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Hosford-Abernethy Bicycle and Pedestrian Connections: An Alternative Routes Analysis Linking SE Clinton Street and the Eastbank Esplanade

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AN ALTERNATIVE ROUTES ANALYSIS LINKING SE CLINTON STREET AND THE EASTBANK ESPLANADE

Portland State University
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The Master of Urban and Regional Planning program at Portland State University provides practicing and aspiring planners with knowledge of history, practice, methodology and consideration of ethical responsibility surrounding the planning profession. The Planning Workshop is the culmination of the Masters Program and it allows students the opportunity to put their knowledge and skills into practice.

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Executive Summary

SE Clinton is a popular bicycle route for commuter, utilitarian and recreational bicyclists that fails to provide a safe and direct connection to the Eastbank Esplanade and downtown Portland. Furthermore, residents in the Hosford-Abernethy and Brooklyn neighborhoods do not have a safe bicycle and pedestrian connection to access the Eastbank Esplanade. This gap in the bicycle and pedestrian network must be removed to serve the needs of bicyclists and pedestrians.

This project presents four alternative bicycle and pedestrian routes that connect the Eastbank Esplanade and the SE Clinton bikeway through the Central Eastside Industrial District. Each alternative, with improvements, is evaluated based on five criteria, and a preferred route is recommended.

This area is dominated by industrial land uses. Particular hazards to bicyclists and pedestrians include an active main line railroad corridor, a high volume of heavy truck traffic, and wide intersections designed to accommodate trucks.

Recent literature and technical documents were reviewed to guide our assessment of the study area and formulation of five evaluation criteria. Existing conditions were documented, and four route alternatives were identified. Each route is described in full detail in the study.

A preferred route was selected based on the evaluation criteria. The preferred route utilizes existing bicycle routes, wide sidewalks and signalized intersections, and avoids the most hazardous streets and intersections. A long term recommendation is made as well, which is largely dependent on changing land uses and the introduction of light rail in the railroad corridor.

1. Introduction

Types of Bicyclists

Type A *– Advanced Bicyclists are experienced riders who can operate under most traffic conditions. They are best served by direct access to destinations usually via the existing street and highway system, the opportunity to travel at maximum speeds with minimum delays, and sufficient operating space on the roadway or shoulder.*

Type B *– Basic Bicyclists are generally casual or new adult and teenage riders who are less confident of their ability to operate in traffic without special provisions for bicycles. Group B riders prefer comfortable, direct, low speed and traffic volume streets or designated paths to reach their destinations. Additionally, well-defined separation of bicycles and motor vehicles on arterial and collector streets or separate bike paths are preferred.*

Type C *– Children are pre-teen riders whose roadway use is initially monitored by parents. They and their parents prefer access to key destinations surrounding residential areas including schools, recreation facilities, shopping, or other residential areas; residential streets with low motor vehicle speed limits and volumes, and well defined separation of bicycles and motor vehicles on arterial and collector streets or separate bike paths.*

1.1 *Purpose*

The purpose of this project is to evaluate the bicycle and pedestrian conditions in the area between the Eastbank Esplanade and the SE Clinton bikeway, identify route alternatives, and present the best alignment with all necessary improvements. These improvements are intended to serve Type B and Type C bicyclists and pedestrians of all abilities.

Four possible routes are formulated and evaluated based on five criteria: accessibility, cost, directness, ease of implementation, and safety. All four alignments are discussed in detail, and a variety of recommendations are offered for each. A preferred alternative is recommended based on the evaluations.

1.2 *Background*

In the last ten years, promoting bicycling and walking has become a part of public policy for transportation and land use planning, environmental, and public health departments in metropolitan areas. Bicycling and walking are non-polluting, efficient and inexpensive modes of transportation. Moreover, both activities are excellent ways to improve cardiovascular health and prevent chronic diseases associated with excessive body weight. Most trips made by US households are within comfortable bicycling distance (49% of all trips are shorter than 3 miles, 40% are shorter than 2 miles, and 28% are shorter than one mile). Subsequently, there has been a push to encourage people to walk or bicycle for these trips instead of driving.

US Census data from 1990 and 2000 indicate that the percentage of people who commute to work in Portland by bicycle rose from 1.1% to 1.8% (*Figure 1*). Bicycle to work trips have nearly doubled during that time period from 2,453 people to 4,775 people, a rate that has greatly surpassed the rate of population growth. The percentage of people in Portland who walked to work increased in the last decade as well, up to 5.4% from 5.3%.

Comparatively, only 0.4% of people in the United States who commuted to work in 1990 and 2000 did so by bicycle. Moreover, the percentage of people who walked to work decreased from 3.9% in 1990 to 3.0% in 2000 (*Figure 2*).

The growing number of bicycle and walking trips in Portland is partially a result of progressive statewide transportation and land use policies, which have slowed suburbanization rates, kept the metropolitan region relatively compact, and focused development around regional town/ employment centers, transit corridors, and the central city. The compact urban form has allowed Portland to develop a comprehensive bike and pedestrian network that enables easy and convenient bicycle trips throughout the region. Although Portland has done a commendable job to date, there are still a number of short, but dangerous, gaps in the network that prohibit complete regional access. The transition between SE Clinton and the Eastbank Esplanade is such a gap.

SE Clinton Street is a bicycle boulevard paralleling SE Division Street, a high traffic roadway. Bicycle boulevards are often residential streets outfitted with traffic calming treatments that parallel busy arterial or collector roadways. Bicyclists share the roadway with vehicles; pedestrians have separate facilities (i.e., sidewalks).

The intent of the bicycle boulevard is to encourage bicycling and walking by reducing traffic speeds and discouraging through automobile traffic, which may use the residential street to bypass congestion on the busier roadway. Speed bumps and traffic circles were installed between SE 12th and SE 39th in 1998 to slow through traffic speeds and to create a more pleasant walking and bicycling environment.

Results of the traffic calming indicate that traffic calming on SE Clinton has successfully reduced the average 85th percentile speed closer to the posted speed and also decreased the number of cars using the street. Approximately 300 bicyclists use SE Clinton each day to access various parts of the city.

SE Clinton Street terminates at SE 12th and limits safe and direct access to the OMSI-Springwater Corridor Trail and the Eastbank Esplanade. This gap prevents Type B and Type C bicyclists and pedestrians from accessing these routes, as well as other desirable destinations, like the Oregon Museum of Science and Industry (OMSI) and downtown Portland. This project addresses the gap that prevents bicyclists and pedestrians from connecting to SE Clinton and the Eastbank Esplanade.

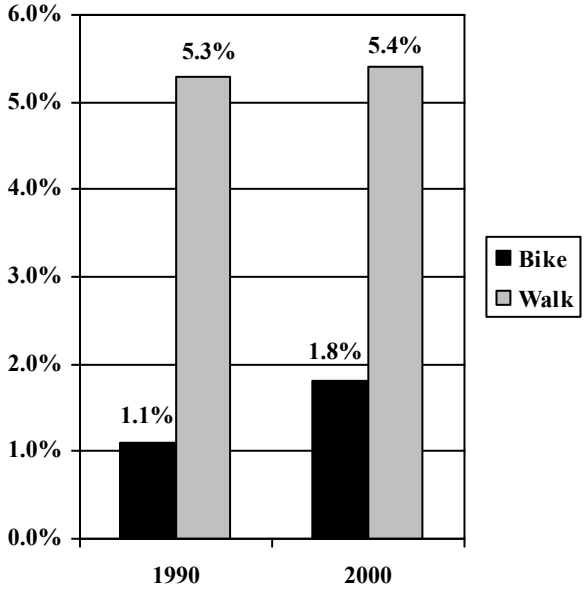


Figure 1. Portland, Oregon commute to work travel data: Bicycling and Walking, 1990 and 2000, US Census.

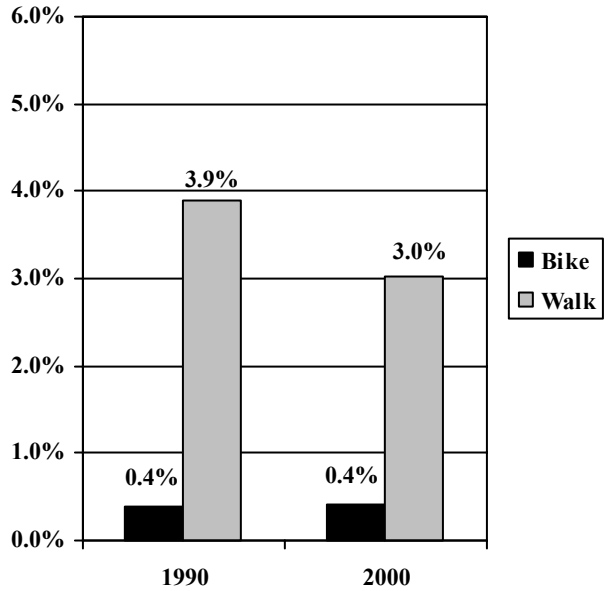
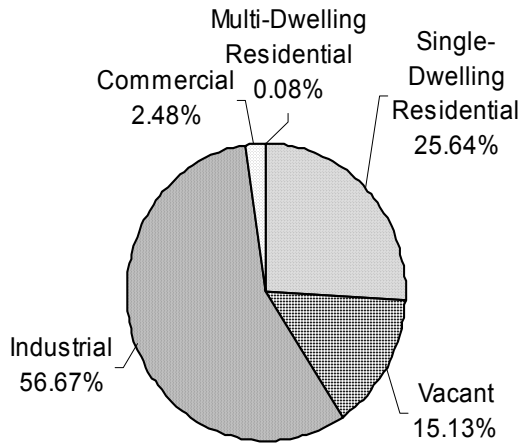


Figure 2. United States commute to work travel data: Bicycling and Walking, 1990 and 2000, US Census.

Figure 3. Project Area Land Use



1.3 *Project Area*

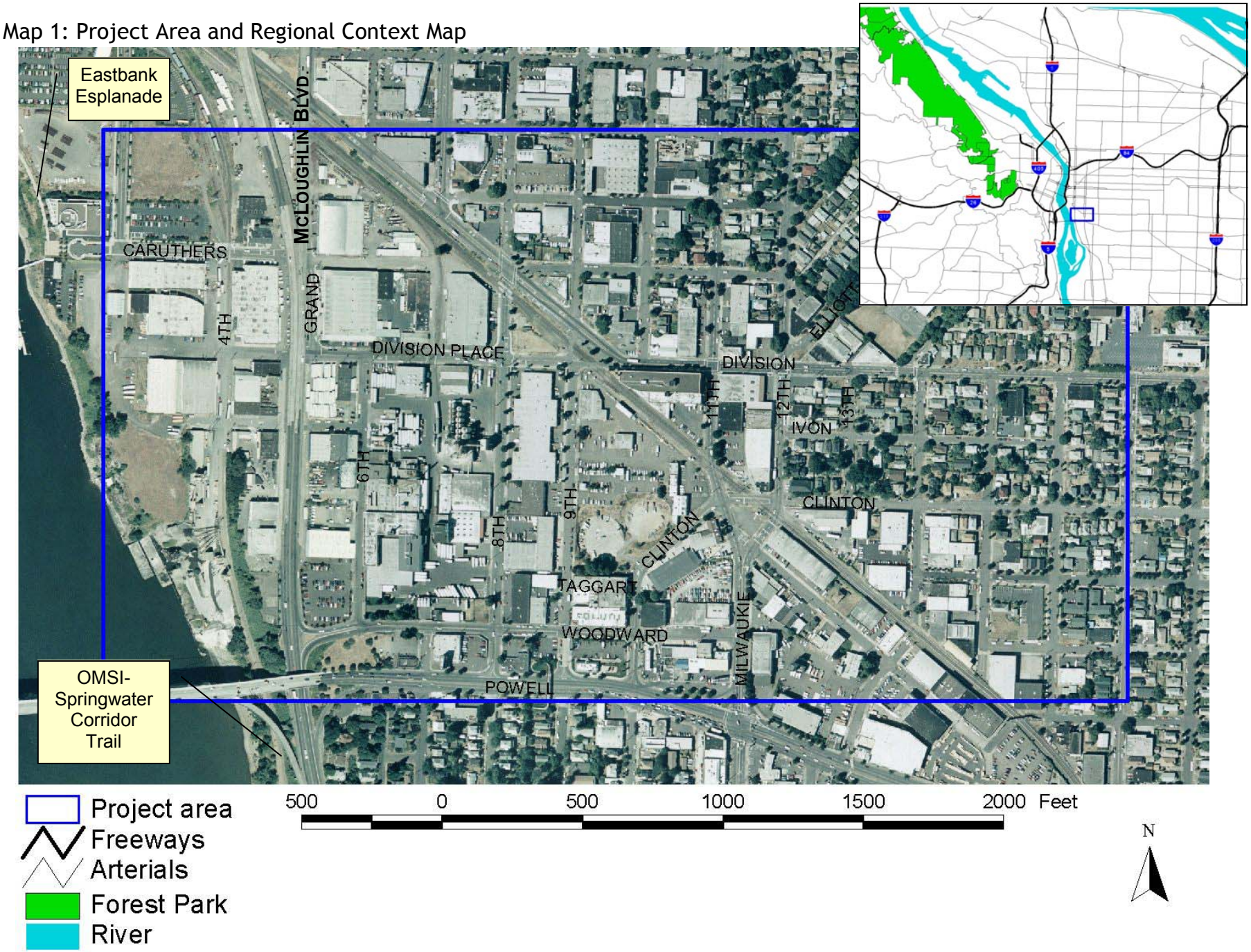
The project area extends from the western terminus of the SE Clinton bikeway to the Eastbank Esplanade, a straight-line distance of approximately .5 miles (*Map 1*). The project area is roughly bounded on the north by SE Caruthers, on the west by the Willamette River, and on the south by SE Powell. McLoughlin Boulevard is an elevated highway (viaduct) that crosses the west side of the project area.

The bulk of the project area is located in the Central Eastside Industrial District. Nearly 60% of the land is devoted to industrial and manufacturing uses, including Ross Island Sand and Gravel, Darigold and Northwest Natural Gas. Residential land uses are located almost entirely east of SE 12th in the Hosford-Abernethy neighborhood.

The Union Pacific Railroad diagonally transects the project area. The railroad tracks parallel SE Division in the northern part of the project area, cross SE 11th and SE 12th at SE Clinton, and continue southeast through the Brooklyn neighborhood. The railroad line carries freight and passenger service.

Two regional trails exist in the project area: the OMSI-Springwater Corridor Trail and the Eastbank Esplanade. The OMSI-Springwater Corridor Trail is a 3-mile trail that extends south to Sellwood and connects to the Springwater Corridor Trail. The Eastbank Esplanade extends from the project area north along the Willamette River to the Steel Bridge.

Map 1: Project Area and Regional Context Map



2. Methodology

First, city and neighborhood plans were reviewed (*Appendix A*) to determine: 1) the city's commitment to expanding bicycle and pedestrian facilities throughout the city, 2) project area neighborhoods' desires to improve bicycle and pedestrian facilities and better connect area neighborhoods to the Willamette River and East Bank Esplanade, and 3) important features of streets, sidewalks, and traffic to consider when planning and designing bicycle and pedestrian facilities. These features include:

- Traffic mix
- Traffic volume
- Traffic speeds
- On-street parking
- Site distance – how far bicyclists and pedestrians can see oncoming traffic
- Number and types of intersections, roadway width, and street crossing angles
- Presence, surface condition (including obstructions), and width of sidewalks

Second, through numerous site visits, the entire project area was surveyed to identify and document these and other features, and to identify both hazards and opportunities. The project team recorded sidewalk and street width, pavement quality, and the presence of bicycle and pedestrian hazards (e.g. railroad tracks, potholes and obstructions). The project team then recorded the information into GIS to spatially analyze hazards. Based on these surveys, four bicycle and pedestrian routes were formulated.

Third, each route was analyzed in detail. Specific improvements were formulated to address each hazard. These improvements are discussed in detail.

Fourth, evaluation criteria were formulated and applied to each route alternative to determine a preferred route. These criteria are based on local plans and current best practices for bicycle and pedestrian facility design including Portland's *Bicycle Master Plan* (1995), the Oregon Department of Transportation's *Oregon Bicycle and Pedestrian Plan* (1995), and the Institute of Technical Engineers' *Innovative Bicycle Treatments* (2001).

Each criterion is scored on a 1-3 scale and given a rating of low, moderate or high. Scores for each criterion for each route are relative to all other routes and are summarized later in the document. For example, a high or low score indicates that particular route's performance relative to the other routes. Criteria are totaled for each route alternative – providing a means of comparison and selection of the preferred alternative.

The criteria are discussed in detail below:

Accessibility

This is a measure of the distance a bicycle or pedestrian facility is from a specified origin or destination, the ease by which this distance can be traveled by bicycles and pedestrians, and the extent to which all likely origins and destinations are served. For example, a high priority destination such as the Eastbank Esplanade should be accessible by bicyclists and pedestrians. Accessibility is rated on a scale of 1 to 3. A higher score reflects a route alternative that links a greater number of existing paths and neighborhoods relative to other route alternatives.

Cost

For each route alternative, a rough cost estimate is formulated

based on improvements required to create a route that meets the basic requirements of Type B and Type C bicyclists, pedestrians of all abilities, and State and Federal Design Requirements. These improvements include route signage, crosswalks, road and surface repairs, and/or improvements to satisfy Americans with Disabilities Act (ADA) requirements. Cost is rated on a 1 to 3 scale. A lower score reflects a more costly alternative relative to other routes.

Directness

Studies have shown that most bicyclists and pedestrians will not use even the best bicycle facility if it greatly increases the travel distance or trip time over that provided by less desirable alternatives. As described above, the Central City Transportation Management Plan (CCTMP) calls for bicycle and pedestrian routes that are direct, connecting "areas and sites in as direct a line as possible" (CCTMP, p. 9). Therefore, route alternatives that are shorter and straighter receive a higher score than longer and less direct routes.

Ease of Implementation

The ease or difficulty of implementing proposed improvements depends on available space and existing traffic operations and patterns. For example, an area or route with few cars and wide well-surfaced sidewalks would receive a high score relative to routes with high traffic volumes and poor or absent sidewalks. Also, ease of implementation refers to political difficulty of the proposed project due to it's proximity to private property.

Safety

Safety is a composite measure of existing or potential inter-modal conflict at intersections, driveways, and on routes. Measures that may be available include average daily traffic, average vehicle speed, site distance, railroad crossings, and number of traffic lanes. A higher score reflects a safer route.

3. Project Area Existing Conditions

3.1 Automobile and Heavy Truck Travel Patterns

Existing conditions were observed and documented during extensive field observations. Automobiles and heavy trucks are the dominant transportation modes in this area. There are two distinct vehicular travel movements in the project area: automobile and truck through traffic and local circulation automobile and truck traffic (*Map 2*). The arterials and major collectors located on the periphery of the project area carry most of the through traffic for automobiles, trucks, and heavy trucks. These roadways include SE 11th and SE 12th, SE Milwaukie, SE Powell/US 26, SE Division, and SE McLoughlin/Hwy 99E. Many heavy trucks travel through the project area to access these periphery roads. There are several intersections that have been designed with large turning radii specifically to handle long trucks. SE 8th, SE 6th, and SE Grand are frequently used by heavy trucks to access SE Woodward, US 26 and the Ross Island bridge, the northbound lanes of Hwy 99E, and the southbound lanes of Hwy 99E, respectively. Average Daily Traffic (ADT) on the periphery roads range from 9,343 vehicles a day on SE 12th to 13,103 vehicles a day on SE Division at SE 12th (*Table 1*).

Table 1. Traffic Counts for Selected Project Area Roadways

Road	Total Volume	East/North	West/South	Date
SE Division at SE 12th	13,103	5,864	7,239	1999
SE 8th at SE Division	5,016	1,072	3,944	1997
SE 7th at SE Division	10,496	7,148	3,348	1999
SE 12th at SE Clinton	9,343	9,343		1996
SE 11th at SE Division	10,041		10,041	1996
SE Clinton at SE 12th	3,505			1998
SE Clinton at SE 14th	3,519	1,483	2,036	1998
SE Clinton at SE 19th	2,291	988	1,303	1999
SE Clinton at SE 21st	2,375	1,132	1,243	1999
SE Woodward at McLoughlin	12,733	9,658	3,075	1998

Source: Portland Office of Transportation

The second travel movement is local circulation traffic, which is primarily comprised of heavy trucks with origin points in the project area accessing US 26 and Hwy 99E, and local employee automobile traffic. SE Division Place from SE Grand to SE 8th is a major thoroughfare, and SE 6th and SE Grand enable many trucks and automobiles to directly access Hwy 99E. SE Grand and SE Caruthers access businesses in the northern part of the project area and OMSI. Similarly, in addition to employee trips, many of the businesses in the project area use automobiles and light trucks (i.e., delivery and service trucks) for work trips, which frequently enter and exit the project area throughout the workday. Traffic movement is generally highest during the standard workweek from early morning to late afternoon. Weekend truck and automobile traffic is light.

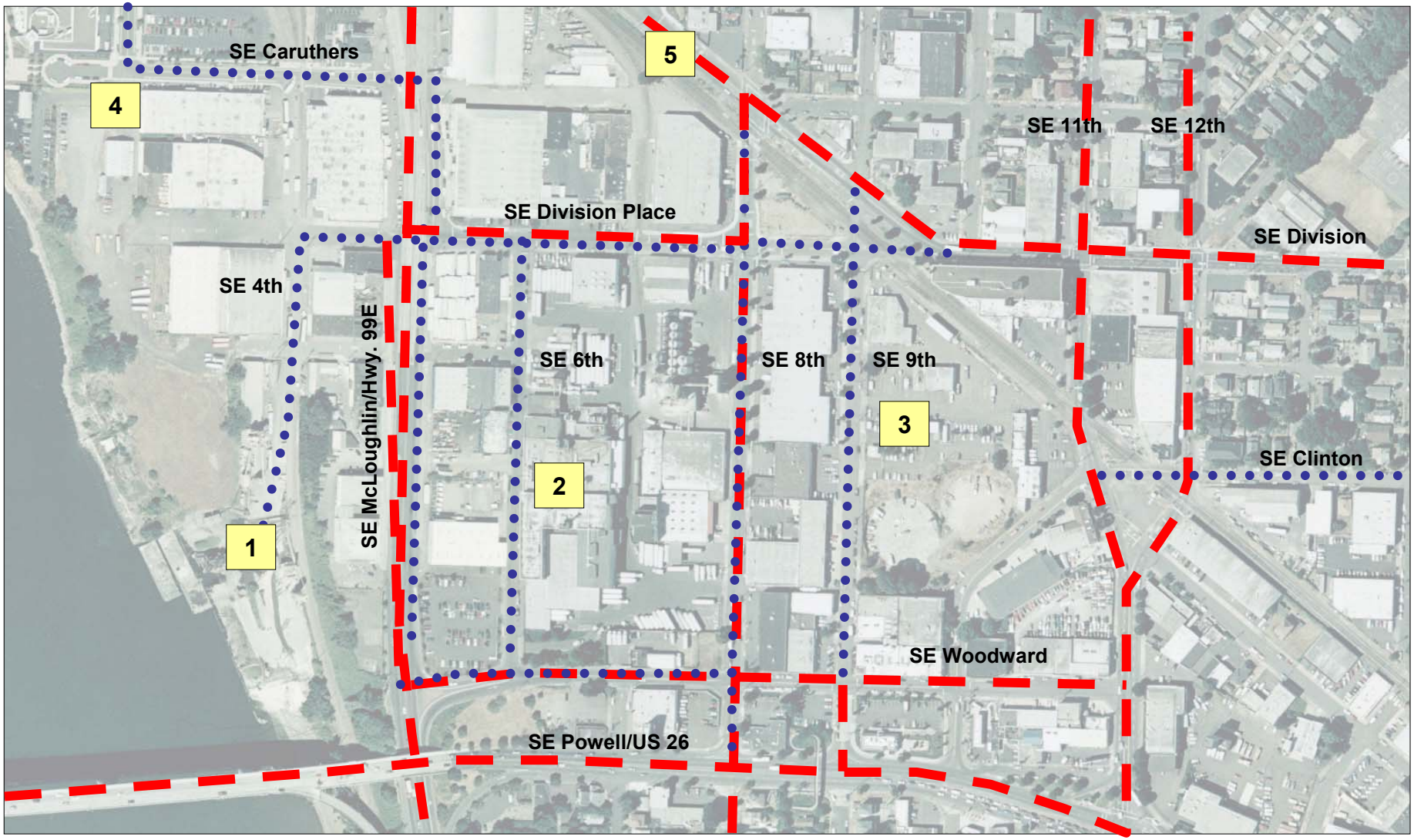
3.2 Truck Origin Points and Routes

Heavy trucks (multi-axle trucks, dump trucks, and semi-trailer trucks) originate from a number of locations (*Map 2*).

1. **Ross Island Sand and Gravel Company** – Large trucks hauling gravel and cement move into and out of the processing facility each day, using SE 6th, SE Division Place, and SE 8th to access the periphery roads and highways.

2. **Darigold, Incorporated and Land O' Lakes**

Map 2: Automobile and Heavy Truck Patterns



Farmland Feed, LLC – Heavy trucks moving dairy products and animal feed use the main driveway on SE 6th to access SE Woodward and SE Division Place.

3. **Northwest Natural Gas –** Light duty trucks frequently enter and exit the plant site during the workday. Heavy trucks enter and exit the site less frequently.

4. **Central Eastside Industrial Sanctuary** – A number of delivery and heavy trucks from businesses on SE Water Avenue between OMSI and SE Hawthorne use SE Caruthers and SE Grand to access Hwy 99E and US 26.

5. **SE 7th and the Central Eastside** – SE 7th is a major north/south route for heavy trucks and local industrial traffic. Many trucks access SE 8th in the project area from SE 7th to access Hwy 99E and US 26.

3.3 Bicycle and Pedestrian Travel Patterns

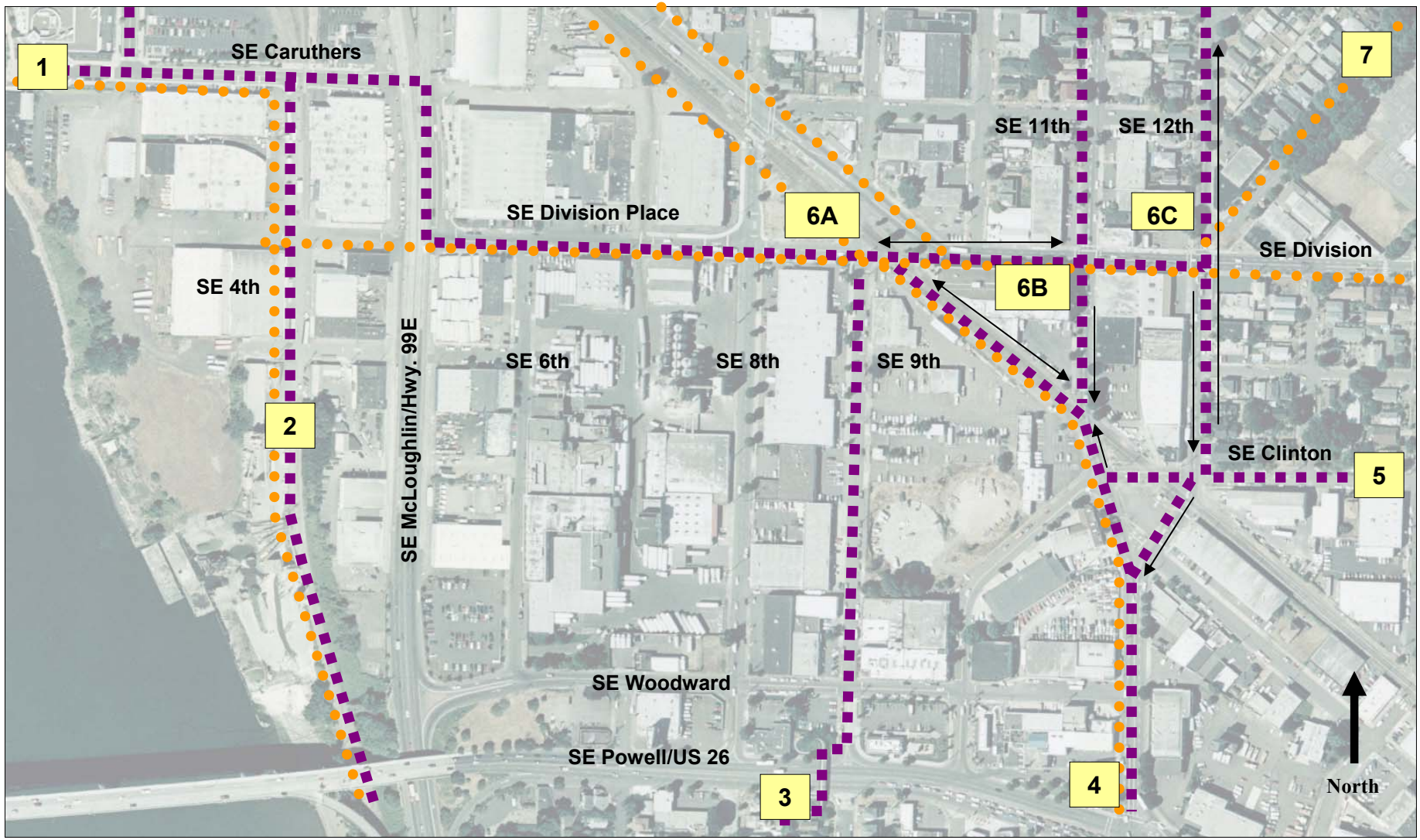
Bicyclists and pedestrians have very similar travel routes through the area (*Map 3*). The project team observed user behavior in the entire project area, and noted many examples of dangerous bicycling behavior: wrong-way riding, riding on sidewalks, and running stop signs were common problems. The team observed pedestrians engaging in dangerous behavior as well: crossing before signalized intersections (jaywalking), walking on the railroad tracks, and walking with their back to traffic on portions of the roadway without sidewalks.

There are three primary bicyclist travel movements in the project area: (1) north/south travel on SE 11th and SE 12th, (2) east/west travel from the Central City (Eastbank Esplanade and points north) to the east and south (Hosford-Abernethy and Brooklyn neighborhoods), and (3) north/south travel between the OMSI-Springwater Trail and the Eastbank Esplanade on SE 4th and SE Caruthers (*Map 3*).

A bicyclist rides against traffic on the sidewalk along SE Division

A number of bicyclists use SE 11th and SE 12th for north/south travel. However, nearly half of them were wrong-way riding (against traffic) or riding on the sidewalk. Generally, bicyclists wrong-way riding on SE 11th do so to access the sidewalk on the south side of SE Division to enter the industrial district (*see photo above*). There were at least six observed cases of wrong-way riding on SE 12th. Sidewalk riding is prevalent on SE 12th between SE Clinton and SE Division. It is common for westbound bicyclists on SE Clinton to cross SE 12th and ride on the western sidewalk to SE Division. Sidewalk riding on SE Division between SE 12th and the railroad tracks is prevalent. These movements are represented on Map 3 with black arrows. This route appears to be a preferential access point to the area by bicyclists of all

Map 3: Bicycle and Pedestrian Travel Patterns



Bicycle and Pedestrian generator

Observed bicycle travel patterns

Observed pedestrian travel patterns

skill levels. Once bicyclists are on the western side of the railroad tracks, wrong-way riding and sidewalk riding typically discontinue.

East/west travel from the Central City (Eastbank Esplanade and points north) to the east and south is the most frequent travel movement through the area. Bicyclists typically travel on SE Caruthers, SE Grand, and SE Division Place to SE 9th. At the junction of SE 9th and SE Division Place, approximately half of the bicyclists travel south on SE 9th and the other half continue on SE Division Place to the sidewalk at the junction of the railroad tracks. A few bicyclists ride parallel to the Union Pacific railroad tracks. An unpaved, unmarked demand path exists on the western side of the right-of-way, adjacent to the Northwest Natural property. There are few instances of wrong-way riding and sidewalk riding during this travel movement, but repeated instances of running stop signs.

Many bicyclists use a striped, on-road shared use pathway on SE 4th between the OMSI-Springwater Trail and the Eastbank Esplanade. The railroad crossing at SE 4th and SE Division Place is extremely hazardous; the project team observed very few bicyclists accessing SE Division Place from SE 4th.

Pedestrian travel patterns resemble bicycle travel patterns, with the exception of a pedestrian presence on SE Division Place between SE 4th and SE Grand, on SE Division between SE 12th and SE 7th, and on SE Elliot from the Ladds Addition neighborhood. Pedestrians were most frequently seen walking on SE Caruthers and SE 4th from the Eastbank Esplanade to the OMSI-Springwater Trail. East/west pedestrian movement is nominal and is largely contained on SE Division Place.

3.4 Bicycle and Pedestrian Generation Points

Bicyclists and pedestrians generally enter the project area from seven points (*Map 3*):

1. **Eastbank Esplanade/Central City** – This regional shared use facility originates in the Central City and connects to the Willamette Greenway and the OMSI-Springwater Trail. The trail is used by recreational walkers and runners, bicyclists, and skaters, and, less frequently, as a bicycle commuter route. Trail use is heaviest on weekends, in good weather, and at lunchtime on weekdays. An estimated 2,600 people use the trail on summer weekends and approximately 800 people use the facility on weekdays (Portland Office of Transportation, 2002).

2. **OMSI-Springwater Corridor Trail** – This connection to the Springwater Corridor Trail provides an uninterrupted, 3-mile shared use path from SE 4th and SE Ivon to Oaks Bottom natural area and the Sellwood neighborhood. The trail opened in November 2002 and is a popular recreation and commuter trail. Trail use is heaviest on weekends, in good weather, and in the mornings and evenings on weekdays.

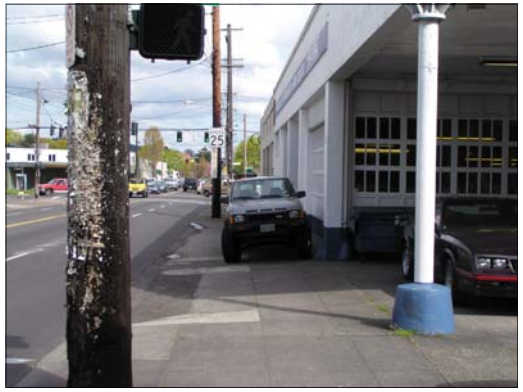
3. **SE 9th Street Bicycle and Pedestrian Bridge** – This shared use facility enables bicyclists, pedestrians, and others to cross SE Powell/US 26 and access the SE 9th bikeway. It is the only protected north/south crossing between SE Milwaukie and the Willamette River and provides critical non-motorized access to and from the Brooklyn neighborhood to the south of the project area. The Brooklyn neighborhood cannot access the OMSI-Springwater Corridor Trail due to the presence of Hwy 99E and a riverside cliff.

4. **SE Milwaukie Avenue** – Despite high ADT and no bicycle facilities, bicyclists use the roadway for north/south travel. Connectivity between the Brooklyn neighborhood and the Central City is poor due to the presence of the railroad, SE Powell/US 26, and Hwy 99E.

Examples of Some Bicycle and Pedestrian Hazards

Broken asphalt and angled railroad tracks pose as a hazard for bicyclists.

A dumpster, wooden pallets, and vehicles block the sidewalk making it difficult for pedestrians and impossible for those with disabilities.



A small truck blocks the sidewalk in front of a business on SE Division making it difficult for pedestrians and bicyclists to use the sidewalk.

A drainage gate indicates where the old curb was before a new curb was installed to make turning large trucks easier. The new curb lacks an ADA required ramp.

Demand paths indicate where a sidewalk should be. Instead, the pavement is intermittent, located only at the driveways.

Broken cement slowly erodes the amount of walkable space on the sidewalk.

SE Milwaukie is the only north/south roadway through the neighborhood and the only signalized intersection across SE Powell/Hwy 26 until SE 26th Street.

5. **SE Clinton Bicycle Boulevard** – SE Clinton Street has been outfitted with traffic calming and bicycle friendly treatments to discourage through automobile traffic and encourage bicycle travel. An estimated 3,000 bicyclists use various sections of SE Clinton each day.

6. **TriMet transit stops** – No bus lines run through the industrial section of the project area, but there are a number of bus stops on the eastern edge. Pedestrians and bicyclists can access the area from these points.

7. **SE Elliot Avenue** – The unique street pattern of Ladds Addition enables residents from the neighborhood to directly access SE Division and the project area. The project team observed pedestrians walking to and from the neighborhood via SE Elliot.

3.5 Bicycle and Pedestrian Hazards

Traveling through an industrial district with a significant volume of automobile and heavy truck traffic is inherently uncomfortable for bicyclists and pedestrians. However, additional hazards make bicycling and walking in the project area even more uncomfortable.

Bicycling hazards include:

- 38 degree railroad track crossings
- Wide flange openings (distance between railroad rail and pavement)
- Broken pavement
- Driveways
- Lack of dedicated facilities
- Left turn conflicts with oncoming traffic

Pedestrian hazards include:

- Inaccessible curbs
- Uncontrolled intersections at high speed/high volume roadways
- Sidewalks in poor condition
- So sidewalks
- Large radius corners
- Sidewalk obstructions

Although there has been some effort to provide ADA compliant curb ramps, there are a number of instances where the ramp is rendered inaccessible due the ramp being blocked. ADA requires a minimum 5' clearance and separation from the roadway with a curb or a 2' buffer. There are many examples of sidewalks that are blocked by vehicles, bushes, trees, and utility poles and do not provide a 5' passage (*see photo below*).

Map 4 identifies bicycle and pedestrian hazards and their approximate locations. The map was used to help visually identify routes with the fewest existing bicycle and pedestrian hazards. The map does not, however, graphically display the magnitude of the hazards.

Sidewalk obstruction

Map 4: Bicycle and Pedestrian Hazards

4. Formulation of Route Alternatives

Four routes were formulated based on the analysis of the project area and their proximity to other neighborhoods (*Map 5*). They are:

Route A diverges from the SE Clinton bikeway onto SE 13th and proceeds north for one block to SE Ivon. The route proceeds west to SE 12th. At SE 12th the route diverts bicyclists and pedestrians to an existing sidewalk north to SE Division. The route utilizes existing signals at SE Division to cross SE 12th and SE 11th on the south side and follows a 10'-12' sidewalk south to the Union Pacific railroad tracks. The route crosses the tracks and links to SE Division Place, where it connects to the Eastbank Esplanade via SE Grand and SE Caruthers on existing bicycle and pedestrian facilities.

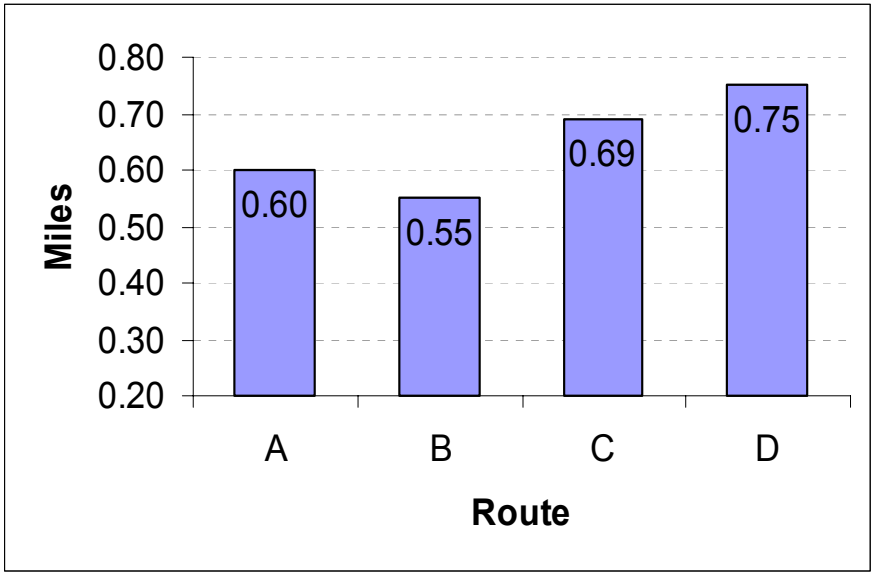
Route B continues east on SE Clinton and crosses SE 12th and 11th. The route then continues northwest along the Union Pacific railroad right-of-way to SE Division Place. Route B then follows SE Division Place, where it connects to the Eastbank Esplanade via SE Grand and SE Caruthers on existing bicycle and pedestrian facilities.

Route C continues west on of SE Clinton across the Union Pacific Railroad crossing at SE 11th and SE 12th, proceeds southwest on SE Clinton, and uses an existing (but underutilized) right-of-way on SE Taggart that connects SE Clinton to SE 9th. Route C then follows SE 9th north to SE Division Place.

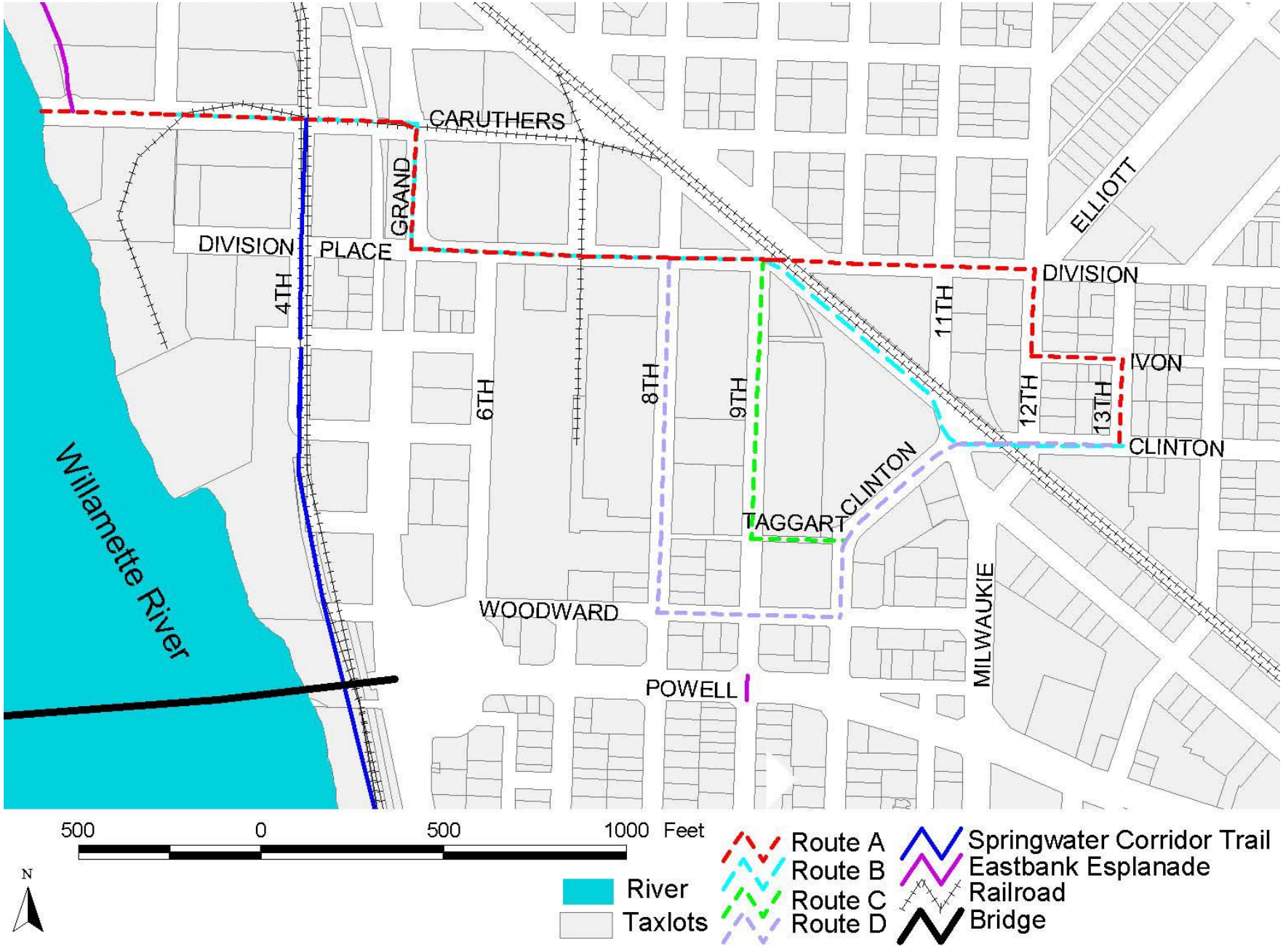
Route D continues west on SE Clinton from SE 12th across the Union Pacific Railroad crossing at SE 11th and SE 12th, proceeds southwest on SE Clinton to SE Woodward, and follows SE Woodward to SE 8th. Route D then follows SE 8th north to SE Division Place.

Other potential routes that utilized heavily traveled roadways or included significant out-of-direction travel were not analyzed (e.g. SE 6th, SE Powell and SE Division).

Figure 4. Route Distances in Miles



Map 5: Route Alternatives



5. Route Alternatives Analysis

5.1 Route A Summary – Shared Use Path

Route A (Map 6) diverges from the SE Clinton bikeway onto SE 13th and proceeds north for one block to SE Ivon. The route then turns west to SE 12th. At SE 12th the route diverts bicyclists and pedestrians to an existing sidewalk and travels north to SE Division. The route utilizes existing signals at SE Division to cross SE 12th and SE 11th on the south side and follows a 10'-12' sidewalk to the Union Pacific Railroad tracks. The route then crosses the tracks and links to SE Division Place, where it connects to the Eastbank Esplanade on existing bicycle and pedestrian facilities.

Distance: .60 miles
Walking time (3 mi/h): 12 minutes
Bicycling time (8.5 mi/h): 4 minutes, 20 seconds

Opportunities

- Uses existing infrastructure
- Cost efficient
- Direct
- Already used by bicyclists and pedestrians
- Controlled crossings
- Access from other neighborhoods (Ladds Addition, Hosford-Abernethy, Brooklyn)

Constraints

- Potential conflict between users
- Potential conflict with businesses on sidewalk
- Driveway conflicts
- Limited sight distance approaching railroad (westbound) from Multnomah County building on SE Division
- Challenging transition area at railroad tracks

Accessibility

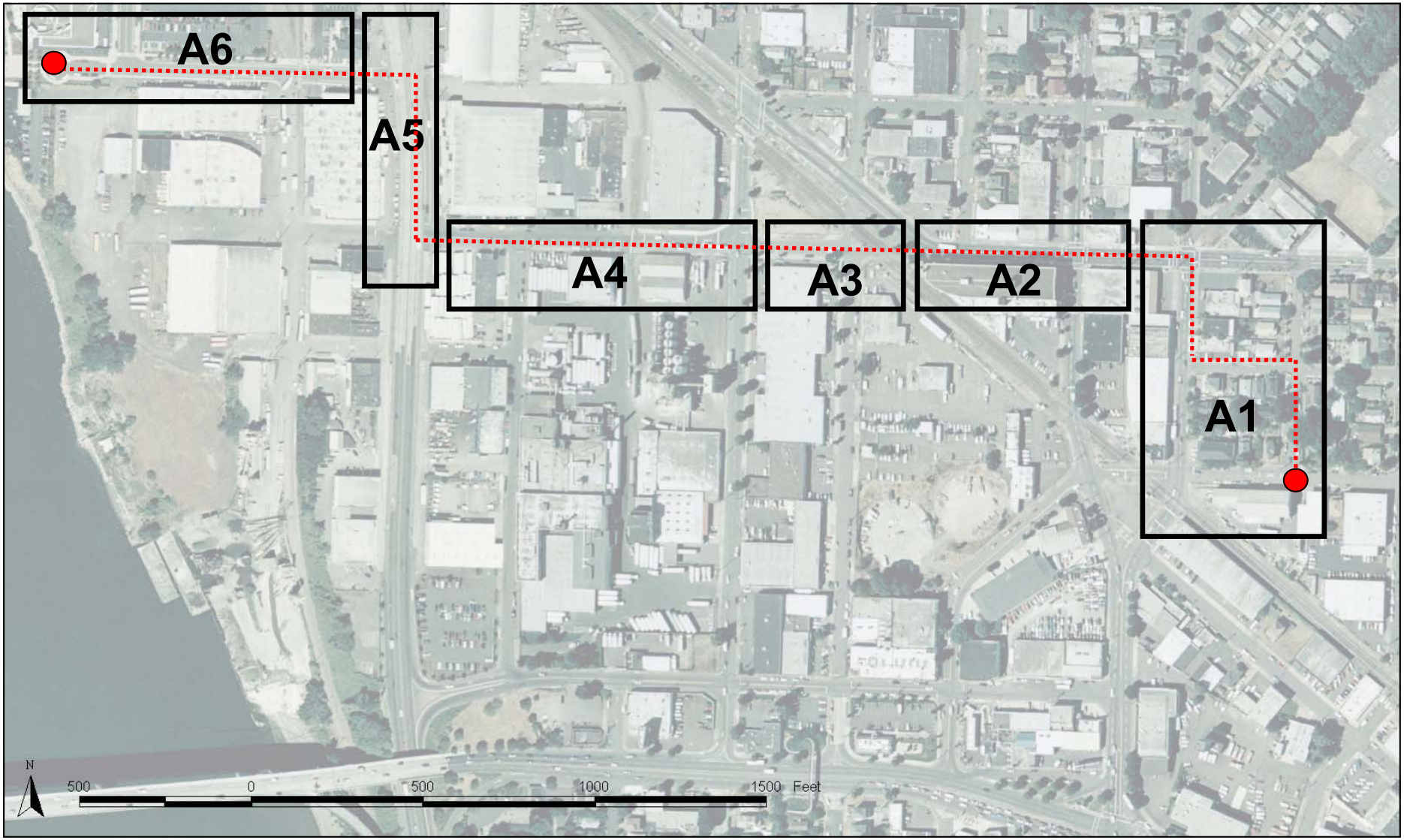
High. Route A would provide a safe path to the East Bank Esplanade for bicyclists and pedestrians traveling from the SE Clinton Street Bikeway, on SE 11th and SE 12th from southeast Portland, the Hosford-Abernathy neighborhood, and Ladd's Addition. Specifically, Route A would directly connect to SE Clinton Street. Bicyclists and pedestrians traveling from Ladd's Addition west could directly reach Route A at the intersection of SE 12th and SE Division. These direct linkages, connecting four origins to a well-recognized destination, demonstrate the ability of Route A to enhance the area's accessibility.

Cost

Moderate/Low. Route A is relatively inexpensive compared to other routes because it requires few major changes. Signs indicating a bicycle and pedestrian route would be needed starting at SE Clinton directing users to the intersection of SE Division and SE 12th. The shared use path from this intersection down to the railroad crossing will require the relocation of a bus stop and shelter, signage indicating a shared use path, and possibly resurfacing in front of the Multnomah County building west of SE 11th to the railroad crossing.

The railroad crossing needs appropriate signage, an apron and resurfacing to safely accommodate bicyclists and pedestrians. A crossing signal would improve safety and comfort. Major improvements along the remaining portion of Route A include improved sidewalk surfaces, addition of curb extensions and crosswalks, and signs to discourage delivery vans from blocking sidewalks. Specific improvements are discussed later.

Map 6: Route A



Directness

High. As Figure 4 indicates, Route A is the second most direct of the four routes.

Ease of Implementation

Moderate/High. Route A is relatively easy to implement because it takes advantage of existing conditions. Route A utilizes existing rights-of-way and existing opportunities, such as the wide sidewalk free of ground level entrances in front of the Multnomah County building. Additionally, Route A utilizes new and good condition sidewalks, bike lanes, and railroad crossings west of the Union Pacific Railroad crossing to the Eastbank Esplanade. However, there are possible challenges confronting implementation such as: obtaining permission to widen the railroad crossing, assurances from the auto repair business on SE Division between SE 11th and SE 12th that measures will be taken to ensure the safety of bicyclists and pedestrians on the adjacent sidewalk, and relocation of TriMet bus stop.

Safety

Moderate/High. Route A is one of the safest alternatives. It draws bicyclists and pedestrians from SE Clinton on low-volume neighborhood streets to the intersection of SE Division and SE 12th. From this intersection west to the railroad crossing bicyclists and pedestrians can utilize a wide existing sidewalk. However, the possibility for conflict with vehicles on the shared use path occurs between SE 12th and SE 11th from vehicles entering and exiting an auto repair business, and at the intersection of SE 11th and SE Division. Additionally, the Multnomah County Building hinders sight lines to the south as bicyclists and pedestrians traveling west approach the railroad crossing. This could be addressed, as discussed later in detail, by installing advanced warning signals or signs to indicate the presence of trains.

The railroad crossing at SE Division Place is safer than the railroad crossing to the southeast at SE 11th and SE 12th – which has multiple road and railroad crossings, and pavement in poor condition. Route A avoids this difficult crossing and instead redirects bicyclists and pedestrians to the existing signalized intersections on SE Division at SE 12th and SE 11th. Nevertheless, as described above, the bicycle and pedestrian crossing of the railroad tracks must be widened, resurfaced, and signed to reduce risk. Overall, Route A's off-street bicycle and pedestrian shared use path and safer rail crossing make it one of the safest route alternatives.

Section A1: SE Clinton at SE 13th to SE 12th and SE Division

Sections A1 through A5 present existing conditions, concerns and proposed improvements for Route A in detail.

Location
- Looking north on SE 13th from SE Clinton.

Existing Conditions
- Low volume residential street
- Sidewalk and street surfaces in good condition

Concerns
- Redirecting bicyclists and pedestrians traveling west on SE Clinton

Proposed Improvements (cost)
- Signs and pavement markings indicating route direction change (low)

Location
- Looking west on SE Ivon from SE 13th

Existing Conditions
- Low traffic volume street
- Sidewalks in fair condition
- Lacking curb ramps

Concerns
- Narrow street
- On-street parking
- No curb ramps at intersection corners

Proposed Improvements (cost)
- Street, sidewalks and surface improvements (moderate)

Location
- Looking north on SE 12th from SE Ivon

Existing Conditions
- ADT 10,000, two traffic lanes heading north
- Dual on-street parking
- 8'-10' foot sidewalk, good condition
- 1 driveway

Concerns
- Potential for bicycle/vehicle conflict

Proposed Improvements (cost)
- Utilize existing sidewalk as a shared use path (low)
- Signs and pavement markings indicating shared use path (low)
- Curb ramps needed on SE 12th and SE Ivon (low)

Section A2: SE 12th and SE Division to SE Division Place

Location
- Looking west on SE Division from SE 12th

Existing Conditions
- ADT 13,000, four lane bi-directional roadway
- Sidewalk and street surfaces in good condition
- 12' sidewalk

Concerns
- Bus stop resulting in potential conflict with transit users

Proposed Improvements (Cost)
- Relocate bus stop to east side of SE 12th on SE Division (moderate)

Location
- SE Division looking west to SE 11th

Existing Conditions
- ADT 13,000, four lane bi-directional roadway
- Sidewalk and street surfaces in good condition
- 12' sidewalk

Concerns
- Bicycle and pedestrian/vehicle conflict with businesses

Proposed Improvements (Cost)
- Work with businesses to limit parking on the sidewalk and to be aware of bicyclists and pedestrians using the sidewalk (low)
- Advanced warning/safety signs for bicyclists (low)

Location
- SE 11th and SE Division looking west

Existing Conditions
- ADT 13,000, four lane bi-directional
- Sidewalk and street surfaces in good condition
- 10' - 12' sidewalk
- Street trees

Concerns
- Vehicle conflict at free right turn (eastbound) and left turn (westbound) from SE Division

Proposed Improvements (Cost)
- Install pedestrian activated demand signal; hold left hand turn light at red when activated (high)

Location
- SE Division looking west towards Union Pacific railroad crossing

Existing Conditions
- Sidewalk and street surfaces in good condition
- 10' - 12' sidewalk
- Street trees

Concerns
- Line of sight diminished looking south by building and west by tree

Proposed Improvements (Cost)
- Remove tree (low)
- Install advanced warning signs for bicyclists and pedestrians (low)
- Install crossing gate (high)

Section A3: SE Division Place from SE Division to SE 9th

(Clockwise from left) Railroad track flange on SE Division Place, Route alternative on the concrete island, intersection of SE Division Place and SE 9th, preferred alignment for pedestrians, entrance to the industrial sanctuary via SE Division Place, and looking across to the concrete island from SE Division Place.

Location

- The intersection of the Union Pacific Railroad, SE Division Place and SE 9th

Existing Conditions

- One way traffic on SE Division Place and SE 9th from SE Division
- Stop signs on SE 9th (south) and on SE Division Place
- Missing sidewalk, existing sidewalk in fair/poor condition
- 38º railroad track crossing angle
- Approximately 20 trains per day
- Speeds range from 5 mi/h—40 mi/h
- Large concrete island split by railroad tracks
- Relatively low-volume roadways, few large trucks
- Wide flange with uneven asphalt

Concerns

- Pedestrian/bicycle conflict with trains
- Bicycle conflicts with on-coming vehicles on SE Division Place at SE 9th
- Railroad track crossing—38º angle, wide flange

Proposed Improvements (Cost)

- Split westbound path users from eastbound users before tracks and divert to concrete island to cross tracks at a 60º angle(Alternative A) (high)
- Improve railroad track crossing with a 10' - 12' wide apron, allowing bicyclists to cross at a 60º angle (moderate/high depending on easement requirements)
- Install advanced warning signs and/or pavement markings (low)
- Repair and widen existing sidewalk (low)
- Install railroad crossing gate for westbound bicyclists and pedestrians (high)
- Install yield or stop sign for vehicles entering area from SE Division on SE 9th

Looking north at the large concrete island adjacent to SE Division. The Union Pacific railroad tracks are on the left side of the island. The island is currently used as a bus stop and sidewalk.

Section A3—Alternative 1: Diverting Users to a Concrete Island

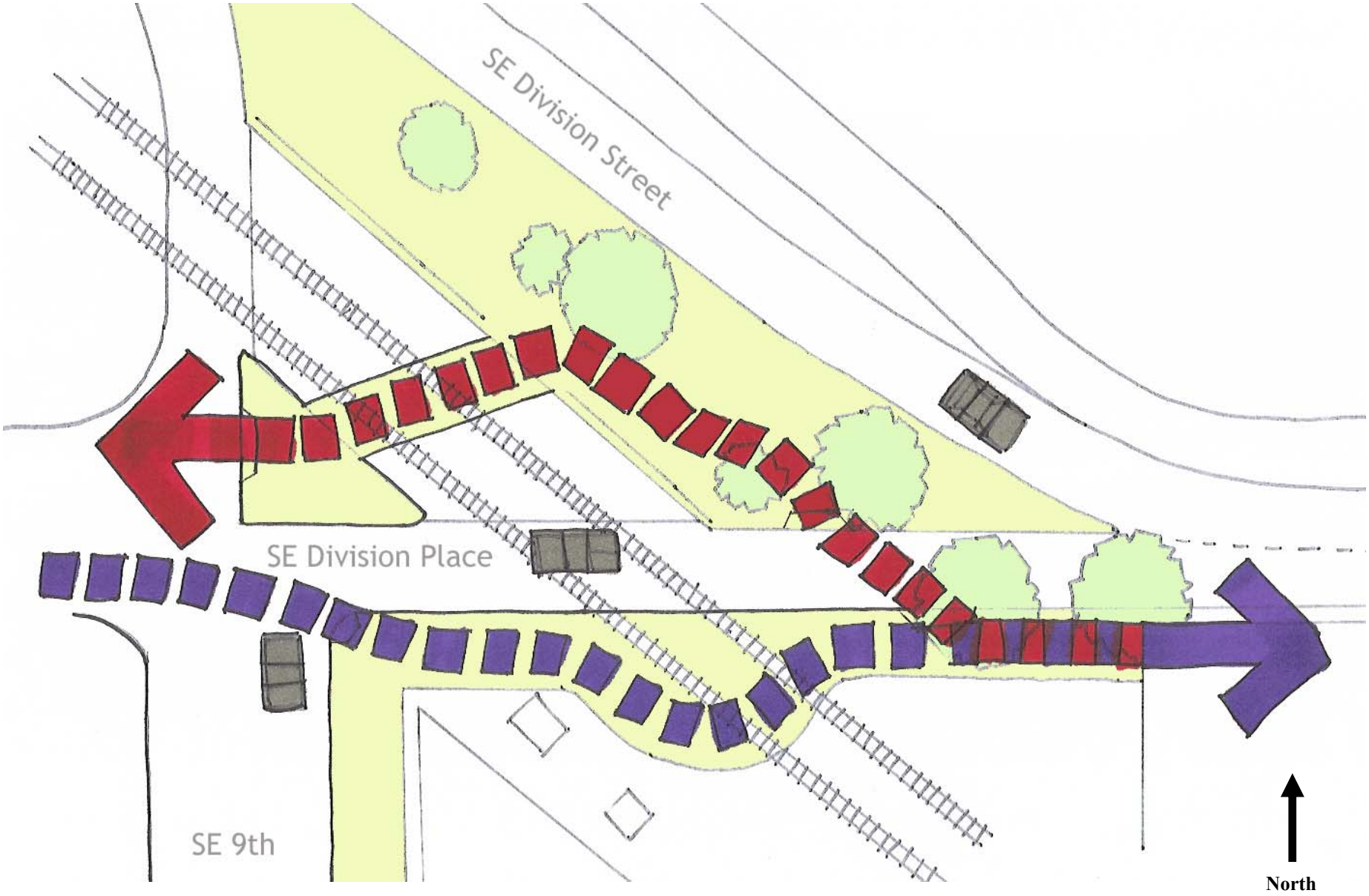
Crossing the Union Pacific Railroad tracks is one of the most challenging aspects of bicycling in this area. Alternative 1 proposes diverting the westbound bicyclists from the shared use path (sidewalk) to the concrete island (*see photo on left*) and constructing a track crossing at a 60º angle to the smaller concrete island (*Figure 5*). This alignment improves sight distance and ultimately reduces bicycle/vehicle conflict at SE Division Place and SE 9th by aligning the bicyclists with the appropriate travel lane (direction). A 10' - 12' asphalt apron would still be necessary for eastbound bicyclists to cross the tracks safely. An asphalt apron is an extension of sidewalk that allows bicyclists to cross the railroad tracks at a better angle.

The challenge of Alternative 1 is communicating to westbound bicyclists when and how to access/navigate the concrete island safely. Pavement marking, signage, and design are the best methods to do this.

Constructing a new at-grade railroad crossing in this section will be costly. A section of the iron railing will need to be removed in order to connect the two concrete islands. A 10' reinforced concrete platform connecting the two islands will need to be built. Additionally, a curb cut will need to be ground out of the small concrete island.

Other costs include removing an existing street tree to improve sight distance and installing appropriate signage. Also, an easement will need to be obtained to cross the railroad right-of-way. It should be noted that the improvements necessary for the Alternative 1 crossing is less expensive than improvements required for Routes B, C and D.

Figure 5. Alternative 1—Diverting Users to a Concrete Island



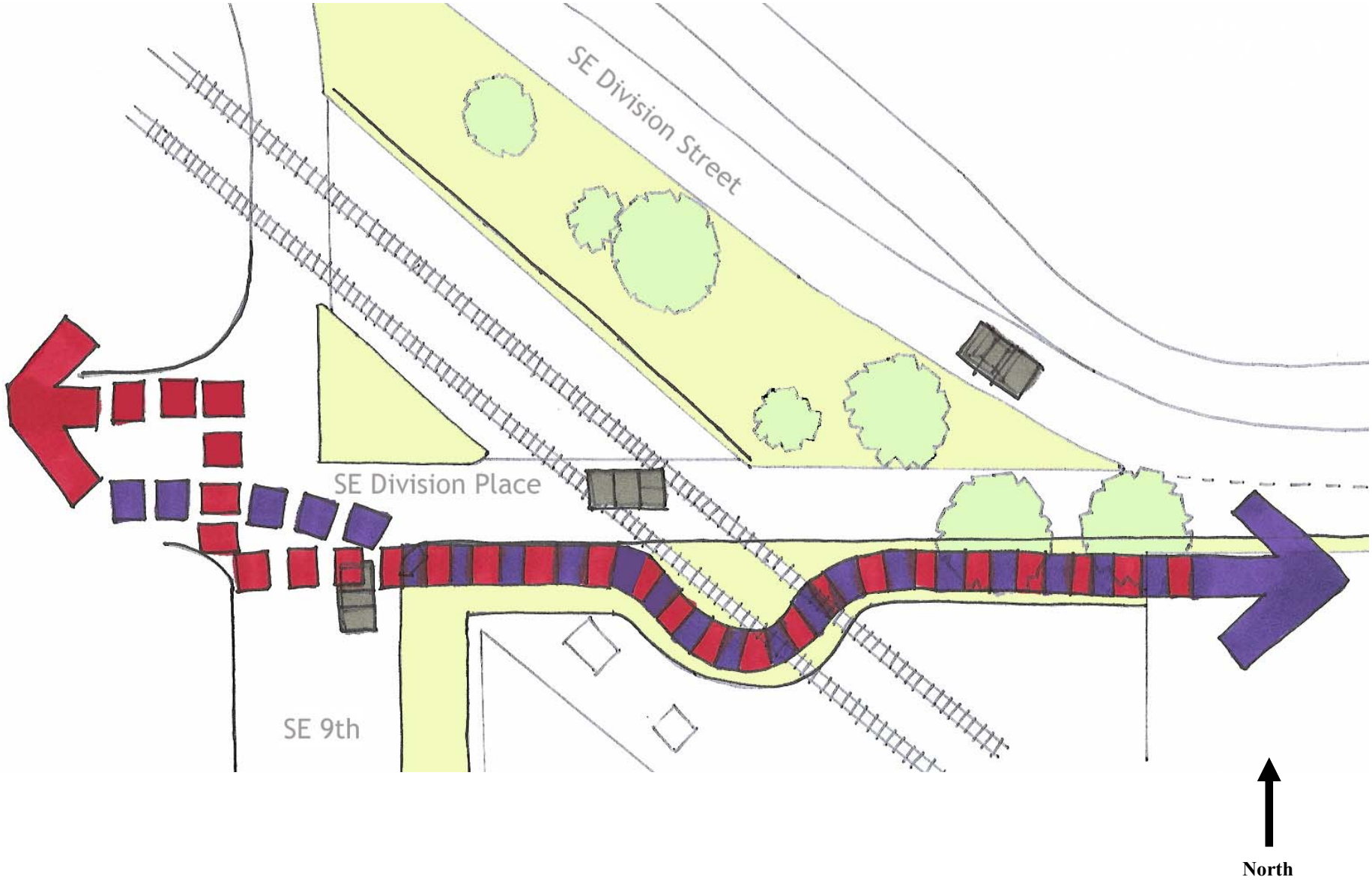
Looking east from SE 9th across the Union Pacific Railroad tracks to SE Division.

Section A3—Alternative 2: Shared Use Path to SE 9th

Alternative 2 does not separate users until SE 9th, at which point bicyclists are encouraged to make a two-stage crossing to access SE Division Place (*Figure 6*). Field observations indicate that a number of bicyclists already use the sidewalk as a shared use path and simply travel diagonally across the intersection at SE Division Place and SE 9th. Children and Type B riders are directed to continue on the sidewalk, as indicated by signage and pavement markings.

Alternative 2 is the less costly alternative. The railroad track crossing needs improvement, which requires a paved 10' -12' apron. Also, the sidewalk on the west side of the railroad tracks needs to be widened from 5' to 10' or more to accommodate both bicyclists and pedestrians.

Figure 6. Alternative 2 — Shared Use Path to SE 9th



Section A4: SE Division Place from SE 9th to SE Grand

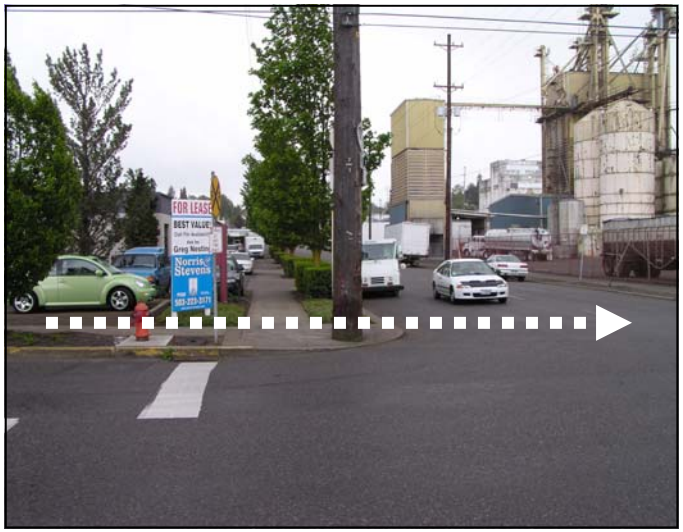
The following sections show an optimal route for pedestrians only, as indicated by the arrow. Bicyclists are encouraged to use SE Division Place as an on-street route.

Location
- SE Division Place at SE 9th looking west

Existing Conditions
- 4-way intersection, free right turn from SE Division on SE 9th
- Sidewalk and street surfaces in fair condition
- 5' sidewalk
- Street trees

Concerns
- Conflicts with the free right turn from SE Division
- Low hanging vegetation blocks sidewalk
- Inconsistent sidewalk pavement
- Pedestrians will not follow the safest route

Proposed Improvements (Cost)
- Trim vegetation back (low)
- Improve sidewalk (moderate)
- Install yield or stop sign on SE 9th before the railroad tracks (low)
- Stripe crosswalk across SE 9th on the south side (low)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Looking down SE Division Place from the NE corner of SE 8th — a large turning radius for trucks increases the crossing distance to 64'. Pedestrians are encouraged to cross SE 8th on the south side.

Location

- SE 8th and SE Division Place looking south

Existing Conditions

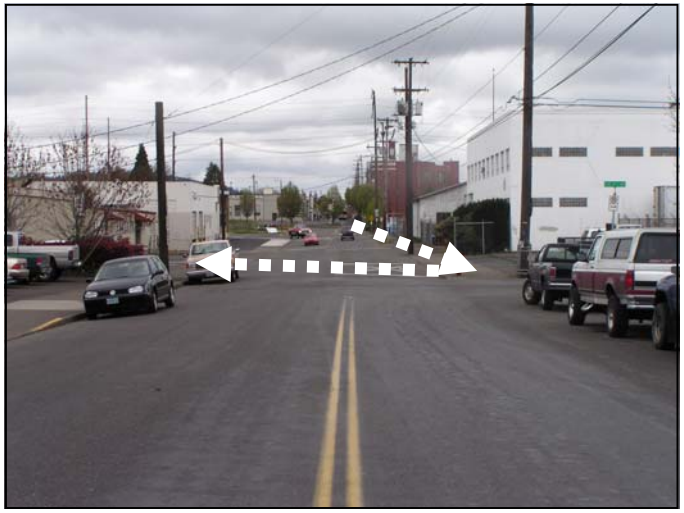
- 5' sidewalk and street surfaces in good condition
- Stop signs on SE Division Place
- Utility poles blocking curb ramps on SE and SW corners of SE Division Place
- 64' intersection crossing of SE 8th on north side of SE Division Place

Concerns

- Sidewalks not accessible
- Pedestrians will not follow the safest route
- Free right turn and intersection distance on north side of SE Division Place
- Truck route

Proposed Improvements (Cost)

- Add curb ramps on either side of the utility poles (low)
- Stripe crosswalk across SE 9th on the south side (low)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Location

- SE Division Place at SE 6th looking east

Existing Conditions

- 8' sidewalk on south side and street surfaces in fair condition
- Railroad track crossing (improved)
- No buffer or curb separating roadway from the sidewalk on the north side
- Vehicles park on sidewalk
- No curb ramp on SE 6th

Concerns

- Sidewalk is blocked by parked vehicles
- Conflicts with vehicles entering and exiting business parking areas
- Current design is not ADA compliant
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)

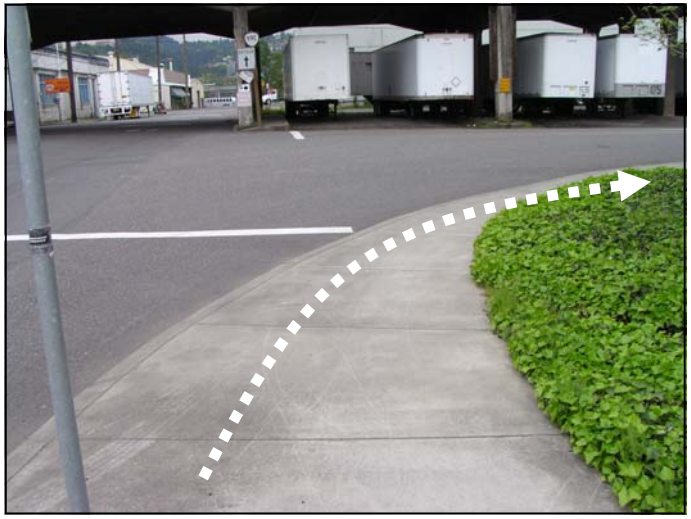
- Improve and expand existing south side sidewalk to 10' (moderate)
- Stripe crosswalk across SE Division Place at SE 6th (low)
- Install curb ramp at SE corner of SE 6th (low)
- Work with businesses to limit parking on the sidewalk (low)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Location
- SE Division Place west of SE 6th looking west

Existing Conditions
- 8' sidewalk and street surfaces in good condition
- 4-way stop at SE Division Place and SE Grand

Concerns
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Location
- SE Division Place at SE Grand looking west

Existing Conditions
- 8' sidewalk and street surfaces in good condition
- 4-way stop at SE Division Place and SE Grand
- No curb ramps
- Large turning radius for trucks

Concerns
- Pedestrians will not follow the safest route
- Truck route (turning trucks)

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Section A5: SE Grand to SE Caruthers

Location
- SE Grand at SE Division Place looking north

Existing Conditions
- 10' sidewalk on east side and street surfaces in excellent condition
- No sidewalk on west side
- 52' crossing on SE Grand at SE Caruthers
- North and south 6' bicycle lanes
- On-street parking

Concerns
- Conflicts with vehicles entering and exiting businesses
- Pedestrians will not follow the safest route
- Uncertain future property use on east side of SE Grand
- Truck route

Proposed Improvements (Cost)
- Stripe crosswalk across SE Grand on the south side of SE Caruthers (low)
- Work with businesses to limit parking on the sidewalk (low)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Section A6: SE Grand and SE Caruthers to the Eastbank Esplanade

Location
- SE Caruthers and SE Grand looking west

Existing Conditions
- 12' sidewalk and street surfaces in good condition
- North and southbound traffic does not stop on SE Grand
- SE Caruthers east of SE Grand is unimproved: dirt and gravel
- East and west 6' bicycle lanes

Concerns
- Pedestrians will not follow the safest route
- Truck route
- Traffic speeds

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Location
- SE Caruthers looking southwest

Existing Conditions
- 8' sidewalk and street surfaces in excellent condition
- East and west 6' bicycle lanes

Concerns
- Pedestrians will not follow the safest route
- Truck route
- Vehicles parking on the sidewalk

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)
- Work with businesses to limit parking on the sidewalk (low)

Location
- SE Caruthers and SE 4th looking east

Existing Conditions
- 8' sidewalk and street surfaces in excellent condition
- East and west 6' bicycle lanes
- Railroad track crossing (improved)

Concerns
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

5.2 Route B Summary – Rail Trail

The highlight of Route B is the utilization of the Union Pacific Railroad right-of-way between SE Clinton at SE 11th and SE Division (at SE 7th and SE 8th). Route B would require a shared use path along the Union Pacific Railroad right-of-way.

One of the major obstacles to this alternative is the use and improvement of the Union Pacific Railroad right-of-way. Use of the right-of-way would require extensive negotiations with Union Pacific Railroad, as would the improvements necessary to create a shared use path, unlike other routes. There are several structures and utility poles directly in the alignment of the proposed shared use path that would have to be relocated. There are also issues of fencing, landscaping, and entry/exit onto the shared use path from the street. There are legitimate concerns from Union Pacific Railroad that safety and liability are addressed, and specifically, that the City of Portland carry liability insurance in the event of an accident.

Distance: .55 miles
Walking time (3 mi/h): 11 minutes
Biking time (8.5 mi/h): 4 minutes, 15 seconds

Opportunities

- Existing "demand" path
- Most direct route, shortest distance alternative
- Safety along railroad corridor is improved with proper treatments
- High potential to reduce trespassing

Constraints

- Potentially insufficient right-of-way (allowing for railroad distance requirements)
- Utility pole removal and relocation
- Railroad structure removal and relocation
- High train speeds
- High train volumes
- Difficult/unsafe crossing on SE Clinton at SE 11th and SE 12th
- High costs: easements, surveying/construction, lease or purchase of right-of-way, liability insurance (annual), signalization and/or improvement of SE 11th and SE 12th , removal and replacement of all structures and utility poles in railroad right-of-way.
- Drainage improvements
- Politically difficult

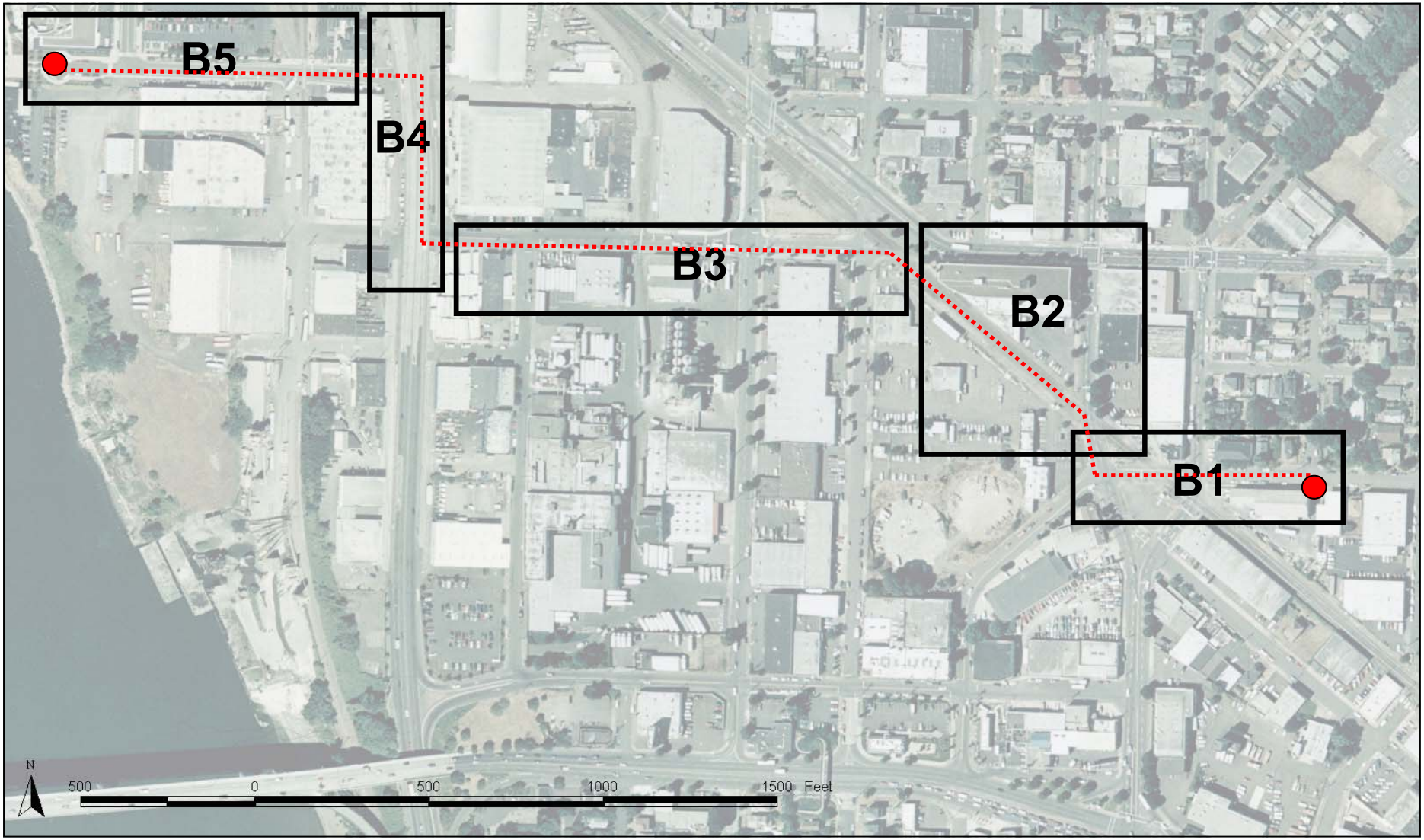
Accessibility

Route B would serve pedestrians and bicyclists on SE Clinton, and users in the Brooklyn neighborhood who use SE Milwaukie. Access to the Union Pacific Railroad right-of-way is more direct than Route A, and roughly the same as all other alternatives at the east end. However, access is impeded by the railroad crossing(s) on SE Clinton at SE 11th and SE 12th.

Cost

High. In addition to the costs needed to make the crossing safe on SE Clinton at SE 11th and SE 12th, major modifications would be needed along the Union Pacific Railroad right-of-way. This alternative would require substantial and significant new construction, in addition to reconstruction and relocation of railroad facilities and structures. A new 12' - 15' shared use path would need to be built along the right-of-way, and a fence would be required in between the path and the railroad. Currently, the minimum required setback of 30' from the closest active rail line does not leave enough room to build such a path in the Union Pacific right-of-way. An easement may be needed along the Northwest Natural Gas property. There are additional costs involved with moving structures and utilities currently in the right-of-way, and any additional landscaping and maintenance. There are also costs involved with right-of-way acquisition

Map 7: Route B



and/or lease, and liability insurance.

Directness

High. This is the shortest, most direct route of all the alternatives considered.

Ease of Implementation

Low. This alternative requires substantial work and cooperation with Union Pacific Railroad. Initial interviews with Union Pacific Railroad staff both in Portland and Omaha (Nebraska) to determine whether or not a shared use path is even possible in the right-of-way were favorable. This indicates a willingness to consider this project but does not indicate that the alignment is feasible.

The primary issues center around a satisfactory amount of space being available between the railroad and the proposed (12-15 foot wide) path, and an appropriate fence and other treatments to keep trespassers off the rail and away from trains. A Union Pacific representative in Omaha said the City of Portland would be required to cover liability issues on their right-of-way (Personal interview with Jon Devish, Manager of Contracts, Union Pacific Railroad, May 16, 2003). Most of the issues here are directly related to the cost barriers listed above.

Safety

The draft "Rails-With-Trails: Lessons Learned" (FHWA, 2003), indicates that existing rails-with-trails were not shown to be inherently dangerous. In fact, they were shown to be safer than rail lines that were not rails-with-trails because instances of trespassing on the railroad property were reduced.

Currently the Union Pacific Railroad right-of-way has trespassing problems, which increase potential safety problems. The installation of a fence and shared use path right-of-way in this corridor would greatly improve safety for all users. Improvements to the Union Pacific right-of-way would improve current safety conditions along the rail corridor, but there are still safety issues on SE Clinton Street where it crosses SE 11th and 12th.

The railroad track crossing on SE Clinton at SE 11th and SE 12th is undesirable due to the wide flange, pavement cracking, and a 38° angle track crossing.

Section B1: SE Clinton at SE 12th to SE 11th

Three of the routes in this analysis require crossing SE 11th and SE 12th at SE Clinton. Subsequently, the existing conditions of the intersection are discussed in detail and specific improvements are outlined that need to be implemented in order for the crossings to be safe for bicyclists and pedestrians. A comprehensive engineering study should be completed in order to determine the best fix for the problems. Cost, ease of implementation, and safety issues pertaining to these crossings are discussed here and are referenced briefly in the Route B, C and D analysis.

The Federal Highway Administration recommends that pedestrians should not be encouraged to cross the street at sites with limited sight distance, complex or confusing designs, sites with certain vehicle mixes (many heavy trucks), or other dangers, without first providing them with adequate design features and/or traffic control devices. The intersections of SE 11th and SE 12th at SE Clinton have all of elements listed above, in addition to moderate levels of vehicle traffic, a difficult railroad crossing, and higher than average bicycle volumes. The intersections will warrant aggressive traffic calming and/or a signalized crossing to ensure complete pedestrian and bicycle crossing safety.

At the last traffic count in 1996, SE 11th and SE 12th had ADT of roughly 10,000 vehicles each. ADT levels on the roadways have likely increased since 1996 as total population and vehicle miles traveled (VMT) have increased. Posted speed is 30 mph. The 85th percentile vehicle speed should be verified by an engineer. State Farm Insurance Agency has ranked the intersection of SE 12th and SE Clinton as the 25th Worst Intersection in the City of Portland. Bicycle and pedestrian accidents generally go unreported if there is no serious injury or need to alert the police. This may suggest that the actual number of bicycle and pedestrian accidents is higher than reported.

Two Union Pacific rail lines cross diagonally through the area. The angle of the tracks at the intersection of SE Clinton is 40º, requiring bicyclists to weave into the vehicle lane to create a safe line of crossing over the tracks. The flange varies in width from approximately 0.5" to 3" (*see photo*). The asphalt pavement parallel to the tracks is cracked and inconsistent. There is no sidewalk on either side of SE Clinton between SE 12th and the railroad tracks. The existing sidewalk is 6' wide and in fair/poor condition due to weeds and cracking. There are no curb ramps on the northwest, northeast, and southeast corners of SE Clinton at SE 12th.

An undesirable railroad crossing condition for bicyclists

Sight distance is poor on SE Clinton at SE 12th due to the roadway angle and the presence of a two-story building. Sight distance on SE Clinton at SE 11th (westbound) is poor due to

the roadway angle and the presence of street trees. Sight distance on SE Clinton at SE 11th (eastbound) is good, but presents a conflict with on-coming vehicles turning left onto SE 11th from SE Clinton. Because SE 11th is a one-way street (southbound), drivers turning left have a tendency to only look right when turning.

Installing two on-demand signalized crossings on SE 11th and SE 12th at SE Clinton may not be feasible for several reasons: (1) SE Clinton is within 400' of a signalized intersection on SE Division, (2) the signal may interfere with the railroad crossing and increase vehicle conflict with trains, and (3) the limited sight distance and required stopping distance/time may increase the number of vehicle collisions. Signalized intersections at SE 11th and SE 12th will require additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity, and safety.

The simplest options are to either direct bicyclists and pedestrians to the existing signalized crossing at SE Division *or* implement various traffic-calming treatments to slow vehicles, reduce the walking/bicycling distance across the road, and improve railroad track crossings, sidewalks, and sight distance. Two improvement alternatives are presented on pages 48 and 50. Other traffic-calming treatment examples are provided in Table 2.

Table 2. Problems and Potential Improvements for the SE Clinton and SE 11th/SE 12th Intersection

Problem	Fix	Cost
Limited sight distance	Remove street trees	Low
Limited sight distance	Remove building	Very High
Limited sight distance	Reconfigure roadway	Very high
Poor railroad crossing	Improve crossing	High
Poor railroad crossing	Construct apron to assist bicyclists	Low
Limited/Poor Access	Construct sidewalks	Moderate
Limited/Poor Access	Reconstruct sidewalks	Moderate
Limited/Poor Access	Install curb ramps	Low
Pedestrian crossing safety	Install bulb outs on intersection corners and marked crosswalk	Moderate
Pedestrian crossing safety	Signalize intersections	High
Pedestrian crossing safety	Install marked crosswalk with flashing light and warning signs	Moderate

SE 11th and SE 12th Crossing Hazards

Heavy traffic, high speeds and limited sight lines

38° double railroad crossing

Poorly maintained railroad track with large gaps and uneven pavement

Frequent trains with speeds up to 40 miles per hour

Railroad crossing on SE Clinton between SE 11th and SE12th

Crossing Alternative 1

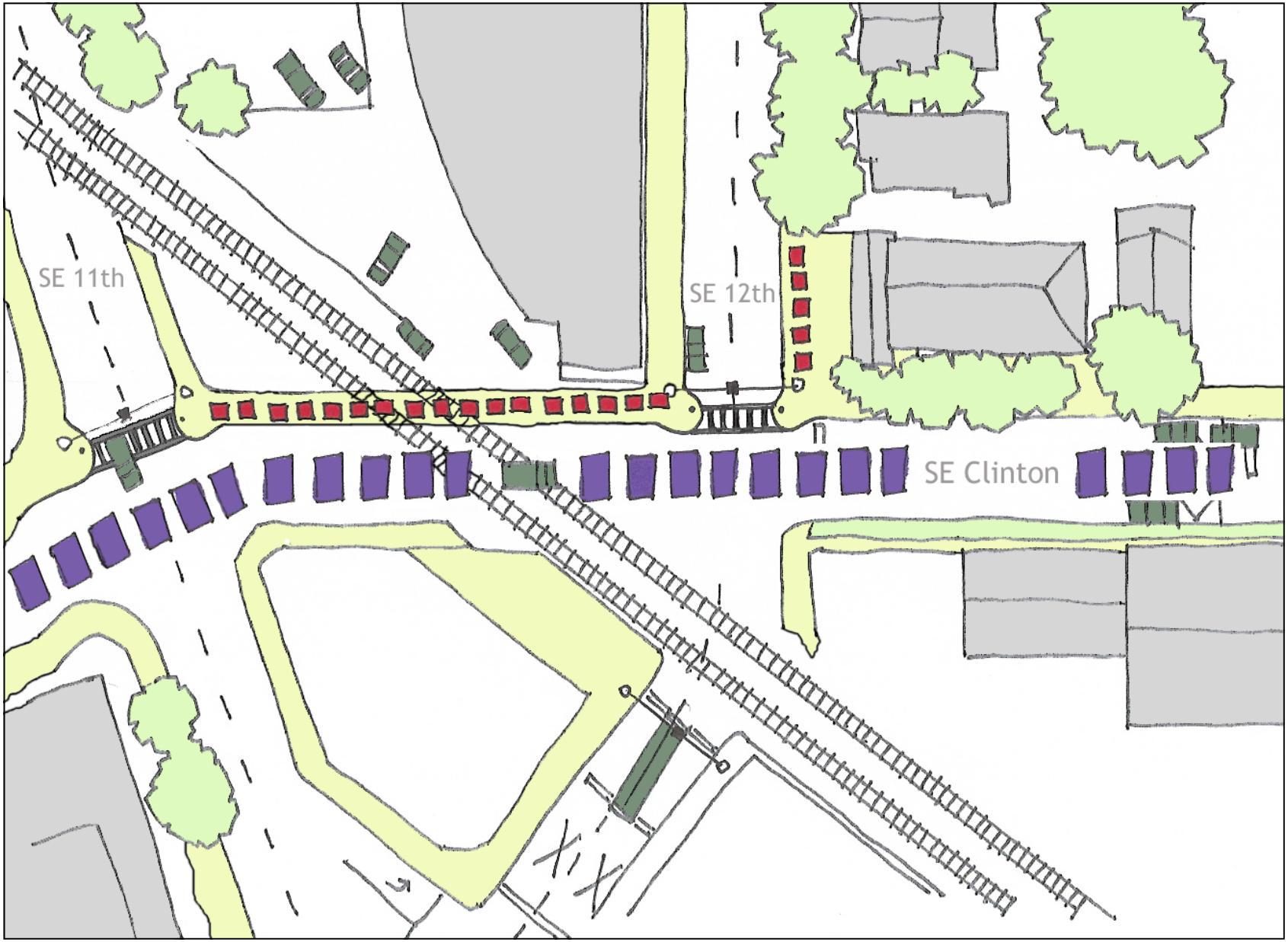
Figure 7 shows a sketch of the treatments necessary to provide a safe bicycle and pedestrian crossing on SE Clinton at SE 11th and SE 12th.

Due to poor sight distance, moderate ADT and high speeds, curb extensions are needed to reduce the crossing width of the street from 32' to 22' and to provide a traffic calming element to the intersection. The curb extensions are linked by a marked crosswalk and pedestrian demand signals.

A new signal would have to be installed at both SE 11th and SE 12th at SE Clinton. The pedestrian demand signals are located at the end of each crosswalk and would change the signal from flashing yellow or green to red within 2 minutes of activation. The activation button could be placed on a pole where bicyclists could easily access it, if necessary. One button would activate only one signal at a time, requiring the pedestrian to wait, at most, 4 minutes.

As discussed previously, installing a signal may or may not be a feasible option. A detailed traffic analysis must be done by a registered engineer to determine how and if a signal is appropriate for this location. There are issues with vehicles stopping on the railroad tracks, collisions due to poor sight distance, and the proximity of the intersection to the signalized intersection at SE Division.

Figure 7. Alternative 1 Crossing: Pedestrian Demand Signal, Curb Extensions, and a Marked Crosswalk



An undesirable railroad crossing condition for bicyclists

Crossing Alternative 2

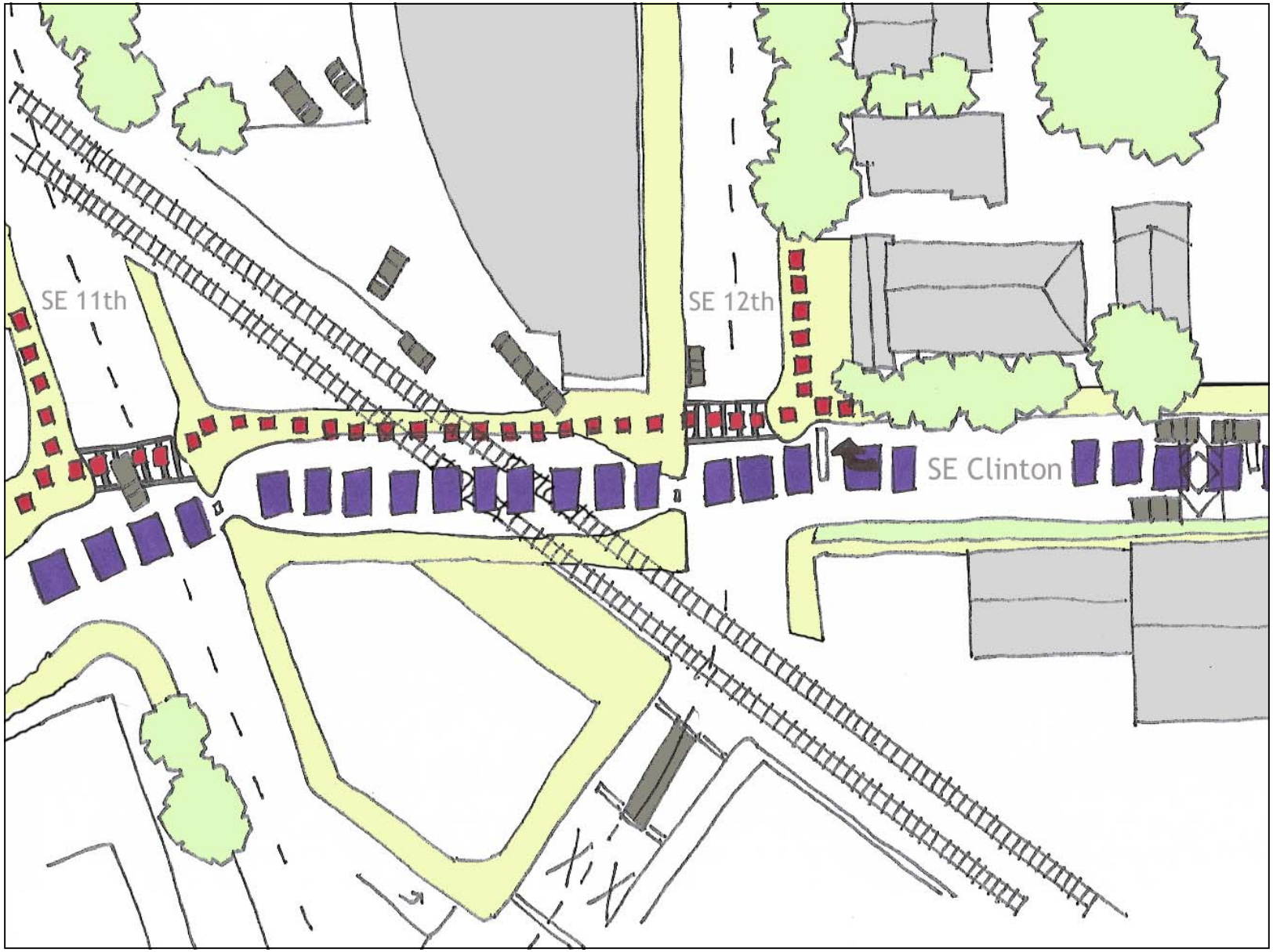
Figure 8 shows a crossing alternative where the section of SE Clinton between SE 12th and SE 11th becomes a limited access roadway. The entrances of the roadway would allow vehicle access for the adjacent business, but encourage bicycle and pedestrian travel. Alternatively, the roadway could be treated as a woonerf ("living street") where vehicular traffic is allowed, but discouraged, and bicyclists and pedestrians share the roadway.

On-street parking exists on both sides of SE 12th from SE Clinton north, and on the east side of SE 11th from SE Clinton north. Crosswalks and curb extensions are recommended for crossing SE 11th and SE 12th. The curb extensions would shorten the crossing distance of the roadway and improve sight distance. They would also improve the visibility of pedestrians crossing the road. The curb extensions would act as a traffic calming device by creating a pinch point at the entrance/exit of the couplet, slowing vehicles as they transition between a commercial area and the edge of a residential area.

In order for the section of SE Clinton between SE 11th and SE 12th to be a partial access roadway, some turning configurations need to be changed. Westbound vehicular traffic on SE Clinton will have a "RIGHT TURN ONLY" indication, utilizing SE Division and SE 11th to continue travel to the west and south. Similarly, vehicles wishing to access SE Clinton from SE 11th will travel past SE Clinton to a "LEFT TURN ONLY" lane, which improves sight distance of on-coming traffic. Vehicles on SE Clinton to the west of SE 11th would make the same turning movements to access SE Clinton eastbound.

This treatment improves the safety of bicyclists and pedestrians crossing the SE 11th and SE 12th couplet by shortening the crossing distance of the roadway, reducing traffic speeds, and preventing vehicles from making turns into bicyclists and pedestrians' path of travel. This treatment also improves the safety of motorists by improving sight distance, preventing vehicles from queuing up and stopping on the railroad tracks, minimizing crossing conflicts, and reducing traffic speeds.

Figure 8. Alternative 2 Crossing: Limited Access Street, Curb Extensions and a Marked Crosswalk



Section B2: Union Pacific Railroad Right-of-Way

Sections B2 through B5 present existing conditions, concerns and proposed improvements for Route B in detail.

Views of the Union Pacific Railroad right-of-way. Notice (A) the structures along the edge of the property; (B&C) the existing (but illegal) demand path; and (D) the proximity to trains, some of which go up to 40 miles per hour.

Location

- Looking northwest from SE 11th toward SE Division Place

Existing Conditions

- Approximately 20-30 trains per day
- Train speeds range from 5 mi/h—40 mi/h
- Demand path on west side of right-of-way
- Used by bicyclists and pedestrians
- 32' from nearest railroad track to Northwest Natural Gas property
- Utility poles and structures in corridor

Concerns

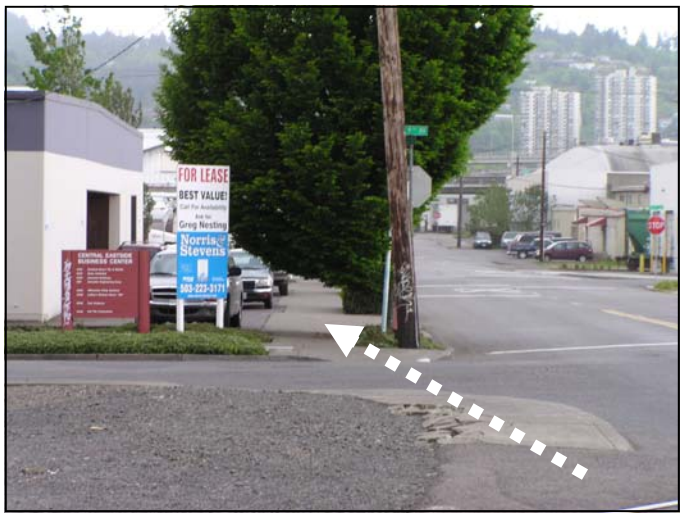
- High train volume/speeds
- Right-of-way may be too restricted for shared use path given train speeds and volume
- Safety of existing users

Proposed Improvements (cost)

- Shared use path in right-of-way (high)
- Barrier (e.g. fencing and vegetation) separating shared use path and trains (moderate)
- Warning and directional signage (low)
- Relocation of Northwest Natural structure and fencing to provide additional room for shared use path (very high)
- Drainage improvements (moderate/high)
- Railroad easements (moderate/high)
- Lighting (moderate)
- Liability insurance required by Union Pacific (moderate)

Section B3: SE Division Place from SE 9th to SE Grand

The following sections show an optimal route for pedestrians only. Bicyclists are encouraged to use SE Division Place as an on-street route.



Location

- SE Division Place at SE 9th looking west

Existing Conditions

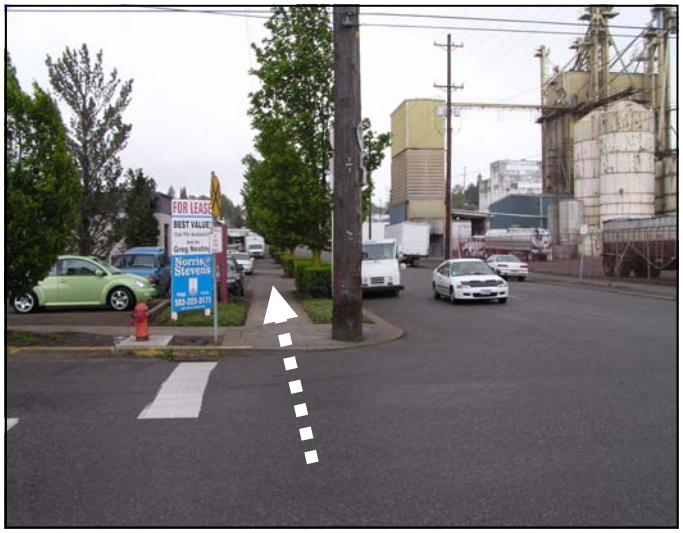
- 4-way intersection, free right turn from SE Division onto SE 9th
- Sidewalk and street surfaces in fair condition
- 5' sidewalk
- Street trees

Concerns

- Conflicts with the free right turn from SE Division onto SE 9th
- Low hanging vegetation blocks sidewalk
- Inconsistent sidewalk pavement
- Pedestrians will not follow the safest route

Proposed Improvements (Cost)

- Trim vegetation back (low)
- Improve sidewalk (moderate)
- Install yield or stop sign on SE 9th before the railroad tracks (low)
- Stripe crosswalk across SE 9th on the south side (low)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Looking down SE Division Place from the NE corner of SE 8th — a large turning radius for trucks increases the crossing distance to 64 feet. Pedestrians are encouraged to cross SE 8th on the south side.

Location

- SE 8th and SE Division Place looking south

Existing Conditions

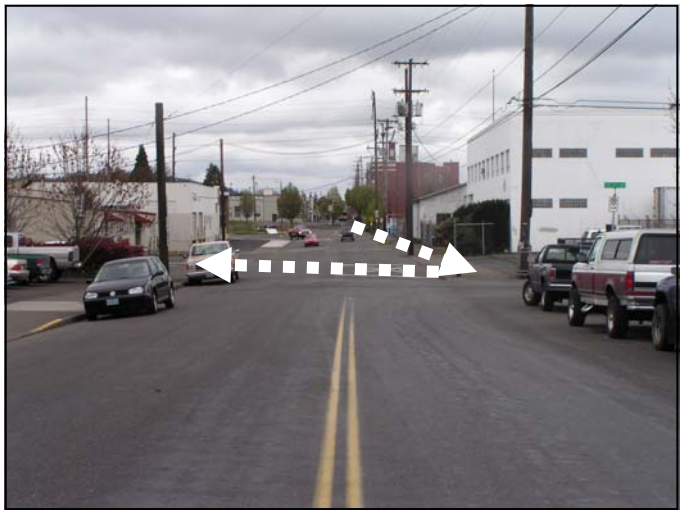
- 5' sidewalk and street surfaces in good condition
- Stop signs on SE Division Place
- Utility poles blocking curb ramps on SE and SW corners of SE Division Place
- 64' crossing on north side of SE Division Place

Concerns

- Sidewalks not accessible
- Pedestrians will not follow the safest route
- Free right turn and intersection distance on north side of SE Division Place
- Truck route

Proposed Improvements (Cost)

- Add curb ramps on either side of the utility poles (low)
- Stripe crosswalk across SE 9th on the south side (low)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Location
- SE Division Place at SE 7th looking west

Existing Conditions
- 8' sidewalk on south side and street surfaces in fair condition
- Railroad track crossing (improved)
- No buffer or curb separating roadway from the sidewalk on the north side
- Vehicles park on sidewalk
- No curb ramp on SE 6th

Concerns
- Sidewalk is blocked by parked vehicles
- Conflicts with vehicles entering and exiting business parking areas
- Current design is not ADA compliant
- Pedestrians will not follow the safest route
- Truck route

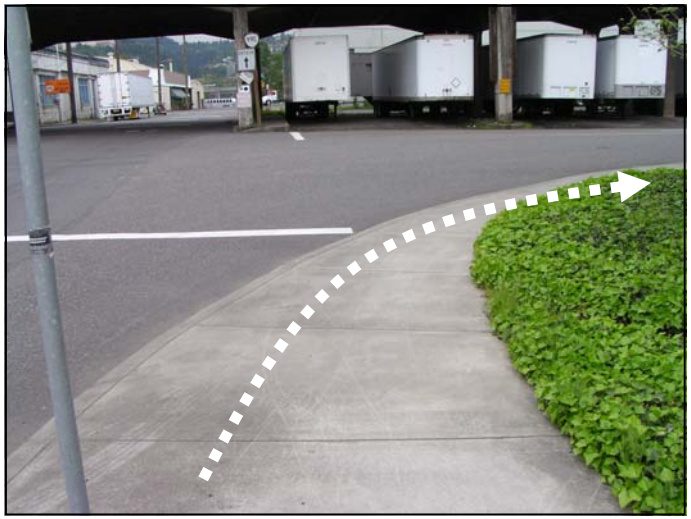
Proposed Improvements (Cost)
- Improve and expand existing south side sidewalk to 10' (moderate)
- Stripe crosswalk across SE Division Place at SE 6th (low)
- Install curb ramp at SE corner of SE 6th (low)
- Work with businesses to limit parking on the sidewalk (low)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Location
- SE Division Place west of SE 6th looking west

Existing Conditions
- 8' sidewalk and street surfaces in good condition
- 4-way stop at SE Division Place and SE Grand

Concerns
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Location
- SE Division Place at SE Grand looking west

Existing Conditions
- 8' sidewalk and street surfaces in good condition
- 4-way stop at SE Division Place and SE Grand
- No curb ramps
- Large turning radius for trucks

Concerns
- Pedestrians will not follow the safest route
- Truck route (turning trucks)

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Section B4: SE Grand to SE Caruthers

Location
- SE Grand at SE Division Place looking north

Existing Conditions
- 10' sidewalk on east side and street surfaces in excellent condition
- No sidewalk on west side
- 52' crossing on SE Grand at SE Caruthers
- North and south 6' bicycle lanes
- On-street parking

Concerns
- Conflicts with vehicles entering and exiting businesses
- Pedestrians will not follow the safest route
- Uncertain future property use on east side of SE Grand
- Truck route

Proposed Improvements (Cost)
- Stripe crosswalk across SE Grand on the south side of SE Caruthers (low)
- Work with businesses to limit parking on the sidewalk (low)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Section B5: SE Grand and SE Caruthers to the Eastbank Esplanade

Location
- SE Caruthers and SE Grand looking west

Existing Conditions
- 12' sidewalk and street surfaces in good condition
- North and southbound traffic does not stop on SE Grand
- SE Caruthers east of SE Grand is unimproved: dirt and gravel
- 6' bicycle lanes on SE Caruthers

Concerns
- Pedestrians will not follow the safest route
- Truck route
- Traffic speeds

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Location
- SE Caruthers looking southwest

Existing Conditions
- 8' sidewalk and street surfaces in excellent condition
- 6' bicycle lanes on SE Caruthers

Concerns
- Pedestrians will not follow the safest route
- Truck route
- Vehicles parking on the sidewalk

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)
- Work with businesses to limit parking on the sidewalk (low)

Location
- SE Caruthers and SE 4th looking east

Existing Conditions
- 8' sidewalk and street surfaces in excellent condition
- 6' bicycle lanes on SE Caruthers
- Railroad track crossing (improved)

Concerns
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

5.3 Route C Summary – SE Clinton/SE Taggart Alleyway

Route C travels west from the 1200 block of SE Clinton across the Union Pacific railroad crossing at SE 11th and SE 12th, continues southwest on SE Clinton, and uses an existing (but underutilized) right-of-way on SE Taggart that connects SE Clinton to SE 9th. Route C then follows SE 9th north to SE Division Place.

Distance: .69 miles
Walking time (3 mi/h): 13 minutes, 48 seconds
Biking time (8.5 mi/h): 4 minutes, 50 seconds

Opportunities

- Improves and makes useable an underutilized existing connection
- Uses existing low-volume bikeway
- Low cost option

Constraints

- Not direct – 3rd longest distance alternative
- Must cross SE 11th and SE 12th at unprotected intersections; poor sight lines
- Must cross railroad on SE Clinton between SE 11th and SE 12th
- Railroad crossing angle of 38 degrees; wide, uneven flange
- Intermittent sidewalks on SE Clinton between SE 11th and the SE Taggart right-of-way and on SE 9th

Accessibility

Moderate/Low. Route C is accessible to residents in the Clinton neighborhood using the SE Clinton bikeway and to bicyclists and pedestrians using the SE 9th Pedestrian Bridge over SE Powell. The route is accessible to bicyclists and pedestrians on SE Milwaukie traveling from the Brooklyn neighborhood but requires a difficult crossing of SE 11th and SE 12th, two railroad track crossings (one improved) and considerable out-of-direction travel.

Cost

Moderate. There are substantial costs to improve bicycle and pedestrian crossing safety at the SE 11th and SE 12th couplet. Railroad crossing improvements are needed. New sidewalks are needed to fill in gaps on SE Clinton from SE 12th to the SE Taggart right-of-way and on SE 9th. Improvements to the SE Taggart right-of-way will require new pavement, lighting, and signage.

Directness

Low. Route C is the third longest route because of the out-of-direction travel required to circumnavigate the Northwest Natural Gas property.

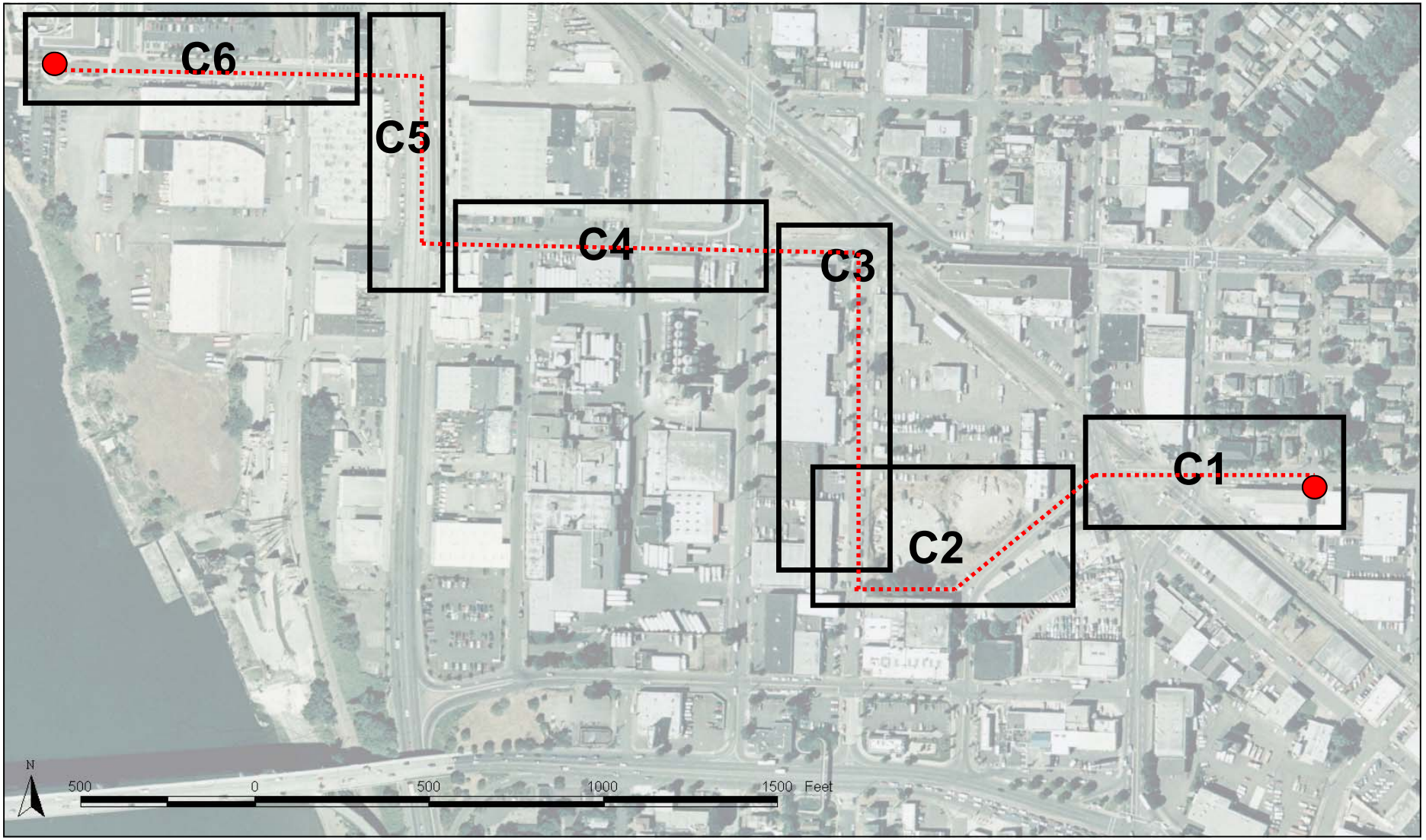
Ease of Implementation

Moderate. The SE Taggart right-of-way is currently used by the adjacent property for refuse storage (*see photo*). The City will need to negotiate with adjacent property owners to formalize the right-of-way and ensure that the refuse storage is contained or moved elsewhere.

Safety

Low. There is a difficult crossing on SE Clinton at SE 11th and SE 12th. There are some additional safety concerns in the SE Taggart right-of-way, which is more than 20 feet wide and bounded by a building to the south and cyclone fencing to the north. Existing vegetation also creates a feeling of enclosure. Though only 200 feet long, the path creates an uncomfortable situation where there are no opportunities to escape if both entrances are blocked. The SE Taggart right-of-way also lacks proper lighting and creates an unsafe pedestrian environment in the evening and early morning. Existing conditions indicate that transients occupy the SE Taggart right-of-way, most likely at night for sleeping.

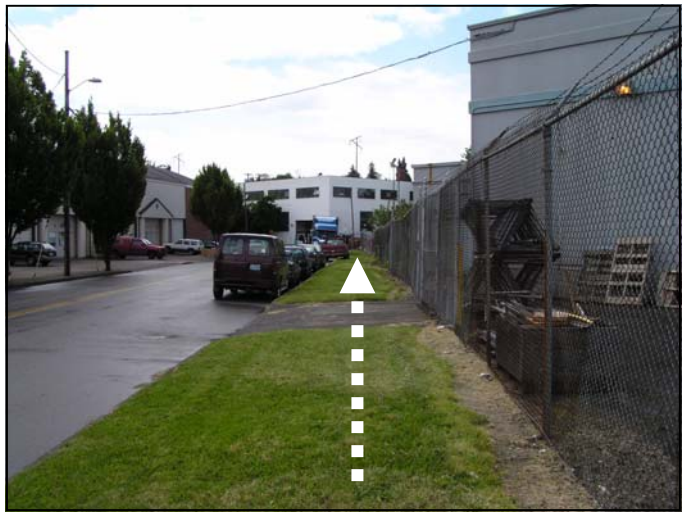
Map 8. Route C



Section C1: SE Clinton at SE 12th to SE 11th

Please refer to pages 45—51 of this document for a detailed analysis of the SE 11th and SE 12th intersection.

Section C2: SE Clinton at SE 11th to SE Taggart Alley



Location
- SE Clinton at SE 11th looking southwest

Existing Conditions
- No sidewalk
- Low ADT

Concerns
- Poor access
- Not a direct connection, route can be confusing

Proposed Improvements (Cost)
- Install a 6' minimum width sidewalk with curb ramps (low)
- Directional signage (low)

Location
- SE Clinton at SE Taggart looking south

Existing Conditions
- No sidewalk
- Low ADT
- Vehicles and trash receptacles block alley entrance

Concerns
- Conflicting uses
- Hidden through route

Proposed Improvements (Cost)
- Install a 6' minimum width sidewalk with curb ramps
- Warning and directional signage (low)

Location
- Looking west from SE Clinton to SE 9th

Existing Conditions
- 20'+ width right of way
- Zero lot line building to the south
- 10' chain link fencing with barbed wire to the north
- Mature vegetation
- Unpaved, not maintained
- Transient use

Concerns
- Safety
- May encroach on business use of corridor

Proposed Improvements (cost)
- Must be paved (moderate/high)
- Vegetation must be trimmed (low)
- Lighting (low)
- Signage and pavement markers (low)
- Work with adjacent business to arrange alternative disposal site (low)
- Bollards at entrances (low)

Section C3: SE 9th from SE Taggart to SE Division Place

Location
- SE 9th looking north toward SE Division Place

Existing Conditions
- No sidewalk
- Low ADT
- 6' chain link fence with barbed wire to the east

Concerns
- Driveways cross route

Proposed Improvements (Cost)
- Install a 6' minimum width sidewalk with curb ramps (low)
- Directional signage (low)

Section C4: SE Division Place from SE 9th to SE Grand

The following sections show an optimal route for pedestrians only. Bicyclists are encouraged to use SE Division Place as an on-street route.

Location

- SE Division Place at SE 9th looking west

Existing Conditions

- 4-way intersection, free right turn from SE Division on SE 9th
- Sidewalk and street surfaces in fair condition
- 5' sidewalk
- Street trees

Concerns

- Conflicts with the free right turn from SE Division
- Low hanging vegetation blocks sidewalk
- Inconsistent sidewalk pavement
- Pedestrians will not follow the safest route

Proposed Improvements (Cost)

- Trim vegetation back (low)
- Improve sidewalk (moderate)
- Install yield or stop sign on SE 9th before the railroad tracks (low)
- Stripe crosswalk across SE 9th on the south side (low)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Looking down SE Division Place from the NE corner of SE 8th — a large turning radius for trucks increases the crossing distance to 64 feet. Pedestrians are encouraged to cross SE 8th on the south side.

Location

- SE 8th and SE Division Place looking south

Existing Conditions

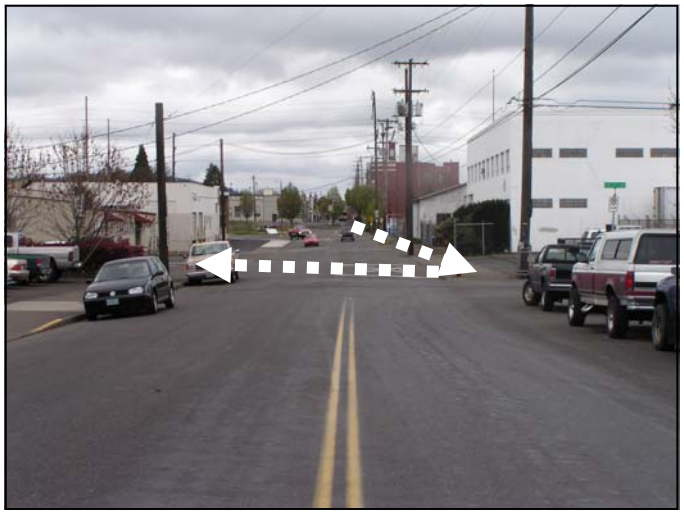
- 5' sidewalk and street surfaces in good condition
- Stop signs on SE Division Place
- Utility poles block curb ramps on SE and SW corners of SE Division Place
- 64' crossing on north side of SE Division Place

Concerns

- Sidewalks not accessible
- Pedestrians will not follow the safest route
- Free right turn and intersection distance on north side of SE Division Place
- Truck route

Proposed Improvements (Cost)

- Add curb ramps on either side of the utility poles (low)
- Stripe crosswalk across SE 9th on the south side (low)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Location

- SE Division Place at SE 7th looking west

Existing Conditions

- 8' sidewalk on south side and street surfaces in fair condition
- Railroad track crossing (improved)
- No buffer or curb separating roadway from the sidewalk on the north side
- Vehicles park on sidewalk
- No curb ramp on SE 6th

Concerns

- Sidewalk is blocked by parked vehicles
- Conflicts with vehicles entering and exiting business parking areas
- Current design is not ADA compliant
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)

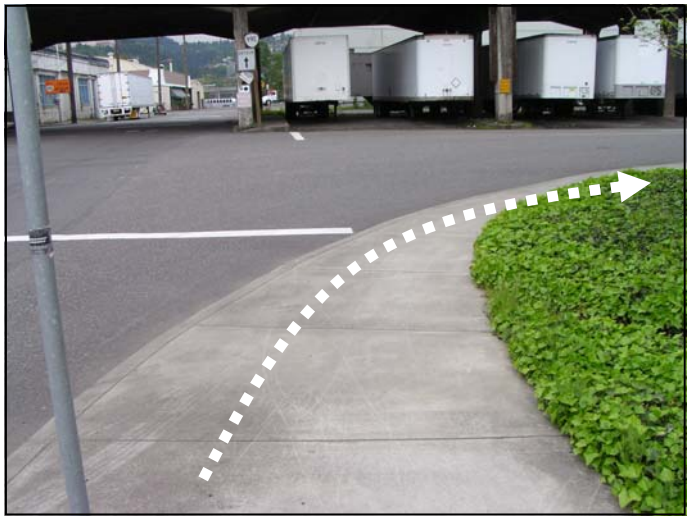
- Improve and expand existing south side sidewalk to 10' (moderate)
- Stripe crosswalk across SE Division Place at SE 6th (low)
- Install curb ramp at SE corner of SE 6th (low)
- Work with businesses to limit parking on the sidewalk (low)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Location
- SE Division Place west of SE 6th looking west

Existing Conditions
- 8' sidewalk and street surfaces in good condition
- 4-way stop at SE Division Place and SE Grand

Concerns
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Location
- SE Division Place at SE Grand looking west

Existing Conditions
- 8' sidewalk and street surfaces in good condition
- 4-way stop at SE Division Place and SE Grand
- No curb ramps
- Large turning radius for trucks

Concerns
- Pedestrians will not follow the safest route
- Truck route (turning trucks)

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Section C5: SE Grand to SE Caruthers

Location
- SE Grand at SE Division Place looking north

Existing Conditions
- 10' sidewalk on east side and street surfaces in excellent condition
- No sidewalk on west side
- 52' crossing on SE Grand at SE Caruthers
- North and south 6' bicycle lanes
- On-street parking

Concerns
- Conflicts with vehicles entering and exiting businesses
- Pedestrians will not follow the safest route
- Uncertain future property use on east side of SE Grand
- Truck route

Proposed Improvements (Cost)
- Stripe crosswalk across SE Grand on the south side of SE Caruthers (low)
- Work with businesses to limit parking on the sidewalk (low)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Section C6: SE Grand and SE Caruthers to the Eastbank Esplanade

Location
- SE Caruthers and SE Grand looking west

Existing Conditions
- 12' sidewalk and street surfaces in good condition
- North and southbound traffic does not stop on SE Grand
- SE Caruthers east of SE Grand is unimproved: dirt and gravel
- 6' bicycle lanes on SE Caruthers

Concerns
- Pedestrians will not follow the safest route
- Truck route
- Traffic speeds

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Location
- SE Caruthers looking southwest

Existing Conditions
- 8' sidewalk and street surfaces in excellent condition
- 6' bicycle lanes on SE Caruthers

Concerns
- Pedestrians will not follow the safest route
- Truck route
- Vehicles parking on the sidewalk

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)
- Work with businesses to limit parking on the sidewalk (low)

Location
- SE Caruthers and SE 4th looking east

Existing Conditions
- 8' sidewalk and street surfaces in excellent condition
- 6' bicycle lanes on SE Caruthers
- Railroad track crossing (improved)

Concerns
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

5.4 Route D Summary – SE Clinton/SE 8th

Route D travels west on SE Clinton from SE 12th across the Union Pacific Railroad crossing at SE 11th and SE 12th, continues southwest on SE Clinton to SE Woodward, and follows SE Woodward to SE 8th. Route D then follows SE 8th north to SE Division Place.

Distance: .75 miles
Walking time (3 mi/h): 14 minutes, 30 seconds
Biking time (8.5 mi/h): 5 minutes, 18 seconds

Opportunities

- Good connection to Brooklyn neighborhood (via SE Powell Pedestrian Bridge)
- Good sidewalks on SE 8th
- Low cost option

Constraints

- Longest route/least direct
- High ADT (traffic) on SE Woodward
- Must cross SE 11th and SE 12th at unprotected intersections; poor sight lines
- Must cross railroad on SE Clinton between SE 11th and SE 12th
- Railroad crossing angle of 38 degrees; wide, uneven flange
- Sidewalk obstructions/impediments on SE Woodward

Accessibility

Moderate/Low. Route D is accessible to residents in the Clinton neighborhood using the SE Clinton bikeway and to bicyclists and pedestrians using the SE 9th Pedestrian Bridge over SE Powell. The route is accessible to bicyclists and pedestrians on SE Milwaukie traveling from the Brooklyn neighborhood but requires a difficult crossing of SE 11th and SE 12th, two railroad track crossings (one improved) and considerable out-of-direction travel.

Cost

Moderate. The costs needed to improve bicycle and pedestrian crossing safety at the SE 11th and SE 12th couplet are substantial. Railroad crossing improvements are needed. New sidewalks are needed to fill in gaps on SE Clinton from SE 12th to the SE Taggart right-of-way. ADA compliant upgrades to the existing sidewalk on SE Woodward will include sign and utility pole relocation and trimming vegetation. Additionally, ADA compliant curb ramps are needed on the corners of SE Woodward and SE 9th and SE 8th.

Directness

Low. Route D is the longest route because of the out-of-direction travel required to circumnavigate the Northwest Natural Gas property and to access SE 8th.

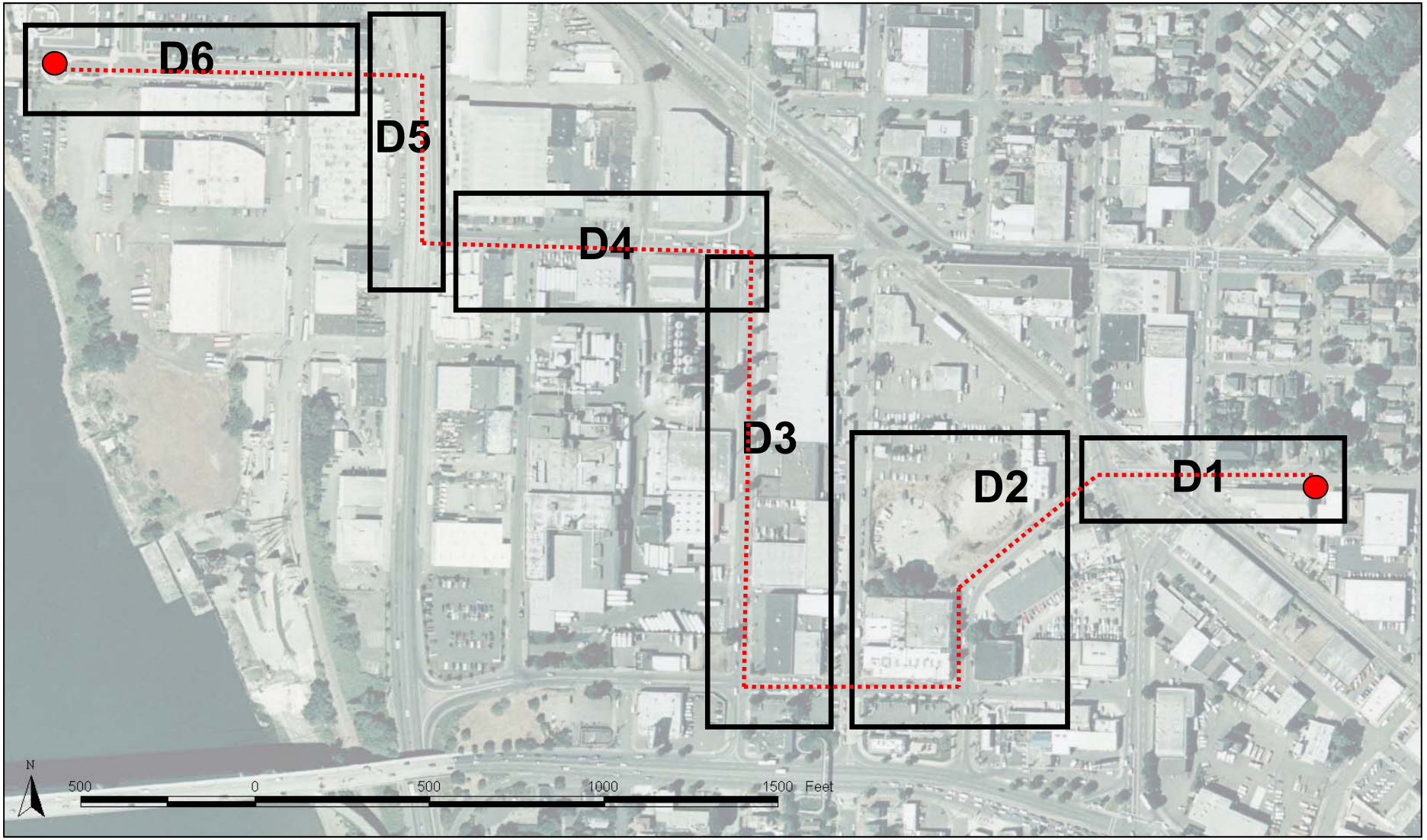
Ease of Implementation

Moderate. Bicycle lanes are needed on SE Woodward. The presence of on-street parking constrains the public right-of-way and would be politically difficult to remove. Sidewalk improvements would require removing utility poles or widening the sidewalk.

Safety

Low. There is a difficult crossing on SE Clinton at SE 11th and SE 12th. Additionally, SE Woodward and SE 8th see significant ADT, at least 30% of which are heavy trucks. Eastbound bicyclists have two left turns across traffic on SE Woodward at SE 8th and SE Clinton. Pedestrian facilities are poor on SE Woodward.

Map 9. Route D



Section D1: SE Clinton at SE 12th to SE 11th

Please refer to pages 45—51 of this document for a detailed analysis of the SE 11th and SE 12th intersection.

Section D2: SE Clinton at SE 11th to SE 8th

Location
- SE Clinton at SE 11th looking southwest

Existing Conditions
- No sidewalk
- Low ADT

Concerns
- Poor access
- Not a direct connection, route can be confusing

Proposed Improvements (Cost)
- Install a 6' minimum width sidewalk with curb ramps (low)
- Directional and signage (low)

Location
- SE Clinton at SE Taggart looking south

Existing Conditions
- 5' sidewalk
- Street trees

Concerns
- None

Proposed Improvements (Cost)
- None

Location

- SE Woodward at SE 10th looking west

Existing Conditions

- 5' sidewalk
- Severe vegetation encroachment
- Utility poles and sign posts in the middle of the sidewalk
- 10,000 ADT
- On-street parking
- No curb ramps

Concerns

- Impeded use of sidewalk
- Vehicle door/bicyclist conflicts

Proposed Improvements (Cost)

- Install curb ramps (low)
- Warning and directional signage (low)
- Trim vegetation (low)
- Remove/relocate utility and sign poles (high)
- Stripe 6' bicycle lane on both sides of SE Woodward (moderate)
- Remove on-street parking (moderate cost, politically difficult)

Section D3: SE 8th to SE Division Place

Location
- SE 8th and SE Woodward looking north

Existing Conditions
- 6'-8' sidewalk
- Truck route
- 5,000 ADT
- On-street parking

Concerns
- High truck volume

Proposed Improvements (Cost)
- Directional signage (low)

Section D4: SE Division Place from SE 8th to SE Grand

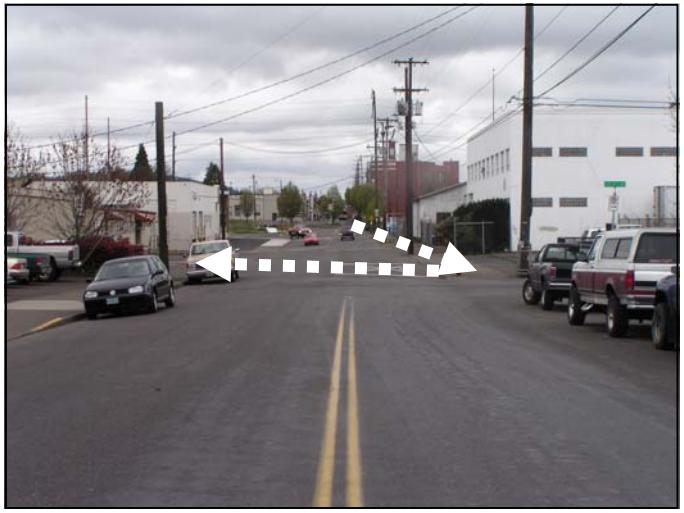
Looking down SE Division Place from the NE corner of SE 8th — a large turning radius for trucks increases the crossing distance to 64 feet. Pedestrians are encouraged to cross SE 8th on the south side.

Location
- SE 8th and SE Division Place looking south

Existing Conditions
- 5' sidewalk and street surfaces in good condition
- Stop signs on SE Division Place
- Utility poles blocking curb ramps on SE and SW corners of SE Division Place
- 64' crossing on north side of SE Division Place

Concerns
- Sidewalks not accessible
- Pedestrians will not follow the safest route
- Free right turn and intersection distance on north side of SE Division Place
- Truck route

Proposed Improvements (Cost)
- Add curb ramps on either side of the utility poles (low)
- Stripe crosswalk across SE 9th on the south side (low)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Location

- SE Division Place at SE 7th looking west

Existing Conditions

- 8' sidewalk on south side and street surfaces in fair condition
- Railroad track crossing (improved)
- No buffer or curb separating roadway from the sidewalk on the north side
- Vehicles park on sidewalk
- No curb ramp on SE 6th

Concerns

- Sidewalk is blocked by parked vehicles
- Conflicts with vehicles entering and exiting business parking areas
- Current design is not ADA compliant
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)

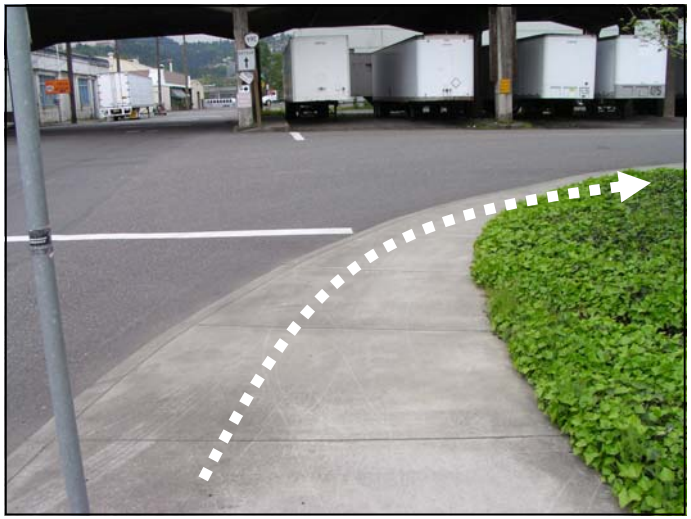
- Improve and expand existing south side sidewalk to 10' (moderate)
- Stripe crosswalk across SE Division Place at SE 6th (low)
- Install curb ramp at SE corner of SE 6th (low)
- Work with businesses to limit parking on the sidewalk (low)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Location
- SE Division Place west of SE 6th looking west

Existing Conditions
- 8' sidewalk and street surfaces in good condition
- 4-way stop at SE Division Place and SE Grand

Concerns
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)



Location
- SE Division Place at SE Grand looking west

Existing Conditions
- 8' sidewalk and street surfaces in good condition
- 4-way stop at SE Division Place and SE Grand
- No curb ramps
- Large turning radius for trucks

Concerns
- Pedestrians will not follow the safest route
- Truck route (turning trucks)

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Section D5: SE Grand to SE Caruthers

Location
- SE Grand at SE Division Place looking north

Existing Conditions
- 10' sidewalk on east side and street surfaces in excellent condition
- No sidewalk on west side
- 52' crossing on SE Grand at SE Caruthers
- North and south 6' bicycle lanes
- On-street parking

Concerns
- Conflicts with vehicles entering and exiting businesses
- Pedestrians will not follow the safest route
- Uncertain future property use on east side of SE Grand
- Truck route

Proposed Improvements (Cost)
- Stripe crosswalk across SE Grand on the south side of SE Caruthers (low)
- Work with businesses to limit parking on the sidewalk (low)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Section D6: SE Grand and SE Caruthers to the Eastbank Esplanade

Location
- SE Caruthers and SE Grand looking west

Existing Conditions
- 12' sidewalk and street surfaces in good condition
- North and southbound traffic does not stop on SE Grand
- SE Caruthers east of SE Grand is unimproved: dirt and gravel
- 6' bicycle lanes on SE Caruthers

Concerns
- Pedestrians will not follow the safest route
- Truck route
- Traffic speeds

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

Location
- SE Caruthers looking southwest

Existing Conditions
- 8' sidewalk and street surfaces in excellent condition
- 6' bicycle lanes on SE Caruthers

Concerns
- Pedestrians will not follow the safest route
- Truck route
- Vehicles parking on the sidewalk

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)
- Work with businesses to limit parking on the sidewalk (low)

Location
- SE Caruthers and SE 4th looking east

Existing Conditions
- 8' sidewalk and street surfaces in excellent condition
- 6' bicycle lanes on SE Caruthers
- Railroad track crossing (improved)

Concerns
- Pedestrians will not follow the safest route
- Truck route

Proposed Improvements (Cost)
- Signage (low/moderate)
- Sidewalk pavement markings (e.g. paint, sandblasting, medallions) to guide pedestrians on the optimal route (moderate)

6. Recommendations

Evaluation criteria were applied to each route alternative. The criteria were scored on a 1 to 3 scale. Table 3 shows a decision matrix, where each route was scored on the five criteria. A higher score indicates that the route meets the criteria relative to other routes. All criteria are equally weighted for this project but can easily be weighted and reconfigured to individual preferences.

Route A scored well on all criteria, particularly on accessibility and cost. Route A takes advantage of existing opportunities, such as wide sidewalks in good condition and signalized intersections. Route A is a direct route, second only to the rail trail along the Union Pacific Railroad tracks. It also can be very safe if the proper improvements are made. Of the routes presented, Route A is the preferred route.

Route B and Route D had similar scores. Route B is the most direct route, but is also the most expensive route. Moreover, Route B would be difficult to implement due to the logistics and restrictions of building a trail adjacent to an active railroad line. Route D would be relatively easy to implement but could be costly due to utility pole removal, widening the sidewalk, and removing on-street parking. However, it is the longest route with out-of-direction travel and has safety concerns with bicycle travel on SE 8th and SE Woodward.

Route C scored the fewest points. Safety in the SE Taggart right-of-way is paramount and would be costly to make the necessary improvements to ensure safety. Route C also has safety issues with crossing SE 11th and SE 12th on SE Clinton.

Table 3: Decision Matrix

	Route A	Route B	Route C	Route D
Accessibility	3	2	1	2
Cost	3	1	2	2
Directness	2	3	1	1
Ease of Implementation	2	1	2	2
Safety	2	1	1	1
Total	**12**	**8**	**7**	**8**

Recommended Alternative: Short Term

Route A is the preferred route for immediate implementation. There are several action items to carry this project forward:

- Public involvement is needed to get additional feedback and recommendations on the four route alternatives.
- If the city cannot secure enough funding to complete the entire project, the final route should have three phases addressing (in order):
  1. Safety issues (i.e. railroad track crossing),
  2. The easiest/low cost improvements (i.e. curb cuts and signage)
  3. The most difficult or complex improvements (i.e. new crossing of the Union Pacific Railroad tracks).
- Incorporate the recommendations and preferred route in corollary transportation planning projects (e.g. SE Division Corridor Project).

Recommended Alternative: Long Term

Due to the changing nature of land use and transportation systems, there is the possibility that a north/south light rail line may utilize part of the Union Pacific Railroad right-of-way. Should this happen, it is possible that a light rail stop would be sited in the vicinity of SE Clinton and SE 11th. The future light rail line could also facilitate land use zoning changes to encourage mixed use redevelopment.

Should zoning and land use changes affect the Northwest Natural Gas property adjacent to the Union Pacific Railroad corridor,

it is recommended that an easement or additional right-of-way is dedicated for a shared use path. This recommendation is made with the assumptions that the land use will be compatible with bicycling and walking, and that the SE 11th and SE 12th intersection will be improved.

Appendix

Background documents

2.1 City and Neighborhood Plans

The following city and neighborhood plans demonstrate and describe: 1) the city's commitment to expanding bicycle and pedestrian facilities throughout the city and close existing gaps in the infrastructure network, 2) the neighborhood's desire to improve bicycle and pedestrian facilities and better connect the neighborhood to the Willamette River and East Bank Esplanade, and 3) important criteria to consider when designing bicycle and pedestrian facilities.

Hosford-Abernethy Neighborhood Action Plan (HANAP)

The HANAP, completed in 1988 by the City's Bureau of Planning and the Hosford-Abernethy Neighborhood Association, presents policies and actions to guide development in the neighborhood. Objective 3.8 of the Transportation Policy seeks to "encourage improvements for pedestrians and bicycle movement."

Central City Transportation Management Plan (CCTMP)

The CCTMP, completed in 1993, is intended to promote economic vitality, livability and environmental quality in Portland's central core. Specifically, the plan seeks to improve the City's air quality by reducing emissions of carbon monoxide and ozone from vehicles. The policies and actions described in the plan seek to reduce reliance on automobiles and promote increased transit use, walking, and bicycling.

Policy 6.12, included in the CCTMP and part of the transportation element of Portland's Comprehensive Plan (1992) directs the City to "plan and provide a bicycle network to increase the modal share of bicycle travel to 10 percent over the next 20 years through accessibility for bicyclists on the transit system, the provision of bicycle parking, streets that are reasonably free of hazards to bicycles, and the provision of other bicycle facilities" (p. 3-4).

Policy Recommendation 4 describes in greater bicycle network in greater detail. The bicycle network should, at a minimum, provide for bicycle access to the Central City from all areas of the city; and connections between major attractions. Furthermore, the CCTMP states that bicycle network routes should:

- Be direct. The network should connect areas and sites in as direct a line as possible.
- Minimize conflicts between bicycles and motorized vehicles. Where turning or other conflict points are unavoidable, traffic designs should accommodate the safety needs of bicyclists.
- Be relatively barrier-free. Barriers such as stairs, surface hazards, lack of adequate shoulders, etc. should not exist on Bicycle Network routes. Where they do, they should be eliminated" (p. 9-10).

The CCTMP also provides goals for pedestrian facilities in the central city. Goal 1 of the Pedestrian Element requires the City to "Improve the pedestrian network so that at least 75 percent of all trips within the Central City Districts, and 20 percent of all trips to the Central City area, are made by pedestrians" (p. 2). Addressing Portland's east side, and the area covered by this study, the CCTMP explains that while some pedestrian facilities exist, "the area does not have an extensive pedestrian infrastructure, and does not have a high level of pedestrian amenity. Pedestrian activity is therefore low, and there are a number of deficiencies in the availability of pedestrian facilities, particularly at intersections and crossings of the major arterials. Opportunities exist for increasing pedestrian amenity along major arterials, increasing pedestrian accessibility to the river, and enhancement of the proposed Willamette Greenway Trail" (p. 8).

The CCTMP identifies particular transportation needs. In this projects study area, the plan makes two recommendations: "Improve accessibility of pedestrians to Downtown, The Esplanade, OMSI, Southeast neighborhoods and other destinations" (p. 8) and "construct pedestrian improvements at the intersections of SE 12th/Sandy/Burnside and SE11th/12th/Clinton" (p. 9).

Overall, the CCTMP Working Group recommended that for the Central Eastside District, "Pedestrian and bicycle access and use must increase to support development in the Central Eastside, and to provide recreational access to the Willamette River" (p. 3).

Bicycle Master Plan (BMP)

Portland's BMP, completed in 1996, provides guidance over a 20-year period for improvements that will encourage more people to ride more frequently for daily needs. The mission of the Master Plan is to make bicycling an integral part of daily life in Portland. Specifically, the BMP address five elements: policies and objectives that comprise part of Portland's comprehensive plan Transportation Element, developing a recommended bikeway network, providing end-of-trip facilities, improving the bicycle-transit link, and promoting bicycling through education and encouragement. Associated with each of these elements are objectives, action items, and five, 10, and 20-year benchmarks to measure progress. In addition, the Plan provides bikeway design and engineering guidelines.

The following policy and objectives guide the city's approach to bicycling. Policy 6.12 encourages bicycle travel for trips of less than five miles, by implementing a bikeway network, providing end-of-trip facilities, improving bicycle/transit integration, encouraging bicycle use, and making bicycling safer. Specific objectives include:

- Complete a network of bikeways that serves bicyclists' needs, especially for travel to employment centers, commercial districts, transit stations, institutions, and recreational destinations.
- Provide bikeway facilities that are appropriate to the street classifications, traffic volume, and speed on all right-of-ways.

The BMP establishes a series of near-term and long-term benchmarks by which to judge progress towards increased bicycling. For the first five years of the BMP, the goal is to increase bicycle mode share to 5 percent in Inner Portland. That figure is expected to rise to 10 percent in 10 years and 15 percent in 20 years.

Policy 11.13 outlines bicycle improvements. The policy calls for bikeway facility designs appropriate to the street classification, traffic volume, and traffic speed. Most importantly, the policy explains that bicycle safety should be the highest priority in the design of all bikeway facilities.

The BMP describes various types of bikeways comprising the City's bicycle network.

Central City bikeways are city bikeways located in the central city, which includes the Lloyd Center, Lower Albina, the Central Eastside Industrial District, the River District, downtown, Goose Hollow, the University District, and North Macadam. The CCTMP identifies Central City bikeways Local Service Bikeways serve as local circulation routes for bicyclists and provide access to adjacent properties. All streets not classified as bikeways or off-street paths, with the exception of controlled access roadways, are considered local service bikeways. Local service bikeways will in general be shared roadways, requiring no special treatment. However, depending on traffic volumes and speeds, some local service bikeways will require other treatments to facilitate safe bicycle travel. These treatments are bicycle lanes, extra width curb lanes, or traffic calming techniques.

Furthermore, the BMP outlines design elements to be considered for bikeways and shared roadways, traffic calming, bicycle lanes and extra width cur lanes. These include:

- On-street motor vehicle parking will not be removed on local service bikeways to provide bicycle lanes.
- Treatment to and operation of local service bikeways should not, as a side effect, create, accommodate or encourage additional through automobile traffic.
- Crossings of local service bikeways and all other rights-of-way should be designed to minimize conflicts and provide adequate bicycle crossings.

The BMP also defines a range of City Bikeway Treatments.

- A bicycle lane is that portion of the roadway designated by eight-inch striping and bicycle pavement markings for the exclusive or preferential use of bicycles.
- A shoulder bikeway is a street upon which the paved shoulder, separated by a four-inch stripe and no bicycle lane markings, is usable by bicycles. Although bicycles can use the shoulder, auto parking can be allowed on a shoulder.
- A bicycle boulevard is a shared roadway (bicycles and motor vehicles share the space without marked bicycle lanes) where the through movement of bicycles is given priority over motor vehicle travel on a local street. Traffic calming devices are used to control traffic speeds and discourage through trips by motor vehicles. Traffic control devices are designed to limit conflicts between automobiles and bicycles and favor bicycle movement on the boulevard street. Examples include SE Harrison/Lincoln and SE Clinton.
- An extra width curb lane is a wider than a normal curbside travel lane provided to give extra room for bicycle operation where there is insufficient space for a bicycle lane or shoulder bicycle lane.
- A signed connection is a bikeway with guide signing to direct bicyclists to a destination or another bikeway. Signed connections are used on local, low-traffic streets where bicycle lanes or bicycle boulevards are not needed, and on and around major recreational cycling destinations, such as Rocky Butte, Council Crest, and Mount Tabor.

The BMP also address railroad crossings. The BMP states that because of their tendency to grab and channelize bicycle tires, railroad crossings present a difficult challenge for bicyclists. Three main factors affect crossing safety: the angle of the crossing (the more oblique, the more dangerous the crossing); the surface quality (the more buckled the asphalt adjacent to the rails, the more dangerous); and the width of the flange between the pavement and rail is also a factor (the wider the flange, the more dangerous).

In the fall of 1994, the Bicycle Program surveyed all railroad crossings in the City of Portland. Each crossing was rated based on its angle and surface quality, with additional consideration given to flange width. As shown on the Railroad Crossings Map, the crossings with a rating of one to four warrant immediate attention, those rated five to six need attention in the near future, and seven and above are reasonably safe.

The 222 crossings on the bikeway network should be considered of highest priority. Of these, about 75 are rated one to four, requiring immediate repair. Another 71 are rated five to six, requiring attention in the near future. The rest are considered reasonably safe.
The maintenance and repair of railroad crossings are the responsibility of rail companies for commercial rail lines, regulated by the Public Utility Commission, and Tri-Met for light rail.

Portland's Transportation System Plan (TSP)

Portland's Transportation System Plan (TSP), completed in 2002, is a long-range to guide transportation investments in Portland. Integrating previous transportation plans, the TSP describes how the City will meet State and regional planning requirements and addresses local transportation needs for cost-effective street, transit, freight, bicycle, and pedestrian improvements. Specifically, the plan describes the City's goals, objectives, and actions for bicycle and pedestrian facilities throughout the city. These are intended to make the City more convenient for walking, and bicycling.

The TSP updated the Transportation Element of the City's comprehensive plan – which outlines the City's transportation policies. Policy 6.7 explains that the city seeks to "maintain a system of bikeways to serve all bicycle users and all types of bicycle trips" (p. 2-12). The following TSP objectives, drawn from the City's BMP, describe different types of city bikeways and important land use and design characteristics to support their use:

Objective A – City Bikeways: "City Bikeways are intended to serve the Central City, regional and town centers, station communities, and other employment, commercial, institutional, and recreational destinations.

- Land Use. Auto-orientated land uses should be discouraged from locating on City Bikeways that are not also classified as Major City Traffic Streets.
- Design. Consider the following factors in determining the appropriate design treatment for City bikeways: traffic volume, speed of motor vehicles, and street width. Minimize conflicts where City Bikeways cross other streets.
- Improvements. Consider the following possible design treatments for City Bikeways: bicycle lanes, wider travel lanes, wide shoulders on partially improved roadways, bicycle boulevards, and signage for local street connections.
- On-street parking. On-street motor vehicle parking may be removed on City-Bikeways to provide bicycle lanes, except where parking is determined to be essential to serve adjacent land uses, feasible options are not available to provide the parking on-site.
- Bicycle Parking. Destinations along City Bikeways should have long-term and/or short-term bicycle parking to meet the needs of bicycles.
- Traffic Calming. When bicycle lanes are not feasible, traffic calming, bicycle boulevards, or similar techniques will be considered to allow bicycles to share travel lanes safely with motorized traffic (p. 2-12).

Objective C - Local Service Bikeways: "Local Service Bikeways are intended to serve local circulation needs for bicyclists and provide access to adjacent properties.

- Classification. All streets not classified as City Bikeways or Off-street paths, with the exception of Regional Trafficways not also classified as Major City Traffic Streets, are classified as Local Service Bikeways.
- Improvements. Consider the following design treatments for Local Service Bikeways: shared roadways, traffic calming, bicycle lanes, and extra-wide curb lanes. Crossings of Local Service Bikeways with other rights-of-way should minimize conflict.
- On-Street Parking. On street parking on Local Service Bikeways should not be removed to provide bicycle lanes.
- Operation. Treatment of Local Service Bikeways should not have a side effect of creating, accommodating, or encouraging automobile through-traffic" (p. 2-13).

Policy 8 and its sub-policies further define the City's bicycle policies. Policy 8.3 requires that the city "ensure that all public streets and public ways within the Central City, except freeways, expressways, and exclusive transit ways, are accessible to bicycles" (p. 2-154). TSP Policy 8.4 reiterates Policy Recommendation 4 of the CCTMP, discussed above; in order to meet the City's mode split targets also discussed in the CCTMP. However, Policy 8.4 adds an additional criterion to bicycle network routes: bicycle routes should "Be complete. The City will support completion of regional bicycle route segments that connect to the central city (p. 2-154).

Policy 7 and its sub-policies outline the City's pedestrian network policies. Policy 7 requires the City to support a "pedestrian friendly environment with good connections to adjacent neighborhoods and a high level of pedestrian activity due to the availability, accessibility, convenience, safety, and attractiveness of the pedestrian network. The network should be:

- Available and Accessible to all users
- Convenient and easily negotiable, with all routes and surfaces having ample capacity and being relatively free of obstruction
- Safe, with pedestrians being able to use the system with minimal concerns about traffic and personal safety
- Comfortable and attractive, with streets, sidewalks, and adjacent development having a high degree of amenities and appeal for pedestrians" (p. 2-152).

Policy 7.2 describes criteria that should be considered in order to create a pedestrian friendly environment. These include: Minimizing air and noise pollution and pedestrian-vehicle conflict, calming vehicular traffic commensurate with the needs of the Central City, providing safe pedestrian access to and across bridges, and providing landscaping and other perimeter treatment around surface parking lots…" (p. 2-153). Policy 7.3 calls for a comprehensive pedestrian network throughout the central city but recognizes that industrial areas "the pedestrian network will have limitations due to industrial-related activities such as loading and truck movements" (p. 2-153). Policy 7.4 states that the pedestrian network should be "direct, have adequate capacity, have minimal delays, and be relatively free of obstructions and obstacles for all groups" (p. 2-153).

2.2 Technical Documents and Reports

These documents provide technical guidance on criteria to be considered in sighting and designing pedestrian and bicycle facilities, and particular design solutions to address specific challenges.

Bicycle Planning Document

This document defines three types of bicyclists. This is an important consideration because it influences both the sighting and design of bicycle facilities. Group A – Advanced Bicyclists are experienced riders who can operate under most traffic conditions. They are best served by direct access to destinations usually via the existing street and highway system, the opportunity to travel at maximum speeds with minimum delays, and sufficient operating space on the roadway or shoulder.

Group B – Basic Bicyclists are generally casual or new adult and teenage riders who are less confident of their ability to operate in traffic without special provisions for bicycles. Group B riders prefer comfortable, direct, low speed and traffic volume streets or designated paths to reach their destinations. Additionally, well-defined separation of bicycles and motor vehicles on arterial and collectors streets or separate bike paths are best.

Group C – Children are pre-teen riders whose roadway use is initially monitored by parents. They and their parents prefer access to key destinations surrounding residential areas, in-

cluding schools, recreation facilities, shopping, or other residential areas; residential streets with low motor vehicle speed limits and volumes, and well defined separation of bicycles and motor vehicles on arterial and collector streets or separate bike paths.

Overall, A riders will be best served by making every street "bicycle friendly". B/C riders will be best served by identifying key travel corridors (typically served by arterial and collector streets) and by providing designated bicycle facilities on selected routes through these corridors.

Second, this document identifies performance criteria for bicycle networks. These criteria include:

- Accessibility: measured by the distance a bicycle facility is from a specified trip origin or destination, and the ease by which this distance can be traveled.
- Directness: routes should be as reasonably direct as possible to encourage use.
- Continuity: the network should have as few missing links as possible. If gaps exist, they should not include traffic environments that are unpleasant or threatening to group B/C riders.
- Route attractiveness: encompassing factors such as separation from motor traffic, visual aesthetics, and real or perceived threat to personal safety.
- Low conflict: routes should present few conflicts between bicyclists and motor vehicle operators.
- Cost: a measure that includes both the financial cost to establish and maintain the network.
- Ease of implementation: defined as the ease or difficulty of implementing the proposed changes based on factors such as available space and existing traffic operations and patterns.

Third, this document identifies traffic operations and design factors to consider when formulating appropriate design treatments. These factors include:

- Traffic volume: higher motor vehicle presents greater potential risk for bicycles and are less comfortable for group B/C riders unless special design treatments are provided.
- Average motor vehicle operating speed: higher motor vehicle speeds can increase risk and reduce comfort for riders unless mitigated by special design treatments.
- Traffic mix: the regular presence of trucks and buses (approximately 30 per hour or more) can increase risk and reduce comfort for riders. All types of bicycles prefer extra roadway width in this environment. Many bicyclists will choose a different route or not ride at all where there is regular truck and bus traffic unless adequate facilities are provided.
- On-street parking: the presence of on-street parking increases the width needed in the adjacent travel lane or bike lane to accommodate bicyclists.
- Sight distance: refers to the distance a bicyclists can see other vehicles clearly.
- Number of intersections: the number and or frequency of intersections should be considered when assessing the use of bike lanes. Moreover, intersections increase the risk of intermodal conflict.

Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations (Federal Highway Administration, 2002)

This study reports on recent research concerning the effect of crosswalks and other street treatments on pedestrian safety, and provides recommendations.

The study results revealed that under no condition was the presence of a marked crosswalk alone at an uncontrolled location associated with a significantly lower pedestrian crash rate

compared to an unmarked crosswalk. Furthermore, on multi-lane roads with traffic volumes greater than 12,000 vehicles per day, having a marked crosswalk was associated with a higher pedestrian crash rate (after controlling for other site factors) compared to an unmarked crossing. Therefore, adding marked crosswalks alone (i.e., with no engineering, enforcement, or education enhancement) is not expected to reduce pedestrian crashes for any of the conditions included in the study. On many roadways, particularly multi-lane and high-speed crossing locations, more substantial
improvements are often needed for safer pedestrian crossings, such as providing raised medians, installing traffic signals (with pedestrian signals) when warranted, implementing speed-reducing measures, and/or other practices. In addition, development patterns that reduce the speed and number of multi-lane roads should be encouraged.

Specific measures are recommended to help pedestrians safely cross streets. These include:

- Providing raised medians (figure 10) or intersection crossing islands on multi-lane roads, which can significantly reduce the pedestrian crash rate and also facilitate street crossing. Also, raised medians may provide aesthetic improvement and may control access to prevent unsafe turns out of driveways. Refuge islands should be at least 4 ft (1.2m) wide (and preferably 6 to 8 ft [1.8 to 2.4 m] wide) and of adequate length to allow for pedestrians to stand and wait for gaps in traffic before crossing the second half of the street. When built, the landscaping should be designed and maintained to provide good visibility between pedestrians and approaching motorists.
- Installing traffic signals (with pedestrian signals), where warranted (see figure 11). On some high-volume or multi-lane roads, traffic and pedestrian signals are needed to better accommodate pedestrian crossings.
- Reducing the effective street crossing distance for pedestrians by narrowing the roads or by providing curb extensions and/or raised pedestrian islands at intersections. Curb extensions at intersections or mid-block locations will shorten the crossing distance for pedestrians.
- Installing traffic-calming measures may be appropriate on certain streets to slow vehicle speeds and/or reduce cut-through traffic.
- Providing adequate nighttime lighting for pedestrians. Adequate nighttime lighting should be provided at marked crosswalks and areas near churches, schools, and community centers with nighttime pedestrian activity.
- Constructing grade-separated crossings or pedestrian-only streets. Grade-separated crossings are very expensive and should only be considered in extreme situations, such as where pedestrian crossings are essential (e.g., school children need to cross a six lane arterial street), street crossing at-grade is not feasible, and no other measures are considered to be appropriate.
- Using various pedestrian warning signs, flashers, and other traffic control devices to supplement marked crosswalks. Pedestrian crossing signs should only be used at locations that are unusually hazardous or at locations where pedestrian crossing activity is not readily apparent.