EVALUATION OF IMPROVEMENT OPTIONS

The improvement options developed in the previous sections were evaluated using a combination of technical analyses, analysis of benefits and disadvantages, and rating with criteria. All of these evaluation steps were used to develop the recommended actions for the SBTCS. This section of the report presents the evaluation for each of the improvement options.

Evaluation Criteria

The potential improvement options were evaluated using a set of criteria that were determined in conjunction with the alternatives. These criteria cover all of the various modes of travel plus parking and business operations. The criteria were rated with four levels: 1) improves condition, 2) has no change or no affect on the condition, 3) makes the condition worse, and 4) is unacceptable. The criteria used in this evaluation are summarized below:

Vehicular Mobility

- Through capacity – Level of service of through traffic on a major street or arterial.
- Side street capacity – Level of service of side streets and/or major driveways.
- Safety for motorists – Potential for vehicle-to-vehicle accidents.
- Clarity of routes – The travel/circulation patterns make sense.

Truck Mobility

- Accommodation of large trucks – Large trucks can easily make turns at intersections.
- Local access for trucks – Ability of trucks to access local businesses.

Transit Operations

- Transit speed and reliability – Delay to transit vehicles using a corridor.
- Convenience for transit users – Ability of transit riders to access stops on both sides of the street.

Bicycle Mobility

- Mobility for bicyclists – Directness/speed of route for bicyclist.
- Safety for bicyclists – Potential for vehicle-to-bicycle accidents.

Pedestrian Mobility

- Continuity of pedestrian connections – Ability of a pedestrian to walk along and/or cross a street.
- Safety for pedestrians – Potential for vehicle-to-pedestrian accidents.

Railroad Operations

- Accommodation of existing rail service and operations – Retains existing services and operations.
- Potential for future expansion of rail service and operations – Allows for the railroad to expand within the existing franchise area.

Parking

- Parking supply – Number of parking spaces.

Business Operations

- Safety of access/egress – Potential for any type of accident at a private driveway.
- Retention of truck load/unload areas – Effect on existing truck loading areas on the shoulder or adjacent to curb.
- Business access and circulation – How traffic must access and/or circulate at local businesses.

Because these criteria cover all the land modes of travel, it is difficult to cross-compare the alternatives using these broad criteria. There is also some degree of overlap among some of the criteria groups. For example, "side street capacity" may indicate the same issue as "safety of access/egress" in some cases. The rating is intended to give an indication of the overall benefits or impacts of a specific option and to determine if there are any options that should be eliminated because of unacceptable conditions. Unacceptable conditions are those that cannot be mitigated or are not feasible because the improvement would not be approved. For example, a traffic signal that is not warranted, or an improvement that causes an extreme impact to a business or property that could require a "taking."

Each of the options is described in detail below. Analysis appropriate to each alternative is also presented along with a brief listing of benefits and disadvantages. The matrix showing the Criteria Ratings is presented in Appendix B. As described above, the matrix has not been used to determine the merits of each project in relation to other projects because the projects may have different benefits. The matrix does show those projects that were eliminated because of a potential fatal flaw.

Improvement Options

Shilshole Avenue/ 46th Street/ 45th Street Corridor

1. Create a one-way couplet on 45th Street and 46th Street

This improvement would create a one-way couplet on 45th Street and 46th Street between Leary Way and Shilshole Avenue. 46th Street would be one-way in the westbound direction and 45th Street would be one-way in the eastbound direction.

Both 45th Street and 46th Street currently have 66-foot rights-of-way. On the north side of 45th Street, there is an additional 30 to 40 feet of property along some sections of the street that is often used for parking. The existing street width on both streets is about 24 feet. However, much of the rail line along 45th Street is within the existing street. Along some sections, the rail line has been imbedded into the pavement and vehicles are allowed to drive on the tracks. In other sections, the tracks are located in a gravel area and the width of the pavement narrows to about 15 feet, which is too narrow for opposing vehicles to pass one another on the street. 46th Street has 6-foot pedestrian walkways located outside of the utility poles, but 45th Street has no pedestrian walkways.

The capacity constraints for both 45th Street and 46th Street are at the intersections with Leary Way. The current configuration provides one lane in each direction at these intersections, and there is no room to widen the street without substantial property acquisition. With a single lane approaching Leary Way on each street, any vehicle waiting to turn left or cross Leary Way blocks all motorists who want to turn right onto Leary Way. The City has proposed to signalize the intersection at Leary Way/ 46th Street; however, a signal would not eliminate the potential blockage of right-turning vehicles.

A one-way couplet on these two streets would have several benefits. The primary benefit is that it would allow the existing street right-of-way to accommodate all of the competing demands that currently use it—through vehicles, on-street parking, rail—and a possible trail corridor. Another benefit is that the configuration would provide two approach lanes where 45th Street intersects Leary Way. This would allow one lane to be designated for left-turn and crossing traffic, the second lane could be designated for right-turn-only traffic. A one-way couplet is also likely to improve safety for vehicles, pedestrians, and bicyclists at many of the intersections since it reduces the number of conflicting traffic movements.

The disadvantages of the one-way couplet are the impacts it may have to local business access along these streets. For example, there may be some business truck loading facilities that can only be accessed from one direction (e.g., Olson Fuel). At these locations, additional space for truck maneuvering may be required. In addition, the vertical clearance under the Ballard Bridge is higher at 45th Street than at 46th Street, which may affect some over-dimension truck movements. With an escort and/or proper flagging, over-dimensional freight movements could continue to access the area on 45th Street opposite the signed traffic direction.

The corridor is not currently part of a transit route; therefore, the change would have no effect on transit operations. However, if transit were ever desired on this corridor, a one-way couplet does make it less convenient for transit riders since a passenger would not embark and disembark on the same street, which can be confusing to those not familiar with the area.

There are several cross-section options that could be considered with one-way flow that have various locations of parking and a potential bicycle/pedestrian trail. The final option should be determined pending the outcome of the City's *South Ballard Transportation Corridor Design Study* (described further in Option 23).

Benefits

- A one-way roadway has more capacity than a two-way roadway.
- Retains and/or increases parking supply
- Allows space for walkway or trail without affecting through vehicle capacity
- Simplifies the intersection at 45th Street/46th Street/Shilshole Avenue
- Reduces conflicts at intersections

Disadvantages

- Increases travel distance to and from local businesses
- May hinder how trucks access local businesses (e.g., Olson Fuel)
- Reduces vertical clearance for westbound traffic at the Ballard Bridge, which may affect over-dimension freight traffic.
- Would make transit access less convenient if these streets are ever used for a transit route in the future.

Recommendation:

Do not convert 45th Street and 46th Street to a one-way couplet. The traffic analysis (summarized at the end of this section) shows no significant difference in delays at Leary Avenue between the couplet and the existing configuration. In addition, the City's *South Ballard Transportation Corridor Design Study* has determined that the couplet would not be needed to facilitate a trail along these streets. The *South Ballard Transportation Corridor Design Study* will evaluate the feasibility of converting 45th Street to a one-way eastbound street and maintaining 46th Street as a two-way arterial street.

2. Improve Shilshole Avenue/17th Avenue intersection

Two improvement options were considered for this intersection: a) a traffic signal, and b) an eastbound left-turn lane on Shilshole Avenue. Before SeaTran would install a traffic signal at this or any intersection, it must first meet certain thresholds for traffic volumes, which are known as signal warrants. Traffic signals that are installed where minimum volume thresholds are not met can be safety hazards because they will seldom change, and drivers can then be surprised when the signal does change. Traffic volume thresholds for signal warrants are outlined in the *Manual on Uniform Traffic Control Devices (MUTCD).* Two of the most commonly used signal warrants (Warrants 1 and 2) require certain thresholds to be met on both the major and minor street for eight hours of the day. Another commonly used warrant (Warrant 9) requires higher traffic thresholds to be met for four hours of a day. A full discussion of the signal warrants is provided in Appendix B.

Existing traffic volumes were reviewed for this location per the MUTCD requirements. Because the volume of traffic exiting 17th Avenue is low during all hours of the day, this intersection is not close to meeting any of the required warrants. If this location were ever used as a major pedestrian crossing location (e.g., a major crossing

on the Burke-Gilman Trail), then a traffic signal could be warranted by the combination of vehicle traffic and pedestrian crossing traffic.

Many commuters from the Sunset Hill and Shilshole areas of Ballard use Shilshole Avenue as a short-cut route to the Ballard Bridge. They proceed east on Shilshole Avenue from Market Street and 24th Avenue and turn left on 17th Avenue to access Ballard Avenue and the on-ramp to the Ballard Bridge. Eastbound traffic volumes on Shilshole Avenue are highest during the morning commute. During this period, about 35% of all eastbound vehicles on Shilshole Avenue (270 out of 770 vehicles) turn left to 17th Avenue. Based on this traffic volume and *Left Turn Storage Guidelines* in the *Washington State Department of Transportation (WSDOT) Design Manual* (Figure 910-8), a separate left-turn lane would be warranted for this location. The *Design Manual* recommends a 200-foot left turn lane for this volume of traffic; however a shorter lane would accommodate the expected left-turn queue. Analysis performed using the Synchro software determined that the peak queue would be approximately 75 feet.

Benefits

- Left-turn lane would reduce conflicts at this intersection.
- Left-turn lane would increase the capacity and improve traffic operations for eastbound through traffic on Shilshole Avenue

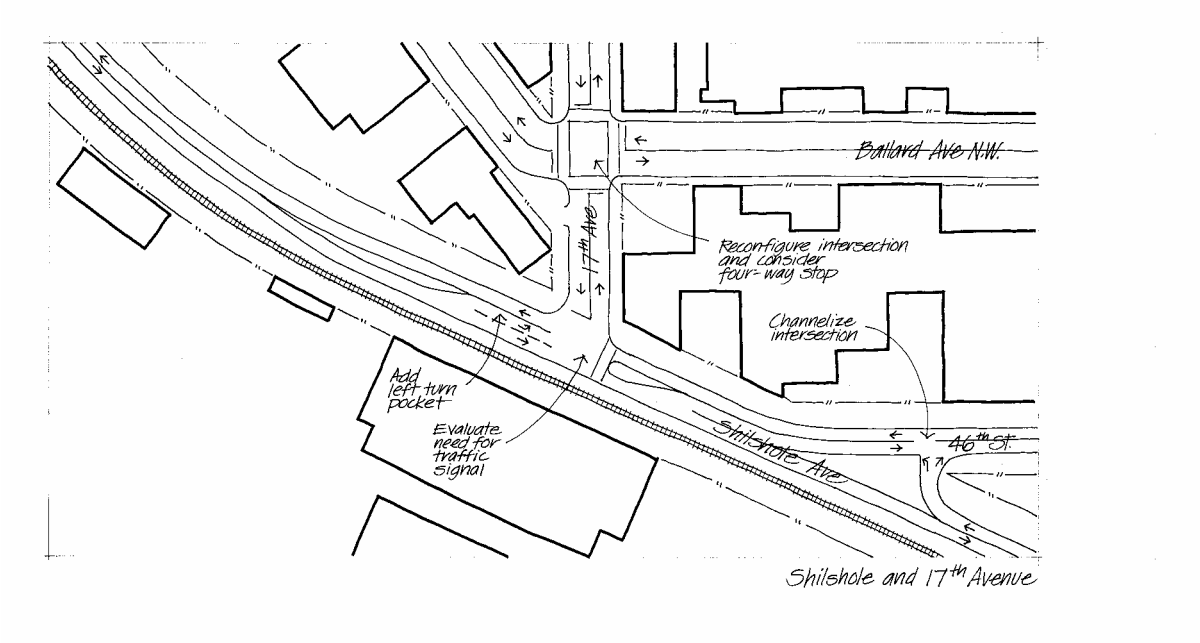
Disadvantages

- May require removal of on-street parking near 17th Avenue
- Reduces space available on Shilshole Avenue for additional modes (e.g., expanded rail, trail).

Recommendation:

Install an eastbound left-turn lane at this intersection. This lane should be at least 75 feet long plus a taper on both sides of the intersection. This potential improvement is shown on Figure 14.

Figure 14. Potential Improvements at Shilshole Avenue, 17th Avenue and Ballard Avenue



3. Install traffic signal on Leary Way at 46th Street or 45th Street

Installation of a traffic signal at the intersection of 46th Street/Leary Way was proposed by Seattle Transportation several years ago, and it is a recommendation of the BINMIC Plan. This new signal has been incorporated into the corridor improvement project for Leary Way. However, if 46th Street and 45th Street are converted to a one-way couplet, then the traffic signal should be installed at 45th Street to serve the eastbound traffic at this location. The signal would be warranted under either scenario.

A signal at Leary Way/45th Street would improve traffic operations if the one-way couplet is created. However, one disadvantage is that it would locate a new signal very close to the existing signal at Leary Way/8th Avenue. These two signals would need to be carefully coordinated to minimize queuing between the signals.

Benefits

- Improves traffic operations at this intersection.
- Improves conditions for vehicles turning left or crossing Leary Way.
- Traffic signal improves ability for pedestrians and bicyclists to cross Leary Way.

Disadvantages

- If a one-way couplet were implemented, the signal location (45th Street) is close to the existing signal at Leary Way/8th Avenue, which may adversely affect traffic operations at both intersections.
- Signals can increase the number of rear-end collisions on the arterials.

Recommendation:

Install a traffic signal at 46th Street/Leary Way as planned. The traffic signal should be interconnected with other traffic signals along Leary Way.

4. Organize parking on Shilshole Avenue and 46th Street

The limited paved walkways that do exist on Shilshole Avenue and 46th Street are flush with the pavement. Cars that park along these streets often pull onto the walkway, which prevents their use by pedestrians. Wheel stops or bollards could be used to prevent vehicles from parking on the walkway. Wheel stops can be a tripping hazard for pedestrians as they move from their parked car to the walkway. The lower turn-over rate for parking spaces and daily use by employees in this area may reduce the likelihood for such incidents. Bollards typically require more maintenance, and the high level of truck activity in this area increases the likelihood for damage to bollards. During the reorganization, care should be taken to maintain the number of parking spaces available along Shilshole Avenue and 46th Street, while also maintaining business access/egress and load/unload zones.

Benefits

- Separates pedestrians from traffic.

Disadvantages

- Bollards may require frequent maintenance.
- Wheel stops may be a potential tripping hazard.

Recommendation:

Install wheel stops between the walkway and the parking areas on Shilshole Avenue and 46th Street to prevent vehicles from parking on the walkway.

5. Consolidate access points along Shilshole Avenue corridor

If a pedestrian/bicycle trail were located along Shilshole Avenue, it would cross many driveways in the section between 11th Avenue and about 26th Avenue. Consolidation of these driveways would reduce potential conflicts between turning traffic and trail users. However, the City of Seattle has no express authority in the Seattle Municipal Code (SMC) to eliminate existing driveways. Thus, for existing uses, eliminating driveways would require that the City purchase or condemn the access rights. The City does have the authority to consolidate driveways when permits for new uses are sought by land owners or developers. This is granted to the City's Traffic Engineer. SMC 11.16.240 states that, "It shall be the function of the Traffic Engineer under the supervision of the Director of Transportation to:

> G. Review and make recommendations concerning all applications for all building permits except in single-family SF and multi-family, Lowrise 1 (L1) zones regarding facilitation of traffic with respect to new or existing driveways;
>
> H. Review and make recommendations concerning all applications for commercial driveways regarding facilitation of traffic with respect to the size, number and location of such commercial driveways."

Thus, if one of the parcels along Shilshole Avenue were to redevelop, the traffic engineer could request that driveways be relocated or eliminated.

Safety is a major consideration in the decision to eliminate driveways. However, the needs of the industrial businesses should also be considered in terms of loading needs, truck circulation and operations. SMC 23.12.090, which defines the City's industrial area land use policies states, "The primary purpose of the Industrial Area Land Use Policies shall be to provide opportunities for industrial activity, including manufacturing uses, advanced technology industries and a wide range of industrial-related commercial functions, such as warehouse and distribution activities. The intent of these policies is to allow existing businesses to expand, facilitate locational opportunities for new businesses, and provide some measure of protection to viable marine and rail related industries from uses competing for scarce resources. In addition, uses that may negatively affect the availability of land for industrial activity, or that conflict with the character and function of industrial areas, shall be restricted or prohibited. Development standards shall be designed to provide for the needs of industrial activity and reduce major land use conflicts between industrial development and abutting residential or pedestrian oriented commercial areas, without placing unnecessary restrictions on manufacturing uses."

Currently, there is not a documented safety issue associated with any of the driveways along Shilshole Avenue. Safety benefits associated with driveway consolidation would only occur if the trail were extended along Shilshole Avenue and bicycle volumes subsequently increased. Therefore, the City should work with property owners to look for opportunities to consolidate driveways if a trail is constructed along Shilshole Avenue. Furthermore, if a property along the corridor were to redevelop with a non-industrial use (e.g., high tech office), the City should seek to reduce the number of existing driveways along that property's frontage.

Benefits

- Improves safety for potential trail users.
- Reduces number of conflict points along street and the potential for vehicle-vehicle accidents.

Disadvantages

- May affect some businesses' ability to continue to operate or expand in the industrial area.

Recommendation:

Work with property owners to look for opportunities to consolidate driveways if a trail is constructed along Shilshole Avenue. If a property is redeveloped, seek to reduce the number of existing driveways along that property's frontage. No changes to access should be made that would significantly affect the ability of industrial businesses to operate in this area.

6. Provide shoulder on Shilshole Avenue for bicycles

Shoulders on Shilshole Avenue could serve as an interim bicycle route or an alternative route for commuters if the Burke-Gilman is ultimately routed outside the Shilshole Avenue corridor. Shilshole Avenue was repaved with a new concrete surface several years ago. The new surface is only 24 feet wide, which provides two 12-foot lanes. Outside of the concrete pavement on the northeast side of the street, much of the shoulder has been paved to provide parking for the adjacent businesses. Along the southwest side of the street, a very narrow asphalt shoulder (about one foot wide) has been added to some sections, otherwise the shoulder is mostly gravel, which is rutted with large potholes. The gravel on the shoulder also kicks onto the adjacent paving.

The shoulder condition should be improved with a wider paved surface for bicyclists and pedestrians. The shoulder should be wide enough to accommodate a bicycle, but not so wide that it encourages parking on it. A four to five-foot shoulder should be sufficient.

Benefits

- Wider shoulder provides additional space for bicyclist along road.
- Would improve safety by increasing the clearance between vehicles and bicyclists on the roadway.
- Improved shoulder would reduce bicycle crashes caused by running off roadway onto pitted, gravel shoulder.

Disadvantages

- Wider shoulder may reduce parking along edge.
- Vehicles may park on shoulder.

Recommendation:

Improve shoulder on Shilshole Avenue for bicycles by paving four to five feet beyond the existing street edge.

7. Improve pedestrian crossing at Vernon Street

Shilshole Avenue has no traffic control between 11th Avenue and 24th Avenue to slow traffic or provide gaps for pedestrians to cross. The intersection at Shilshole Avenue/Vernon Street should be improved to facilitate safe pedestrian crossings. Improvements at this location could include a marked crosswalk (which does not exist today), better pedestrian landings on both sides of the street (a curb bulb, or paved area that does not get muddy when it rains) and better overhead lighting. Also, an improved crossing at this location may require commensurate improvements on the adjacent property on the southwest side of the street to create a pedestrian linkage through the site to the new crosswalk.

Benefits

- Marked crosswalks may improve conditions for pedestrians by highlighting crossing locations to motorists.
- Curb bulbs reduce the crossing distance for pedestrians and improve sight lines between a pedestrian waiting to cross and an approaching motorist.

Disadvantages

- Pedestrians often feel more secure in marked crosswalks and cross a street with less caution.

Recommendation:

Install/improve pedestrian crosswalks on Shilshole Avenue north of Vernon Street. The crosswalk enhancements may require commensurate improvements by property owners to link pedestrians through adjacent parking lots to building destinations.

Ballard Avenue Corridor

8. Allow two-way traffic on Ballard Avenue

Several years ago, Ballard Avenue was changed from a two-way street between 22nd Avenue and Market Street to a one-way street. This allowed additional parking to be added to this street, and also improved traffic operations along Market Street by reducing the amount of traffic at the Ballard Avenue intersection. However, the change to one-way traffic had the negative consequence of increasing traffic on Shilshole Avenue, and increasing the volume of vehicles turning left from Shilshole Avenue to 17th Avenue in order to access the Ballard Bridge.

In addition to the potential for reducing traffic volumes on Shilshole Avenue, converting this section of Ballard Avenue to two-way traffic would better accommodate an on-street bicycle route. Ballard Avenue is one of the alternative routes for the Burke-Gilman Trail (See Option 23) and is included in the City's *South Ballard Transportation Corridor Design Study*.

Based on traffic counts on Shilshole Avenue at 17th Avenue, it is estimated that re-establishing two-way traffic on Ballard Avenue could reduce traffic on Shilshole Avenue by about 160 vehicles during the AM peak hour and by about 80 vehicles during the PM peak hour. These small reductions in traffic on Shilshole Avenue would not reduce the need for any of the improvements on Shilshole Avenue. A left-turn lane would still be warranted at the Shilshole Avenue/17th Avenue intersection, and improvements would still be needed for the intersection at Shilshole Avenue/ Market Street/24th Avenue. The impacts caused by additional traffic in the heart of Market Street and the reduction of parking along Ballard Avenue would not be offset by the possible reduction in traffic along Shilshole Avenue. Therefore, this change is not recommended, unless it is part of recommended bicycle route for the Burke-Gilman Trail.

Benefits

- Reduces traffic on Shilshole Avenue.
- Increases customer exposure for local businesses.
- Reduces driver confusion due to one-way configuration.
- Would allow drivers to loop the block on Ballard Avenue, Vernon Street, Shilshole Avenue, and Market Street when looking for parking.

Disadvantages

- Conflicts with proposed Metro plan for transit hub on Market Street.
- Reduces parking supply.
- Increases traffic through Market Street/ Ballard Avenue intersection.
- Does not reduce need for improvements along Shilshole Avenue.

Recommendation:

No change. Retain one-way traffic on Ballard Avenue. This option may be re-considered if this section of Ballard Avenue is designated as a bicycle route for the Burke-Gilman Trail.

9. Improve Ballard Avenue/17th Avenue intersection

The intersection at Ballard Avenue/17th Avenue is very wide, particularly the west leg of the intersection. The intersection could be narrowed by installing a curb bulb on the southwest corner of the intersection, as shown previously on Figure 14 (see Option 2). The curb bulb would extend into the west (Ballard Avenue) leg. It would be designed to retain access to the parking on the adjacent property and maintain a turning radius appropriate for trucks.

Benefits

- Shortens crossing distance for pedestrians.
- Narrower street may help control traffic speeds.

Disadvantages

- Affects access to adjacent business' parking lot.
- May affect large trucks due to smaller turning radius on corner.

Recommendation:

Install curb bulb on southwest corner of intersection. The curb bulb should be designed to retain access to parking for the adjacent business and provide a sufficient truck turning radius.

West End Access Improvements

10. Increase vehicular capacity at the Market Street/24th Avenue intersection

The intersection at Market Street/24th Avenue/Shilshole Avenue is the bottleneck of the Market Street corridor through the heart of Ballard. This intersection currently operates at LOS C and LOS D during the AM and PM peak hours, respectively. Future growth in the neighborhood is expected to further degrade this intersection.

Additional analyses were performed for this intersections using the Synchro software. This analysis was performed to quickly assess how changes at this intersection may affect traffic operations. The analysis was performed for an isolated intersection, and therefore, the results will vary compared to the results from the VISSIM model (presented earlier), which consider the effect of signal coordination along the Market Street corridor. Based on the outcome of this analysis, the final recommendation was then input into the VISSIM model to determine the effect that the proposed change would have on overall corridor operations. The Synchro analysis determined that future traffic operations at this intersection would degrade to LOS D and LOS E during the AM and PM peak hours, respectively, if no changes are made to the intersection.

Many potential improvements were evaluated to determine their effect on traffic operations at this intersection. Table 6 summarizes how incremental changes in the intersection configuration would change the level of service compared to the No Action (do nothing) condition. As shown, most changes would not cause a substantial reduction in vehicle delay (improvement in the level of service). This is because of the way traffic volumes peak at this intersection—in the southbound and westbound directions in the AM peak hour and the northbound and eastbound directions in the PM peak hour.

One frequently suggested change in the lane configuration—converting the southbound curb lane from a through-right to a right-turn-only would substantially degrade operations at this intersection. Therefore, it is not recommended.

Adding a right turn lane on eastbound Market Street would provide a reduction in delay during the PM peak hour; however, this change may affect the ability to access businesses further south along Shilshole Avenue. If an exclusive right turn lane is added to eastbound Market Street, then vehicles would be able to turn right on red, which would fill the gaps available in the traffic stream available for vehicles on Shilshole Avenue. Such a change in lane configuration would not improve conditions during the AM peak hour. Because of its potential detrimental effect to traffic on Shilshole Avenue south of the intersection, an exclusive eastbound right turn lane is not recommended.

The most effective improvement would be to allow concurrent eastbound and westbound traffic flow, which would improve the intersection operations to better than existing conditions. This would require that one or both of the eastbound and westbound left-turns be prohibited at this intersection. There are limited opportunities for left turns from Market Street in this area—especially for westbound left turns. Therefore, this alternative was tested with a prohibition on eastbound left turns and a lagging protected phase to allow westbound left turns. As shown in the following table, this change alone would improve the future conditions to better than existing during both the morning and afternoon peak periods.

Table 6. Market Street/24th Avenue Intersection Improvement Options

	AM Peak Hour			PM Peak Hour		
Alternative	LOS	Delay 1	V/C 2	LOS	Delay	V/C
Existing (2001) Condition	C	34.4	0.76	D	54.1	0.94
Year 2012 No-Action Condition	D	42.1	0.90	F	85.4	1.07
Year 2012 – Convert southbound through-right lane to a right-turn-only lane	F	88.2	1.16	F	91.3	1.10
Year 2012 – Allow concurrent left turns on northbound and southbound approaches	D	40.7	0.89	F	84.6	1.07
Year 2012 - Convert northbound thru-right lane to a left-thru-right lane	D	42.3	0.90	F	90.1	1.10
Year 2012- Add EB right-turn lane	D	48.2	0.97	E	57.8	1.10
Year 2012- Prohibit EB left turns, allow concurrent eastbound and westbound flow with a lagging protected westbound phase	C	31.9	0.81	D	38.5	0.88

Note: All analysis was performed using the Synchro software, which provides slightly different results than the VISSIM software that was used to determine overall level of service for the area.

Benefits

- Reduces average delays at intersection.
- No additional right-of-way would be required.

Disadvantages

- Eastbound left turn traffic would have to use other routes to access 24th Avenue.
- Would increase traffic on other streets west of intersection such as 28th Avenue, as well as left turns at 22nd Avenue.
- May require an upgraded signal controller to implement modified phasing.

Recommendation:

Do not make changes to this intersection. The only alternative that would improve operations without widening the intersection would require prohibition of the eastbound left turn.

11. Create a new public roadway at "Not 54th Street"

"Not 54th Street" is an unofficial street located parallel to the railroad tracks. It extends from 24th Avenue (near Lund Electric) to 26th Avenue, and provides access to many businesses that front the ship canal, as well as the truck access for several businesses located between the rail tracks and Market Street. Although the City of Seattle now owns the right-of-way in this area, it was formerly owned by the Burlington Northern-Santa Fe Railroad and was never dedicated as public street right-of-way. 54th Street is the address the U.S. Post Office uses for businesses located along this right-of-way.

The existing road adjacent to the railroad tracks is in very poor condition. It is a gravel road rutted with large potholes from the heavy truck traffic that uses the road. The roadbed has created an unstable condition for the rail tracks, which are susceptible to bending when crossed by truck tires. Businesses located south of the road are accessed by relatively steep, angled driveways that make access by trucks difficult.

The Ballard Terminal Railroad Company recently completed construction of a new transloading facility in this right-of-way that allows them to load freight directly to a boxcar using a forklift. The BTRC has constructed a short siding south of their main track that is below the grade of the adjacent roadway. This allows the floor of the boxcar to be at the same elevation as the road so that the forklift can drive into the boxcar to position freight.

Trail advocates desire that the City construct a bicycle/pedestrian trail through this right-of-way, while access to existing businesses and operations by the railroad must be maintained. For this reason, the best solution to serve all uses of the right-of-way may be to pave the roadbed and designate it as a public street as shown in Figure 15. If the railroad tracks are imbedded into the pavement, it would allow this space to be used by the adjacent businesses for truck maneuvering (e.g., Ballard Transfer) while protecting the tracks from damage caused by heavy loads. A separate bicycle lane could be striped on the pavement so that this lane is not blocked by parked vehicles. A sidewalk could be considered along the north side of the roadway, but would likely affect the truck access and maneuvering at Ballard Transfer. Therefore, it may be best to wait until this parcel redevelops at some time in the future to require the sidewalk. Landscaping is also something that may affect access and maneuvering and should be used carefully if at all in this industrial area.

Potential disadvantages of improving the street are the impacts to rail expansion in this area, possible reductions in parking and loading areas, and the potential for increased short-cut traffic between Shilshole Avenue and Market Street to bypass the traffic signal at Market Street/24th Avenue. To reduce the potential for short-cut traffic, traffic exiting the area on 26th Avenue at Market Street could be restricted to right-turn only. This may adversely affect a few trips made by local businesses towards the Shilshole Marina. Some eastbound vehicles on Market Street may also short-cut through on the new street, but it would be difficult to prevent this. Since free right turns to Shilshole Avenue are allowed, it is believed that there will not be a large time advantage for eastbound traffic on this route compared to using the main arterials.

This improvement may change pending outcome of the City's *South Ballard Transportation Corridor Design Study*.

Benefits

- Improves access to local businesses
- Retains existing rail facilities
- Pavement would improve structure of railroad tracks
- Allows use by bicycles and improves use by pedestrians

Disadvantages

- May increase short-cut traffic between Shilshole Avenue and Market Street
- Potential conflicts between bicycles/through-traffic and trucks maneuvering to load and unload
- Could affect future expansion of rail facilities.
- Possible reduction in parking and loading areas available for local businesses.

Recommendation:

Pave a new street in the City right-of-way adjacent to the railroad tracks that extends from 24th Avenue to 26th Avenue. Imbed the existing rail tracks in paving to provide additional maneuvering space for trucks at the adjacent businesses; stripe a separate bicycle lane if appropriate. Sign 26th Avenue for right-turn-only to Market Street to reduce potential for short-cut traffic.

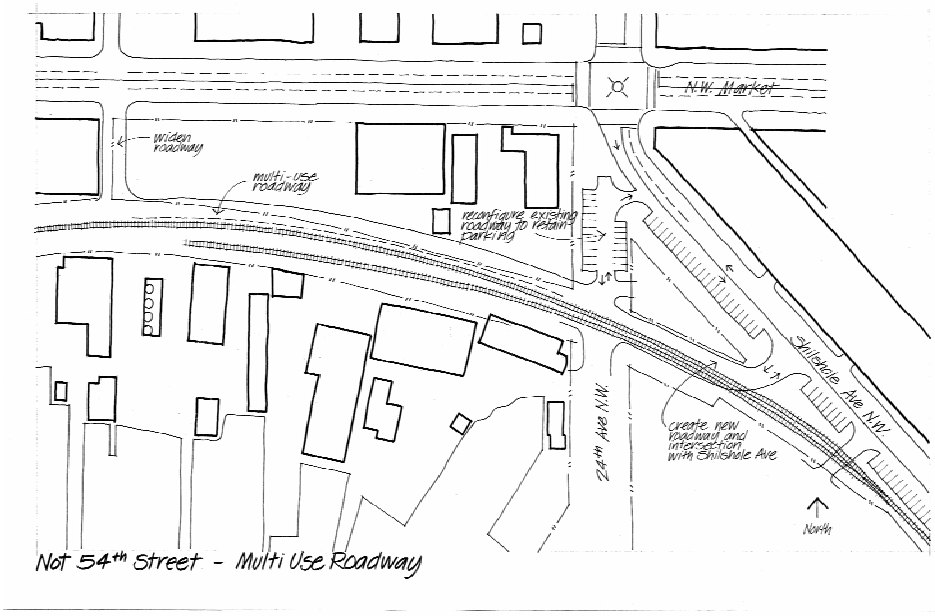
12. Improve the intersection at Shilshole Avenue/24th Avenue

24th Avenue intersects Shilshole Avenue just south of Market Street. It is difficult for vehicles destined to 24th Avenue or the businesses along "Not 54th Street" to turn onto or off of Shilshole Avenue at this location. There are few gaps in oncoming traffic from Market Street/24th Avenue and the sight distance is limited.

The *BINMIC Transportation and Freight Mobility Report* recommended relocating the intersection southeast of the current location. This concept was further developed and paired with the new "Not 54th Street" public street described above in Option 11. A new roadway could be constructed within the existing City right-of-way near the railroad tracks. The concept, shown on Figure 15, would retain 24th Avenue, between "Not 54th Street" and Market Street, as parking for the adjacent businesses. The driveway at the north end of the parking lot would be exit-only for right-turning vehicles only. Motorists wanting to turn left onto Shilshole Avenue could do so via the exit at the south end of the parking lot. Alternatively, there may be potential to combine this abandoned right-of-way with adjacent property for redevelopment opportunities. Another benefit of the change is that it would allow the southbound lane departing the Market Street/24th Avenue intersection to be widened thus improving the merge for southbound traffic. Finally, the change would also improve pedestrian mobility along the southwest side of Shilshole Avenue by reducing the large area of pavement that pedestrians must cross at this location. The crossing would be reduced to the width of the exit driveway from the parking area on 24th Avenue.

This improvement should be analyzed with Burke-Gilman Trail alternatives along the railroad corridor in the *South Ballard Transportation Corridor Design Study*.

Figure 15. Relocated intersection of 24th Avenue/Shilshole Avenue and "Not 54th Street"



Benefits

- Improves sight distance
- Improves traffic operations for vehicles turning onto and off of Shilshole Avenue
- Improves access for businesses along "Not 54th Street"
- Improves pedestrian movement along southwest side of Shilshole Avenue and reduces crossing distance across 24th Avenue
- Allows longer merge area to be created for southbound traffic exiting the adjacent Market Street intersection

Disadvantages

- Reduces the right-of-way available for other uses (trail or rail).
- Moves major access point closer to Yankee Diner driveway

Recommendation:

Construct a new connection from Shilshole Avenue to 24th Avenue along the City-owned right-of-way adjacent to the railroad tracks. Reconfigure the existing section of 24th Avenue between the new roadway and Shilshole Avenue to provide parking for adjacent businesses. Allow an exit-only driveway at the north end of the parking area that is restricted to only right-turn movements. Lengthen the merge area in the southbound departure lane south of Market Street intersection. Provide a pedestrian walkway along the southwest side of Shilshole Avenue.

13. Widen 26th Avenue between Market Street and "Not 54th Street"

26th Avenue south of Market Street has a 30-foot right-of-way. Trucks that access businesses along "Not 54th Street" have been observed using much more than the 30-foot right-of-way when turning to and from 26th Avenue at either "Not 54th Street" or Market Street. This currently works since the property east of 26th Avenue is undeveloped. If development of this parcel ever does occur, the narrow right-of-way width would become an issue for truck mobility. Therefore, concurrent with development, it is recommended that the right-of-way be dedicated to the city standard of 52-feet for a local street.

Benefits

- Maintains street for truck movements.

Disadvantages

- Reduces property available for development on adjacent site.

Recommendation:

Obtain additional right-of-way for 26th Avenue as a condition of new development on adjacent parcels.

14. Improve pedestrian crossing of Market Street at 28th Avenue

Improving the pedestrian crossing of Market Street at 28th Avenue was the Ballard District Council's top priority for 2001 (Source: Letter from Ballard District Council to Rebecca Herzfeld and Shauna Walgren at the City of Seattle, November 16, 2001). The District Council proposed that the City install curb bulbs on the northwest and southwest corners of the intersection to reduce the crossing distance across Market Street, and improve signage and overhead lighting.

This improvement makes sense for this location. The nearest signalized pedestrian crossings of Market Street are located at 24th Avenue and 32nd Avenue. It is the location of a Metro Transit stop where transit passengers must cross the street for one of their transit trips. The curb bulbs would extend into the parking lane on both sides of the street, still allowing for two travel lanes in each direction on Market Street. The bottleneck for traffic flow on Market Street is located at 24th Avenue, and it is unlikely that additional lane capacity will be needed on Market Street at 28th Avenue.

Benefits

- Improves safety of pedestrian crossing
- Curb bulbs prevent vehicles from parking too close to crosswalk

Disadvantages

- Restricts future capacity increases on Market Street

Recommendation:

Install curb bulbs at 24th Avenue to reduce the crossing distance across Market Street, add a crosswalk between the bulbs, and improve signage and overhead lighting.

15. Improve bicycle access across the Ballard Locks

Narrow passageways across the Locks hinder bicycle movements. Also, the Locks are only open from 7:00 A.M. to 9:00 P.M., which is not conducive to some bicycle and pedestrian crossings, particularly during the summer months when daylight extends beyond these hours.

The Army Corps of Engineers recently improved one of the lock gates and widened the passageway across the top of the gate. This has made it easier to pass through with a bicycle during crowded summer periods. When the Corp proposes improvements to the other lock gates, it should also consider widening those pedestrian ways to better accommodate bicycles.

In addition, the Corp should review the hours when bicycles and pedestrians can cross the locks or access the main route through the grounds. Extending these hours one hour in the morning and one hour in the evening during summer months would improve mobility for bicycles.

Benefits

- Wider passageways would improve bicycle mobility across the Locks.
- Extended hours would allow more bicycle commuters to use this route.

Disadvantages

- Extended hours would increase security needs at the Locks.

Recommendation:

Widen pedestrian passageways across the Locks to better accommodate bicycles. Extend hours when bicycles and pedestrians can cross the Locks.

Leary Way Corridor

16. Convert Leary Way to three lanes between 17th Avenue and 20th Avenue

Three-lane configurations have been used on several arterials throughout Seattle to improve access to and from side streets and to provide additional space for parking and/or bicycle lanes. A three-lane configuration provides one through lane in each direction plus a center, two-way-left-turn lane. At major intersections, the center-turn lane may be designated as a single-direction left-turn lane. Local examples of former four-lane roads that have been converted to three lanes include Phinney Avenue N, 8th Avenue NW, N 45th Street through Wallingford, and Dexter Avenue N north of Mercer Street. Traffic volumes for these various three-lane road segments were compiled from the City of Seattle's historic traffic count database and are summarized in Table 7.

Peak hour traffic volumes on these other three-lane roadways ranged from about 830 vehicles per hour on Dexter Avenue N to more than 1,500 vehicles per hour on N 45th Street. Average weekday traffic volumes (AWDT) ranged from 10,700 vehicles per day on Dexter Avenue N to 24,500 vehicles per day on N 45th Street. The existing traffic volumes on Leary Way range from a high of about 1,390 vehicles per hour at 15th Avenue to about 720 vehicles per hour just southeast of Market Street. An intersection traffic count performed at Leary Way/17th Avenue determined that many vehicles turn to and from Leary Way at this location. Therefore, the traffic volumes west of 17th Avenue are well within the range of what a three-lane roadway can accommodate. In fact, the traffic volumes on this section of Leary Way would be some of the lowest volumes of any similar three-lane facility in Seattle.

Table 7. Existing Traffic Volumes on Three-Lane Arterials in Seattle

Existing Three-Lane Arterials	AM Peak Hour	PM Peak Hour	AWDT a
N 45th Street at Eastern Avenue	1,366	1,552	24,580
8th Avenue NW at NW 65th Street	1,116	1,266	13,411
Phinney Avenue at NW 65th Street	1,015	1,237	14,690
Dexter Avenue N at McGraw Street	834	1,000	10,702
Comparison to Leary Way Segments			
Leary Way west of 15th Avenue NW	1,005	1,386	15,705
Leary Way west of 17th Avenue NW b	775	1,070	12,100
Leary Way south of Market Street	516	718	8,135

a Average weekday traffic volume

b Estimated from actual PM peak hour traffic count performed at the Leary Way/17th Avenue NW intersection

The biggest disadvantage of a three-lane configuration is the effect that it has on transit. Current practice in Seattle Transportation is to only allow buses to stop in a traffic lane if there are two or more lanes in each direction. If a bus stops in the lane of traffic where there is only one travel lane, it causes vehicles to queue behind the bus or pass the bus in the center two-way-left-turn lane, which can be dangerous to oncoming motorists and pedestrians. If the bus pulls to the curb to load and unload passengers, the bus may have difficulty re-entering the traffic stream. Therefore, the three-lane option along Leary Way should incorporate measures to minimize delays to transit if it is implemented..

Benefits

- A center-turn lane makes it easier to turn to or from Leary Way
- Three-lane roadway could reduce crossing distance for pedestrians
- Center lane could include raised medians for pedestrian crossings.
- Three-lane roadway retains or increases on-street parking supply
- Reduces possibility for head-on collisions

Disadvantages

- Potential for delays to transit as buses will have to pull out of the traffic lane for transit stops
- Reduces through-vehicle capacity

Recommendation:

Analyze options for converting Leary Way to three lanes between 17th and 20th Avenues. The options should incorporate measures, such as queue jumps, to maintain reasonable transit times through this section. Coordinate this option with improvements at Leary/17th Avenue and Leary/20th Avenue (Options 21 and 22.)

17. Convert Leary Way to five lanes between 15th Avenue and Market Street

A five-lane section would consist of two lanes in each direction plus a center, two-way-left-turn lane. As described above, the traffic volumes on Leary Way are within the range of traffic volumes often found on three-lane arterials in Seattle and are not likely to warrant five lanes. The addition of a center turn lane to the existing roadway would require removing parking along one or both sides of Leary Way. For these reasons, a five-lane section on Leary Way is not recommended.

Benefits

- A center turn lanes makes it easier to turn to or from Leary Way
- Increases through vehicle capacity
- Could accommodate in-lane transit stops
- Allows for medians to be used to provide two-step pedestrian crossing
- Reduces possibility for head-on collisions

Disadvantages

- Reduces/eliminates on-street parking
- Increases pedestrian crossing distance (however, medians could be used to facilitate two-step crossing)

Recommendation:

Do not convert Leary Way to five lanes.

18. Install traffic signal on Leary Way at 17th Avenue and 20th Avenue

Traffic signal warrants were evaluated for the intersections at Leary Way/17th Avenue and Leary Way/20th Avenue. The need for a traffic signal at Leary Way/20th Avenue was evaluated using both existing and future traffic volumes. A traffic signal is not currently warranted, but would be in the future with the new development, which would add traffic to the side streets. In addition to installing a traffic signal, it is recommended that the intersection be reconfigured to separate the two legs on the southwest side of the intersection (20th Avenue and Vernon Street), and create a standard four-legged intersection. The south leg of 20th Avenue is used by very little traffic; therefore, it is recommended that this leg not be included in the traffic signal, but remain with stop sign control. This would require motorists destined north of Leary Way to use Vernon Street. This reconfiguration is described further in Option 22. With the traffic signal, this intersection would operate at LOS B. The traffic signal would also improve the ability of pedestrians to cross Leary Way. It may also improve conditions along Market Street by providing another route to Leary Way besides 22nd Avenue and 24th Avenue.

A traffic signal is not currently warranted at the intersection of Leary Way/17th Avenue. Substantial growth in the side street traffic on 17th Avenue would be required before such a warrant is met. Therefore, a traffic signal is not recommended for this intersection.

Benefits

- Traffic signal at Leary Way/20th would serve traffic growth from major development proposed near this intersection.
- Traffic signal at Leary Way/20th Avenue would improve ability for pedestrians and bicyclists to cross Leary Way.

Disadvantages

- Traffic signal at Leary Way/20th Avenue would increase delay to through traffic on Leary Way (although it would be less than delay at adjacent Market Street intersection.)
- Traffic signal is not warranted for Leary Way/17th Avenue.

Recommendation:

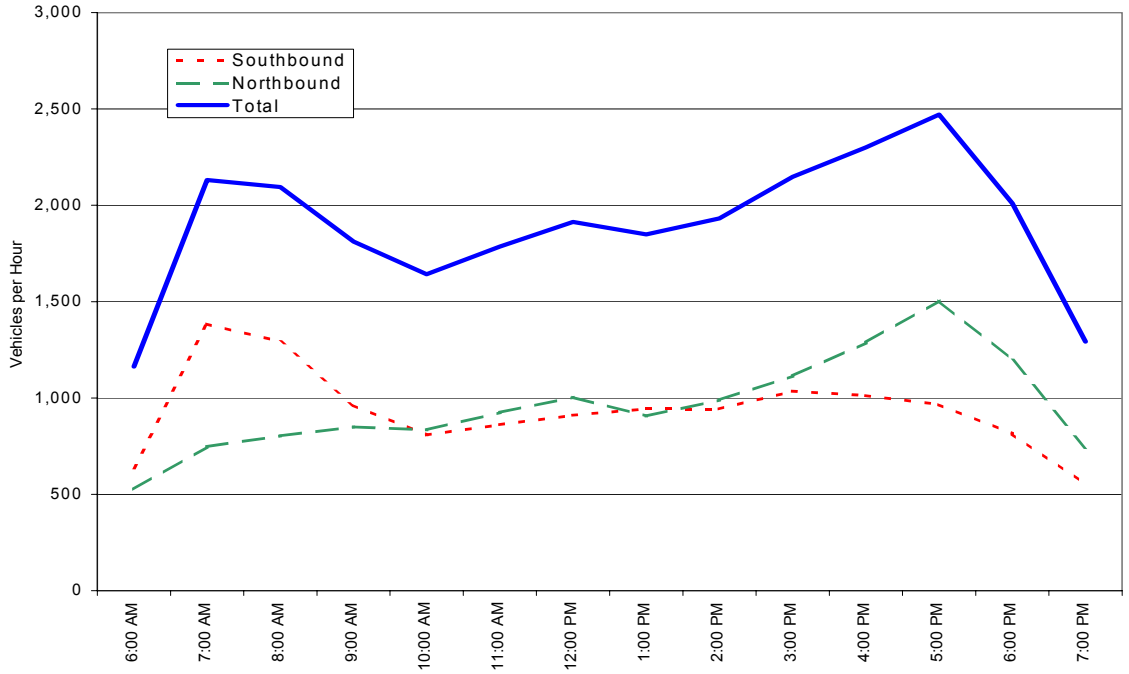
Install a traffic signal at Leary Way/20th Avenue in conjunction with new development. Re-align the intersection as proposed in Option 22.

19. Prohibit parking on west side of Leary Way south of 48th Street

The east side of Leary Way between 48th Street and 36th Street (northbound traffic) is signed, "No Parking 7 to 9 A.M. and 4 to 6 P.M." The west side of this street (southbound traffic) is signed, "No Parking 7 to 9 A.M." When parking on this section of Leary Way is restricted, there are two through lanes in each direction. When cars are parked at the curb, there is one lane in each direction.

Midday traffic volumes on Leary Way remain relatively high, unlike many other arterials in Seattle. Figure 16 shows the existing traffic volumes on Leary Way north of 3rd Avenue. The difference between the AM peak period traffic volumes and the midday traffic volumes differ by only about 400 vehicles per direction. The combined direction volumes continually exceed 1,600 vehicles per hour even during the midday. As shown previously in Table 7, 1,500 vehicles during the peak hour is about what N 45th Street through Wallingford carries during its peak hour. Therefore, midday traffic operations would likely improve on this section of Leary Way with two lanes for traffic in each direction.

Figure 16. Hourly Traffic Volumes on Leary Way North of 3rd Avenue



Midday parking along Leary Way causes through traffic to merge and weave on Leary Way. On street parking along the west side of Leary Way has only been observed near 43rd Street. Other on-street parking is available for businesses on 8th Avenue and 43rd Street. This parking is located farther from the business' front door, but is within a reasonable walking distance. Given the high midday traffic volumes along Leary Way, it is recommended that the parking on both sides of Leary Way be prohibited from 7:00 A.M. until 6:00 P.M. on weekdays. On-street parking in the evenings and on weekends would be acceptable given the existing traffic volumes.

Benefits

- Increases midday capacity
- Eliminates weaving movements caused by curbside parking
- Removes conflicts between bicycles and cars pulling in and out of parking spaces.

Disadvantages

- Eliminates on-street parking for businesses on west side of street near 43rd Street (e.g., Hale's Brewery)

Recommendation:

Prohibit parking along Leary Way south of 48th Street from 7:00 A.M. to 6:00 P.M. on weekdays. This new restriction could begin with the west side (southbound traffic direction) of Leary Way, and if needed, added to the east side of Leary Way. Parking could be allowed in the evening and on weekends.

20. Improve Market Street/22nd Avenue/Leary Way intersection

This intersection has a fifth approach (Leary Way), which requires additional signal phases and results in higher delays than a standard four-legged intersection. There are several potential changes that could be made to improve traffic operations at the Market Street/Leary Way/22nd Avenue intersection. These include:

- Removing parking on the west side of 22nd Avenue north of the intersection to provide an additional through/right-turn lane.
- Prohibiting northbound and southbound left-turn movements from 22nd Avenue to Market Street, while continuing to allow the left turn from southbound 22nd Avenue to Leary Way.
- Change 22nd Avenue south of Market Street to a one-way southbound street.

Analysis was performed to determine how each of these changes would affect the intersection's level of service. Only PM peak hour volumes are available for this location. This analysis in Table 8 shows that the intersection currently operates at LOS D during the PM peak hour. With future growth, the intersection would continue to operate at LOS D.

Table 8. Market Street/22nd Avenue/Leary Way Intersection Improvement Options

	PM Peak Hour		
Alternative	LOS 1	Delay 2	V/C 3
Existing (2001) Condition	D	36.0	0.71
Year 2012 No-Action Condition	D	44.7	0.90
Year 2012 – Add southbound thru-right lane	D	35.1	0.76
Year 2012 – Prohibit northbound and southbound left turns	D	35.9	0.79
Year 2012 – Convert 22nd Avenue to one-way southbound south of Market Street	D	38.7	0.81

1 Level of service

2 Delay expressed in seconds of average delay per vehicle.

3 Volume-to-capacity ratio

The analysis shows that none of the changes would cause a substantial improvement in the intersection's level of service. Prohibiting northbound and southbound left turns or converting 22nd Avenue to a one-way street could cause secondary impacts at other intersections along Market Street, particularly at the intersection of 24th Avenue, which is already the corridor's bottleneck. Therefore, neither of these changes is recommended. The option of modifying the existing curb bulb on the northwest side of the intersection and creating an additional thru-right lane would provide the biggest improvement to traffic operations. This change would allow vehicles turning right to Market Street or proceeding through the intersection to bypass vehicles waiting to turn left. This change would eliminate two metered parking spaces plus one 30-minute loading space along the west side of 22nd Avenue. It would also increase the crossing distance for pedestrians at this location. Since this intersection is still forecast to operate at an acceptable level of service in the foreseeable future, it is recommended that this change not be installed until warranted by future traffic growth.

One change that should be made at this intersection is to formalize the dual-left turn movements from northbound Leary Way to westbound Market Street. Observations at this intersection found that many drivers now make this left turn from the outside curb lane; however, there is no signage or lane striping that indicates this move is legal. Adding overhead signage, adding in-pavement arrows, and adding lane delineation buttons in the intersection would formalize this movement. Not allowing this dual-left turn movement would substantially reduce the level of service at this intersection.

Benefits

- Formalizing dual-left-turn movement from northbound Leary Way to westbound Market Street would enhance intersection operations.
- Additional thru-right lane on southbound approach would increase intersection capacity and improve level of service.

Disadvantages

- Curb bulb increases crossing distance for pedestrians
- Curb bulb removes two parking spaces plus a load zone.

Recommendation:

Formalize dual-left-turn movement from northbound Leary Way to westbound Market Street. Add overhead signage, in-lane pavement arrows, and lane delineation in the intersection as necessary to allow left turn movement from the curb lane on Leary Way.

Monitor traffic volumes and operations at this intersection. If warranted by traffic growth, modify curb bulb on the northwest corner of the Market Street/22nd Avenue/Leary Way intersection to provide an additional lane designated for thru-right traffic. Remove two metered parking spaces and the 30-minute load zone north of intersection to provide queuing space.

21. Reconfigure Leary Way/ 48th Street/17th Avenue intersection

The intersection at Leary Way/ 48th Street/17th Avenue is a five-legged intersection with a vast amount of pavement. It is an inhospitable place for pedestrians to cross because of the long distances and uncontrolled traffic on Leary Way. Several options were developed to reduce the crossing distances and separate conflicting traffic movements. These options are shown on Table 9.

Because truck mobility is a high priority in the industrial area of Ballard, concern was expressed about options that may eliminate one direction of traffic from either 17th Avenue or 48th Avenue. The concern related specifically to trucks that may be arriving from the Ballard Bridge and destined to businesses along Shilshole Avenue. These trucks currently turn west on Leary Way and use 17th Avenue to access Shilshole Avenue. Although some truck drivers may be able to turn right off of the bridge and use 14th Avenue to access the same location, the concern related to truck drivers who are unfamiliar with the area. If 17th Avenue is not available, other streets to the north are quite narrow with restricted turning radii. For this reason, an improvement option that maintains access from Leary Way to both 17th Avenue and 48th Street is recommended.

Option 21.5 includes one large island on the south side of the intersection, combined with one small channelization island in the center of Leary Way just north of 48th Street. These would improve pedestrian mobility at this intersection. The exit roadway from 17th Avenue direct to eastbound Leary Way is proposed to retain existing on-street parking and truck loading space for the adjacent businesses. If the business were to change operations or the site was redeveloped, it may be possible to eliminate this roadway and connect the channelization island to the adjacent curb. Left turns from 48th Street to 17th Avenue and then to Leary Way may have to be prohibited under Option 21.5 because of the potential for these vehicles to queue across the intersection into the travel way for vehicles turning from Leary to 17th Avenue.

The need for a traffic signal at this location was reviewed under Option 18 above. This analysis determined that a traffic signal is not currently warranted at this location, and substantial growth in side street traffic volumes would be required before a signal were warranted.

Benefits

- Island on south side of intersection would reduce pedestrian crossing distances.
- Left-turn lane on Leary Way would improve traffic operations on Leary Way.
- Island on Leary Way north of 48th Street would shadow left-turn lane and provide a refuge for pedestrians.

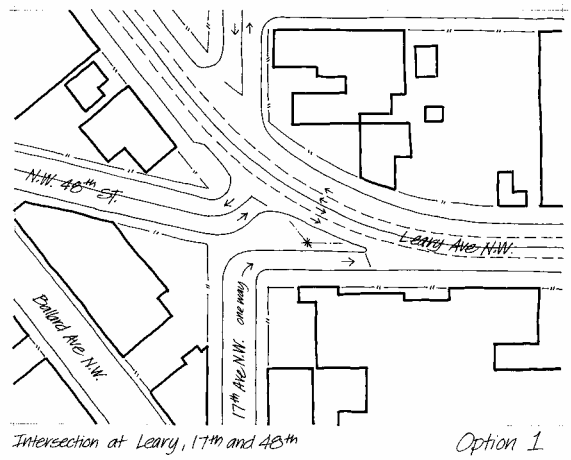
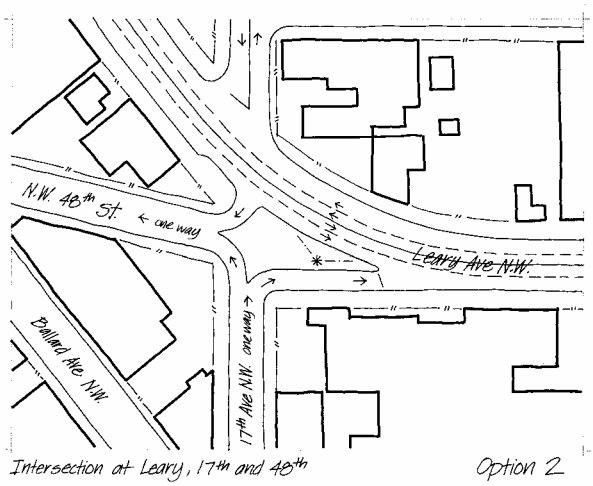
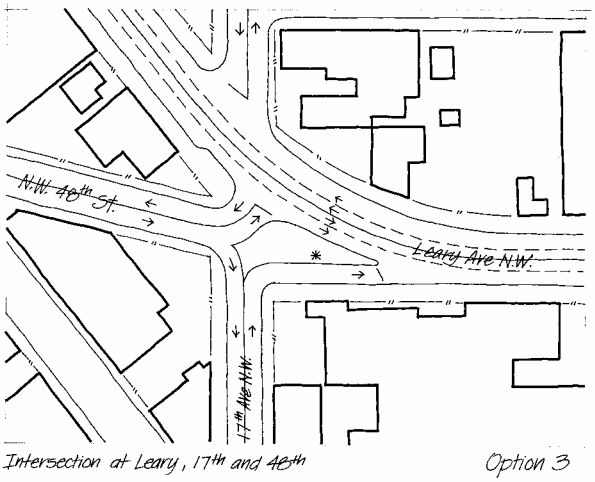
Disadvantages

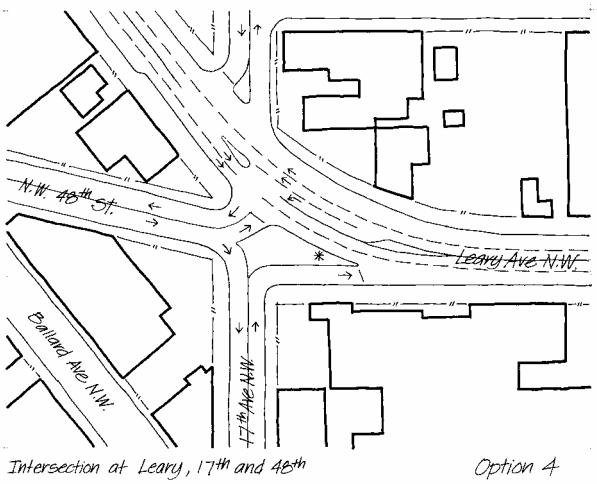
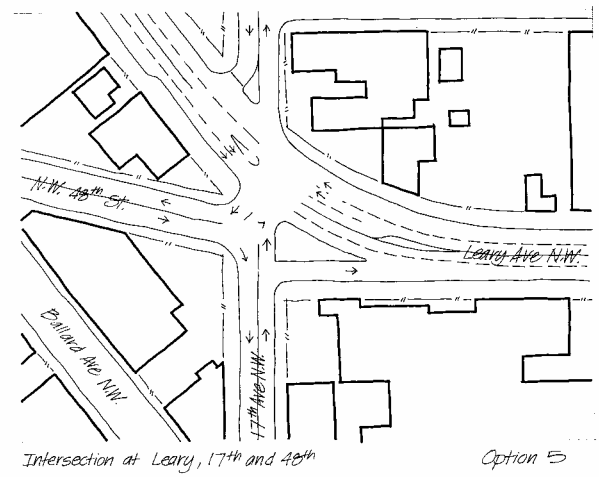
- Islands would reduce turning radii for large trucks.
- Addition of left-turn lane would require on-street parking to be removed near intersection.
- One or more turn movements would likely be prohibited, due to safety and operational concerns.

Recommendation:

Construct a channelization island on the south side of Leary Way east of 17th Avenue to narrow the intersection and a small channelization island in the center of Leary Way to improve pedestrian mobility at this intersection (similar to Option 21.5 in Table 9). Review the need for an additional access road on the south side of the large island for businesses that front Leary Way. Review the need to restrict movements at 17th Avenue/48th Street to address safety and operational concerns. Provide a left-turn lane on northwest-bound Leary Way for vehicles turning left to 17th Avenue/48th Street. Provide crosswalks across all minor legs of the intersection and Leary Way between 48th Street and the north leg of 17th Avenue. Reconfigure 17th Avenue north of Leary Way to reduce throat width of that street.

Table 9. Leary Way/NW 48th Street/17th Avenue NW Intersection Options

Potential Options	Features
	• Provides pedstrian refuge on south side of Leary Way to reduce crossing distances. • Completely separates conflicting traffic movements on 48th Street and 17th Avenue southwest of Leary Way. • One-way northbound on 17th Avenue with right-turn only to eastbound Leary Way. • Would negatively affect business and truck access on 17th Avenue NW, particularly oversize freight that arrives via the Ballard Bridge.
	• Provides pedstrian refuge on south side of Leary Way to reduce crossing distances. • Completely separates conflicting traffic movements on 48th Street and 17th Avenue southwest of Leary Way. • One-way northbound on 17th Avenue with right-turn only to eastbound Leary Way. • One-way westbound on 48th Street. • Would negatively affect business and truck access on 17th Avenue NW, particularly oversize freight that arrives via the Ballard Bridge.
	• Provides pedstrian refuge on south side of Leary Way to reduce crossing distances. • Separates conflicting traffic movements on 48th Street and 17th Avenue southwest of Leary Way. • Two-way traffic on both 17th Avenue and 48th Street, but northbound traffic on 17th Avenue restricted to right-turn only movement to eastbound Leary Way. • Cannot access southbound 17th Avenue from Leary Way, which would negatively affect business and truck access.

	• Provides pedstrian refuge on south side of Leary Way to reduce crossing distances. • Provides left turn lane from Leary Way to 48th Street with pedestrian island for crossing Leary Way. • Separates conflicting traffic movements on 48th Street and 17th Avenue southwest of Leary Way. • Two-way traffic on both 17th Avenue and 48th Street, but northbound traffic on 17th Avenue restricted to right-turn only movement to eastbound Leary Way. • Cannot access southbound 17th Avenue from Leary Way, which would negatively affect business and truck access.
	• Provides pedstrian refuge on south side of Leary Way to reduce crossing distances. • Provides left turn lane from Leary Way to 48th Street with pedestrian island for crossing Leary Way. • Does **not** separate conflicting traffic movements on 48th Street and 17th Avenue. • Two-way traffic on both 17th Avenue and 48th Street with all movements allowed.

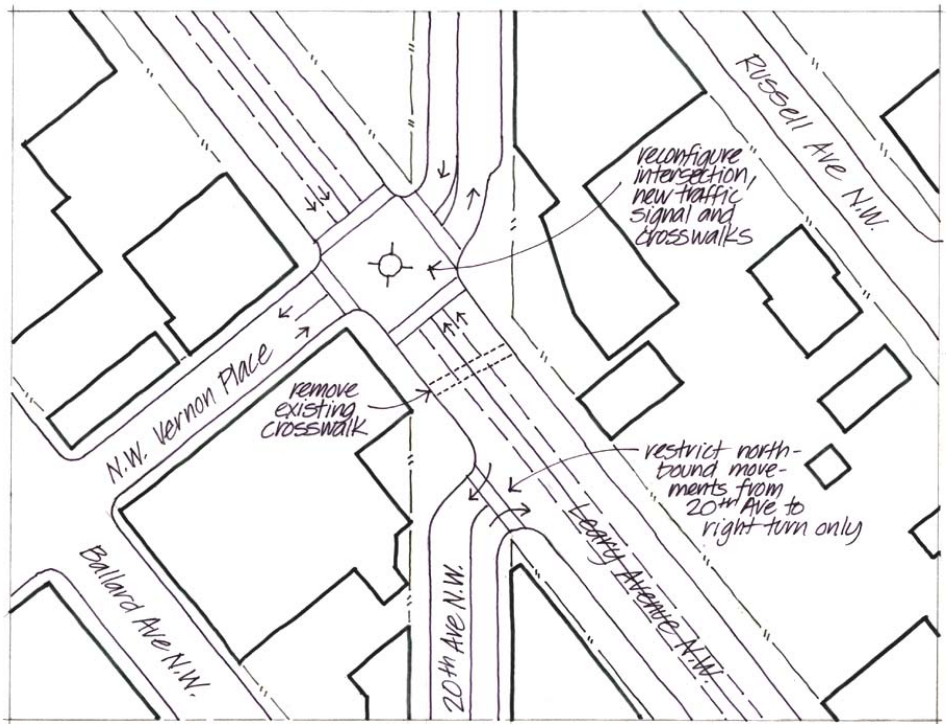
22. Reconfigure Leary Way/ Vernon Street/20th Avenue intersection

The intersection at Leary Way/ Vernon Street/20th Avenue is another location where it is difficult for a pedestrian to cross Leary Way. There is a marked crosswalk across Leary Way located just south of 20th Avenue that crosses four lanes of traffic without a center pedestrian refuge. Traffic on Leary Way is uncontrolled at this location, and all of the intersecting side streets are controlled by stop signs.

A large development is proposed on several parcels located on both sides of Leary Way in the vicinity of this intersection. This development would have about 440 housing units and 19,000 sf of commercial development. Vernon Street, south of Leary Way, and 20th Avenue, north of Leary Way, will provide the primary access to this new development.

The need for a traffic signal at this location was evaluated based on both existing and future traffic volumes. A traffic signal is not currently warranted, but would be in the future with the new development, which would add traffic to the side streets. In addition to installing a traffic signal, it is recommended that the intersection be reconfigured to separate the two legs on the southwest side of the intersection (20th Avenue and Vernon Street) and create a four-legged intersection. The south leg of 20th Avenue is used by very little traffic; therefore, it is recommended that this leg not be included in the traffic signal, but remain with stop sign control. This would require motorists destined north of Leary Way to use Vernon Street. One potential concept is illustrated in Figure 17.

Figure 17. Leary Way/ Vernon Street/20th Avenue



Benefits

- Traffic signal will increase capacity for side street traffic movements.
- Traffic signal will make it easier and safer for pedestrians to cross Leary Way.
- Reconfigured intersection will reduce the number of conflicting movements.

Disadvantages

- Traffic signal will reduce capacity for traffic on Leary Way (although the intersection would have less delay than adjacent signal at Market Street/Leary Way).
- Left turns prohibited from south side of 20th Avenue would likely cause a slight increase in traffic on Vernon Street.
- May require change in access to business at south corner of Vernon Street/Leary Way.

Recommendation:

Reconfigure the intersection at Leary Way/ Vernon Street/20th Avenue so that the south leg of 20th Avenue is separate and the remaining legs form a four-legged intersection. Install a traffic signal when new development in the vicinity is built. Remove existing unsignalized pedestrian crosswalk on Leary Way south of 20th Avenue and replace with new signalized pedestrian crossings at the intersection.

Burke-Gilman Trail Improvements

23. Complete study related to Burke-Gilman Trail extension

On October 22, 2001, the City Council adopted a resolution directing SeaTran to lead a "technical design study of bicycle and pedestrian route options between 11th Avenue and the Chittenden Government Locks." This study, which for the purpose of this report will be referred to as the "*South Ballard Transportation Corridor Design Study*", will include a detailed analysis of design feasibility for bicycle route options identified by the SBTCS. Seattle Transportation will work with business and property owners, trail advocacy groups, community groups, and the SBTCS Project Advisory Committee to gather input and provide information as the study progresses. SeaTran will begin the study once alternatives, as determined through the work of the SBTCS, are finalized. The study is expected to be complete by November 2002.

During the SBTCS Study, many bicycle/pedestrian route options were discussed. These have been narrowed to four options to be continued by the South Ballard Transportation Corridor Design Study. It should be noted that the final route could combine elements from any of the four options, which are described below:

a. Adjacent to Rail Tracks. This option would follow the existing rail tracks as proposed by the Friends of the Burke-Gilman Trail in its "The Missing Link Study," (July 2001). The trail would extend west from 11th Avenue along 45th Street, the southwest side of Shilshole Avenue, and "Not 54th Street."

b. Opposite Side of Street within the Rail Corridor. This route would be along 46th Street, the northeast side of Shilshole Avenue, crossing to the west side of Shilshole Avenue north of Vernon Street, and "Not 54th Street." If the one-way couplet is created on 46th Street and 45th Street, then 46th Street could accommodate a multi-use trail on either side of the street (the best side should be determined by the City's study). The trail would then continue on the northeast side of Shilshole Avenue crossing at either Vernon Street or its proposed new intersection at "Not 54th Street."

c. Ballard Avenue corridor. This option would use either 45th Street or 46th Street between 11th Avenue and 17th Avenue. The route would then proceed north along 17th Avenue and Ballard

Avenue to reach Market Street. The route would then extend west to the Locks along Market Street. Alternatively, the route could use 22nd Avenue to reach lower-volume streets north of Market Street (e.g., 57th Street or 58th Street described in the next option.)

d. Bike Boulevards on 14th Avenue and 57th Street. This option would create facilities on streets that favor bicycles over all other non-motorized modes. The route would use 14th Avenue to connect from 45th Street to 57th Street. This street was selected because it already has traffic signals controlling the major cross street intersections at Leary Way and Market Street. Other streets, such as 11th Avenue, may also be used instead, or in addition to 14th Avenue. The east-west link would use 57th Street between 14th Avenue (although it could be extended east to 8th Avenue) and 32nd Avenue, then along 58th Avenue across the railroad tracks to Seaview Avenue.

There are many issues that have been raised related to the four route options. These issues are presented below for the benefit of the City's South Ballard Transportation Corridor Design Study. The design study will produce a full summary of the benefits and disadvantages of each alternative.

Option A. Adjacent to Rail Tracks

Options A and B provide the most direct route and have the least change in elevation. Furthermore, they are the only alternatives identified that provide an off-street trail for pedestrians and bicycles. Most of the concerns related to Option A were raised by business owners along the corridor who perceive that the trail would adversely affect the industrial character of the area, their own business access, and the Ballard Terminal Railroad's operations. The main issues include:

- There are more driveways along this route than on any other section of the Burke-Gilman Trail. Trail design should address the potential for bicycle-vehicle accidents at driveways.

- Traffic control at driveway crossings is also an issue. If traffic on the driveway were required to yield to bicycle and pedestrian traffic, then trucks and other vehicles would need to stop well behind the street edge. This would increase the size of the gap that a vehicle needs to turn onto Shilshole Avenue from a driveway. With the limited gaps in traffic along Shilshole Avenue, this could adversely affect traffic operations for vehicles exiting the businesses, particularly trucks. If vehicles pull forward to the street edge, the back end of a vehicle may extend into or beyond the trail.

- If bicycle traffic on the trail is controlled by stop signs, bicyclists may ignore stop signs if they are placed too close together.

- If more active control is used for bicyclists (e.g., gates that close when traffic is approaching), some bicyclists will avoid the trail and ride along Shilshole Avenue.

- The Ballard Terminal Railroad uses double-track in some sections of the corridor so that a moving train can bypass one that is staged for loading/unloading or storage. Trail design along this corridor must accommodate double-tracking in these sections.

- The Ballard Terminal Railroad has customers who are not located immediately adjacent to the rail line. These customers use "team" loading areas to move freight from a railcar into a truck. Loading takes place on both sides of the cars at some locations. One loading area is located near Vernon Street, and a new loading area has just been constructed west of 24th Avenue adjacent to Ballard Transfer. These facilities should be retained with any trail configuration.

- The right-of-way west of 24th Avenue ("Not 54th Street") is the historic access to many businesses north and south of the right-of-way. Bicycles would have to interact with trucks maneuvering to load and unload. If the railroad tracks in this area were imbedded in the pavement, it would be possible to share the rail bed with trucks and provide the needed

maneuvering space. Access also needs to be retained for the businesses located south of the tracks.

- Trail design in this area should consider potential changes to railroad operations, such as additional side tracks or loading areas.

Option B. Opposite Side of Street within Rail Corridor

Creating a trail on the north side of Shilshole Avenue opposite from the rail tracks would eliminate most of the concerns related to rail operations, and would have fewer driveway crossings than a trail located along the rail tracks. However, there would be some issues to overcome, including:

- Under this route option, bicyclists and pedestrians would need to cross the major east-west street - 46th Street or Shilshole Avenue - to reach the northeast side of Shilshole Avenue. This could be done at 11th Avenue where its intersection with 45th Street is controlled by a four-way stop and its intersection with 46th Street is controlled by a traffic signal. Bicyclists would need to re-cross Shilshole Avenue on the northwest end to reach the rail corridor. A new traffic signal may be warranted wherever this new crossing occurs.

- Customers and others visiting businesses along the northeast side of Shilshole Avenue would have to cross the trail between their parked cars and the sidewalk. Visitors unfamiliar with the area would not expect to have faster-moving bicycle traffic where the sidewalk should be located, which could create a safety hazard for pedestrians.

- Issues related to business access on "Not 54th Street" west of 24th Avenue (see discussion for Option A) would continue for this option.

Option C. Ballard Avenue Corridor

Ballard Avenue provides access through the Ballard historic district. The route option along Ballard Avenue would not be a trail, but an on-street bike route. The connection along Market Street is the biggest issue with this route. This and other issues that would need to be addressed are presented below:

- Ballard Avenue ends at Market Street. The short section of Market Street between Ballard Avenue and 24th Avenue may be the most difficult challenge of this corridor. The high traffic volume, high pedestrian volume on the sidewalks, desire for on-street parking, and location of the new transit center may limit the ability to add a substantial volume of bicycle traffic to this street.

- Market Street, west of 24th Avenue, likely has excess capacity that could be converted to bicycle use. However, this may require that the street be reconfigured (to three lanes plus bicycle lanes) or require that parking be removed from the street.

- Ballard Avenue is a one-way street between 22nd Avenue and Market Street. Thus, two-way bicycle travel on this street may require changes in the street configuration and parking layout.

- Bicycles and pedestrians would need to cross Shilshole Avenue at 17th Avenue. The high volume of pedestrians could warrant a traffic signal at this location.

- Parking along Ballard Avenue may be a hazard for bicycles on this street.

- The brick pavement on some sections of Ballard Avenue can be hazardous for a bicyclist.

- A variation of this option would use 22nd Avenue to access Market Street and proceed north to 57th Street or west on Market Street. Additional bicyclists at the intersection of Market

Street and 22nd Avenue could adversely affect traffic operations for southbound traffic on 22nd Avenue destined to Leary Way. These vehicles would have to yield to oncoming bicyclists.

Option D. NW 57th Street

NW 57th Street could be designated and signed as a bike route and connect to the existing Burke-Gilman Trail via north-south streets, such as 11th or 14th Avenues on the east and 32nd Avenue on the west. This route has the advantage of avoiding the industrial business along Shilshole Avenue, but it is the furthest out of the way and has the greatest elevation changes between 45th Street/11th Avenue and the Locks.

A bicycle route on 57th Street could include traffic control treatments at major cross streets to facilitate safe crossings, and it could include additional treatments to give the bicycle route priority at some cross streets. Ultimately, the street could be designed as a bike boulevard.

The bike boulevard concept would be similar to facilities that have been constructed in other major cities (e.g., parallel to Broadway in Vancouver B.C.) It would create high-speed bicycle routes on streets that are off of the main vehicle arterials. The proposed alignment along 57th Street is very wide (approximately 40 feet curb-to-curb). This width could allow existing uses of the street to be consolidated or changed to accommodate a bicycle facility. For example, it may be possible to change the street to a one-way street for vehicles, consolidate the parking with angle parking on one side of the street, and provide up to a 12-foot bike trail on the other side of the street. Other potential configurations should be evaluated. There are many issues that would need to be addressed to implement a bike boulevard.

- A high-speed corridor for bicycles would need to be constructed without creating a high-speed short-cut route for vehicles. This could be accomplished using neighborhood traffic control measures (similar to those found throughout Seattle) that would allow a bicycle to pass but not a vehicle.

- Traffic control would likely need to be changed to provide the least resistance to bicycle traffic. This would require that existing stop and yield signs for traffic on 57th Street (at 17th, 20th, and 22nd Avenues) be changed.

- Improved traffic control (e.g., traffic signals) may be needed where the bicycle boulevard crosses major arterials such as 15th Avenue. Bicyclists should be able to activate new and existing traffic signals without dismounting their bicycle.

- Parking along 57th Street may be a hazard for bicycles on this street.

- Local access and parking needs for residents and businesses along the corridor will need to be addressed.

- The grades along 57th Street are relatively steep for bicycling west of 28th Avenue.

- It may be difficult to get bicyclists destined to the locks or Golden Gardens to use this route. It must be convenient and safe to get bicyclists to use it.

Recommendation:

Proceed with South Ballard Transportation Corridor Design Study for the four routes listed above.

Miscellaneous Improvements

24. Reconfigure 14th Avenue

14th Avenue is a boulevard type street because of the existing rail spur located in the center of the street. This rail spur serves Bardahl Oil and has been unused for many years. Cars now park on the gravel median in the center of the street, as well as along the edges of the street. 14th Avenue has a planted median further north, and the Crown Hill/Ballard Neighborhood Plan recommends extending the median south to Market Street. The Elevated Transportation Company (ETC) is evaluating 14th Avenue as a potential route for a future monorail.

14th Avenue is a street that could accommodate additional traffic or functions (e.g., bike route). Its intersections with major cross streets—Leary Way and Market Street—are signalized. The existing configuration, however, with parking in a center median creates awkward intersections at its unsignalized cross streets. Some of these intersections are controlled with stop signs on 14th Avenue and some of these are controlled with stop signs on the side streets. The parking along the street is unorganized and inefficient, and some vehicles park too close to intersections, which restricts the sight lines at these intersections.

One way to improve the function of 14th Avenue is to change it into a conventional street configuration with the traffic lanes in the center of the street and parking at the edges. The street right-of-way is wide enough to accommodate angle parking on both sides of the street; therefore, the change in configuration would not reduce the number of parking stalls available. The existing rail spur could be accommodated in the center of the street if it were imbedded into the pavement. If the spur were ever re-activated, it would be more efficiently operated if the rail line was located in the driving lanes rather than in the parking strip. In addition, traffic control at the minor side street intersections should be consistent. It is recommended that all side streets intersecting 14th Avenue be controlled by stop signs on the minor streets (similar to 8th Avenue). This configuration would maximize the capacity of the street. Finally, with the new configuration, adequate truck turning radii at the intersections should be provided.

Benefits

- Increases capacity of 14th Avenue.
- Improves sight distance at intersections.
- Retains parking supply.
- Retains/improves rail spur.

Disadvantages

- Change not needed for current traffic conditions.
- Elimination of median area may hinder use of street for future monorail.

Recommendation:

Move the parking to the edge of the street and put traffic in the center of the street. Retain rail spur in the center of the street, and provide adequate truck turning radii at intersections. Control minor intersections with a stop sign on the side street.

25. Designate a hierarchy of streets

The City of Seattle has just started a process to update the *Seattle Street Improvement Manual.* City Design (The City of Seattle's urban design department) has just completed a draft report documenting the topics that should be addressed in the new manual and presenting examples of manuals used by other cities. It is expected that SeaTran will begin working on the new manual in Summer 2002. The Seattle Manufacturing Industrial Council (MIC) has been working with the City to develop street design standards for truck streets. Different standards would apply to different classifications of truck streets. Currently, there are only two classifications of truck streets in Seattle: "truck street" and "major truck street." The MIC has proposed that these trucks streets be classified as regional truck streets, major trucks streets, and minor truck streets. The SBTCS Advisory Committee should work with the MIC to appropriately designate streets within the Ballard industrial area.

Benefits

- Improves predictability of required frontage improvements when new development occurs along a street.
- Retains truck mobility in developing areas.
- Guides the prioritization process for truck mobility improvements.

Disadvantages

- Street standards have not yet been adopted and there is no certainty that standards related to a hierarchy of streets will be adopted.

Recommendation:

Work with the City and Seattle Manufacturing Industrial Council (MIC) to designate a hierarchy of trucks streets to support future update of the City's street design standards. Other stakeholders, such as the SBTCS Advisory Committee, should be included in the discussion of truck street designations in the South Ballard area.

26. Improve directional signage for various modes of travel.

Many of the truck drivers who deliver goods to and from Ballard are from out of town and are unfamiliar with Seattle's street system. There currently exists only one sign that directs drivers to Ballard and that is the "Truck Route" sign located on Aurora Avenue N north of N 155th Street. There are also few signs that direct drivers back to the interstates or SR 99 from Ballard. A comprehensive signing program is recommended to guide drivers, particularly truck drivers, to Ballard and back to the regional highway system. The signs would direct drivers to principal arterials that can accommodate trucks. Such signage would also be useful for other motorists who are unfamiliar with Seattle, even if the route for trucks is not the most direct route to and from the highway system.

Improved signage for bicyclists is also needed to direct bicyclists to appropriate routes or to popular destinations off of the signed bike route. Signage for bicyclists should follow routes where it is possible to cross major arterials (e.g., 14th Avenue and 20th Avenue that have or will have traffic signals at Leary Way and Market Street).

Benefits

- Signage improves mobility for those who are unfamiliar with the area.
- Signage reduces chance of trucks using streets that are not appropriate for large trucks.

Disadvantages

- Direction signage is often perceived to indicate the only route available.

Recommendation:

Install truck route signs directing vehicles to Ballard from Interstate 5 and SR-99 along routes that are appropriate for large trucks. Signs should also be installed along the return routes.

Install signs directing bicyclists to appropriate routes where it is easy to cross major arterials and reach popular destinations.

Traffic Operations with Improvements

Traffic operations with all of the recommended improvements were evaluated in the VISSIM model. This analysis included those projects that would affect vehicle capacity in the corridor (e.g., new traffic signals, lane changes.). Table 10 summarizes the results of this analysis.

Table 10. PM Peak Hour Intersection Level of Service – Future Conditions

	2012 Without Improvements		2012 With Improvements	
Signalized Intersections	LOS	Delay1	LOS	Delay1
Market Street/24th Avenue	E	60.7	C	31.3
Market Street/Ballard Avenue	B	10.3	A	3.5
Market Street/Leary Way/22nd Avenue	D	48.0	D	44.3
Leary Way/15th Avenue	D	54.3	D	37.0
Leary Way/14th Avenue	B	19.6	B	12.8
46th Street/Leary Way	C	22.9	C	22.9
Leary Way/8th Avenue	B	10.0	B	13.9
Leary Way/20th Avenue	n/a	n/a	B	11.8
Unsignalized Intersections				
Leary Way/20th Avenue	A	3.3	n/a	n/a
Leary Way/17th Avenue	E	58.3	E	58.5
Shilshole Avenue/17th Avenue	F	67.1	B	15.1
45th Street/11th Avenue	B	14.5	B	17.6
Leary Way/45th Street	D	48.3	D	48.3

1. Average vehicle delay. These values are comparable to Intersection Control Delay (decel+stop+accel delay) in the Highway Capacity Manual that are used to determine level of service.

As shown most of the intersections in the study area would experience better levels of service with the proposed improvements. The exception is the intersection at Leary Avenue/17th Avenue. Since this intersection would not likely warrant a traffic signal, left turn movements from 17th Avenue onto Leary Way will continue to be difficult to make. With the proposed traffic signal at 20th Avenue, some of the motorists who now use 17th Avenue may divert to this new signal where it will be easier to turn left. This shift is not reflected in the analysis. All other intersections in the corridor would operate at LOS D or better with the recommended improvements.