



# Coal Train Traffic Impact Study

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**Parametrix**  
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# Executive Summary

## STUDY PURPOSE

The purpose of the study is to evaluate the impacts of coal train operations on existing train operations, traffic operations and affected stakeholders in Seattle's North Waterfront and South Downtown (SODO) districts. Findings from this initial transportation study will inform the Seattle City Council, City management, interested stakeholders and the general public of the potential range and magnitude of impacts the coal train proposal could have on travel patterns and existing transportation infrastructure.

## COAL TRAIN OPERATIONS

Coal trains were assumed to be 7,000 feet long in 2015 and are expected to be up to 8,500 feet long in the future. In 2015, 10 total coal train trips (5 round trips) are expected each day, which is approximately one train approximately every 2.4 hours at crossings through Seattle. In 2026, the number of daily trains would increase to 18 total daily trips (9 round trips), which is approximately one train every 1.3 hours.

## AFFECTED AREA

The North Waterfront study area included evaluation of four at-grade crossings: Broad Street, Clay Street, Vine Street, and Wall Street. The SODO study area included evaluation of four at-grade crossings: South Holgate Street, South Lander Street, South Horton Street and South Spokane Street.

- Port of Seattle
- Cruise Ships
- Olympic Sculpture Park
- Victoria Clipper
- Waterfront businesses
- Freight Community
- Area Residents
- Edgewater Hotel
- Marriott Waterfront Hotel
- SODO businesses
- Industries
- Stadiums
- Washington State Ferries

## EFFECTS OF INCREASED RAIL OPERATIONS

- **Crossing Delays/Gate Down Time** - Daily gate down times at railroad crossing would increase with coal train operations. The increase is dependent on the length of train, how fast it is travelling, and how many daily trains are scheduled.
  - In 2015, the estimated additional daily gate down time for coal trains could be 31 to 83 minutes. This could represent an increase in daily gate down time of approximately 18% to 49% at Broad Street and 15% to 39% at both Holgate and Lander Street.
  - In 2026, the estimated additional daily gate down time for coal trains could be approximately 67 to 183 minutes. This could represent an increase in daily gate down of approximately 39% to 108% at Broad Street and 31% to 86% at Holgate and Lander Streets.
- **Vehicle Queues at Railroad Crossings** - Overall vehicle queue lengths at railroad crossings vary depending on when trains, including coal trains, arrive in relation to other trains. Freight trains longer than the coal trains already operate today. The maximum number of vehicles queuing from a single train would not increase provided coal trains are operating at 20 mph or greater. Coal trains added to the current demand would increase the number and frequency of vehicles waiting in a queue. Depending on the time between gate closures, vehicle queues may not fully dissipate before the next gate closing. This would result in longer vehicle queues for some of the coal train trips.

- **Safety** – In the past 10 years, trains were directly involved in a total of four collisions at Broad Street, Wall Street, and Holgate Street. A total of 127 improper crossings were recorded within a 24-hour period at the Broad Street, South Holgate Street, and South Lander Street crossings involving vehicles, bicycles and/or pedestrians. Improper crossings are when vehicles, bicycles and pedestrians cross the tracks as the red lights start to flash or the railroad gates are down. This type of behavior could increase with more delays and could increase the potential for train collisions with vehicles, pedestrians, or bicyclists, and blocking incidents.
- **Emergency Vehicle Access** – Blockage from the proposed coal trains would impact emergency vehicle trips to and from the waterfront. Delays not only affect local area responses, but also affect the ability to send more resources from one area of the city to another area. Blocked train crossings affect response time for fire responses, technical rescue groups, hazardous materials responses, and emergency medical responses where rapid response times are especially important.

## POTENTIAL CROSSING IMPROVEMENTS

Grade separation of Broad Street and South Lander Street, and the closure of South Holgate Street have been evaluated in past studies and could be considered if freight and passenger rail activity reaches a threshold warranting such a commitment of capital funds. While the addition of coal trains alone in the near future does not appear to increase traffic delays to a level warranting such large-scale investments, a number of smaller scale improvements at specific crossing locations could be implemented to improve safety and accessibility at and around crossing locations.

# Overview

## PROJECT BACKGROUND

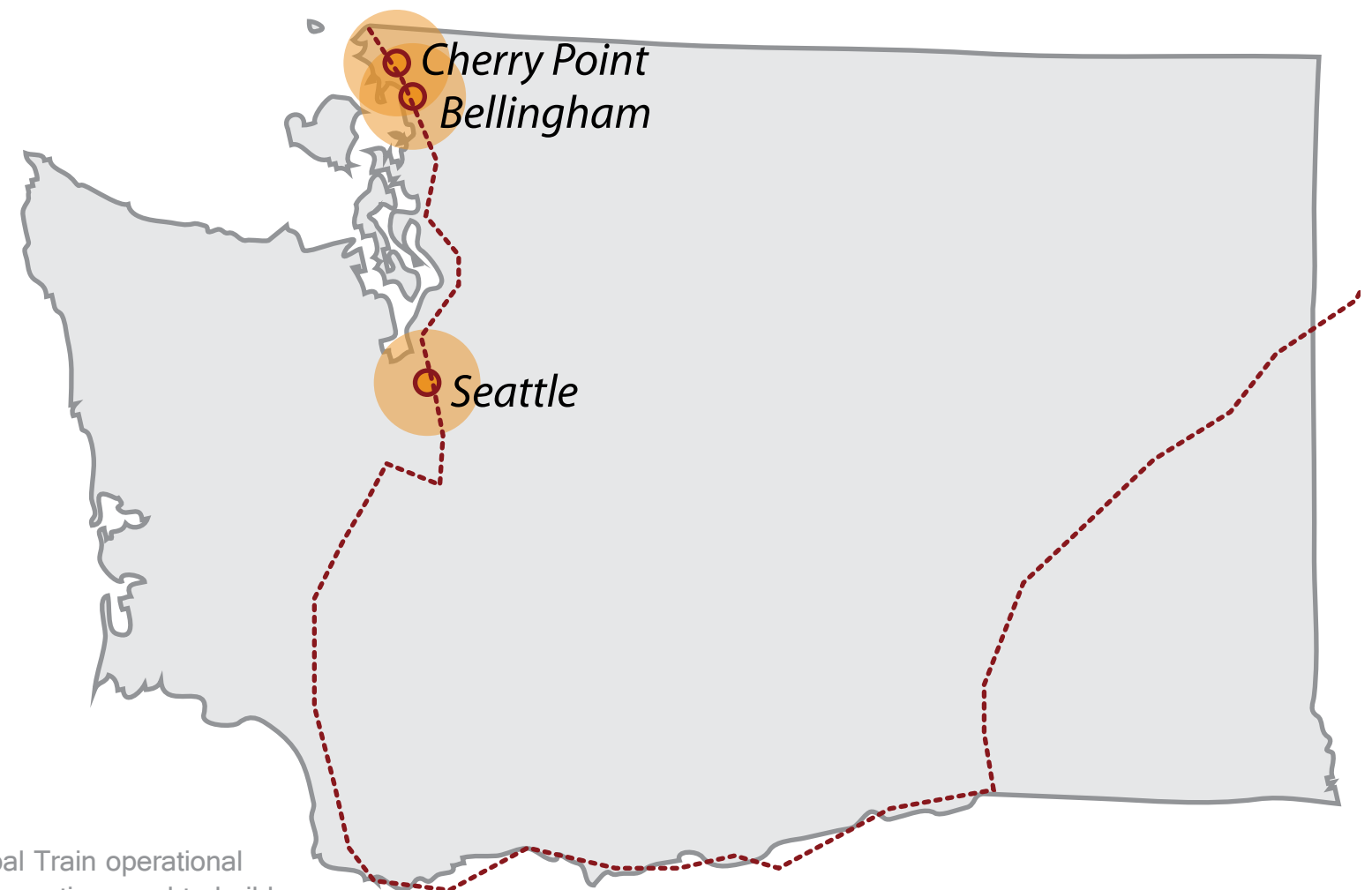
Pacific International Terminals, a subsidiary of SSA Marine, is proposing to develop the Gateway Pacific Terminal at Cherry Point, Washington. This terminal, located north of Bellingham, would be capable of exporting 48 to 54 million dry metric tons of coal per year. The likely route of the coal delivery trains would be from Wyoming/Montana, through Spokane, along the Columbia River and north through Seattle to Cherry Point.

Full build out of the coal export facility is scheduled for 2026, this would result in up to 9 fully-loaded northbound train trips per day (or 18 total trips) along the Burlington Northern Santa Fe mainline (*Project Information Document*, 2011). Each train would be approximately 7,000 feet in length. In 2015 there would be approximately 10 total coal train trips. Coal train arrivals through Seattle were assumed to be evenly spaced throughout a 24-hour period, resulting in approximately one train every 2.4 hours in 2015 and one train every 1.3 hours in 2026.

## STUDY PURPOSE

The purpose of this study is to evaluate the impacts of coal train operations on existing train operations, traffic operations and affected stakeholders in Seattle's North Waterfront and South Downtown (SODO) districts. Findings from this initial transportation study will inform the Seattle City Council, City management, interested stakeholders and the general public of the potential range and magnitude of impacts the coal train proposal could have on travel patterns and existing transportation infrastructure. An expanded transportation impact analysis may be conducted as part of a more detailed project review to comply with the State Environmental Policy Act (SEPA).

Figure 1. Project Vicinity Map



Coal Train operational information used to build the analysis assumptions for this report can be found in the Project Information Document (February 28, 2011), which can be found at: [www.coaltrainfacts.org/pid](http://www.coaltrainfacts.org/pid)

# Affected Area

The federal inventory of railroad crossings identifies nearly 200 rail and spur crossings within the Seattle city limits. Of these, nine at-grade railroad crossings are affected by through-haul trains in the North Waterfront and South Downtown (SODO) districts in Seattle.

## NORTH WATERFRONT

Seattle's north waterfront district is located at the north end of downtown along the Elliott Bay shoreline. There are four at-grade crossings in this location, which are also Quiet Zones (see Figure 2):

- Broad Street
- Clay Street
- Vine Street
- Wall Street

### Stakeholders

- Port of Seattle
- Cruise ships
- Olympic Sculpture Park
- Victoria Clipper
- Waterfront businesses
- Freight Community
- Area residents
- Edgewater Hotel
- Marriott Waterfront Hotel
- Washington State Ferries

Figure 2. North Waterfront District



## AFFECTED AREA

### SODO

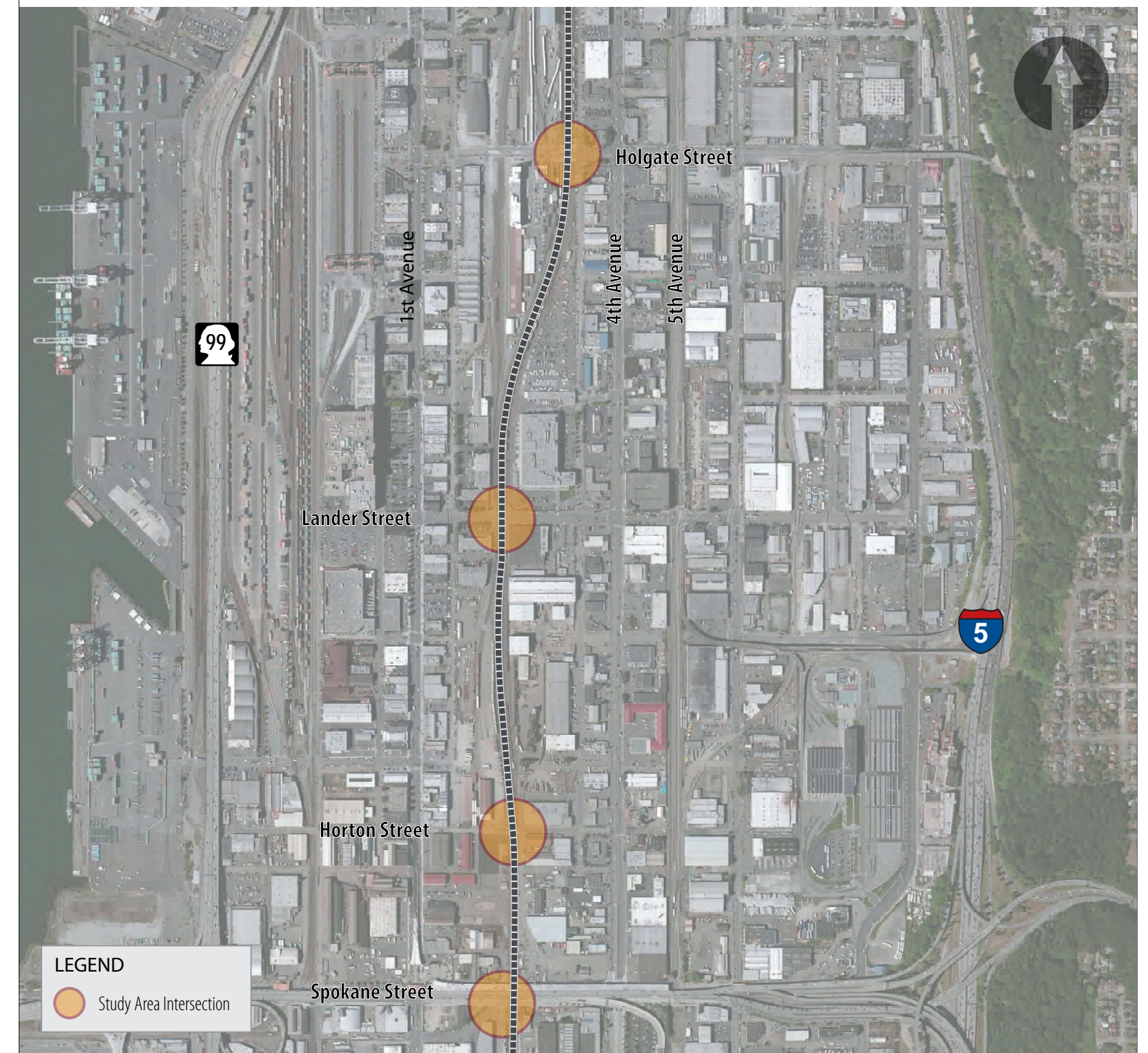
Seattle's South Downtown district, commonly referred to as SODO, is primarily an industrial, warehousing, and sports entertainment area with other supporting commercial and residential land uses. The main line track has five at-grade crossing locations, which include (also see Figure 3):

- S. Holgate Street
- S. Lander Street
- S. Horton Street
- S. Spokane Street – westbound and eastbound

### Stakeholders

- SODO businesses
- Industries
- Stadiums
- Port of Seattle facilities
- Washington State Ferries

Figure 3. SODO District



# Stakeholders

A number of stakeholders in the North Waterfront and SODO areas rely on access to and from these areas for their operations. Many of these stakeholders' operations would be affected by increased rail crossing delays.

## NORTH WATERFRONT

### Bell Street Pier Cruise Terminal

The Bell Street Pier Cruise Terminal, operated by the Port of Seattle, is located west of Wall Street along Seattle's north waterfront. This cruise terminal serves as homeport to Celebrity Cruises and Norwegian Cruise Line, which depart from Pier 66 on Fridays, Saturdays, and Sundays. The 1,700-space Bell Street Pier parking lot is located across Alaskan Way and offers shuttle service to and from the terminal. Cruise operations from this terminal continue to grow and are expected to result in increased vehicular and pedestrian traffic to and from the waterfront. Surges in vehicle trips generated by passenger drop-off and tourist activity around the terminal are affected by rail crossing delays in the north waterfront area.

### Victoria Clipper

Located on Alaskan Way between Clay Street and Vine Street, the Victoria Clipper provides passenger-only ferry services with year-round daily departures between Seattle and Victoria, B.C., and seasonal daily departures between Seattle and the San Juan Islands. Similar to the cruise terminal, surges in vehicle trips generated by passenger drop-off activity, shuttle trips to and from the Bell Street Pier parking lot, and tourist activity around the terminal are affected by rail crossing delays in the north waterfront area.

### Seattle Waterfront Businesses and Tenants

The Art Institute, Marriott Hotel, Edgewater Hotel, Bell Harbor Conference Center, Seattle Aquarium, World Trade Center, Argosy University, and numerous other businesses along the Seattle waterfront and in the Belltown neighborhood represent a few of the tenants in north waterfront area that would be affected by additional traffic delays at rail crossings.

### Seattle Waterfront Parks

The Seattle Art Museum's Olympic Sculpture Park, City of Seattle's Myrtle Edwards Park, and Port of Seattle's Elliott Bay Park are all located north of Broad Street along the Seattle waterfront. Entry to the Olympic Sculpture Park parking garage is provided on the north side of Broad Street between Western Avenue and Elliott Avenue. For bicycles and pedestrians, the Elliott Bay Trail provides a connection along the Seattle waterfront from Alaskan Way to these parks. Vehicle, bicycle, and pedestrian trips to and around these parks are frequently affected by rail crossing delays in the north waterfront area, particularly during summer months when a number of events are hosted at the Olympic Sculpture Park.

## SODO

### Freight/Manufacturing Community

Broad Street, Alaskan Way, South Holgate Street, and South Spokane Street are all designated by the City of Seattle as Major Truck Streets, and are frequently used for moving freight through the Seattle waterfront area and SODO District. In the north waterfront area, the ability to move freight from the Ballard/Interbay/Northend Manufacturing Industrial Center to the SR 99 corridor is critical. Maintaining accessibility via Elliott Avenue and Western Avenue is important to the freight community. Therefore, the effects of traffic queues from increased crossing delays would create additional delays for freight movement. Broad Street and Alaskan Way also serve as the designated haul route for oversized, over-legal trucks.

In the SODO district, South Holgate Street and South Spokane Street are important east-west routes for truck traffic to and from the Port of Seattle. The new Atlantic Street overpass will continue to facilitate east-west travel in the SODO district. However, the lack of reliable east-west access routes is and will continue to be a concern. A secondary effect of additional crossing delays is that port facilities rely on a steady influx of freight vehicles to avoid queues forming at the container terminal gates. Spokane Street is a key route for freight movement between the Port of Seattle terminals and I-5.

### SODO Stadiums

Safeco Field and CenturyLink Field are both located north of South Holgate Street. Currently, vehicles and pedestrians accessing these stadiums to and from the south experience long delays during train crossings, particularly during major sporting events that occur during peak travel periods. Increasing the frequency and duration of crossing gate closures in this area would also increase the likelihood of major crossing delays during these major sporting events.

### SODO District Businesses and Tenants

Seattle Public Schools, Starbucks, Home Depot, and Sears represent a few of the tenants in the SODO District that would be affected by additional traffic delays at rail crossings.

## OTHER POTENTIAL STAKEHOLDERS

### Washington State Ferries

Washington State Ferries (WSF) provides a combined vehicle and passenger service to Bainbridge Island and Bremerton at Colman Dock, located near Alaskan Way and Yesler Way. Service is provided approximately every 50 minutes during weekdays and weekends to Bainbridge Island and approximately 70 minutes to Bremerton. Although Colman Dock is located north of the SODO district, vehicles accessing the ferry terminal via neighborhoods to the south (such as West Seattle, Beacon Hill, and Georgetown) may encounter increased travel delays due to train crossings.

### West Seattle Residents

For West Seattle residents, surface arterials such as Alaskan Way South, 1st Avenue South, and 4th Avenue South provide key routes for trips to and from the SODO district and the Seattle Central Business District. Travel along these routes would be affected by additional traffic delays at rail crossings.

# Planned Infrastructure and Service Improvements

Several transportation projects and plans will have an effect on traffic flow near and around the study area. These projects include the following:

## **Spokane Street Viaduct Widening Project**

This project creates a new two-lane eastbound off-ramp from the Spokane Street Viaduct to 4th Avenue South, relocates the westbound on- and off- ramps to a new 1st Avenue South ramp, widens the upper roadway between 6th Avenue and East Marginal Way, and rebuilds the lower roadway with new curbs, sidewalks and improved pedestrian and bicycle access. This project is anticipated to be completed in 2012. Improvements will reduce congestion on the Viaduct and improve overall access, but is likely to attract additional traffic volumes to the SODO area.

## **Alaskan Way Viaduct**

The project includes the SR 99 South Holgate Street to South King Street Project (anticipated to open in 2013) and the SR 99 Tunnel Project (anticipated opening in 2015). Improvements to SR 99, city streets and transit will provide capacity in the transportation system for today and the future and improve access and mobility to and through downtown Seattle. The bored tunnel under the Central Waterfront will not include direct access to the Seattle Downtown; therefore, there will be a greater reliance upon surface arterials such as Alaskan Way S, 1st Avenue S, and 4th Avenue S.

## **Souder Commuter Rail**

Sound Transit will increase the capacity of the Tacoma-Seattle service by adding trains and expanding train lengths. Four round trips will be added (in addition to the 9 round trips today) and the number of passenger cars per train will be increased from seven to eight.

## **WSDOT Amtrak Cascades**

Amtrak Cascades currently runs four round trips between Seattle and Portland, two of which serve Eugene. To the north, Amtrak Cascades runs three round trips between Seattle and Bellingham, with one route extending to Vancouver, B.C. Amtrak has goals to increase service by 2023 to provide 13 round trips between Seattle and Portland, and 4 round trips between Seattle and Vancouver B.C.

## **Lake to Bay Loop**

Originally referred to as the Potlatch Trail, this pedestrian and bicycle route between Lake Union and Elliott Bay creates a connection to some of Seattle's civic treasures – Lake Union Park, Seattle Center, the Olympic Sculpture Park and Myrtle Edwards Park.

## **Port of Seattle Century Agenda**

The Port of Seattle is creating a "Century Agenda" vision and strategic plan that focuses on the port's next 25 years of business and operations. The goal of the Century Agenda is to add 100,000 jobs through economic growth led by the Port of Seattle, for a total of 300,000 port-related jobs in the region, while reducing its environmental footprint. To help achieve this, the Port will position the Puget Sound region as a premier international logistics hub by growing the seaport annual container volume, optimizing infrastructure investments and financial returns, and tripling the value of outbound cargo. With this anticipated growth, freight movement on the BNSF main line would be expected to increase, as would east-west truck movements to and from container terminals in the SODO district.



# Existing Rail Operations

The coal trains would be scheduled on the Burlington Northern Santa Fe (BNSF) main line and compete for track space with other freight and passenger rail service. This section summarizes known freight and commuter service on the BNSF main line. Other rail lines and tracks located adjacent to the BNSF main line are also briefly described.

## FREIGHT RAIL

Currently, approximately 30 freight train movements occur each day at the North Waterfront crossings and 65 to 85 freight train movements occur at the SODO main line crossings. These trains include long-haul trains that are 8,300-foot in length (about 150 train cars) to shorter movements. Train volumes and schedules vary from day to day, depending on shipment arrivals and daily railroad operations. Because shipment arrivals occur most frequently between Wednesday and Saturday, freight train activity is typically heaviest between Thursday and Saturday. On a given weekday, freight train traffic is typically heaviest in the midday hours (between 9 AM and 3 PM), and in the evening and nighttime during which many of the longer freight trains run.

## PASSENGER RAIL

### Souder Commuter Rail

Sound Transit Souder commuter rail provides service along the BNSF main line between Seattle's King Street Station and areas to the north and south. There are a total of 4 Souder commuter rail trains operating to the north between King Street Station and Everett and 9 trains operating south to Tacoma. These trains operate in the AM and PM peak periods (approximately 6 AM to 9 AM and 4 PM to 7 PM)

### Amtrak

Amtrak operates passenger rail service through Seattle with a stop at King Street Station. Amtrak operates 14 trains daily on the BNSF main line through Seattle.

## ADDITIONAL RAIL LINES

### Sound Transit Link Light Rail

Sound Transit provides Link light rail service through downtown Seattle via the downtown transit tunnel. In the SODO district, light rail trains operate alongside the 5th Avenue South/SODO Busway, where they cross Royal Brougham Way South, South Holgate Street and South Lander Street. Light rail trains operate between 5 am and 12 am on weekdays, with 7.5 minute headways during peak periods and 10-15 minute headways during off-peak periods.

### BNSF Seattle International Gateway (SIG) Yard and Spur Tracks

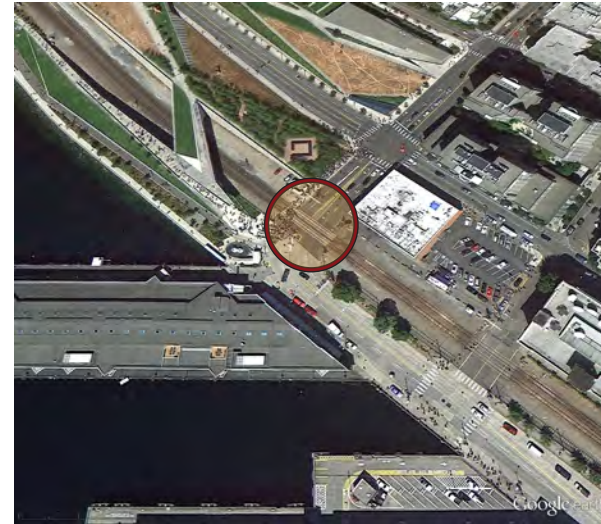
In the SODO district, BNSF also operates rail tracks east of East Marginal Way South that serve its Seattle International Gateway (SIG) intermodal terminal and its adjacent Stacy classification and storage yard.

A number of spur tracks branch off of the BNSF mainline between I-5 and Fourth Avenue.

# Study Area Railroad Crossing Information

## NORTH WATERFRONT

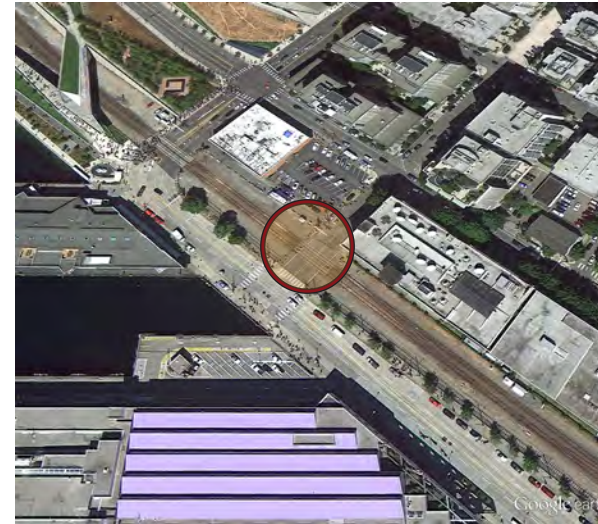
### Broad Street



Total Existing Trains	55
Total Switching	0
Day Thru	28
Speed Range	mph 1-30
Maximum Timetable Speed	mph 30
Type/Number of Tracks	Main 2 Other 1
Number of Traffic Lanes	4
Nearby intersecting arterial street	feet <75
Percent Trucks	7
Average Daily Traffic	8,900
Arterial Classification	Principal
Major Truck Street	Yes



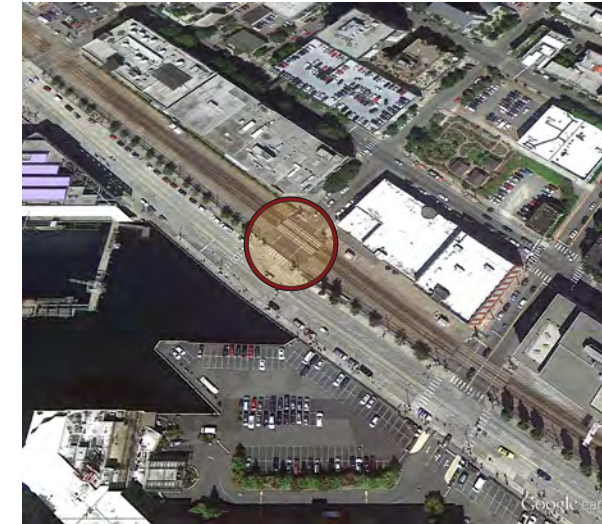
### Clay Street



Total Existing Trains	55
Total Switching	0
Day Thru	28
Speed Range	mph 1-30
Maximum Timetable Speed	mph 30
Type/Number of Tracks	Main 2 Other 1
Number of Traffic Lanes	4
Nearby intersecting arterial street	feet <75
Percent Trucks	1
Average Daily Traffic	1,350
Arterial Classification	Access Street
Major Truck Street	No



### Vine Street



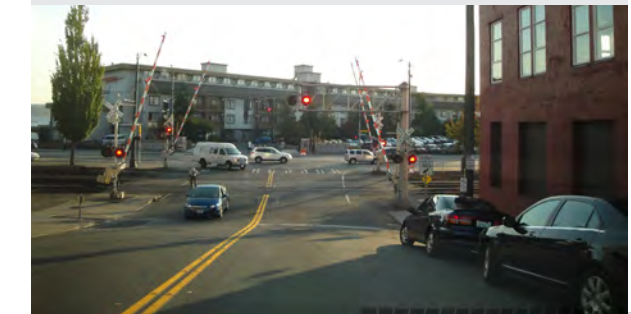
Total Existing Trains	55
Total Switching	0
Day Thru	28
Speed Range	mph 1-30
Maximum Timetable Speed	mph 50
Type/Number of Tracks	Main 2 Other 1
Number of Traffic Lanes	2
Nearby intersecting arterial street	feet <75
Percent Trucks	2
Average Daily Traffic	840
Arterial Classification	Access Street
Major Truck Street	No



### Wall Street



Total Existing Trains	55
Total Switching	0
Day Thru	28
Speed Range	mph 1-30
Maximum Timetable Speed	mph 50
Type/Number of Tracks	Main 2 Other 0
Number of Traffic Lanes	2
Nearby intersecting arterial street	feet <75
Percent Trucks	2
Average Daily Traffic	3,680
Arterial Classification	Minor
Major Truck Street	No



Source: United States Department of Transportation Crossing Inventory

# SODO

## Holgate Street



Total Existing Trains		67
Total Switching		0
Day Thru		34
Speed Range	mph	1-50
Maximum Timetable Speed	mph	50
Type/Number of Tracks	Main	2
	Other	4
Number of Traffic Lanes		4
Nearby intersecting arterial street	feet	<75
Percent Trucks		9
Average Daily Traffic		10,490
Arterial Classification		Minor
Major Truck Street Classification		Yes



## Lander Street



Total Existing Trains		67
Total Switching		0
Day Thru		34
Speed Range	mph	1-50
Maximum Timetable Speed	mph	50
Type/Number of Tracks	Main	2
	Other	2
Number of Traffic Lanes		5
Nearby intersecting arterial street	feet	N/A
Percent Trucks		15
Average Daily Traffic		14,080
Arterial Classification		Minor
Major Truck Street Classification		No



## Horton Street



Total Existing Trains		67
Total Switching		0
Day Thru		34
Speed Range	mph	1-50
Maximum Timetable Speed	mph	50
Type/Number of Tracks	Main	2
	Other	2
Number of Traffic Lanes		2
Nearby intersecting arterial street	feet	N/A
Percent Trucks		6
Average Daily Traffic		3,440
Arterial Classification		Planned
Major Truck Street Classification		No



## Spokane Street



Total Existing Trains		67
Total Switching		0
Day Thru		34
Speed Range	mph	1-50
Maximum Timetable Speed	mph	50
Type/Number of Tracks	Main	2
	Other	1
Number of Traffic Lanes		2
Nearby intersecting arterial street	feet	<75
Percent Trucks		12
Average Daily Traffic		14,600
Arterial Classification		Minor
Major Truck Street Classification		Yes



# Daily Vehicle Volumes at Railroad Crossings

## NORTH WATERFRONT

Daily vehicle volumes in the study area have an AM and PM Peak, with the PM Peak having almost double the traffic compared to the AM Peak. The peak periods for daily vehicle traffic at the north waterfront area crossing locations are approximately from 6 AM to 9 AM and 4 PM to 7 PM.

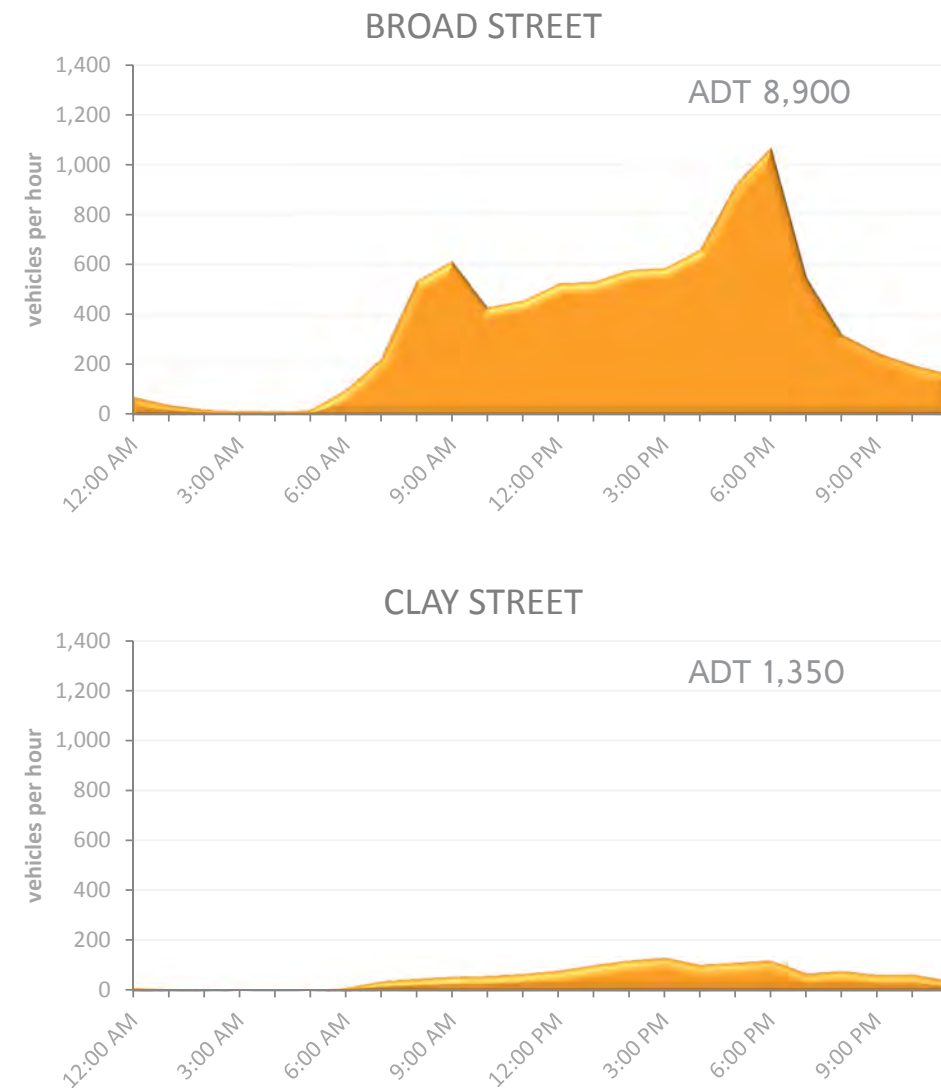
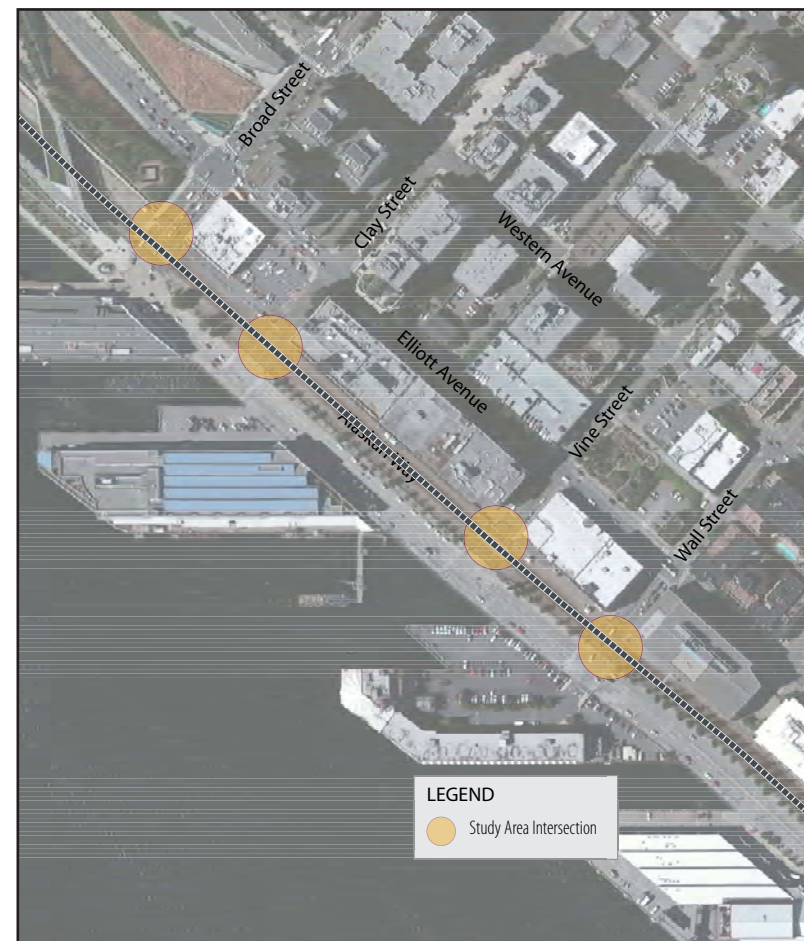
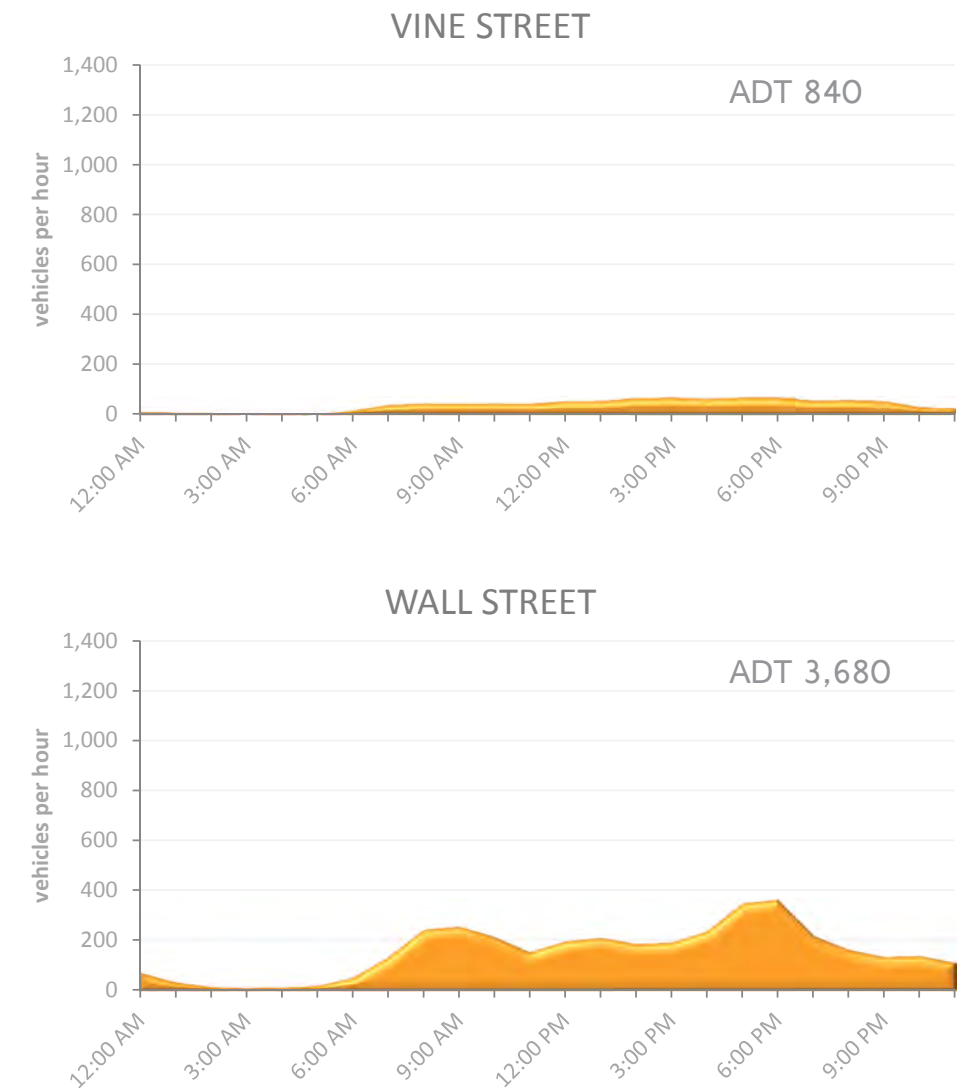


Figure 4. North Waterfront Daily Vehicle Volumes



Traffic counts collected between 2004 and October 2012 were used in this analysis.



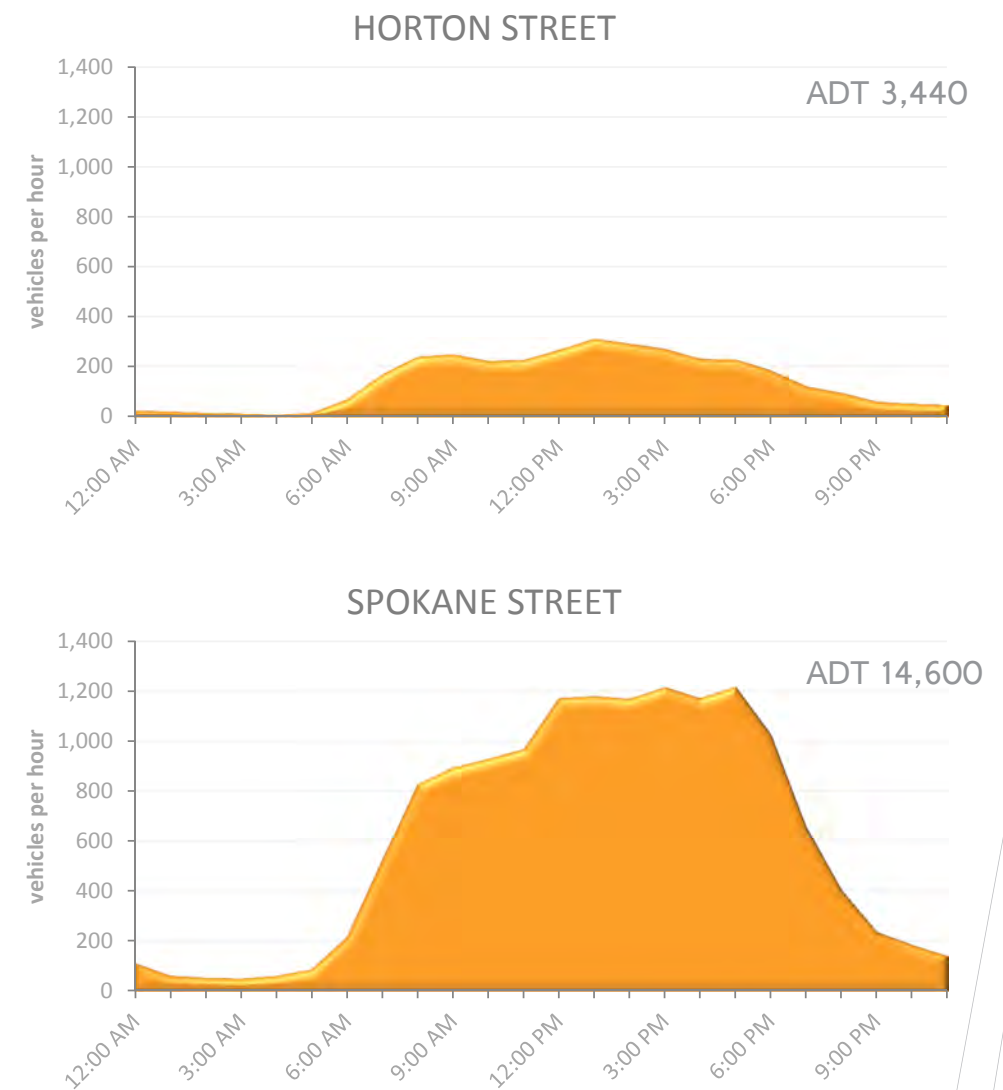
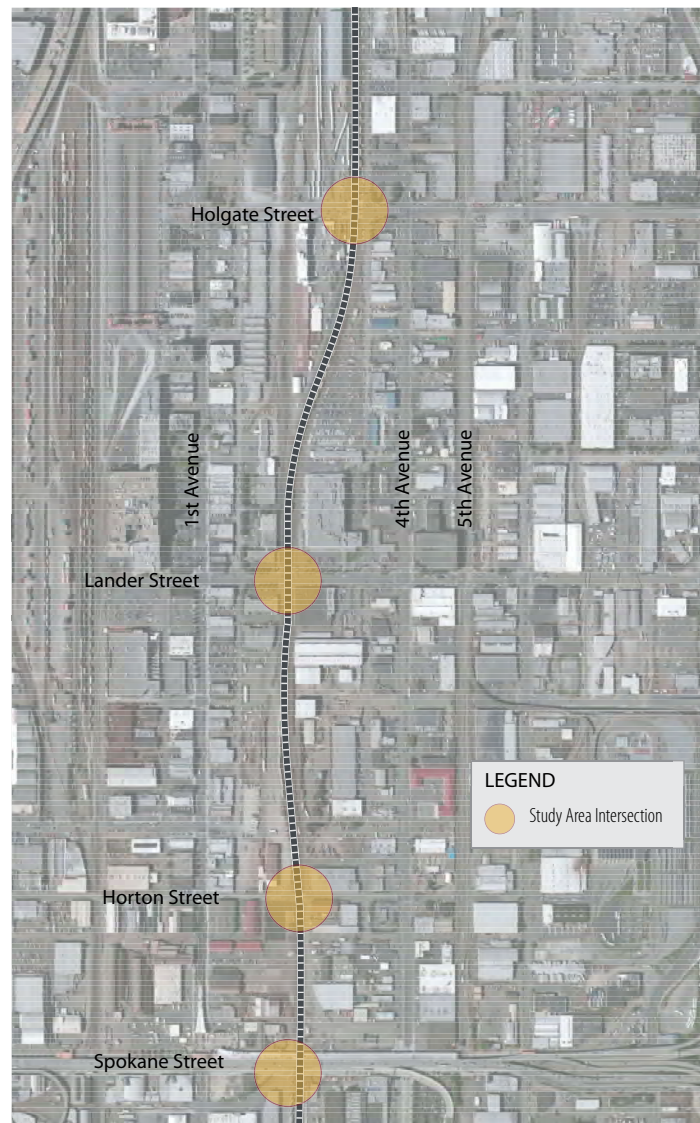
Vehicle counts collected: Broad Street (January 2009), Clay Street (September 2012), Vine Street (June 2008), Wall Street (April 2009)

## DAILY VEHICLE VOLUMES AT RAILROAD CROSSINGS

### SODO

Daily vehicle volumes in the south downtown study area generally increase steadily throughout the day. The peak periods are approximately from 7 AM to 9 AM and 3 PM to 6 PM, although midday traffic volumes are greater than the AM Peak Period.

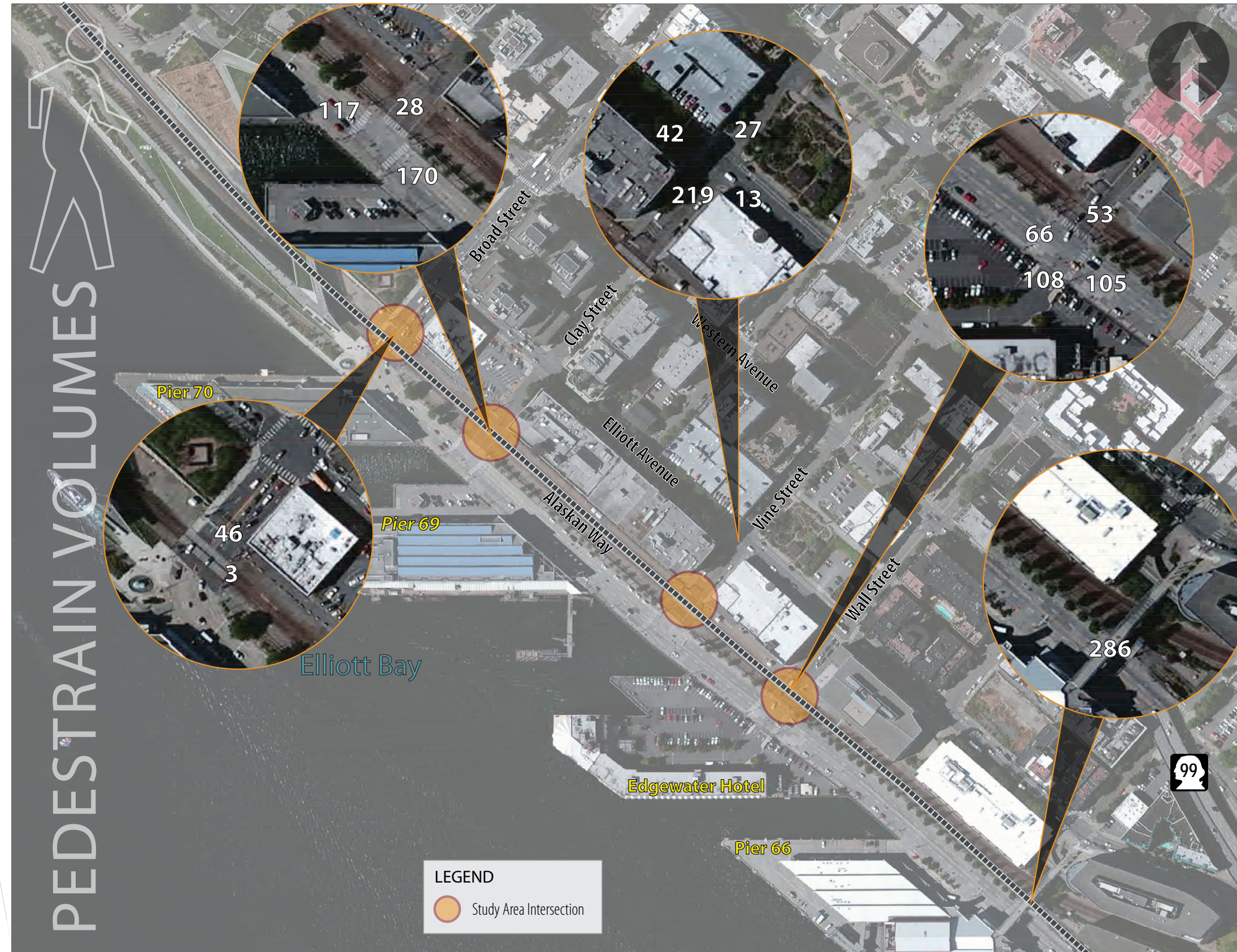
Figure 5. South Downtown Daily Vehicle Volumes



Vehicle counts collected: Holgate Street (October 2009), Lander Street (December 2008), Horton Street (July 2006), Spokane Street (March 2004 and October 2006)

# Pedestrian Volumes at Railroad Crossings

Figure 6. North Waterfront Pedestrian Volumes (PM Peak Hour)



Pedestrian counts collected: Clay Street and Bell Street (June 2006), Wall Street (October 2009), Vine Street (August 2010), and Broad Street (January 2011)

## NORTH WATERFRONT

The adjacent image (Figure 6) summarizes pedestrian volumes observed at study area intersections in the North Waterfront Area during the PM Peak Hour.

Pedestrian volumes can be higher in the North Waterfront area with cruise ship activities, which have higher pedestrian volumes in the early weekday mornings and weekends. Generally, people walk from the cruise ship terminals to businesses in Seattle, such as the Pike Place Market or from parking garages.

Grade separated pedestrian connections over the railroad are limited. North of Broad Street, pedestrians can use the Olympic Sculpture Park bridge to travel between Alaskan Way and Elliott Avenue. This facility is ADA accessible, but requires additional out of direction travel compared to taking the stairs. Near Terminal 66, a pedestrian bridge connects to Wall Street over the railroad tracks. ADA access is located on the east side of Alaskan Way.

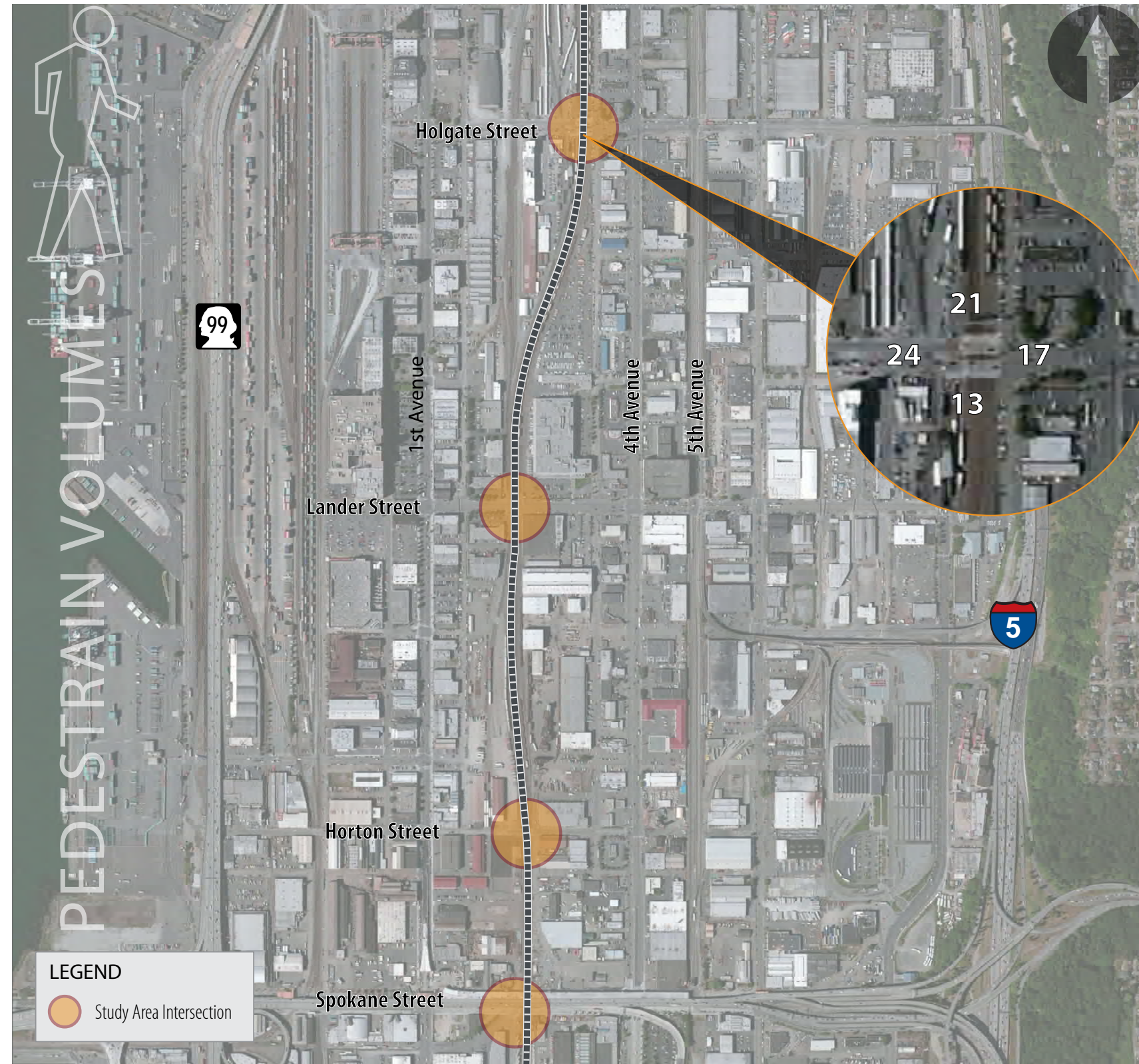
## PEDESTRIAN VOLUMES AT RAILROAD CROSSINGS

### SODO

The adjacent image (Figure 7) summarizes pedestrian volumes observed at study area intersections in the SODO area. Pedestrian volumes at the other railroad crossing locations would be similar or lower compared to Holgate Street.

All study area crossings for pedestrians are at-grade. The nearest pedestrian grade separated crossing is north of Holgate Street at Edgar Martinez Drive. Pedestrians can access this crossing from Occidental Avenue, 1st Avenue, and 4th Avenue.

Figure 7. South Downtown Pedestrian Volumes (PM Peak Hour)



Pedestrian counts collected: Holgate Street (February 2008)

# Railroad Track Schedule

## RAILROAD SCHEDULE

The illustration below (Figure 8) summarizes observed gate down times and potential coal train gate down times for Broad Street, Holgate Street, and Lander Street.

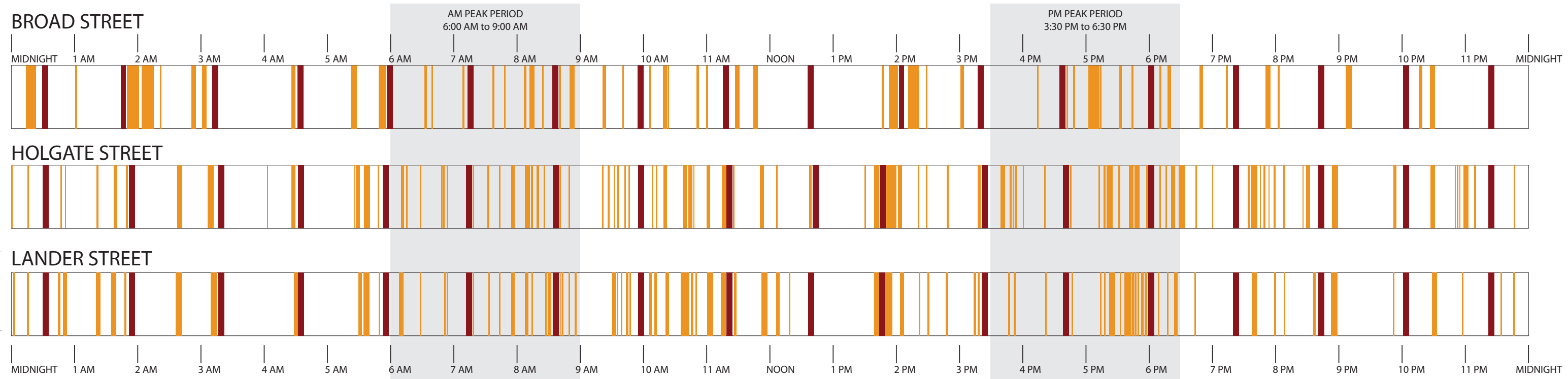
Observed gate down times were recorded in September 2012 for one day at the Broad Street, Holgate Street, and Lander Street railroad crossings. As summarized in Figures 8 and 9, the number of train crossing events was almost twice as many in the SODO district (Holgate Street and Lander Street) compared to the North Waterfront district (Broad Street).

The coal train gate down time is assumed to be 5.3 minutes in 2026: this time includes assumptions about the number, speed, and length of coal trains, which are described in this section.

Figure 9. Summary of Observed Railroad Crossings

	Broad Street	Holgate Street	Lander Street	
Number of Train Crossing Events	52	107	87	NOTE: Train speed is calculated from the observed number of railroad cars per train, observed gate down time subtracting an assumed gate down time in advance of the train and following the train (approximately 30 seconds), and an assumed railcar length of 60'.
Total Gate Down Time (hours)	2.8	3.6	3.7	
Average Gate Down Time (minutes)	3.3	2.0	2.5	
Minimum/ Maximum Gate Down Time (minutes)	1.1 - 11.6	0.3 - 8.2	0.5 - 8.1	
Average Train Speed (mph)	6.7	7.4	8.1	
Minimum/Maximum Train Speed (mph)	0.3 - 22.7	0.4 - 24.6	0.5 - 22.9	

Figure 8. Existing Gate Down Times and Assumed 2026 Coal Train Schedule



Legend  
█ Observed Gate Down Time  
█ Coal Train Gate Down Time

This illustration represents one day of observed gate down times (September 28, 2012) plus an assumption of 18 total train trips equally distributed throughout the day. The 18 total train trips would occur in 2026. Coal trains were assumed to be 8,500 feet long and operating at 20 mph. In 2015, approximately 10 total train trips would pass through downtown Seattle according to the *Project Information Document, 2011*.



## COAL TRAIN OPERATIONS

The following characteristics were assumed for coal train operation to calculate the range of potential coal train gate down times discussed in the *Gate Down Time* section on the following page.

### Number of Coal Trains per Day

Coal trains were assumed to operate on an evenly distributed time schedule. As illustrated in Figure 8, the coal train would arrive at crossings approximately every 1.3 hours with the 18 total daily trips expected in 2026. In 2015 there would be approximately 10 total coal train trips (one train every 2.4 hours).

### Speed of Coal Trains Through Seattle

Coal trains were assumed to operate at 20 mph. The United State Department of Transportation crossing inventories indicate the maximum timetable speed (train speed at a crossing) is 30 mph through the North Waterfront district and 50 mph through the SODO district.

As summarized in Figures 9 and 10, the estimated speeds of trains through the North Waterfront and SODO districts were less than the maximum timetable speeds. However, observed trains of comparable length to the coal train were estimated to be travelling around 20 mph.

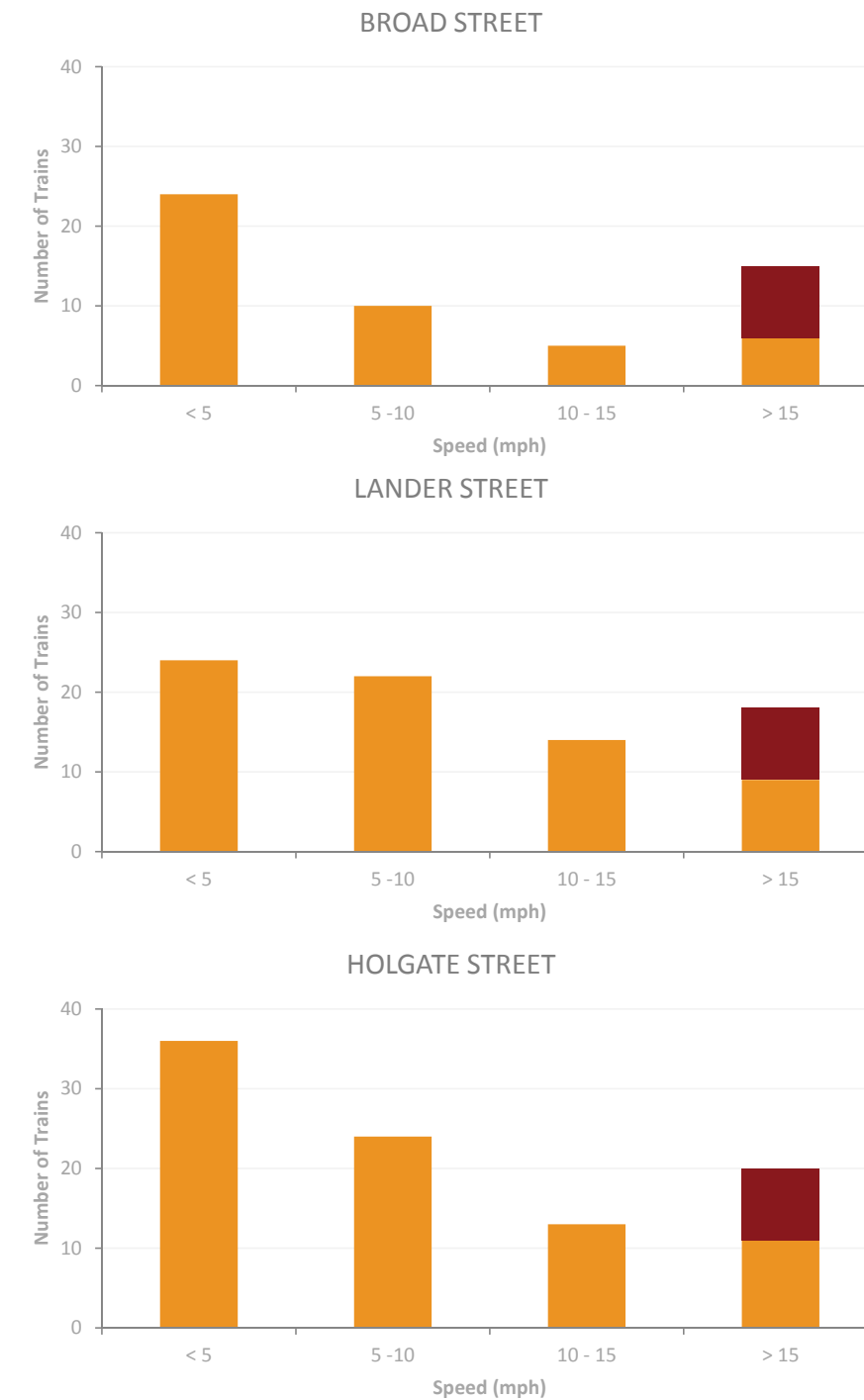
### Length of Coal Trains

Coal trains were assumed to be 7,000 feet long. According to the *Project Information Document* (2011), 7,000-foot long coal trains are expected to be operated initially and longer coal trains up to 8,500 feet long may service the coal terminal in the future.

In 2015, the coal train was assumed to have a gate down time of approximately 4.4 minutes (based on a 7,000-foot long coal train traveling at 20 mph).

In 2026, the coal train was assumed to have a gate down time of approximately 5.3 minutes (based on a 8,500-foot long coal train traveling at 20 mph).

Figure 10. Observed Train Speeds



### A Source for Coal Train Information

Coal Train operational information used to build the analysis assumptions for this report can be found in the Project Information Document (February 28, 2011), which can be found at: [www.coaltrainfacts.org/pid](http://www.coaltrainfacts.org/pid)

The Project Information Document states there would be four operational phases with different number of trains anticipated to arrive at and depart the Terminal daily, based on the assumption of trains up to approximately 7,000 feet long. Starting in 2015, approximately 5 trains would operate daily. By 2017, there would be 6 trains in operation. When the Terminal is developed to its full operating capacity in 2026, there would be up to nine trains per day. Also, the length of the coal train is anticipated to increase from 125 rail cars in 2015 to 150 rail cars in 2021.

# RAILROAD TRACK SCHEDULE (CONTINUED)

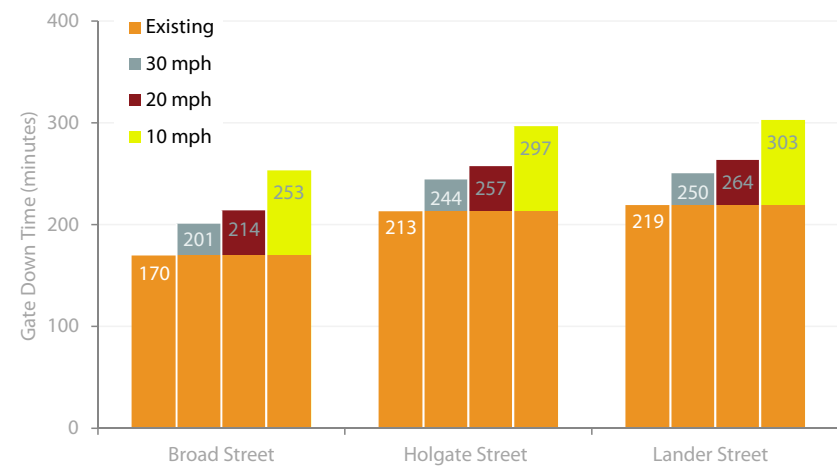
## GATE DOWN TIME

### Daily Gate Down Times

Observed railroad gate down times were less than 3 hours for the North Waterfront district and less than 4 hours for the SODO district. Figure 11 summarizes the total time railroad gates were closed at the Broad Street, Lander Street, and Holgate Street railroad crossings on September 28, 2012. Also, Figure 11 illustrates the assumed increase in daily gate down times for 2015 and 2026 at each crossing: daily gate down times could increase by 31 minutes to 83 minutes in 2015 and by approximately 67 minutes to 183 minutes in 2026.

In 2015, this could represent an increase in daily gate down time of approximately 18% to 49% at Broad Street and 15% to 39% at both Holgate Street and Lander Street. In 2026, this could represent an increase in daily gate down of approximately 39% to 108% at Broad Street and 31% to 86% at both Holgate Street and Lander Street.

Figure 11. Anticipated Daily Gate Down Times in 2015 and 2026

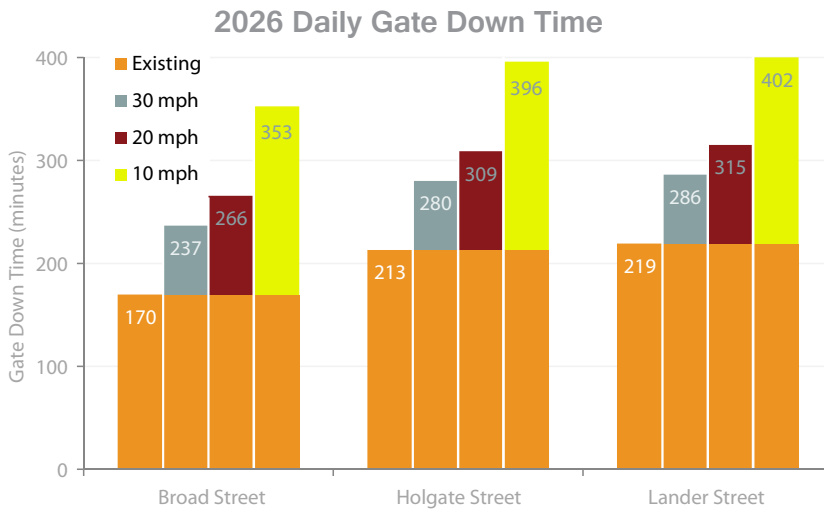
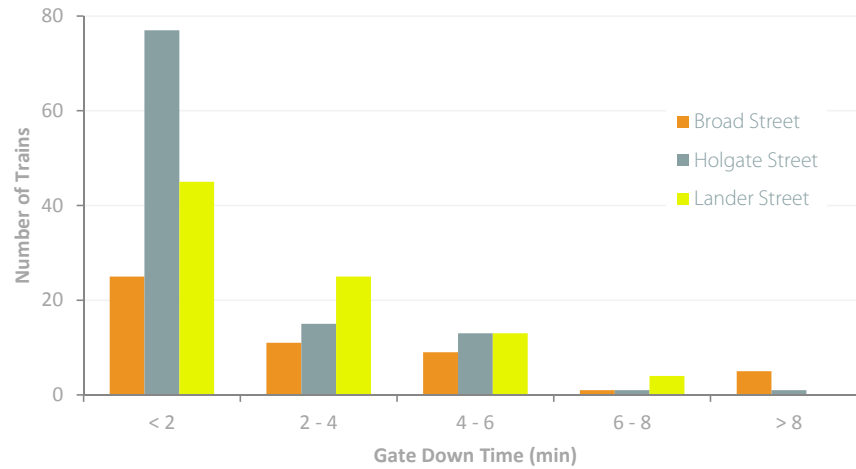


The above figure illustrates the increase in existing gate down time in 2015 with varying coal train operating speeds. It assumes there would be approximately 10 daily coal trains that are 7,000 feet (1.3 miles) long.

### Frequency of Gate Down Times

As summarized in Figure 12, railroad crossing locations in SODO exhibited a greater frequency of shorter length trains at the crossings. This is because of railroad operations which assemble and organize railcars in the area. Also, passenger rail service (Sounder and Amtrak) offers more service from Seattle to the south compared to the north. During the day when traffic volumes are highest, existing freight trains have gate down times that are higher than the assumed year 2015 4.4 minute gate down time for a coal train.

Figure 12. Frequency of Existing Gate Down Times

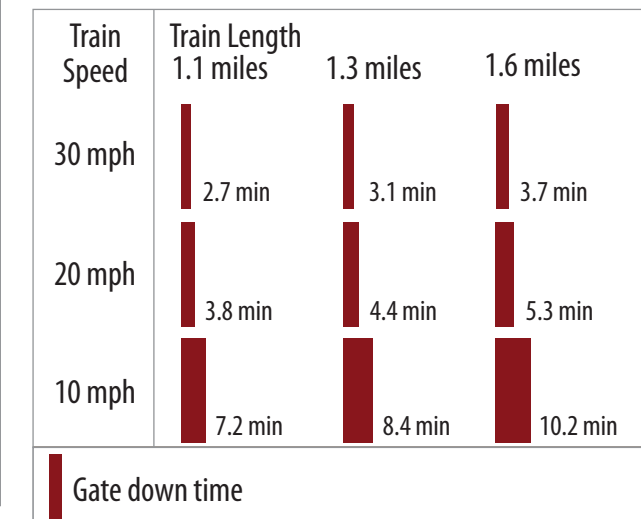


The above figure illustrates the increase in existing gate down time in 2026 with varying coal train operating speeds. It assumes there would be approximately 18 daily coal trains that are 8,500 feet (1.6 miles) long.

## Coal Train Gate Down Time Sensitivity Test

Coal train gate down time is dependent on a train's speed and length. Figure 13 summarizes a sensitivity test demonstrating the variability in coal train gate down times with different train speeds and lengths. Gate down time for a coal train increases slightly (approximately 1 minute) from a 1.1-mile long train to a 2.0-mile long train. However, gate down times for a coal train traveling 10 mph is more than double the same train traveling at 30 mph. These potential coal train gate down times include a total of 30 seconds for railroad gates to lower and raise. The time for gates to raise varies from 20 to 25 seconds.

Figure 13. Potential Train Gate Down Times



# Queues at Railroad Crossings

Overall vehicle queue lengths at railroad crossings vary depending on when trains, including coal trains, arrive in relation to other trains. The coal train is proposed to operate 10 daily trains in 2015 and 18 in 2026. These trains would increase driver and pedestrian delay in the study area because the number of train railroad gate closures would increase throughout the day.

Existing maximum vehicle queues at railroad crossings were calculated for the following crossing locations (the PM Peak Period impact of coal train crossings at Lander Street is also shown):

- Broad Street
- Holgate Street
- Lander Street

## EXISTING VEHICLE QUEUES

The longest vehicle queues caused by railroad crossing events typically occur during the shoulder periods of the evening commute, around 2 PM and then again just before 6 PM. During the night and early-morning hours, between 9 PM and 8 AM, railroad crossing events do not cause substantial congestion because vehicle volumes are typically low (see Figures 13 and 14), but still delay vehicles and pedestrians.

- At the Broad Street crossing, queues on Alaskan Way northbound extend just past Wall Street, and queues on the southwestbound approach would extend up Elliott Avenue to Bay Street and on Broad Street back to 1st Avenue, with 75 to 80 vehicles waiting to cross in each direction.
- The longest queues at the Holgate Street and Lander Street crossings extend back onto 1st Avenue and 4th Avenue, with 55 to 75 vehicles waiting to cross in each direction.

Figure 13. North Waterfront Maximum Train Queue

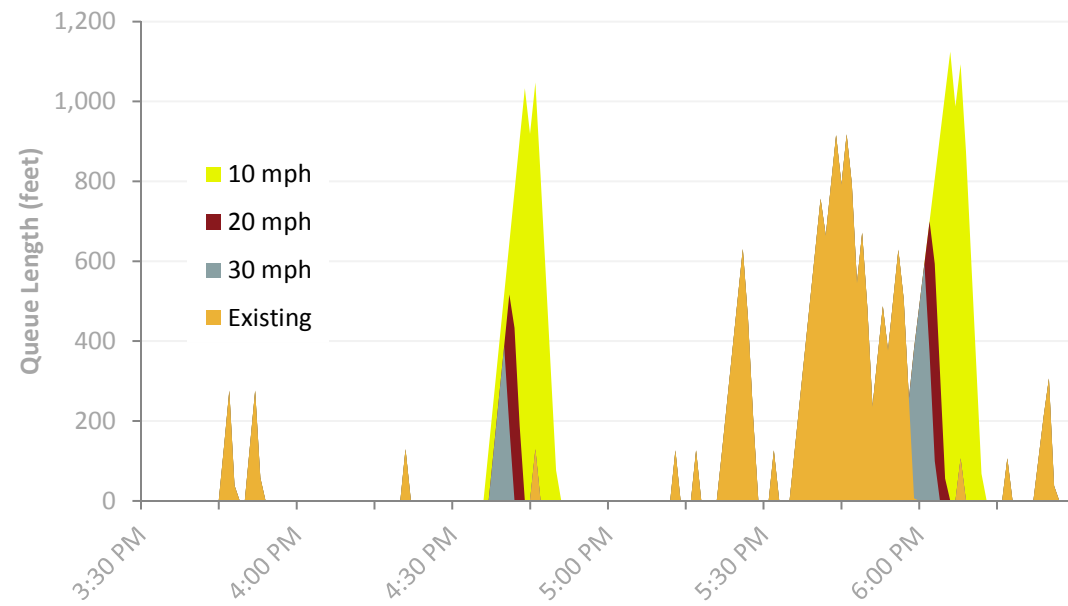


The maximum queue illustrated above is for existing railroad crossing closures in the PM peak period. Gate down times for coal train crossings are not the longest closures. However, vehicle queues would form at these crossing locations and add delay to vehicles traveling on adjacent streets. Vehicle queues were also observed to dissipate before the arrival of the next train, except at Lander Street (see Figure 15).

## QUEUES AT RAILROAD CROSSINGS (CONTINUED)

As illustrated in Figure 15, upward trends indicate when the railroad gate is closed and vehicles are queuing. Downward trends indicate the railroad gates are open and traffic is moving (if present, queues are clearing). As shown, the existing queue before 6:00 PM would not fully dissipate before a coal train arrives. This figure also demonstrates how coal train impact varies greatly depending on its operating speed.

Figure 15. Lander Street Hourly Queues

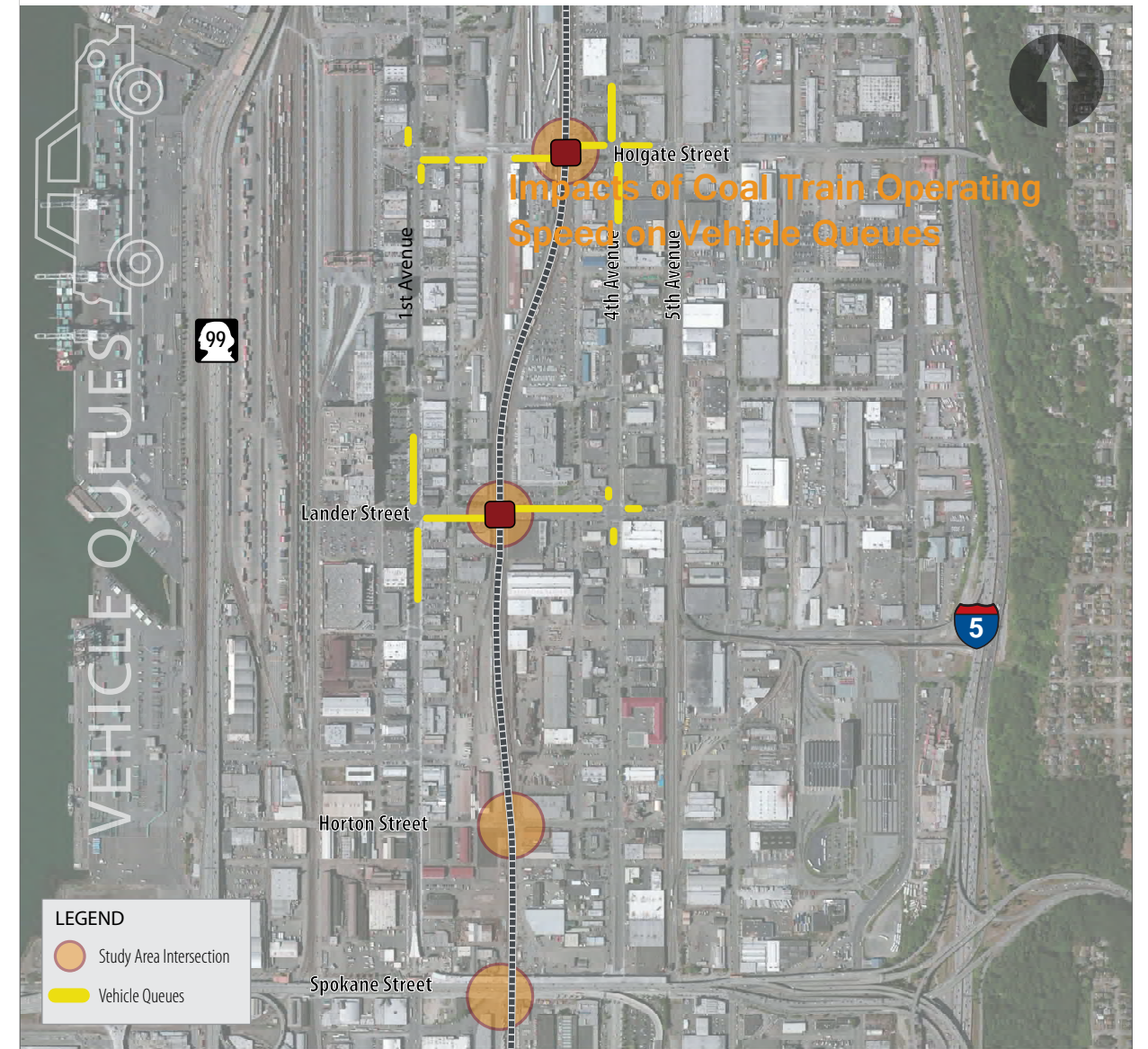


## COAL TRAIN QUEUES

In 2015, a 1.3-mile long coal train traveling at 20 mph passing through Seattle at 6 PM would have approximately 4.4 minutes of gate down time at each study area rail road crossing. The vehicle queues anticipated to form are as follows:

- The Broad Street crossing would have 30 to 40 vehicles waiting to cross in each direction.
- The Holgate crossing would have approximately 25 to 30 vehicles waiting to cross in each direction
- The Lander Street crossing would have approximately 55 vehicles waiting at the eastbound approach and 40 vehicles waiting at the westbound approach.

Figure 14. SODO Maximum Train Queue



# Rail Capacity

The Pacific Northwest Marine Cargo Forecast Update and Rail Capacity Assessment, published by BST Associates and MainLine Management in December 2011 included an assessment of rail capacity between Tacoma and Seattle, and between Seattle and Everett. A summary of rail capacity for these lines is included below.

## SEATTLE-TACOMA

Rail capacity between Tacoma and Seattle is estimated at 140 trains per day. The Point Defiance Bypass project will further improve freight and traffic flows through Tacoma and between Tacoma and Seattle and would increase capacity to up to 160 trains per day. Year 2012 rail crossing inventory reports from the U.S. DOT indicate that approximately 67 trains currently use this rail segment daily. Therefore, rail capacity is sufficient to accommodate the projected additional 18 coal trains per day estimated in 2026, while reserving additional capacity for other freight and commuter services growth along this segment (Source: BST report, 2011).

## SEATTLE-EVERETT

Between Seattle and Everett, approximately 80 trains per day can be accommodated on the existing mainline. Year 2012 U.S. DOT crossing inventory reports show that approximately 55 trains currently use this rail segment on a daily basis. Although the projected 18 additional coal trains per day by 2026 could be accommodated along this segment, limited additional capacity remains for other freight and commuter services growth.

# Collisions

## COLLISION HISTORY

Figure 16 summarizes the collisions that occurred at or near the eight crossing locations evaluated in this study area between January 1, 2002 and September 16, 2012 is summarized in the table below. Of the 116 collisions recorded at the eight crossings. 54 occurred at the north waterfront crossings and 62 at the south crossings. During the 10 year period, one collision resulted in a fatality near the Wall Street crossing. Trains were directly involved in four collisions at the following locations:

- 1 collision at Broad Street
- 2 collisions at Wall Street
- 1 collision at Holgate Street

The collision data obtained did not include information on contributing factors, so the number of collisions that occurred due to a train crossing event is unknown.

### Improper Crossings

The 24-hour video records from September 28, 2012 provided information on the number of improper vehicle, pedestrian and bicycle crossings occurring at the Broad Street, Holgate Street and Lander Street crossings. Improper crossings included people crossing the tracks when rail road crossings become active; i.e. the red lights start to flash in wig-wag pattern or the railroad gates were down (rail road gates were not down during all violations). As shown in Figure 17, a total of 127 improper crossings were observed. This type of behavior could increase with more trains operating in the project area and could increase the potential for train collisions with vehicles, pedestrians, or bicyclists, and blocking incidents.

### Observed Behavior

A 2008 study by the City of Seattle demonstrated that vehicles were violating the warning indications at grade crossings in the study area. Typically these violations involved motorists crossing the tracks as the warning beacons/lights were flashing and even when gates were closing.

Figure 16. 10-Year Collision History Summary

	Total Collisions	Property Damage Only	Injury	Fatality	Other*
<i>North Crossings</i>	54	31	16	1	6
Broad Street	17	9	6	0	2
Clay Street	12	6	4	0	2
Vine Street	2	1	1	0	0
Wall Street	23	15	5	1	2
<i>South Crossings</i>	62	44	10	0	8
Holgate Street	20	14	4	0	2
Lander Street	10	7	2	0	1
Horton Street	8	6	1	0	1
Spokane Street	24	17	3	0	4

\*Includes "Not Enough Damage" and "Non-State Matched" collisions

Figure 17. Summary of Observed Improper Crossings 2012

	Bicycle	Pedestrian	Vehicle	Total
Broad Street	6	1	26	33
Lander Street	0	15	34	49
Holgate Street	0	0	45	45
Total	6	16	105	127

# Emergency Vehicle Access Potential Crossing Improvements

Blockage from the proposed coal trains would impact emergency vehicle trips to/from the waterfront. Fire and Medical Emergency vehicles will be affected, and should there be a fire onboard a ship, fire station 5 is the staging area to load responding fireboats.

Delays caused by the coal train not only affect local area responses, but also affects the ability to send more resources from one area of the city to another area across the SODO district. Blocked train crossings affects response time for not only fire responses, but technical rescue group, hazardous materials responses as well as emergency medical responses where even a few seconds of delay can be dangerous.

More specifically, the Seattle Fire Department identified the following 3 fire stations that are directly impacted by current rail delays in the SODO and North Waterfront districts.

- Station 14 - 3224 4th Avenue South (Under Construction)
- Station 5 - 925 Alaskan Way
- Station 2 - 2320 4th Avenue

The number of train blockages would increase with the addition of coal train movements through the city and would result in longer average response times for emergency vehicles.

The Seattle Fire Department has identified areas where the proposed coal train may affect standard response times:

- North of Wall Street along Alaskan Way up into Myrtle Edwards Park and the Elliott Bay Trail
- Pike Place Market and Post Alley area
- S Holgate St and S Horton St along the 1st Street Corridor
- 1st Avenue south of Spokane Street
- Along the Eastern Docks of the Harbor Island/East Marginal way North and South of Spokane Street

Train delays at crossings can sometimes be eliminated by constructing grade separation, which allows traffic or pedestrians/bikes to pass over or under railroad tracks. While grade separation can be a desirable solution, these improvements are typically very costly and involve substantial amounts of public funding. Grade separation of Broad Street and South Lander Street, and the closure of South Holgate Street have been evaluated in past studies, and could be considered if freight and passenger rail activity reaches a threshold warranting such a commitment of capital funds. These and other key capital improvements to improve freight mobility and access were recommended by the City and Port of Seattle and summarized in the Access Duwamish Report (June 2000). The North Waterfront Access Project (March 2002) and the South Holgate Street Railroad Crossing Study (January 2010) further evaluated the feasibility and potential effectiveness of some of these larger-scale improvements, and also presented lower cost improvements that could be implemented in the short-term to improve mobility and improve safety.

Recommendations from these studies are summarized below and could be considered as options to offset some of the impacts of the additional coal train traffic to the Seattle waterfront and SODO district. However, some of the recommendations should be re-evaluated to determine if they are still valid for present day conditions.

## BROAD STREET AND OTHER QUIET ZONE CROSSINGS

The potential for grade separating Broad Street was considered in SDOT's North Waterfront Access Project, completed in March 2002. Alternatives evaluated through the course of the study included both large scale and small scale actions, taking into account both transportation analysis and urban design.

The results of the study suggested that existing and immediately foreseeable transportation conflicts between waterfront users are not of a magnitude that warrants

bearing the cost and impact of a grade separation solution. The study also recognized that grade separation may become warranted in the future if rail traffic increases significantly. Placing vehicles below-grade in an underpass was the recommended solution to improve accessibility and the street-level environment. The eventual realignment of the mainline into a tunnel was also considered, recognizing that both physical and financial constraints may make this option infeasible.

Other possible improvements were recommended that could be implemented in the short-term and with lower cost included the following:

- Install streetscape improvements, fencing and plantings that define areas where pedestrians are safe, and those areas where pedestrians must be alert.
- Install manually operated pedestrian gates at sidewalks leading to pedestrian/rail crossings.
- Utilize city-owned space east of the tracks for drop-off and short-term parking to serve the North Waterfront and reduce the need for vehicles to cross the tracks.
- Build a pedestrian bridge across Alaskan Way in the block between Broad and Clay Streets.
- Rearrange the street layouts in the block of Alaskan Way/Broad Street/Elliott Avenue/Clay Street to function as a couplet with westbound traffic on Broad, eastbound traffic on Clay, southbound traffic on Alaskan, and two-way traffic on Elliott.
- Provide a bicycle trail on the east side of Alaskan Way so that northbound bicycles can connect safely with the Elliott Bay bicycle trail.
- Coordinate variable message signs with sensors along the tracks to alert vehicles of long trains approaching so that drivers may choose to take alternate routes.

### SOUTH HOLGATE STREET

SDOT completed the South Holgate Street Railroad Crossing Study in January 2010, which evaluated the potential closure of South Holgate Street between Occidental Avenue and 3rd Avenue to increase safety for employees, eliminate collisions, and improve efficiency of maintenance operations. A grade-separated overpass was also considered, but preliminary analysis indicated that this was not a feasible option given its high cost and the lack of sufficient space to achieve required clearances with reasonable grades.

The study report concluded that closing S. Holgate Street would be too disruptive at the present time and through the replacement of the Alaskan Way Viaduct and Seawall. The study also suggested that closure could be considered in the future should conditions change significantly, such as with an increase in the number and duration of gate closures, implementation of Lander Street grade Separation Project, Amtrak's willingness to fund pedestrian/bicycle overpass over S. Holgate Street.

A number of other safety enhancements were recommended as high priority capital improvement projects – to be jointly implemented by the City and railroad operators. These include the following:

- Consolidate crossing gates to prevent vehicle queues between gates.
- Install quad-gates to prevent vehicles from going around gates.
- Complete gaps in the sidewalk system on South Holgate Street between 1st Avenue S and 4th Avenue S.
- Add crossing gates for pedestrians to prevent pedestrians from crossing the railroad tracks when a train is approaching
- Provide raised medians with a pedestrian refuge to facilitate pedestrian crossings along railroad tracks
- Add U-turn routes to allow for drivers to choose alternative routes
- Provide electronic message signs for drivers on area arterials to show when the train gates are down and provide an indication of how long the gates may be closed

### SOUTH LANDER STREET

The South Lander Street Grade Separation was recommended in the Access Duwamish Report published in 2000, and a type, size and location study for the project was initiated in 2003. In January 2007, SDOT staff and a design consultant began the early stages of design, with construction anticipated to begin in 2009. The project was placed on hold as of March 2008 due to funding limitations.

The project, as designed, would grade separate South Lander Street and the BNSF tracks between Occidental Avenue South and Third Avenue South. The proposed typical crossing section includes four vehicle travel lanes (two eastbound and two westbound), a center turn lane, two 5-foot bicycle lanes and two 8-foot sidewalks. The intent of the proposed grade separation is to improve safety and improve mobility in the area.

### OTHER IMPROVEMENT OPTIONS

In 2008, SDOT explored photo enforcement as a tool to reduce vehicle crossing violations. Though not implemented at the time, this tool could be considered again if compliance continues to be an issue with increased train crossing delays.

