

See the demand reduction strategies proposed as mitigation in the Transportation section of this EIS. In addition to addressing predicted significant adverse impacts on the road network, transportation demand reduction strategies would aid in reducing parking demand. Furthermore, these strategies could include parking-specific actions, such as "parking cashout" and residential-oriented TDM programs (using options such as FlexCar and bus pass incentives).

Possible Mitigation Strategies

The following strategies are other possible mitigation strategies that could be pursued at the decisionmakers' option, to further influence parking in Downtown as growth occurs over the long term.

Influence Parking Demand Through Financial Mechanisms

Over the long-term, the City could explore methods of more aggressively influencing parking demand through direct or indirect financial mechanisms. Methods could include parking taxes or other user fees. This could influence a greater percentage of single-occupant vehicle commuters to seek alternative transit modes that more efficiently use the transportation network.

Lower Minimum and Maximum Parking Requirements

Minimum and maximum parking requirements in the Land Use Code could be reduced for specific zones to discourage single-occupant-vehicle commuting by employees. Such changes should be targeted to the supply of long-term employee-oriented parking rather than short-term customer-oriented parking.

Area-Specific Changes in Parking Requirements

Reductions or waivers in parking requirements could be targeted to specific locations (such as portions of the Denny Triangle) to help reduce parking supplies with future development. This would aid in encouraging use of transit and other non-single-occupant-vehicle travel modes and thereby discourage growth in traffic congestion.

Reduce Parking Demand and Trip Generation Through Area-Specific Rezones

The probable amount of traffic generation and parking demand could be influenced through rezones of certain areas. For example, future development of residential uses might generate fewer overall vehicle trips than office development on the same properties. Specific zoning could be targeted to certain locations where high traffic volumes might otherwise generate significant adverse impacts on traffic operations.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

Additional development over the long term would contribute to increased commuter vehicle trips to and from the Downtown study area, and increased parking demand.

ENERGY

AFFECTED ENVIRONMENT

Introduction

Seattle City Light (SCL) serves Downtown customers with an underground network system fed by three substations. This system is known as the Downtown Network. Many of the region's largest businesses and governmental operations depend on the highly reliable power supply from the network system, and certain new businesses consider this reliability when deciding where to locate. Downtown electrical load has continued to grow over the last several years.

Description of the Downtown Network

The Downtown Network serves the Downtown area between Denny Way and S. King Street, plus a dozen other blocks north of Denny Way in the Aurora/Broad Street and Fairview Avenue vicinities. This is a 1.2-square mile area. The Downtown Network accounts for approximately 10% of total system load. Three distribution substations located at Broad Street, Union Street and S. Massachusetts Street serve this area. The Downtown Network is connected via transmission lines and 142 circuit miles of feeder lines. The network is designed to provide highly reliable electric power by means of a complex system of multiple power-supply cables, transformers and network protectors to each customer. This reliability is highly desired in a Downtown core area and is more costly to build, operate and maintain. In recognition of this, several years ago a separate electric rate was established for medium and large commercial customers served from the Downtown network.

Downtown Demand and Substation Capacity

The current peak demand in Downtown is approximately 260 MVA. Summer and winter peak demands are comparable. Commercial customers account for approximately 95% of energy sales in the Downtown service area.

A report by R.W. Beck titled "Downtown and First Hill Load Analysis" was published in March 2002. Based on a revised load forecast, the report states that "a new substation serving the Downtown network must be energized by 2012 in order to provide for a service need date of 2015." This study assumed a load growth throughout the Downtown network area of 2% per year and identifies factors that could accelerate or delay the date the substation is needed (such as greater-than-expected "large loads").

Seattle City Light has currently embarked on a comprehensive Capacity Plan to identify improvements to the transmission and distribution systems that may be needed to meet the load growth requirements in the entire Seattle City Light service area. Included in that effort will be a review of the 2002 R.W. Beck report. Seattle City Light will pursue the recommendations that result from the Capacity Plan, including those relating to the Downtown area. This Capacity Plan will be completed by the end of 2004.

In the near term, City Light is performing work that will maximize the available substation and distribution feeder capacities. Capacity work is being phased in by re-conductoring feeders using larger cables, balancing and redistributing feeder loads between neighboring substations, increasing some network capacities, and adding a small amount of transformer capacity at an existing substation. City Light is also promoting load management to reduce loading of the existing Seattle City Light system. This work will result in maximum capacity for the network feeder cables that best utilizes the substation capacity available from the three existing substations.

Economic development and its impact on the electrical system will be regularly and closely monitored. If loads ramp up or the request for large loads happens sooner than presently projected, the need for infrastructure will accelerate. Ultimately as development and loads ramp up over time, additional substation and distribution capacity will be needed and a new Downtown substation and associated distribution feeders will be built.

HIGH ENERGY DEMANDING USES

The economic boom of the late 1990s and early 2000 spurred greater demand for electricity to serve "wired" offices, laboratories, and concentrations of computers and telecommunications equipment. "Server farms" or "server hotels" are an emerging category of high-tech use that concentrates many computer servers into a hub that handles computer and telecommunication traffic and business data processing needs. These uses have few employees but very large energy demands, up to 150 watts per square feet, many times more than typical commercial energy demands. Air conditioning to prevent equipment overheating is a key need, as is highly reliable power to prevent interruptions of service. In 1999 and 2000, there was much competition to develop server farms, and several projects were pending or contemplated.

During 2000 and 2001, however, the high-tech and telecommunications sectors experienced rapid changes that dramatically altered future expectations for those sectors as well as the overall national and regional economy. Numerous local high-tech business ventures failed, resulting in vacation of office space and significant implications for local real estate leasing and development. Added to this were further economic challenges of an earthquake, a regional drought and an energy crisis. These economic factors combined to delay or cancel the development of several "server hotels" and high-tech-oriented office projects.

Predicting future energy use in this context is difficult. Future growth in energy consumption will relate to the regional economy, including the rather volatile high-tech economic sectors, and the pace of new real estate development. Economic challenges may continue to limit demand for new facilities oriented to high-tech uses over the next year or two. However, future energy projections should bear in mind the large energy demands of individual "server hotels" (see the Impacts section below for further discussion) and the significant energy demands of large or high-rise buildings primarily dedicated to high-tech office and/or bio-tech uses.

Downtown System Plans and Policies

NETWORK STRATEGIC SYSTEM PLAN

City Light's Network Strategic System Plan (September 2000) addresses planned system upgrades to increase system capacity, reliability and safety. It presents a Capital Improvement Plan for the network including approximately $20 million annually for network additions and new service, rebuilding of vaults, and improvements to increase feeder capacity at the substations.

LARGE LOAD ORDINANCE

In October 2001, the City Council adopted a "large load ordinance" that defined a new rate class for New Large Loads to help recover some of the additional costs to City Light to serve large energy users. A large load is defined as "any service fed from an expanded or a new installation equal to or greater than 12.5 MVA energized capacity installed within any consecutive 5-year period." The ordinance notes that the Pacific Northwest Power Planning and Conservation Act requires the Bonneville Power Administration to set higher prices for electricity provided to customers "whose consumption of electricity increases by more than 10 average MW over any consecutive 12-month period." The ordinance allows City Light to recover the incremental costs for transmission, distribution, capacity, administration, and mitigation of greenhouse gas emissions associated with energy production.

SUSTAINABLE BUILDING POLICY

On February 22nd, 2000 the Seattle City Council unanimously approved the Sustainable Building Policy that is part of the City's Environmental Management Program (EMP). The Office of Sustainability and Environment (OSE) guides City governmental operations toward sustainability by coordinating implementation of Seattle's Environmental Management Program and the Mayor's Environmental Strategy. The mission of the EMP is to foster the City's compliance with environmental laws, assist departments to reduce environmental impacts from operations, and improve environmental performance.

The purpose of a Citywide policy on sustainable building is to:

- demonstrate the City's commitment to environmental, economic and social stewardship;
- yield cost savings to the City taxpayers through reduced operating costs;
- provide healthy work environments for staff and visitors;
- contribute to the City's goals of protecting, conserving and enhancing the region's environmental resources; and
- help set a community standard of sustainable building.

The City of Seattle's Sustainable Building Policy is tied to a "green building" rating system known as LEED[1], developed by the US Green Building Council (USGBC). LEED is a self-certifying system designed for rating new and existing commercial, institutional and high-rise residential buildings. Different levels of green building certification (Certified, Silver, Gold, Platinum) are awarded based on the total credits earned in each of several categories: site, energy, material resources, indoor environmental quality and water.

To date, a total of 12 City of Seattle new development and renovation projects (totaling 2.7 million square feet) are expected to meet or exceed the "Silver" LEED Standard. Examples include the City's Justice Center, City Hall, Downtown Library, McCaw Performance Hall and Key Tower remodel. The 12 projects are expected, on average, to exceed ASHRAE/IESNA[2] standards by 24 percent. Using a baseline energy consumption of 15/KwH/sf/yr for an average office building, this can be estimated to result in a reduction of energy use of 10,000 KwH/year, saving the City an estimated $491,000 annually. The City's internal policy requires a minimum of a 20% efficiency increase over ASHRAE standards. Most of the City's projects have exceeded this requirement, in some cases achieving up to a 40% increase in energy efficiency. A monitoring and evaluation program is planned for the City's LEED projects once they are completed, in order to track actual savings.

In Council Resolution 30280, Seattle City Council asked for "possible steps and measures for the City to require or provide incentives to developers of commercial buildings to meet the Silver LEED standard by 2003." A full report was given to Council with recommendations on sustainable building incentives as well as other issues outlined in the resolution.

In addition, the Resolution directed DCLU with support from City Light to propose "*Energy Code amendments options for amending the Seattle Energy Code to achieve energy savings up to 20% beyond the current...ASHRAE and...IESNA energy efficiency requirements for nonresidential buildings: ASHRAE/IESNA Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.*"

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[1] LEED is a trademark and abbreviation for "Leadership in Energy and Environmental Design."

[2] ASHRAE/IESNA refers to the American Society of Heating, Refrigerating and Air-Conditioning Engineers and the Illuminating Energy Society of North America.

In September 2001, the City Council adopted and the Mayor signed Ordinance 120525 containing revisions to the Seattle Energy Code for nonresidential buildings. These revisions will achieve estimated energy savings of 15-20% compared to the baseline in ASHRAE/IESNA Standard 90.1-1999.[3]

"GREEN" POWER

In 2001, the State Legislature passed a new law to allow customers to partner with their electric utility to purchase new clean, renewable energy sources. Seattle City Light responded by creating "Seattle Green Power" whereby any customer can make voluntary payments that will go toward building and acquiring a wider range of new renewable energy sources. In 2002, City Light brought Seattle's first wind-generated electricity to its customers.

CONSERVATION AND DEMAND MANAGEMENT

City Light has been a forerunner in conservation and demand side management. In 2001-2002, load analysis studies for Downtown reviewed various strategies for gaining capacity, including distributed generation, renewable energy, solar power, wind power, demand peak shaving, and energy conservation. While these strategies may offer incremental positive benefits, a number of technical issues continue to be a challenge. At least for the near future, implementing further strategies of this type would not be sufficient to deal with projected electrical loads on the Downtown Network.

IMPACTS

Alternative 1 – High End Height and Density Increase

GROWTH SCENARIOS AND CAPACITY IMPACTS

Comparability between EIS projected commercial growth rate and City Light electrical load growth rate: The EIS growth scenario projects commercial development trends on a year-by-year basis for the next 20 years. The amount of commercial growth predicted by this model fluctuates between 0% and 6% per year, with a 20-year average of 2.1% per year. This is relatively comparable to City Light's base economic forecast assumption of 2% annual load growth. This is a rough indicator that the amount of growth studied in the EIS is generally consistent with City Light projections.

Real estate analyses for this EIS conclude that "*changes to zoning, in and of themselves, do not change the supply and demand cycles. In other words, increasing commercial densities does not necessarily lead to more development occurring Downtown. However, changes in zoning will influence where development occurs and the size and density of the buildings developed.*" Thus capacity needs to be available to serve areas of growth. If several new large projects with significant energy demands are located in a concentrated area, this could challenge available electrical infrastructure capacity. These limitations and needed improvements will be closely monitored on an ongoing basis and addressed in City Light's Capacity Plan in 2004.

A new substation needs to be energized by 2012, and significant planning and construction over 7-8 years is needed: Under the assumptions in the 2002 R.W. Beck report, a new Downtown substation needs to be energized by 2012. Permitting, transmission and design/construction work required to build and energize a new substation will take 7-8 years (to 2010 or 2011 if started immediately). Exact timing

[3] This is a comparison to the baseline in the standard, not to current practice in Seattle, Washington State or the State's Energy Code. Actual energy savings are not estimated because of past variation in design practices and variation in building types.

of the need for a new substation will vary to some degree depending on several factors. The R.W. Beck report identifies the following factors that could accelerate or delay growth in electrical loads over time:

Factors potentially accelerating load growth

- Higher than forecast economic activity (1 to 3 years acceleration).
- Greater than expected high-density loads such as server hotels (7 new server hotels would accelerate this date by 2 to 3 years).
- A policy decision that greater redundancy is required.

Factors potentially delaying load growth

- Lower than forecast economic activity (3 to 4 year delay).
- Greater than expected energy efficiency improvements (1 to 2 year delay).
- Greater acceptance of demand-side management strategies such as peak load shifting (1 to 2 year delay).

All of the above comments apply to all Alternatives. The following comment applies only to Alternative 1.

Limits of capacity in a portion of the Denny Triangle: The portion of the Denny Triangle bounded by 8th Avenue, Westlake, Denny Way and Interstate 5 is served by the Broad East subnetwork. This subnetwork is already accommodating emerging developments. Higher zoning height/density limits in this area could result in more immediate capacity limitations due to increased commercial load. City Light will address needed short-term and long-term infrastructure improvements in its capacity plan.

Cumulative Impacts

Future growth over the next 10 to 20 years is likely to occur across several economic sectors, including the high-tech and biotech sectors. Regional and national economic trends will likely influence the overall amount of employment growth. Demand for office space will likely continue to grow in Downtown, in high-tech as well as other employment sectors. South Lake Union, adjacent to Downtown, may also continue to attract high-tech and biotech growth due to the tendency of research/development efforts to cluster around centers of intellectual resources. Because separate distribution systems serve these two neighborhoods, these areas will not compete for use of the same substation transformer and distribution capacity. Depending upon the amount and location of load growth within this timeframe, there could be competition for transmission capacity, capital funds and labor resources.

Alternative 2 – Concentrated Office Core

GROWTH SCENARIOS AND CAPACITY IMPACTS

The total amount of growth predicted to occur over 20 years under Alternative 2 would be nearly the same as predicted for Alternative 1. The predicted pattern of growth would also be very similar, with a majority of redeveloped properties located within the Denny Triangle neighborhood. Existing zoning would remain unchanged in areas near Denny Way, in the 1st Avenue and Western Avenue vicinity, and the southern edge of Belltown. Under Alternative 2, the overall commercial and residential development capacity would be approximately 12% less than under Alternative 1.

Given the similarities in the amount and location of predicted 20-year growth, the overall energy impacts of Alternative 2 would be approximately similar to impacts of Alternative 1. However, slightly less-intensive zoning changes in portions of the Denny Triangle east of 8th Avenue could reduce the worst-case potential for electrical infrastructure impacts in that portion of the Denny Triangle. The potential for large load impacts under Alternative 2 would be essentially the same as under Alternative 1.

Alternative 3 – Residential Emphasis

GROWTH SCENARIOS AND CAPACITY IMPACTS

The total amount of growth predicted to occur over 20 years under Alternative 3 would be nearly the same as predicted for Alternative 1. The predicted pattern of growth would also be roughly similar, with a majority of redeveloped properties located within the Denny Triangle neighborhood. However, zoning changes in portions of Denny Triangle, the 1st Avenue and Western Avenue vicinity and the edge of Belltown would maintain lower commercial densities and place more emphasis on housing production. Under Alternative 3, the overall commercial development capacity would be approximately 20% less and residential capacity 3% less than under Alternative 1.

Given the differences in zoning emphasis, the overall energy impacts of Alternative 3 would be somewhat less than impacts of Alternative 1. Alternative 3's concept of lower commercial densities and greater residential emphasis in portions of the Denny Triangle east of 8th Avenue would reduce the magnitude of impacts on the electrical system compared to Alternatives 1 and 2, because residential uses would generate lower electrical demands than commercial uses. Alternative 3's impacts would even be lower than impacts of Alternative 4 (No Action). The potential for large load impacts would be similar to impacts of other alternatives.

Alternative 4 – No Action

GROWTH SCENARIOS AND CAPACITY IMPACTS

The total amount of growth predicted to occur over 20 years under Alternative 4 would be nearly the same as predicted for Alternative 1. The predicted pattern of growth would be similar to Alternative 1, but may spread over a few more properties in the Commercial Core vicinity. Under Alternative 4, the overall commercial development capacity would be approximately 25% less and residential capacity 19% less than under Alternative 1.

Given the shades of differences in the pattern of predicted 20-year growth, the overall energy impacts of Alternative 4 would be somewhat less than Alternatives 1 and 2, but greater than Alternative 3. Permissible commercial densities within most of the Denny Triangle would be less than Alternative 1. The potential for large load impacts on energy demands under Alternative 4 would be similar to Alternative 1. Under all alternatives, a new Downtown substation will be needed.

MITIGATION STRATEGIES

Proposed Mitigation Strategies

Given the significant adverse impacts identified in this section, approval of zoning changes should be accompanied by a combination of mitigation strategies that would adequately address the identified significant impacts. These could be selected from the following range of possible strategies, or other strategies not yet identified.

- **Implement recommendations of City Light's Capacity Plan:** Complete City Light's Capacity Plan in 2004 and implement the recommendations that result from that Plan.
- **Strategically address high-energy-demanding uses:** A combined land use and energy strategy could be developed to address impacts of new large loads or staged new large loads in the Downtown.

- **Incorporate LEED into the Downtown Density Bonus program:** Incentives or requirements to use the LEED system's Green Building energy efficiency strategy could promote better energy conservation in future development. In response to the City Council's Resolution 30280, City staff have discussed integration of sustainable building incentives into the building permitting process, and integration of the LEED system into the Downtown density bonus system. The LEED system could be required for participation in the Downtown Density Bonus program as a mitigation strategy to help offset impacts on the electrical system.

  A particular threshold of performance in the energy category could be established. Consistent with the City's own internal sustainable building policy, this requirement could be set as a minimum achievement in energy efficiency.

  A minimum overall LEED performance could also be set in order to capture other benefits of the program, such as mitigating increased demands on water and wastewater infrastructure, reduction of stormwater impacts, and mitigation of global climate effects. If this was implemented, a development project would go through the certification process administered nationally by the US Green Building Council. A copy of the certification package could be submitted to the City to endorse the required participation in the program. Since LEED certification is not fulfilled until after construction, a strategy would be needed to handle projects that did not meet performance targets when built.

- **Incorporate LEED into Land Use Code, Design Review, or Building Code:** Alternatively, the City could seek to incorporate elements of the LEED system into the Land Use Code, the design review guidelines, and potentially the Building Code. Measures and tools developed as part of LEED would be required or encouraged to be met before a project receives its land use approval. For example, the Downtown design guidelines could be amended to include guidelines on floorplate design, encouraging designs that would allow natural light to intrude to the center of buildings, potentially reducing the amount of lighting required during the day.

- **More efficient design of buildings' electrical systems:** Developers could be required to design their buildings' electrical services so that their average monthly power factor is no less than 0.97. The present financial penalty for having a power factor below 0.97 could be increased to encourage installation of better equipment and/or power factor correction equipment.

- **Coordination with the building permit process:** DPD and City Light will continue their efforts to work with developers during the pre-application process, before issuing building permits.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

With implementation of recommended mitigation strategies, significant unavoidable adverse energy impacts are unlikely to occur.

WATER UTILITY

AFFECTED ENVIRONMENT

Supply and Demand

Seattle Public Utilities (SPU) manages the water system that serves Seattle and numerous suburban cities. Approximately 1.3 million residents are served in this area, including 595,000 direct customers (through 175,000 metered connections) and nearly 687,000 customers served by water districts and cities that are wholesale purchasers. The system's water supply sources are the Cedar River and Tolt River watersheds, and the Highline well field. SPU does not anticipate needing any additional water rights in order to meet system demands over the next 20 years. SPU is negotiating an agreement to participate in a "Second Supply Project" that should help further assure long-term supply availability and reliability.

SPU correctly predicted that per capita water demands would decline during the 1990s due to programmatic changes, conservation, plumbing code changes and rate increases. Since a 1992 drought, growth in water demand from suburban purveyors has been less than predicted, and total water demand in Seattle actually decreased during that period. Average daily water demand is projected by SPU to decline slightly through 2010, from 149 million gallons per day (mgd) in 1999 to 144 mgd in 2010. Conservation efforts were effective in spring/summer 2001 as the region dealt with limitations brought about by low snowfall conditions in winter 2000/2001.

Infrastructure

In Downtown, a majority of water mains are more than 50 years old. Portions of the system have been upgraded over time concurrent with road improvements. The older pipes are predominantly cast iron, and upgraded sections are ductile iron. Pipes range in size from 6 to 30 inches in diameter. Planned system improvements in central Seattle include replacement of the Lincoln Reservoir with a new below-ground reservoir, and major improvements at the Beacon reservoir as well. In general, SPU considers the system to have adequate capacity to meet existing demands. SPU is engaged in a long-term planning effort to comprehensively analyze the system and prioritize future improvements, taking into consideration factors such as need for seismic protection.

Water Pressure

Within Seattle, the reservoirs and distribution system provide gravity flow in most areas. The Commercial Core, Denny Triangle and Belltown areas are all within the 326 pressure zone; storage for water serving these areas is provided at the Lincoln reservoir on Capitol Hill and the Beacon reservoir on Beacon Hill. Water pressure ranges from adequate to very good (see Table 62).

Table 62
Existing Water Pressure Ranges in Downtown Seattle

Area	Pressure Range	Pressure Quality
Commercial Core	40 to 135 psi	Adequate
Denny Triangle	68 to 113 psi	Very good
Denny Regrade	68 to 135 psi	Very good

Note: 30 psi is the standard minimum working pressure for new construction.

Fire Flow Capability

Fire flow capability relates to the volume of water available to fight fires, typically accessed by hydrants. Fire flow needs for structures relate to the age, type of construction, size and presence of fire-protective features such as sprinkler systems. Due to the superior fire protection provided by sprinkler systems, a sprinkler-equipped building requires roughly half as much fire flow capability at nearby hydrants as an older building without sprinklers.

The network of water mains in the study area has segments varying considerably in age, size and condition. Cement-lined pipes less than 60 years old are typically in excellent internal condition, but older cast iron pipes can have reduced flow capabilities due to corrosion problems.

In order to characterize the capabilities of the system in the study area, SPU used a calibrated hydraulic model (EPANET) to evaluate fire flow capacities. This model had been recently revised and updated, and available field test data and other technical data were used to help verify model results. Per recommendations of the Fire Department, the worst-case, conservative fire flow criteria are 4,000 gallons per minute (gpm) for a sprinklered building and 8,000 gpm for an unsprinklered building. For individual hydrants, availability of 2,000 gpm at residual pressure of 20 psi is the threshold to meet those worst-case criteria.

Within the study area, the analysis identified two locations in the study area with relatively minor deficiencies in hydrant capacity: 1) Boren Avenue between Stewart and Virginia Streets; and 2) the Olive Way/Boren Avenue vicinity. At the first of these locations, the hydrant near Boren Avenue/Virginia Street has approximately 1,200 gpm of fire flow capacity rather than the desired 2,000 gpm, and the water line is only 6 inches in diameter. At Olive Way/Boren Avenue, the two hydrants together have fire flow capacity of approximately 2,500 gpm rather than the desired 4,000 gpm. In both cases the 80 to 100-year age of the pipes may contribute to capacity limitations. Project-specific review by Fire Department and SPU staff helps determine fire flow sufficiency, and allows the City to require system improvements if necessary.

IMPACTS

Alternative 1 – High End Height and Density Increase

SUPPLY, DEMAND AND INFRASTRUCTURE

This analysis addresses water use impacts for full buildout conditions and for 20 years of growth. While both are long-term analyses, the full-buildout analysis illustrates the maximum potential impacts over time and the variations among the alternatives.

Buildout Water Use

With zone changes proposed for Alternative 1, full buildout of the affected zones would generate up to approximately 24-25 percent more water demand in the study area than full buildout under the No Action Alternative.[1] This would be equivalent to an additional 1.2 to 1.4 million gallons per day if full buildout

[1] Quantitative estimates are used for daily water use per residence (80 gallons/dwelling unit), per office employee (30 gallons/employee) and per hotel room (80 to 130 gallons/room). The buildout that could occur under Alternative 4 (the No Action Alternative) is defined as the baseline condition.

was achieved. Table 63 illustrates the maximum potential water demands generated by full buildout of the alternatives in this EIS. Office and hotel development would be primarily responsible for the additional demands of Alternative 1. This maximum additional water demand of Alternative 1 at buildout is the greatest among the alternatives but would represent less than one percent of the current citywide daily water demand. Potentially occurring more than 20 years in the future, it would not represent a significant adverse impact on the City's water system infrastructure due to its relatively limited magnitude. If location-specific infrastructure problems are identified in the future, development review for individual projects would afford opportunities to require specific improvements.

Table 63
Comparison of Maximum Additional Water Demands from Full Buildout of Alternatives

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Maximum additional water demand at buildout (gal/day)	6.3 - 7.1 million gallons	5.7 - 6.4 million gallons	5.4 - 6.0 million gallons	5.1 - 5.7 million gallons
Difference from existing zoning buildout (gal/day)	1.2 - 1.4 million gallons	650,000 - 750,000 gallons	300,000 - 350,000 gallons	0 gallons
Percent change from existing zoning buildout (%)	24 - 25%	12 - 13%	6%	0%

Source: SPO, 2002

Twenty-Year Growth in Water Use

Over twenty years, predicted amounts of total development are very similar among the alternatives, so predicted new water demands are in the range of 2.9 to 3.1 million gallons per day. Additional water demands from Alternative 1 would likely fall in the upper portion of this range, only about 1 to 2 percent (40,000 - 60,000 gallons per day) more than additional demands from the No Action Alternative. Alternative 1's additional water demand would not represent a significant adverse impact on the City's water system infrastructure due to its relatively limited magnitude.

Location of Water Meters

The location of water meters in future development is an infrastructure-related concern noted by SPU staff, for all alternatives. Water meters are commonly located in subsurface chambers within public rights-of-way, which can hinder accessibility to the meters for maintenance and require expensive work to cut open streets and sidewalks. To increase accessibility and lessen or avoid construction/maintenance impacts within public rights-of-way, the City could require water meters to be located within buildings. This would also contribute to more effective and maintainable metering of water use, to the City's benefit.

Fire Flow Capability

With zone changes proposed for Alternative 1, the potential for taller, denser buildings throughout the study area would not significantly affect the ability of the water system to provide adequate fire flows. Future development over time would increase the total number of buildings protected by the fire flow capabilities of the system.

In the locations with existing deficiencies (in comparison to worst-case fire flow criteria), project-specific review of future development proposals would allow identification of system improvements to meet fire flow requirements. Potential future improvements might be to increase the size of water lines, through City and/or project-related funding. The existing 6-inch water line along Boren Avenue between Howell Street and Denny Way is the segment most likely to be considered for replacement.

Alternative 2 – Concentrated Office Core

SUPPLY, DEMAND AND INFRASTRUCTURE

Buildout Water Use

With zone changes proposed for Alternative 2, the full buildout of the affected zones would generate approximately 12-13% more water demand in the study area than full buildout under the No Action Alternative (refer to Table 63). This would be equivalent to an additional 650,000 to 750,000 gallons per day if full buildout was achieved. Office and hotel development would be primarily responsible for the additional demands. This maximum additional water demand at buildout is approximately half as much as generated by Alternative 1, and would represent about 0.5% of the current citywide daily water demand.

Twenty-Year Growth Water Use

Additional water demand generated by Alternative 2 would be essentially the same as generated by the No Action Alternative (2.9 to 3.1 million gallons per day), and therefore no adverse impacts are identified.

Fire Flow Capability

Similar to Alternative 1, fire flow impacts of Alternative 2 would not be significant. The vicinity of Boren Avenue between Stewart and Virginia Streets with an existing fire flow deficiency would not be subject to rezone in Alternative 2.

Alternative 3 – Residential Emphasis

SUPPLY, DEMAND AND INFRASTRUCTURE

Buildout Water Use

With zone changes proposed for Alternative 3, the full buildout of the affected zones would generate approximately 6% more water demand in the study area than full buildout under the No Action Alternative (refer to Table 63). This would be equivalent to an additional 300,000 to 350,000 gallons per day if full buildout was achieved. Office, hotel and additional residential development would be responsible for the additional demands. This maximum additional water demand at buildout is approximately one-quarter as much as generated by Alternative 1, and would represent about 0.25% of the current citywide daily water demand.

Twenty-Year Growth Water Use

Additional water demand generated by Alternative 3 would be essentially the same as generated by the No Action Alternative (2.9 to 3.1 million gallons per day), and therefore no adverse impacts are identified.

Fire Flow Capability

Potential fire flow impacts of Alternative 3 would not be significant, and could be less than under Alternatives 1, 2 or 4. The vicinity of Boren Avenue between Stewart and Virginia Streets with an existing fire flow deficiency would be rezoned with lower densities and a greater emphasis on residential development, which could make fire flow needs less than expected under current zoning. Zoning in the

Olive Way/Boren Avenue vicinity with an existing deficiency would change in a way with only minor implications for building bulk and fire flow needs.

Alternative 4 – No Action

The No Action Alternative would not result in adverse impacts on the water system. Future development under the existing Land Use Code would be accommodated by the existing system. Past studies, such as analyses for the 1994 Comprehensive Plan EIS, indicated that the system would be able to handle the anticipated growth. This analysis reaches the same conclusion, even for a larger amount of growth than previously studied.

SUPPLY, DEMAND AND INFRASTRUCTURE

Buildout Water Use

No zone changes are proposed for Alternative 4, so no adverse impacts would occur. As shown on Table 63, the future buildout of existing zoning would generate approximately 5.1 to 5.7 million gallons per day of additional water demand in the study area. No adverse impacts related to infrastructure are identified.

Twenty-Year Growth Water Use

The No Action Alternative would generate additional water demand of approximately 2.9 to 3.1 million gallons per day with 20 years of growth. No adverse impacts are identified.

Fire Flow Capability

Alternative 4 would result in no adverse impacts related to fire flow. However, existing deficiencies in two locations of the Denny Triangle may need to be addressed over the long term to serve future development.

MITIGATION STRATEGIES

Although no significant adverse supply/demand impacts on the water system are expected, a strategy could be implemented to address an identified shortcoming of the water system infrastructure.

Possible Mitigation Strategies

Require water meters in accessible on-site locations

Implement code changes to require future development to locate water meters in on-site spaces, to improve accessibility and avoid needless utility maintenance work within public rights-of-way. This would also contribute to better metering of water use and greater cost-effectiveness in the City's utility operations.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

None identified.

SEWER AND STORMWATER UTILITIES

AFFECTED ENVIRONMENT

Sewage/Stormwater Drainage Collection Systems

Seattle Public Utilities (SPU) manages drainage, surface runoff and sewer systems in the City, with overall goals of maintaining public safety, water quality and resource protection. Seattle has three types of drainage and wastewater systems: combined sanitary/stormwater sewers, partially separated sanitary/stormwater sewers, and fully separated sanitary and stormwater sewer systems. Combined sewers that handle both surface stormwater drainage and sewage volumes serve most of the Commercial Core and Denny Triangle neighborhoods.

The system consists of concrete pipes ranging from a minimum of 8 inches in diameter, to a maximum of approximately 144 inches in diameter, typically located within rights-of-way. Portions of the 1st Avenue, Western Avenue, and 3rd Avenue vicinities are served by partially separated systems that have stormdrains separating the stormwater runoff from the sewage volumes. The system routes Commercial Core wastewater flows toward King County Metro lines under 2nd Avenue, and Denny Triangle flows northward to Republican Street and then westward. Metro King County's system then conveys flows to the West Point Treatment Plant via Interbay.

Current drainage codes require new development to limit the peak volumes of stormwater runoff to a rate similar to runoff from an undeveloped site. In contrast, long-established land uses such as older paved parking lots contribute to rapid stormwater runoff because they are impervious surfaces that typically do not have detention capabilities or allow for infiltration into soils. Given the more stringent requirements imposed with new construction, new development Downtown will aid in controlling peak stormwater flows generated by a typical site.

The City's Capital Improvement Program included sewer rehabilitation projects at 1st/Union/Pike in 1997, Western Avenue/Bell Street in 1998, and Pike Street in 2000-2001. Other than incidental repair, replacement or relining of pipes, no wastewater system improvements are anticipated for the study area (SPU, 2001).

Treatment Facilities

The City's collection system delivers wastewater from Downtown to larger interceptor lines operated by King County that convey it to the West Point Treatment Plant. King County's regional wastewater treatment system serves approximately 1.3 million people. The West Point plant, located near Discovery Park, provides primary and secondary treatment of wastewater flows, and is designed for a maximum monthly average flow of 215 million gallons per day (mgd) and instantaneous maximum capacity for 440 mgd. The plant's annual flows are equivalent to an average of 191 mgd. Two other treatment plants at Alki and Carkeek Park are used only for wet weather flows.

Combined Sewer Overflow (CSO) Planning

In some areas, the capacity of the wastewater system is limited when larger peak stormwater flows enter the combined systems. When runoff volumes are large due to intense rainfall, there may be "combined sewer overflows" (CSOs) into area waters in several locations. CSOs occur in both the regional and City systems. Seattle adopted a CSO Control Plan in 1988 to address specific improvements to control CSOs. SPU has already completed improvements (primarily increased storage and overflow monitors) to approximately 80-90 percent of the CSO locations, including outfalls to Portage Bay, Elliott Bay, the Duwamish River, Lake Union and the Ship Canal. Joint efforts with King County are still ongoing at Lake Union and the Ship Canal.

The City is updating the 1988 CSO Control Plan to direct further improvements in areas near Ballard, Magnolia, Delridge, Duwamish, Rainier, Seward Park, Wallingford, and Laurelhurst. Areas in or near Downtown are identified on a recent CSO-related map as improved basins that will be monitored.

IMPACTS

No significant adverse impacts on sewer/stormdrain capacity are anticipated. Future development under any of the alternatives would result in two different types of impacts on stormwater and sanitary sewage volumes:

- Increased volumes of sanitary sewage from new commercial and residential development; and
- Reduced size of peak stormwater flows during storms through installation of required improvements at redeveloped sites. The Drainage Control Ordinance requires on-site detention of stormwater (such as roof runoff), typically in vaults with flow control devices.

With greatly improved drainage controls on redeveloped sites, stormwater would be held on properties for longer periods of time and released in a more controlled manner to the system, thereby moderating peak flows.

Alternative 1 – High End Height and Density Increase

With Alternative 1, future development could occur in a denser manner and generate more sanitary sewage volumes in some areas than under current zoning. Infill development on a limited number of properties would occur in the Commercial Core and edge of Belltown, but the Denny Triangle vicinity would accommodate the greatest amount of future development.

The most common site conditions within the Denny Triangle are either large paved areas or older buildings. Both conditions include large amounts of impervious surfaces and minimal drainage controls, which promote rapid runoff of stormwater during rainstorms. Total rainfall volume for a 2-year/1-hour storm (a one-hour storm of a size likely to occur only once every two years) within the Denny Triangle is approximately equivalent to 20,200 gallons per minute (gpm). Most of this volume drains quickly from impervious surfaces to the combined sewer system.

With future development, the installation of required stormwater control facilities would slow down runoff such that the peak flows leaving redeveloped sites and entering the drainage system would be less than existing conditions. As more redevelopment occurs in the Denny Triangle over time, progressively better control of stormwater means the drainage system would be less likely to exceed capacity from surges of stormwater rapidly draining from impervious surfaces.

Compared to stormwater, sanitary sewage volumes use a much smaller fraction of system capacity. The estimated peak sanitary sewage flow with future development in the Denny Triangle by 2020 is approximately 3,750 gpm. This is much less than the estimated 2-year storm's flow of 20,200 gpm.

It is possible that the improved control of peak stormwater flows with redevelopment would more than offset the additional sewage volumes generated by new development. This suggests that adverse impacts on combined sewer systems would be avoided, and that net impacts would be positive. However, the EIS analysis did not identify enough conclusive information to prove this hypothesis.

This EIS identifies no sewer/drainage system capacity problems in specific locations within the study area. SPU staff reviewed the Denny Triangle sewer/drainage system and found it will have sufficient capacity for the level of development that could occur with these zoning changes. If specific localized problems are identified in the future, development review for individual projects would afford opportunities to require site-specific improvements.

The maximum additional sewage that could be generated due to Alternative 1 would not represent a significant adverse impact on sewage treatment facilities. If all of the additional predicted daily water use from buildout of Alternative 1 was assumed to become sewage (1.2-1.4 million gallons), this would represent only approximately 0.75% of the annual average daily flow at the West Point treatment facility.

Alternative 2 – Concentrated Office Core

The storm drainage and sewage volume impacts of Alternative 2 on the sewer/drainage system would be similar to those of Alternative 1. The estimated peak sewage volumes generated by future development in the Denny Triangle vicinity by 2020 would be approximately 3,822 gpm, or 1.5% greater than for Alternative 1, due to a greater concentration of residential uses. However, similar to Alternative 1, no significant adverse impacts on system capacity are identified.

The maximum additional sewage that could be generated due to Alternative 2 would not represent a significant adverse impact on sewage treatment facilities. If all of the additional predicted daily water use from buildout of Alternative 2 was assumed to become wastewater (650,000-750,000 gallons), this would represent less than 0.5% of the annual average of daily flows at the West Point treatment facility.

Alternative 3 – Residential Emphasis

The storm drainage and sewage volume impacts of Alternative 3 on the sewer/drainage system would be similar to those of Alternative 1. The estimated peak sewage volumes generated by future development in the Denny Triangle vicinity by 2020 would be approximately 3,805 gpm, or about 1.5% greater than for Alternative 1, due to a greater concentration of residential uses. However, similar to Alternative 1, no significant adverse impacts on system capacity are identified.

The maximum additional sewage that could be generated due to Alternative 3 would not represent a significant adverse impact on sewage treatment facilities. If all of the additional predicted daily water use from buildout of Alternative 3 was assumed to become wastewater (300,000-350,000 gallons), this would represent less than 0.2% of the annual average of daily flows at the West Point treatment facility.

Alternative 4 – No Action

The No Action Alternative would generate no significant adverse impacts on sewers and stormdrains. Future development under the existing Land Use Code could be accommodated by the existing system. Required stormwater control facilities with new development would provide better control of peak stormwater flows than existing conditions. Past studies, such as analyses for the 1994 Comprehensive Plan EIS, indicated that the system would be able to handle the anticipated growth. This EIS supports those conclusions, even for a larger amount of growth than previously studied.

The impacts of Alternative 4 on the sewer/drainage system would be slightly less than those of Alternative 1. The estimated peak sewage volumes generated by future development in the Denny Triangle vicinity by 2020 would be approximately 3,616 gpm, or about 3.6% less than for Alternative 1.

MITIGATION STRATEGIES

No mitigation measures are required because this analysis does not identify any significant adverse impacts on the sewer/drainage system.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

None identified.