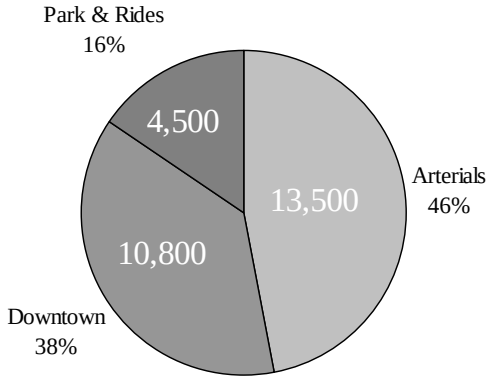
CHAPTER IX-ARTERIAL IMPROVEMENTS

Introduction

The vast majority of bus service within the City of Bellevue operates on local city streets in mixed traffic. As such, most bus service is affected by the same traffic conditions that impact general traffic, including congestion. The impact of congestion on transit operations can be significant. Extended travel times and schedule delays resulting from congestion result in increased operating costs and reduce the attractiveness of transit to potential patrons.

The need to support transit with arterial improvements is considered essential given that almost 50% of the City's 30,000 average weekday transit riders (ons and offs) occur on the city's arterial street system outside of downtown Bellevue and outside of the City's park-and-ride lots (see Figure IX-1). Given the significant transit ridership activity along arterials, it is essential that the City collaborate with the region's transit providers to improve and expand the route structure and the transit-supportive infrastructure of treatments that improve bus speed and reliability as well as amenity improvements such as sidewalks and shelters.

Figure IX-1
Location of Average Weekday Ridership Activity in Bellevue, 2001
(28,800 Total)



The continued support for arterial improvements is consistent with the policy guidance within regional policy and Bellevue's Comprehensive Plan:

Regional Policy

Puget Sound Regional Council *Destination 2030*
Destination 2030 supports priority treatment for high occupancy vehicles (HOV). Higher vehicle occupancies mean that personal mobility is achieved at a greater level of system efficiency. Higher occupancies, in the form of transit, carpools, and vanpools, result in lower traffic volumes, lower vehicle emissions, less costly

investment in capacity over time, and less private resources dedicated to the maintenance of the region's private vehicle fleet. *Destination 2030* includes the policies recommended by the Regional HOV Policy Advisory Committee in 1999. The regional policies endorse and recommend inclusion of the Washington State Department of Transportation's (WSDOT) HOV system policies and operational definitions, including speed and reliability, capacity, and carpools definition. The regional HOV system will, in part, be achieved through investment in the following HOV facilities:

- Core HOV network on regional freeways, including HOV bottlenecks
- Direct access for more efficient use of HOV facilities
- Arterial HOV investments that directly link to the core HOV facilities
- HOV by-pass lanes and priority systems on arterials, corridors, and within centers

Destination 2030 clearly supports arterial HOV improvements to provide enhanced speed and reliability for HOVs.

Bellevue Comprehensive Plan

Policy TR-53

Work with transit providers to create, maintain, and enhance a system of supportive facilities and systems such as transit centers, passenger shelters, park-and-ride lots, bus queue by-pass lanes, bus signal priorities, pedestrian and bicycle facilities, pricing, and incentive programs.

A major goal for these arterial improvements is to optimize transit usage of city streets, as reflected in the Bellevue City Council's policy interest statement in reference to King County Metro (Metro) (adopted May 8, 2000):

Policy TR-68f

Support multi-modal transportation solutions including general purpose lanes, High Capacity Transit, HOV lanes, transit and non-motorized improvements that use the best available technologies.

Policy KCM-25

As part of the City's Arterial Classification Review and Arterial System development, seek opportunities to:

- Optimize transit speeds and reliability on key local and state corridors that present the best chance for increased transit service and preservation of neighborhood quality; and
- Optimize transit services and treatments on key arterials in the City.

This chapter examines several improvements that can facilitate the movement of buses in an arterial setting. Initially, bus stop design and improvements are examined. In addition, transit-oriented arterial improvements are examined, including queue jump lanes, HOV options, as well as design considerations for buses. Within the discussion of arterial improvement options, suggested improvements for Bellevue's arterial system are outlined. These recommendations are fully summarized in the final section of this chapter.

Many of the treatments developed and described in this chapter can be developed for both transit and HOV users. Transit only improvements are referred to as "transit" whereas improvements for both transit and HOV users are referred to as "HOV".

Please note that transit signal priority (TSP), which is another capital improvement option designed to support speed and reliability goals, is discussed in Chapter XII.

Bus Stop Improvements

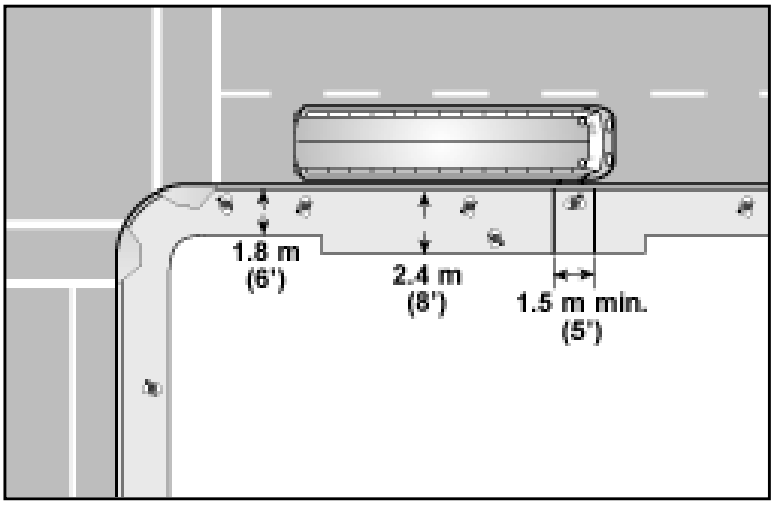
Three different bus stop configurations are found in the City of Bellevue: bus bulbs, in-lane stops, and pullouts. This section describes the amenities found for each stop type and typical applications. Bus pullouts are reviewed in this section, even though they are not regarded as improving the operating environment for transit. However, bus pullouts are a capital improvement option that is sometimes necessary to manage overall traffic flow in a travel corridor.

An additional option for improving transit speed and reliability is consolidating bus stops. However, this option is facilitated through operation and planning choices; as such, it is not examined within this chapter.

In-Lane Stops

In-lane stops are defined as those where buses stop in the actual travel lane. The travel lane is blocked while the bus is dropping off or boarding passengers. The majority of Metro's transit stops in Bellevue are in-lane stops. Metro's practice of stopping in-lane, even in high traffic settings like downtown Bellevue, is consistent with national and international practice in the transit industry. The reason for the standardization of this approach is to avoid delay associated with reentering the traffic stream any time the bus leaves the travel lane. Buses reentering the travel lane from bus pullouts reduce schedule reliability, add to operating costs, and reduce the quality of service for bus riders. This also is the source of motorist complaints and near miss accidents as other vehicles often ignore the state law requiring them to yield to emerging buses. Figure IX-2 depicts a typical in-lane stop.

Figure IX-2
Typical In-Lane Stop[1]



Consideration for In-Lane Stops

Metro's use of in-lane stops in Bellevue is consistent with how it operates in most areas of the county. There are some situations, like downtown Seattle, where designated bus stops are signed within a lane typically used for parking or turning traffic (also called a bus bay stop). In those cases the bus can pull out of the traffic lane while loading and unloading passengers. This design is generally not applicable in Bellevue because there is very little designated on-street parking.

A variation on bus stop use of the parking lane also occurs in downtown Seattle on 2nd and 4th avenues. The variation allows on-street parking during non-peak hours and designates the entire lane for transit only use during peak hours. This option is usually limited to streets where bus and passenger volumes are high. This approach requires aggressive parking code enforcement to clear the lane prior to the start of the peak-hour period to provide for unobstructed bus operations. Again, this has no parallel in Bellevue due to the lack of on-street parking; however, it might be considered in the future, especially in downtown.

Potential In-Lane Development in Bellevue

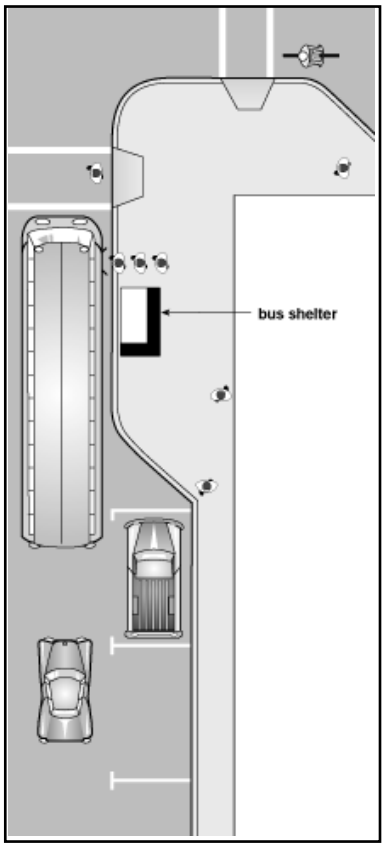
The in-lane bus stops are typically used throughout Bellevue. No recommendations for further applications are made.

[1] Source: Oregon Department of Transportation.

Bus Bulbs

Bus bulbs operate similar to curbside bus stops. A bus bulb is a section of sidewalk that extends from the curb of a parking lane to the edge of a through lane (see Figure IX-3). Buses stop in the traffic lane instead of weaving into a parking-lane curbside stop.[2] Bus bulbs should not be installed at the end of a travel lane, where traffic must merge into the adjacent lane, so they are typically located in parking lanes. Bus bulbs placed on the far side of intersections must be long enough that an articulated coach can stop at the bulb without encroaching on travel lanes or crosswalks. The cities of Seattle, WA; San Francisco, CA; and Portland, OR have a number of bus bulbs in use. Bellevue has one operational bus-bulb at present. It is located on westbound Main Street between 102nd Avenue NE and 103rd Avenue NE (Figure IX-4).

Figure IX-3
Typical Bus-Bulb Stop[3]

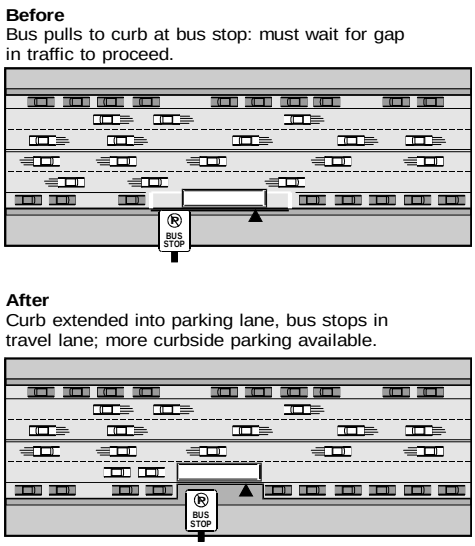


[2] Transportation Research Board. TCRP Report 65: Evaluation of Bus Bulbs. 2001.
[3] Source: Oregon Department of Transportation.

Figure IX-4
Bus Bulb at Main Street and 102nd Avenue NE

A major advantage of using bus bulbs is the creation of additional space at bus stops. This increased space allows development of bus patron amenities such as shelters and benches (Figure IX-3), and for additional landscaping to improve the visual environment. Additionally, bus bulbs reduce pedestrian crossing distances and provide pedestrians with a more comfortable place to determine the location of oncoming traffic at the start of a crossing. This significantly improves pedestrian safety, especially for older or physically disabled pedestrians. Finally, bus bulbs require less street space than other bus stop options. The bulb can be the length of the bus or the minimum length required for boarding and alighting activities. In cases where a bus bulb is replacing a bus bay in a parking lane, this minimal amount of space requirement can result in the creation of additional parking spaces because the bulb does not require the inclusion of weaving space for a bus to enter the bay (Figure IX-5).

Figure IX-5
Example Operation of Bus Bulbs[4]



There are some potential disadvantages of bus bulbs that should be considered when identifying locations for siting these types of stops. Bus bulbs may create potential sight distance problems for automobile drivers. Also, right-turn-on-reds may be more challenging in cases where a bus bulb is present.

Potential Bus Bulb Development in Bellevue

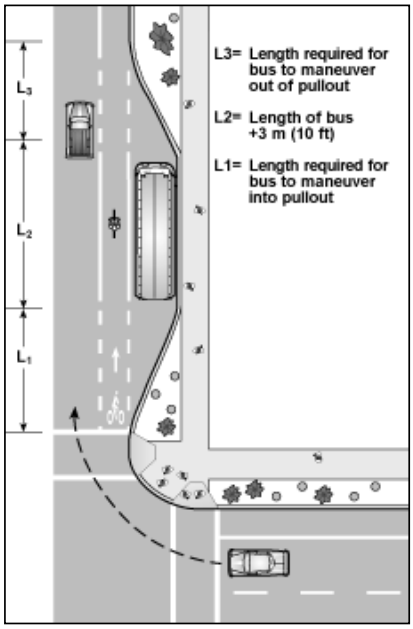
Although bus bulbs present some advantages for bus operations, potential use in Bellevue is limited. As noted, bus bulbs are typically sited on streets with on-street parking. Further, bus bulbs should not be considered on streets where existing on-street parking space is projected to be converted to regular traffic carrying lanes. With regard to Bellevue's arterials, very few locations fit these primary criteria. However, if the present on-street parking located on NE 2nd Street and 106th Avenue NE is maintained, then the feasibility of bus bulbs on that corridor should be examined. According to the Downtown Implementation Plan, on-street parking on both NE 2nd Street and 106th Avenue NE are likely interim; in the long-run, the parking lanes will be required to accommodate projected traffic volumes.

Bus Pullouts

A pullout is a specifically constructed area outside the travel lanes of a roadway that provides for the pickup and discharge of passengers (Figure IX-6). In general, pullouts help automobile traffic flow at the detriment of buses. Buses can experience significant delays exiting the pull-out, particularly in saturated traffic conditions. Barring a unique operating environment, pullouts should be avoided if transit speed and reliability is a priority.

[4] Source: Kittleson & Associates Transit Preferential Treatments Presentation to TRB

Figure IX-6
Typical Bus Pullout Stop[5]



Considerations for Bus Pullouts

In some instances it is appropriate to consider bus pullouts as a means of diminishing the impact of stopped or slower transit vehicles on faster-moving general-purpose traffic. However, Metro's *Administrative Guidelines*, as related to bus pullouts, asserts:

> *"Bus pullouts should be provided only where buses, when stopping on the roadway, present a serious traffic and safety problem. This is because of the delay bus drivers encounter when trying to get back into the stream of traffic. The following is a list of conditions under which pullouts should be considered:*
>
> - *Speed limit of 35 mph or more on a two-lane road; 40 mph on a four-lane road*
> - *Poor sight distance (on curve or crest of hill)*
> - *Long dwell time at bus zone (more than 30 seconds)*
> - *High accident rate (rear-end collisions, sideswipes)*
> - *Regular disabled stop*
> - *No area to unload passengers safely*
>
> *In order to improve system on-time performance and minimize merging conflicts, a traffic study should be conducted to determine if a pullout is warranted."*

[5] Source: Oregon Department of Transportation.

Potential Bus Pullout Development in Bellevue

Given the above criteria, only 148th Avenue has bus stops in pullouts and no additional efforts are being made to implement pullouts elsewhere in the City. In 1976, the City undertook the 148th NE/SE Project between Bel-Red Road and SE 28th Street along 148th Avenue. This roadway improvement project created a free-flow environment for traffic along 148th Avenue by minimizing access to/from adjacent side-streets. As a result, access to adjacent neighborhoods is provided vis-à-vis u-turn routes in left-hand turn pockets. Although not the intent of this project, the need for traffic turning radius modifications at these points resulted in tapers that function as pullout locations for transit at the following locations along 148th Avenue: NE 15th, NE 8th, NE 6th, NE 3rd, Lake Hills Blvd, SE 22nd, SE 24th. Metro has not expressed any reservations about the use of these sites, because a number of these pullouts are significantly longer (up to 500 feet) than those required by Metro (between 70 feet and 110 feet in length); as such, they do not pose a significant travel time and schedule reliability problem to coaches re-entering the travel lane.

While it would be possible to locate additional bus pullouts along city streets, this option of serving the City would have the following consequences:

- The construction of pullouts in some areas of Bellevue (e.g., downtown) would require either: a) a modification of the City's Land Use Code to allow for narrower walkways, or b) the purchase of additional right-of-way to add the equivalent of another travel lane. Within downtown Bellevue, the street rights-of-way vary from 60 to 90 feet and typically, the street occupies all or most of the available public right-of-way, with the sidewalk and buffer strip located on private property through easements. Most of the bus stops in downtown Bellevue are located on streets with 16-foot-wide sidewalks.
- Construction of pullouts is costly. The optimal measurements for a pullout are 70 feet to 110 feet in length and 10 to 12 feet in width. Pullouts often include such improvements as landing pads, walkways, curb ramps, and corner radius work. Pavement design must be sufficient to handle 40-foot and 60-foot buses that are classed as "heavy weight vehicles." Metro's general concern is to meet or exceed a minimum standard of a compacted subgrade and 10 inches of ATB (Asphalt Treated Base) and 3 inches of Class B Asphalt overlay. Based on recent bus pullout construction experience along 156th Avenue, a pullout could be assumed to cost (ROW and construction) approximately $200,000.
- Delays to transit vehicles could be substantial, which could increase costs to Metro and reduce ridership because of slower running times. Moreover, increased transit travel time can lead to reduced transit resources for Bellevue. In Anchorage, AK, bus pullouts on an arterial street similar to 148th Avenue in Bellevue added up to 5 minutes of travel time during congested periods to a route that normally took approximately 50 minutes. Buses were regularly trapped in the pullouts by heavy

traffic for over a minute.[6] Often buses would stop in-lane prior to or after the pullout to avoid being trapped.

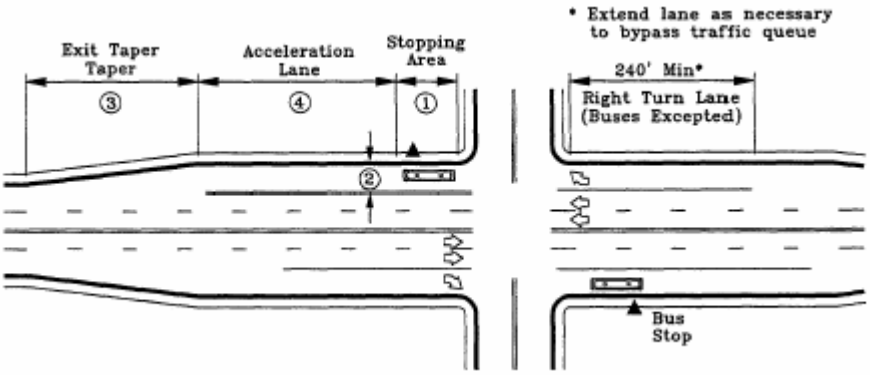
While some negative impacts to general-purpose traffic may be caused by transit coaches stopping in-lane, these impacts are considered negligible relative to other safety and congestion issues.

Signal Queue Jump Lanes

A signal queue jump lane provides short lanes at the approach to an intersection reserved for buses or HOVs. These lanes may be used in combination with a bus stop or a bus pull-in or as stand-alone projects. These lanes allow buses and HOVs to move around the line of general traffic at a signal and travel through the intersection. A way to merge back into the general traffic lane after the intersection must be provided with this approach. One technique is to provide a separate traffic signal head for the HOV queue jump lane and to give the lane an advance green light, while holding the general traffic lanes on red. This approach allows HOVs to move through the intersection and re-enter the general traffic lanes in advance of other traffic (Figures IX-7 and IX-8)

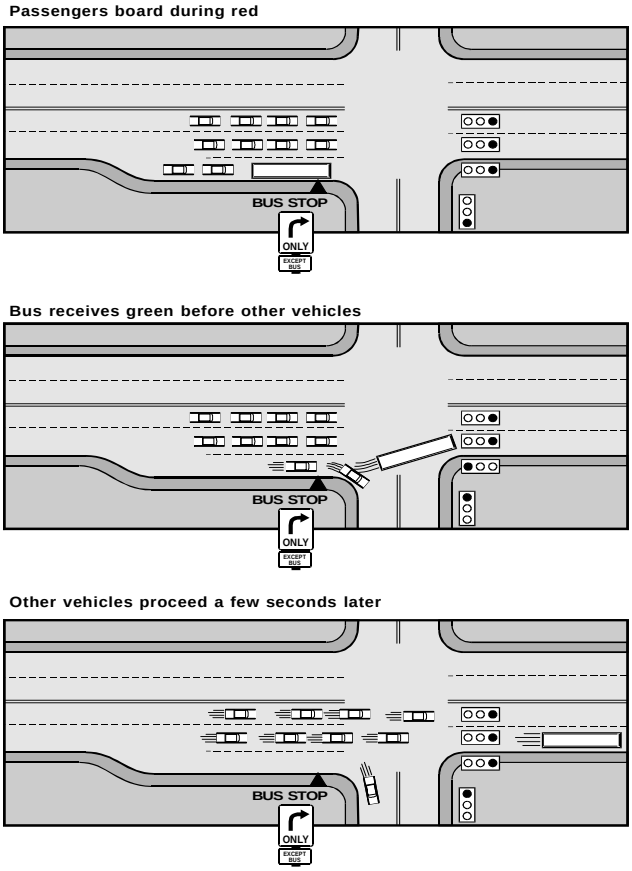
The concept of signal queue jump lanes in Bellevue has been discussed for almost two decades. The May 1985 *Central Business District Transit/Carpool Facility Study* conducted by Entranco included a discussion of HOV queue jump lanes at 108th Avenue NE.

Figure IX-7
Typical Signal Queue Jump Lane[6]



[6] Source: Thomas Wittmann Observations of People Mover Route 75, September 2001

Figure IX-8
Typical Operation of Queue Jump Lane[7]



Considerations for Bus Queue Jump Lanes

According to the transit agencies that use queue jump bus lanes, these lanes should be considered at arterial street intersections when the following factors are present[8]:

- High-frequency bus routes have an average headway of 15 minutes or less;
- Traffic volumes exceed 250 vehicles per hour in the curb lane during the peak hour;
- The intersection operates at a level of service "D" or worse (see the Transportation Research Board's *Highway Capacity Manual* for techniques on evaluating the operations at an intersection); and
- Land acquisitions are feasible and costs are affordable.

[7] Source: Kittleson & Associates Transit Preferential Treatments Presentation to TRB
[8] Source: TCRP Report 19 – Guidelines for the Location and Design of Bus Stops

An exclusive bus lane, in addition to the right-turn lane, should be considered when right-turn volumes exceed 400 vehicles per hour during the peak hour.

One caveat for implementing queue jump lanes is that the City of Bellevue signal system does not have the ability to provide more than eight phases to an intersection. If left-turns are unprotected at an intersection, then a queue jump phase may be possible. However, if left-turns are protected, the Bellevue central signal software would need modification. Based on the locations identified above for potential queue jump improvements, every candidate intersection for queue jump lanes on NE 8th Street appears to operate currently with 8-phase signal timing; software improvements would be necessary to implement queue jump lanes.

Potential Queue Jump Development in Bellevue

Currently, several corridors have service and traffic characteristics consistent with the recommended guidelines for queue jump considerations. These corridors include Bellevue Way SE and NE 8th Street. Both NE 8th Street and Bellevue Way SE are being considered for Bus Rapid Transit (BRT) service by Metro and Sound Transit respectively. Transit queue jump lanes are appropriate capital improvements for this future occurrence. Downtown Bellevue locations do not have the right-of-way available to accommodate queue jump lanes.

Bellevue Way SE has very frequent bus service and experiences severe congestion during the peak hours. Throughout the Bellevue Way SE corridor, right-turn lanes do not exist. Therefore, any queue jump lanes would require widening on the near and far side of the intersection. The Downtown Implementation Plan Update, which is currently in progress, considered several options to widen Bellevue Way SE to accommodate future traffic volumes. In August 2002, the Bellevue City Council put further examination of these options on hold due to lowered downtown Bellevue growth forecasts, neighborhood opposition, and ongoing discussions concerning I-405 improvements.

An HOV lane on Bellevue Way SE should be considered in the future as a complement to transit/HOV improvements in the I-90 corridor, and as a mechanism to address congestion in the longer term. The HOV improvements on Bellevue Way SE would need to be considered from a system perspective that would weigh freeway-oriented improvements against local access issues. Bellevue Way HOV/transit improvements would address an immediate and acute need. However, an investment of this magnitude should be considered within a broader context that encompasses freeway improvements, the future of the South Bellevue Park-and-Ride lot, and the potential of a high capacity transit system.

NE 8th Street has very frequent bus service and experiences congestion throughout the day. Several locations along the corridor have existing right-turn lanes that could be used as queue jump lanes, including the eastbound leg at 148th Avenue NE, and the eastbound leg at 120th Avenue NE.

148th Avenue is heavily congested during the p.m. peak in particular. In addition, several segments of 148th Avenue have high levels of bus service. The 148th Avenue Mobility Improvement Package outlines several different transportation improvements that optimize north-south travel. The project Technical Advisory Committee and the Bellevue Transportation Commission recommended a southbound HOV queue jump lane between SE 22nd Street to SE 24th Street to improve the speed and reliability of approximately 25 daily buses. The Bellevue City Council, on October 22, 2002, did not agree to carry this recommendation forward. The Council desires resolution on the I-405 widening process prior to addressing improvements to corridors parallel to I-405. A similar recommendation applies north of SE 22nd Street. The Mobility Improvement Package recommends that an approximately 2,100-foot-long HOV lane be constructed between Lake Hills Boulevard and SE 22nd Street that connects to the queue jump lane.

Arterial HOV Lanes

Arterial street HOV projects facilitate the movement of buses, carpools, and vanpools through congested areas, providing travel time savings and improved trip time reliability. Arterial street HOV facilities may also provide time savings to transit operators, improve fuel efficiency, reduce energy use, and enhance air quality.

An arterial HOV lane is a traffic lane on a surface street reserved for the exclusive use of buses, carpools, and vanpools. With curbside bus lanes, bicyclists and right-turning vehicles are usually permitted. In King County, Business Access Transit (BAT) lanes are the preferred option for arterial bus lanes. Buses and right-turns are allowed uses; carpool users are not. Examples of arterial HOV lanes in King County are found in Tukwila on Pacific Highway, and an example of a BAT lane is found on SR 522 in Kenmore.

The benefits of arterial HOV lanes include:

- Reserved lanes help buses pass congested traffic.
- HOV lanes can carry more people than general-purpose lanes by definition. On both Airport Road in Snohomish County, WA and on Hastings Street in Vancouver, B.C., arterial HOV lanes carry more people than in both adjacent lanes.
- Travel time advantage for transit/HOVs because they can bypass delays. For example, adding arterial HOV lanes to a 4.3-mile-long segment of Hastings Street in Vancouver B.C. resulted in a 3-minute savings for carpools and buses. On Airport Road, carpool users averaged savings of one-minute over a 3-mile segment of roadway. [9]
- Delays on arterials happen predominately at signals. HOV lanes help bypass queues at signals and reduce the overall signal delay to buses.
- HOV lanes improve transit speed and reliability, which translates into more controllable operating costs (costs don't steadily increase with increased congestion)

[9] Sketch Planning Tools for Arterial HOV Evaluation, Chris Wellander, P.E., Kathy Leotta, Susan Serres, P.E., Michael Horn., Paper to ITE, Appendix I.

and more efficient use of transit dollars. In addition, transit reliability is critical for the general public to choose transit over driving.

- Arterial HOV lanes result in increased numbers of carpools, a condition which is sought-after as a congestion mitigation result. After one year, the number of carpools on Hastings Street in Vancouver, B.C. increased by 12 percent from 31 percent to 43 percent (Table IX-1). The number of carpools on Airport Road in Snohomish County, WA increased by 1 percent as a result of opening arterial HOV lanes (Table IX-2)[10].

Table IX-1
Airport Road HOV Lane Carpool Creation Results

	Before Volumes			Actual Results		
Vehicle Classification	HOV Lanes	Mixed Lanes	Total	3 mos.	6 mos.	12 mos.
SOVs	0	1,267	1,267	1,282	1,187	1,102
HOVs	0	239	239	288	318	272
Buses	0	0	0	0	0	0
Total	0	1,506	1,506	1,570	1,505	1,374

Table IX-2
Hastings Street HOV Lane A.M. Peak Carpool Creation Results

	Before Volumes			Actual Results (7 Months Later)	
Vehicle Classification	HOV Lanes	Mixed Lanes	Total	HOV Lanes	Mixed Lanes
SOVs	0	1,545	1,545	74	1,476
HOV 2	0	430	430	426	175
HOV 3+		50	50	45	19
Buses	0	33	33	33	0
Trucks	0	37	37	0	37
Motorcycles	0	4	4	4	0
Total	0	2,099	2,099	583	1,706

Arterial HOV lanes should be considered when the number of persons per hour carried by buses in a given corridor approaches the people-carrying capacity of a general-purpose lane. They do have operational issues that may hinder implementation. Arterials generally have severe right-of-way (ROW) constraints due to driveways, turns, signals, multiple users, and

[10] May 11, 2000 presentation to Bellevue Transportation Commission by Susan K. Serres, P.E.

adjacent land uses. In addition, depending on the location, multiple agencies are involved such as the City, Metro, WSDOT, Sound Transit, etc. Arterial HOV lanes are subject to the same perception problem as expressway HOV lanes; even when an arterial HOV lane has a higher throughput (persons per hour) than other traffic lanes, it may appear under-used. Due to the "empty lane syndrome", sufficient demand for arterial HOV lanes should be documented prior to construction.

A number of different approaches can be used to provide priority to buses, vanpools, and carpools on arterial streets. Most of these techniques use existing travel or curb lanes rather than adding new lanes. These approaches include using bus malls, right-side lanes, center lanes, contraflow lanes on one-way streets, and providing priority to buses at signalized intersections.

Bus Malls

Bus malls are streets reserved exclusively for public transit vehicles. Most also include improved sidewalks and other pedestrian amenities. Access to emergency vehicles is usually provided and some projects allow taxis. Bus or transit malls are primarily found in downtown areas. Existing transit malls range in length from a few blocks to facilities covering 10 to 15 blocks. Transit and pedestrian malls were developed in a number of cities in the 1970s. Some of these facilities have been removed or modified, but a number are still in operation.

Three of the best examples of successful bus malls are found in downtown Portland, downtown Denver (Figure IX-9), and downtown Minneapolis (Figure IX-10). Bus malls provide a number of benefits to transit operators and transit riders. These facilities provide a high level of service for bus operations by enhancing the flow of transit vehicles through a congested area and providing a focal point for transit within an area. Additional benefits may be realized through coordinated traffic signal phasing or providing priority for buses at signalized intersections.

Bus Mall Considerations

Bus malls are usually considered only in major activity centers with high bus volumes and congested streets. It is important that capacity exists on the remaining street system so that general-purpose traffic is not negatively affected. Some existing bus malls were one part of larger downtown redevelopment programs. The capital costs associated with bus malls frequently limit the application of this technique. Variables that may influence capital costs include the length of the facility, modifications in street or sidewalk design, passenger waiting areas or bus stations, links to buildings or skywalk connections, passenger amenities, trees, and other street furniture or enhancements.

Figure IX-9
Denver 16th Street Transit Mall[11]

Figure IX-10
Nicollet Mall in Minneapolis.

11 Arterial Street High-Occupancy Vehicle (HOV) Lanes in Texas, Katherine F. Turnbull, Texas Transportation Institute

Bus Mall Potential Opportunities

The only area where a bus mall may be appropriate within the City of Bellevue's city limits is along the NE 6th Street pedestrian corridor between 112th Avenue NE and Bellevue Way. A bus mall would focus bus service on the entire core of downtown Bellevue, provide east-west mobility, and remove buses from congested thoroughfares such as NE 8th Street and NE 4th Street. The May 1985 *Central Business District Transit/Carpool Facility Study* included a discussion of an East-West CBD Core Area Transit-Way on NE 6th Street. Due to the existing development patterns and right-of-way limitations, creating a bus mall on NE 6th Street does not appear to be feasible at this time. Bus malls do not appear to be a reasonable strategy elsewhere in Bellevue, at this time, though improved transit access would be desireable in several locations, such as Crossroads Mall, Overlake, and Factoria Mall. Limited street capacity, a lack of parallel routes, and generally limited transit service preclude consideration of dedicating substantial right of way to exclusive transit use at this time.

Right-Side HOV Lanes

This type of HOV facility uses the right-side lane, usually the curb lane or the second lane, on an arterial street for an HOV lane. This approach represents the most common application of HOV lanes on arterial streets. Right-side HOV lanes may be open only to buses, although vanpools, and carpools may be allowed. Bus-only lanes are found in many downtown areas. These facilities may operate only during the morning and afternoon peak hours or throughout most of the day and help move buses through congested downtown areas.

Right-Side HOV Lane Considerations

Curbside lanes are difficult to keep uncongested. The major threats to smooth curbside bus lane operation are (1) illegal parking and standing and (2) right-turning vehicles waiting for pedestrians. One solution to the first problem is to designate the next lane away from the curb as the bus lane, thereby providing a legal place for curbside parking. Some spots can be reserved for deliveries. One solution to the second problem is to prohibit right turns at locations where serious delays would otherwise be encountered. Another solution is also using the lane *adjacent* to the curb lane as a bus lane and mark a right-turn-only lane next to the curb at intersections with heavy right-turn volumes.

Right-side arterial street bus lanes are currently in operation in downtown Seattle. The City of Bellevue operated a curb-side HOV lane on NE 4th Street between 108th Avenue NE to 112th Avenue NE for almost 16 years. The lanes are being removed as part of the Downtown Access Project that is constructing a direct access ramp from the I-405 HOV lanes to NE 6th Street.

The May *1985 Central Business District Transit/Carpool Facility Study* identified the NE 4th Street arterial as an HOV lane. The 1985 study also called for other improvements, including an HOV only left-turn lane on NE 8th street at the 116th Ave NE intersection, HOV turn lanes on 108th Ave NE at NE 4th street, and a northbound HOV only left-turn lane on 112th Ave NE at NE 6th Street. Of these projects, only the NE 4th Street arterial HOV lane was in operation for an extended period of time. A lack of right-of-way currently constrains any future development of HOV turn lanes at downtown Bellevue intersections.

Potential Right-Side HOV Lane Opportunities

Curbside HOV lanes should be considered in future 148th Avenue NE studies and downtown Bellevue long-range planning efforts. Right-side bus-only lanes may be appropriate for downtown Bellevue streets if one-way pairs are adopted in the future. For example, if either street providing access to the Bellevue Transit Center, 108th Avenue NE or 110th Avenue NE, becomes one-way between Main Street and NE 10th Street, right-side bus lanes should be strongly considered to maintain bi-directional access to the Bellevue Transit Center. The Downtown Implementation Plan currently is considering making both 108th Avenue NE and 106th Avenue NE one-way streets. Currently, 110th Avenue NE is not under consideration for one-way operation.

In the future, peak-hour bus lanes should be considered for downtown Bellevue streets with on-street parking and a concurrent high volume of bus traffic. Currently, this does not exist, however, as bus volumes continue to grow in the next ten years, removing on-street parking for bus only facilities should be considered. Creating off-peak on-street parking/peak-hour bus lanes assumes that the streets with on-street parking have not been modified to accommodate bus bulbs. Bus bulbs and off-peak on-street parking/peak-hour bus lanes are incompatible.

Left-Side HOV Lane Considerations

Nationwide, few examples exist of left-side HOV lanes. Operating an HOV facility in the left lane of an arterial street eliminates potential traffic conflicts related to curb lanes, such as on-street parking, delivery vehicles, and right-turn movements at driveways and intersections. This approach may be appropriate for longer-distance HOV facilities or one-way streets. Potential issues with this technique include accommodating left-turns for general traffic and significant problems to transit operations if buses must pull over to the curb to pick up and drop off passengers. An alternative is to provide passenger waiting platforms adjacent to the left lane, which requires additional right-of-way and capital expenditures.

Left-Side HOV Lane Opportunities

One location in Bellevue may be appropriate for a left-side bus-only/HOV lane, depending on the ultimate decision on whether the proposed Bellevue Way direct access ramp has a left- or right-lane HOV access onto I-90. Bellevue Way SE between 112th Avenue SE and I-90 experiences severe congestion related delays. In the southbound direction, buses are often delayed for minutes at a time as they crawl through traffic on Bellevue Way. One hundred seventy buses a day travel in the southbound direction on this segment (16 buses per a.m. peak hour and eleven buses per p.m. peak hour). A southbound left-side bus-

only/HOV lane between I-90 and 112th Avenue SE would allow buses to travel past any congestion related queues and onto the proposed I-90 bidirectional HOV lanes. There are no southbound bus stops in this segment, so a left-side HOV lane is feasible.

Median HOV Lane Considerations

Bus lanes can also be located in the median, usually of a wide boulevard. Many similar reservations were created for trolleys, a few of which still exist in the United States. Some of these rights-of-way were converted to bus use, for example, Canal Street in New Orleans (Figure IX-11) and Market Street in San Francisco (both of which now have shared trolley and bus use). Median lanes are usually separated from general traffic lanes by a raised curb. Passenger platforms are usually on the right, and can be staggered to reduce the overall width needed. Center platforms can also be used, but this requires left-side doors on all vehicles using the median lanes. If there is sufficient room, median lanes can be designed to permit buses to pass each other, but this is not always feasible.

Median lanes are much less likely to be congested by other traffic than curbside lanes. On the other hand, they do present a few disadvantages relative to curbside lanes:

- Left-turning traffic conflicts with straight-through buses. Either left turns must be banned or they must be permitted only in a separate phase.
- Passengers must cross traffic lanes to reach stops. Where there are several lanes of fast traffic, this can create safety problems, especially since passengers often are anxious to cross to catch an approaching bus.
- Because of the need for passenger loading areas in the center of the street, the overall street width needed is larger than in the case of curbside lanes.

Despite these drawbacks, median HOV lanes are sometimes appropriate for high volume routes, particularly when they connect to freeway HOV direct access ramps.

Median Lane HOV Lane Opportunities

Bellevue has no locations where median lanes are under consideration in the near-term. In the long term, opportunities for median transit lanes should be explored, particularly in areas where higher capacity transit will become necessary. Bellevue Way SE is the most viable long-term candidate for median transit lanes, whether for light rail, bus rapid transit, or even expanded bus service. Other corridors such as NE 8th Street, 156th Avenue NE, and 148th Avenue NE should also be considered as part of long-term planning processes.

Figure IX-11
Median Bus Lanes in New Orleans[12]

[12] Arterial Street High-Occupancy Vehicle (HOV) Lanes in Texas, Katherine F. Turnbull, Texas Transportation Institute

Contraflow Lane Considerations

Another option is to provide a *contraflow lane* to carry buses in the opposite direction on what would otherwise be a one-way street (Figure IX-12). Contraflow lanes can provide more direct routing for buses when one-way street patterns create detours. Contraflow lanes do not have the same enforcement problems as curbside lanes, since violators are easy to spot and catch.

This option is under consideration for 108th Avenue NE in downtown Bellevue as part of the Downtown Implementation Plan. It would permit two-way bus access to the new Bellevue Transit Center, with buses operating in the outside lanes on both sides of the street. This arrangement allows for the ongoing use of existing heavily used bus stops.

Figure IX-12
Contraflow Bus-only Lane on Spring Street in Downtown Los Angeles[13]

Most contraflow lanes in the past were installed adjacent to the curb. This design prevents the use of the curb for deliveries, which may be a serious problem for businesses without rear loading access, such as via side streets or alleys. One solution to this problem was devised in San Francisco in 1997. The next lane from the curb on Sansone Street was designated as a contraflow bus-only lane. The curb lane was reserved for commercial deliveries, and commercial vehicles were authorized to use the lane. Essentially the project

[13] Arterial Street High-Occupancy Vehicle (HOV) Lanes in Texas, Katherine F. Turnbull, Texas Transportation Institute

involved converting a northbound one-way street with three travel lanes and curb parking into a two-way street with a southbound lane and curb parking restricted to buses and commercial vehicles.

The Lymmo downtown circulator in Orlando, FL provides another option in bus lane design. For most of the route, the Lymmo travels on streets that were formerly three lanes in the same direction (one-way streets). After conversion to bus lanes, the right-most lane remains for general traffic use and provides access to on-street parking. The center lane was converted to a bus-only lane, with a raised curb separating it from the general traffic lane and providing space for loading.

The left-most lane becomes a bus-only lane for opposite-direction bus traffic; loading is on the opposite sidewalk and there is no on-street parking on that side. These configurations can produce complications at intersections. Orlando's solution was to provide separate bus phases at every intersection, controlled by special bus-only signals, to permit buses to make all movements free of conflicting traffic moves. These signals are only activated when an approaching bus is detected.

A contraflow bus lane is in operation in downtown Seattle on 5th Avenue between Terrace Street and the Cherry Street Express Lane reversible off/on-ramp. The lane is three blocks long and has bus-only signals. The segment also includes one bus stop.

Contraflow Lane Opportunities

Contraflow bus lanes may be appropriate for downtown Bellevue streets if one-way pairs are adopted in the future. For example, if either street providing access to the Bellevue Transit Center, 108th Avenue NE or 110th Avenue NE, becomes one-way, contraflow lanes should be strongly considered to maintain access. The Downtown Implementation Plan is examining making both 108th Avenue NE and 106th Avenue NE one-way streets. Currently, 110th Avenue NE is not being considered for one-way operation. Otherwise, contraflow lanes are not applicable to the Bellevue streetscape, and should not be considered.

Arterial Design for Buses

Transit route design often encounters roadways where buses cannot safely operate. Often in these cases, bus routes are designed not for the passenger market on a particular street, but simply on how to most effectively get from point A to point B.

Turn Radii

In a meeting with Metro supervisors and planning staff, seven different locations were identified where turn radii make bus turns difficult, if not impossible. These eight locations all either have existing bus traffic on them, or the desired movement is currently not possible:

- Eastbound right turn 148th Avenue at Landerholm Circle – Routes 271, 245, and 222 make this turn out of the Bellevue Community College. Drivers report that often the turn radius causes them to swing into adjacent lanes (splitting lanes), and during congested times, splitting lanes is often impossible. This turn radii issue will be addressed by a project in Bellevue's 2003 CIP.
- 156th Avenue at Bel-Red Road – The Overlake region has limited turn movements and large blocks. Metro has difficulty efficiently turning buses around and creating routing through the area that meets customer needs. Adding left-turn movements between 156th Avenue and Bel-Red Road would address these concerns and allow routes to be routed more efficiently through Overlake.
- Southbound right turn 156th Avenue at Northup Way – The Overlake region has limited turn-movements and large blocks. Metro has difficulty efficiently turning buses around and creating routing through the area that meets customer needs. Buses currently cannot make a southbound right-turn movement from 156th Avenue onto Northup Way, which limits the area routing possibilities and creates inefficient routing patterns.
- Eastbound right turn 156th Avenue at NE 24th - Routes 253 and 229 currently make this movement. Bus operators report the turn radii causes them to swing into the adjacent lane, which is difficult during peak hours.
- Southbound right turn 164th Avenue at Northup Way - Route 230 in east Bellevue is routed to avoid a right-turn, which is too tight for buses, from Northup Way onto 164th Avenue NE. In the process of avoiding the right-turn, a potentially higher ridership area remains unserved by route 230.
- Northbound right turn 164th Avenue at Northup Way – Currently, Route 230 travels through this intersection. Metro planning staff indicated that routing in the area could change and become more efficient if the northbound right-turn from 164th Avenue onto Northup Way were possible for buses.
- Westbound right turn 139th Avenue SE at SE 32nd Street – Currently, it is difficult for a bus to make this movement. Currently there is no service on 139th Avenue SE, but it is a City of Bellevue service goal to begin providing transit to this area. To facilitate service patterns between 139th Avenue SE and the Eastgate Park-and-Ride bus loop, the westbound right turn from SE 32nd Street to 139th Avenue SE must be possible.

Roadway Standards

Transit routing is also affected by arterial design standards. Three locations in Bellevue were identified where roadways are currently not ideally designed for bus traffic. The roadway issues involve permission to use private roadways and inadequate pavement depths (pavement standards are discussed in Chapter X). The three locations are:

- SE Perimeter Road from Bellevue Community College (BCC) to Eastgate – Currently, only vans are able to drive on SE Perimeter Road between Landerholm Circle and 142nd Place SE. This roadway has an inadequate pavement depth for full-size buses, which is the most direct connection between the BCC and the Eastgate Park-and-Ride. A more direct routing between the north end and south end of the BCC campus is desired to improve transit speed and reliability for several bus routes that currently travel between BCC and the Eastgate Park-and-Ride. For this to occur, SE Perimeter Road must be upgraded to accommodate full-size buses.

  An alternative to upgrading SE Perimeter Road and providing a more direct routing through the BCC campus, is to improve the campus roadway that connects 142nd Place with 145th Place at SE 24th Street. This roadway, once upgraded to accommodate buses, does not provide any significant parking access, yet provides close pedestrian proximity to buildings.

- SE 32nd Street between 139th Avenue and 140th Place - According to Metro planning staff, reconstructing the Eastgate bus turnaround will likely create bus traffic on SE 32nd Street. According to operators, the existing roadway is not constructed for buses. The Eastgate Park-and-Ride expansion project will improve this roadway to accommodate buses.

- Westbound left turn NE 8th Street to 108th Avenue NE – According to Metro operators, the existing left-turn lane is very narrow considering the high bus traffic (over 100 daily buses). The left-turn lane is 11 feet wide, and the adjacent through lanes are all 11 feet wide as well. The only cost-effective method to widen the left-turn lane is to restripe the eastbound and westbound through lanes to slightly less than 11 feet wide. The increased width for the left-turn lane would result in narrower through lanes. The estimated cost of restriping NE 8th Street between 108th Avenue NE and 110th Avenue NE is $15,000.

Transit Facilities Access

The majority of transit facilities in Bellevue were constructed prior to today's congested traffic levels. Upon year of opening, transit facility access was not problematic, because the street traffic volumes were not substantial. Today, however, traffic on arterials throughout the city is reaching new highs, and it is affecting the ability of buses to access transit facilities.

According to Metro operators, two different Bellevue facilities have existing access issues that are substantially delaying buses:

South Bellevue Park-and-Ride – The southbound access for buses into the park-and-ride is currently unsignalized. During peak hours, Metro operators indicated that the southbound left turn from Bellevue Way into the park-and-ride can be delayed by up to two minutes. Over 170 daily buses make this movement and are subject to these delays. The operators recommended installing a bus-actuated left-turn signal to minimize this delay. This recommendation would need to be examined for signal warrants and impacts to northbound traffic flow on Bellevue Way.

South Kirkland Park-and-Ride – Access for buses from 108th Avenue NE to the park-and-ride is currently unsignalized. Metro operators report that limited sight distances and heavy traffic on 108th Avenue NE create delays whenever buses access the park-and-ride lot. Six routes are affected by delays at this access. The operators recommended installing a signal at the park-and-ride entrance that is synchronized with the 108th/Northup Way signal. In addition, the intersection of NE 38th Place/108th Avenue NE would need to be accommodated by this signal as well. This recommendation would need to be examined for signal warrants and impacts to traffic flow on 108th Avenue NE. This recommendation is currently being evaluated by Sound Transit as part of their Kirkland transit improvement project.

Identified Arterial Trouble Spots that Affect Transit Speed and Reliability

As part of the planning effort, several congestion hot-spots were identified by Metro operators. These congestion areas regularly delay routes through the area, but they are also indicative of general-purpose vehicle congestion rather than a transit-specific issue. Table IX-3 shows the identified congestion hot spots as well as a proposed solution by the operators, if a solution was possible. Improvements to these locations for general-purpose traffic would also assist in reducing transit delays, and would enhance overall transit speed and reliability.

The January 24, 2002 Downtown Implementation Plan Transportation Analysis Summary identifies 35 projects groupings that were analyzed on a planning-level basis. Eighteen project groupings were recommended for further analysis. The groupings contained projects that would help address future traffic congestion and access to downtown Bellevue. While most of the groupings were not transit specific, improvements in traffic flow in downtown Bellevue would benefit transit. Table IX-4 lists the improvements from the plan that would improve general-purpose traffic and also assist in reducing transit delays, resulting in enhanced overall transit speed and reliability.

Table IX-3
KCM Identified Arterial Trouble Spots that Affect Transit Speed and Reliability

Location	Identified Issue	Identified Potential Solution
148th Ave. south to Landerholm Circle.	Landerholm Circle light causes a backup on 148th in the southbound direction	Have BCC reroute internal traffic better using the 142nd access to the west
164th Ave. at NE 24th	Congestion at this intersection.	
156th Ave. between NE 24th and NE 8th	Congestion and many driveways	
156th Ave. at Lake Hills Blvd.	Congestion at Lake Hills Shopping Center	
Northup Way at Lake Washington Blvd.	Southbound and westbound left-turning buses are often severely delayed by this signal.	Install left turn TSP
Northup Way at 108th Ave - Eastbound LT	Eastbound buses trying to access the 108th Ave NE on the way to the South Kirkland Park-and-Ride are delayed by the congestion at this left turn.	Retime signal or install eastbound left turn TSP
NE 8th St between 102nd and 100th	Buses often have trouble pulling out of the bus stop in the curb-lane and shifting into the inside through-lane.	
148th Ave. between SR 520 and NE 8th St.	Corridor congestion.	
NE 20th between 148th and 116th	Congestion increasing	
Bellevue Way SE between 112th Ave and I-90	Southbound p.m. peak congestion backs up traffic between 112th Ave SE and I-90	Add southbound HOV lane between 112th Avenue SE and I-90

Table IX-4
Downtown Implementation Plan Identified Arterial Trouble Spots that Affect Transit Speed and Reliability

Location	Identified Issue	Identified Potential Solution
Bellevue Way @ NE 4th Street	Intersection operates at poor LOS	Add dual northbound left-turn lanes, an eastbound right-turn lane, and a westbound right-turn lane.
Bellevue Way @ Main Street	Intersection operates at poor LOS	Add dual westbound left-turn lanes
Bellevue Way between NE 8th Street and NE 12th Street	Intersections operate at poor LOS	Add southbound lane from NE 8th Street to NE 12th Street
Bellevue Way between Main Street and NE 4th Street	Intersections operate at poor LOS	Add southbound lane from Main Street to NE 4th Street
Bellevue Way between I-90 and 112th Avenue SE	Intersections operate at poor LOS	Widen by one lane in each direction
Bellevue Way between 112th Avenue SE and Main Street	Intersections operate at poor LOS	Widen by one lane in each direction
Bellevue Way @ SR 520	Lack of freeway access	Add eastbound on-ramp to SR 520 from Bellevue Way
Bellevue Way between SR 520 and NE 12th Street	Intersections operate at poor LOS	Widen by one lane in each direction
112th Avenue NE between Main and SE 8th	Left-turning vehicles delay through vehicles	Add center turn-lane
112th Avenue SE @ SE 8th Street	Intersection operates at poor LOS	Add southbound through lane
112th Avenue NE between SR 520 and NE 12th Street	Intersections operate at poor LOS	Add one through lane in each direction
NE 12th Street @ 116th Avenue NE	Intersection operates at poor LOS	Add dual eastbound left-turn lane

Recommendations

The goal of all improvements listed in this chapter is to improve overall transit speed and reliability, which will in turn improve service for Bellevue residents and other users. The City of Bellevue, in conjunction with Metro and Sound Transit, should continue to monitor roadways and transit operations for problems with speed and reliability. Routes change,

transit service expands, new needs and travel markets emerge, and new congestion patterns may appear. All these factors speak to creating an ongoing monitoring process.

Based on an examination of the technology and techniques used nationwide to improve arterial-based transit convenience, speed, and reliability, a list was developed of recommended arterial improvements for consideration. The listed recommendations are consistent with the adopted plans and policies of the City of Bellevue, including the 2001 Service Plan (Chapters I-V) service vision approved by the City Council. Each recommendation must be developed further to ensure that signal timing, turn movement, property, or local environmental issues are properly addressed. The identified needs also point to the need for partnerships with neighboring cities, King County, and other institutions (e.g., Bellevue Community College) to develop transit corridors that comprehensively address the multitude of arterial projects. The total cost of all recommendations is approximately $15,000,000[14]. Each recommendations is discussed below, displayed in Figure IX-13, and summarized in Table IX-5:

- Implement Transit Queue Jump Lanes and Transit Signal Priority on Eastbound NE 8th Street

  Queue jump lanes are recommended on eastbound NE 8th Street at 120th Avenue and at 148th Avenue. They are an appropriate method to improve speed and reliability in the NE 8th Street corridor. The rationale includes:
  - NE 8th Street is congested at both locations.
  - Both locations have a high number of daily buses (75 daily eastbound buses, with nine buses per p.m. peak hour) that would benefit from being able to bypass long queues at these congested intersections.
  - Both locations have existing right-turn lanes, which facilitate implementation.
  - NE 8th Street has been chosen by Metro as a potential BRT corridor. Transit queue jumps are a cost-effective way to prioritize buses in this corridor.

  Implementing queue jump lanes would require constructing a receiving lane on the far side of the intersection, modifying signal timing and protocol, and modifying the central Bellevue signal control software. The estimated cost of the NE 8th Street/120th Avenue NE improvement is $570,000 and the NE 8th Street/148th Avenue NE improvement is estimated to cost $1,000,000.

- Implement HOV Lane and Transit Queue Jump Lanes and Transit Signal Priority on 148th Avenue

  The 148th Avenue Mobility Improvement Package recommends two different projects, including a southbound queue jump lane between SE 22nd Street to SE 24th Street ($1,178,000) and constructing an approximately 2,100-foot-long HOV lane between Lake Hills Boulevard and SE 22nd Street ($2,636,000) that connects to the queue jump lane. The Bellevue City Council has not endorsed either the HOV lane

[14] These cost estimates should be considered as planning-level only. Unless otherwise specified, the cost estimates do not include right-of-way costs, utilities, or water treatment.

or the transit queue jump lane on 148th Avenue. While HOV lanes on 148th Avenue may not fit into the existing vision for 148th Avenue, the long-term vision for 148th Avenue should consider HOV lanes and queue jump lanes. The rationale includes:

- 148th Avenue is severely congested in this segment, especially during the p.m. peak.
- The improvement enhances speed and reliability of approximately 25 daily buses.
- Capacity of the southbound general-purpose lanes will be improved.

Implementing the extended 148th Avenue queue jump lanes would require constructing an entirely new southbound lane between Lake Hills Boulevard and SE 24th Street, modifying signal timing and protocol, and modifying the central Bellevue signal control software. The estimated cost for this project, based on the 148th Avenue Mobility Improvement Package, is $3,814,000.

- Construct a Southbound HOV Lane on Bellevue Way SE

  Congestion on the I-90 ramps often backs up traffic on Bellevue Way SE for over a mile to the intersection with 112th Avenue SE. During the p.m. peak hour in particular, this congestion severely reduces bus speed and reliability on Bellevue Way SE. One hundred seventy buses a day travel in the southbound direction on this segment (16 buses per a.m. peak hour and eleven buses per p.m. peak hour).

  As considered by the Downtown Implementation Plan, construction of a southbound bus-only/HOV lane between I-90 and 112th Avenue SE is recommended. The HOV lane should be placed on Bellevue Way so that it ties seamlessly into the proposed bidirectional I-90 HOV lanes.

  To maintain easy bus access for 170 daily buses from the southbound HOV lane to the South Bellevue Park-and-Ride, a left-side HOV lane is preferred. There are no bus stops along Bellevue Way between the intersection with 112th Avenue SE and I-90 other than at the South Bellevue Park-and-Ride. According to the September 2002 *Bellevue Way Concept Definition and Technical Feasibility Study* completed by CH2M Hill, the estimated cost for an HOV lane between the South Bellevue Park-and-Ride and I-90 is $980,000.

- Construct a Contraflow Lane on Southbound 108th Avenue NE

  One of the preliminary recommendations for Bellevue's Downtown Implementation Plan is to make 108th Avenue NE and 106th Avenue NE a one-way pair. In this plan, 108th Avenue NE is one-way in the northbound direction and 106th Avenue NE is one-way in the southbound direction. If 108th Avenue NE becomes a northbound one-way street, then a transit-only contraflow southbound lane is recommended. This would provide bidirectional transit access to the Bellevue Transit Center, which is crucial for that facility to operate effectively and efficiently. Without it, bus riders would be subjected to more out-of-direction travel, and operating costs would be increased due to circuitous routing. Most importantly, ridership would suffer as certain connections could no longer be made. Between NE 8th Street and Bellevue Transit Center, 128 daily buses currently use southbound 108th Avenue NE

to access the Bellevue Transit Center. Between the Bellevue Transit Center and NE 4th Street, 143 daily buses use southbound 108th Avenue NE. The estimated cost for this improvement, along with the northbound right-side bus-only lane described below, is $5,630,000.

- Construct a Northbound Right-Side Bus-Only Lane on Northbound 108th Avenue NE

  One of the preliminary recommendations for Bellevue's Downtown Implementation Plan is to make 108th Avenue NE and 106th Avenue NE a one-way pair. In this plan, 108th Avenue NE is one-way in the northbound direction and 106th Avenue NE is one-way in the southbound direction. If 108th Avenue NE becomes a northbound one-way street, then it is recommended that one of the lanes be striped for transit only. Every bus accessing the Bellevue Transit Center travels on 108th Avenue NE. A bus-only lane will minimize delays and associated operating costs for buses traveling to and from the Bellevue Transit Center. The estimated cost for this improvement, along with the southbound contra-flow lane described above, is $5,630,000.

- Improve Turn Radii for Buses

  The turn radii at six intersections in Bellevue should be improved to accommodate buses. Metro staff/operations supervisors and Bellevue staff identified these locations as spot improvements where minor changes in turn-radii would improve automobile, bus, and pedestrian safety. The following locations are recommended for improvements:
  - Eastbound right-turn 148th Avenue at Landerholm Circle. The estimated cost for this improvement is $230,000, which is included in an upcoming CIP project.
  - Southbound right-turn 156th Avenue NE at Northup Way. The estimated cost for this improvement is $390,000.
  - Eastbound right-turn 156th Avenue NE at NE 24th Street. The estimated cost for this improvement is $320,000.
  - Southbound right-turn 164th Avenue NE at Northup Way. The estimated cost for this improvement is $325,000.
  - Northbound right-turn 164th Avenue NE at Northup Way. The estimated cost for this improvement is $440,000.
  - Westbound right-turn at SE 32nd Street at 139th Ave SE. The estimated cost for this improvement is $100,000.

  Implementing these projects would improve turning movements for buses and allow routes to be more efficiently routed. This would lower operating costs, improve service timing and reliability, improve safety, and be more attractive to transit users, potentially increasing ridership.

- Improve Roadways that Cannot Accommodate Buses

  Several existing roadways are recommended for improvements to facilitate/enable bus movements:

  – SE Perimeter Road from Landerholm Circle to 142nd Place (BCC to Eastgate) – Currently, only vans are permitted to drive on SE Perimeter Road between Landerholm Circle and 142nd Place SE. Full-size buses are not permitted to use this roadway, which is the most direct connection between the BCC and the Eastgate Park-and-Ride. A more direct routing between the north end and south end of the BCC campus is desired to improve transit speed and reliability for several bus routes that currently travel between BCC and the Eastgate Park-and-Ride. One of the primary issues preventing the more direct routing is pavement loadings on SE Perimeter Road. Therefore, we recommend upgrading SE Perimeter Road to accommodate full-size buses. The estimated cost for this improvement is $960,000.

    An alternative to upgrading SE Perimeter Road and providing a more direct routing through the BCC campus is to improve the campus roadway that connects 142nd Place with 145th Place at SE 24th Street. This roadway, once upgraded to accommodate buses, does not provide any significant parking access, yet provides close pedestrian proximity to buildings.

  – SE 32nd Street between 139th Avenue and 140th Place - The existing roadway is not constructed for buses, but it is scheduled to be upgraded to accommodate buses as part of the Eastgate Park-and-Ride project. This improvement will be accomplished within the scope of the existing Eastgate Park-and-Ride expansion project.

  – Westbound left turn NE 8th Street to 108th Avenue NE – According to Metro operators, the existing left-turn lane is very narrow considering the high bus traffic (over 100 daily buses). We recommend examining opportunities to widen the left-turn lane by up to one foot to better accommodate the bus traffic. The estimated cost for this improvement is $15,000 (assuming restriping only).

- Improve Transit Facility Access

  Poor access to the Overlake Park-and-Ride, the South Bellevue Park-and-Ride, and the South Kirkland Park-and-Ride regularly causes delays to buses using the facilities. To improve transit speed and reliability at each facility, we recommend examining the Overlake Park-and-Ride entrance, South Bellevue Park-and-Ride southbound bus entrance, and South Kirkland Park-and-Ride entrance for signalization. The estimated cost for both signals is $215,000 (South Bellevue Park-and-Ride estimate is $85,000 and the South Kirkland Park-and-Ride estimate is $130,000). We recommend completing a signal warrant analysis and determining the overall impacts of the new signal on the surrounding streets.

Figure IX-13
Recommended Arterial Projects

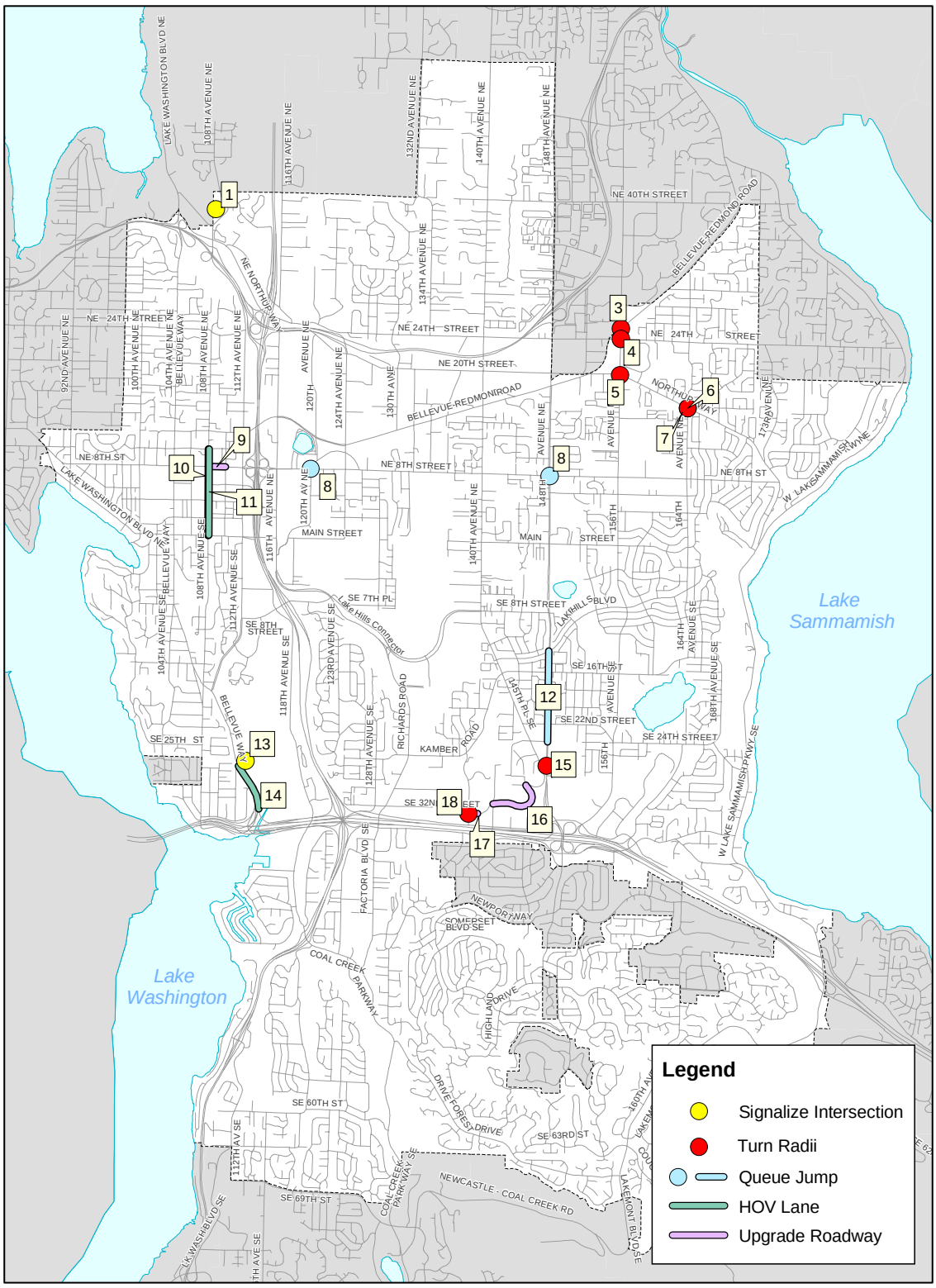


Table IX-5
Recommendation Summary and Projected Utilization

No.	Recommendation	Existing Daily Buses	Projected Daily Buses	Estimated Cost
1	Signalize South Kirkland Park-and-Ride entrance	327	~350	$130,000
3	Improve turn radii for eastbound right-turn 156th Avenue at NE 24th Street	35	~60	$320,000
4	Improve turn radii for southbound right-turn 156th Avenue at Northup Way	0	~25	$390,000
5	Improve turn radii for southbound right-turn 164th Avenue at Northup Way	0	~30	$325,000
6	Improve turn radii for northbound right-turn 164th Avenue at Northup Way	0	~30	$440,000
7	Implement Transit Queue Jump Lanes and Transit Signal Priority on Eastbound NE 8th Street at 120th Avenue NE	75	~110	$570,000
8	Implement Transit Queue Jump Lanes and Transit Signal Priority on Eastbound NE 8th Street at 148th Avenue NE	75	~110	$1,000,000
9	Widen westbound left-turn lane from NE 8th Street to 108th Avenue NE	100	~80	$15,000
10	Construct a Northbound Right-Side Bus-Only Lane on Northbound 108th Avenue NE	85	~50[a]	inc. in $5,630,000
11	Construct a Contraflow Lane on Southbound 108th Avenue NE	143	~175	$5,630,000
12	Implement HOV Lane and Transit Queue Jump Lanes and Transit Signal Priority on 148th Avenue between Lake Hills and SE 24th Street	25	~50	$3,814,000
13	Signalize South Bellevue Park-and-Ride north access	170	~200	$85,000
14	Construct a southbound HOV Lane on Bellevue Way SE between South Bellevue Park-and-Ride and I-90	170	~200	$980,000
15	Improve turn radii for eastbound right-turn 148th Avenue at Landerholm Circle	110	~70[b]	$230,000
16	Upgrade SE Perimeter Road between Landerholm Circle and 142nd Place to accommodate full-sized buses.	39	~100	$960,000
17	Upgrade SE 32nd Street between 139th Avenue and 140th Place to accommodate full-sized buses.	0	~25	inc. in Eastgate PR
18	Improve turn radii for westbound right-turn 139th Ave SE at SE 32nd Street	0	~25	$100,000

[a] The future number of buses decreases at this location because bus routes using the movement to access I-405 northbound at NE 8th Street will use the new NE 6th Street direct access ramps instead.
[b] The future number of buses decreases at this location because the proposed improvements to SE Perimeter Road will cause several bus routes currently making this right turn to be routed on SE Perimeter Road instead.