

# Pierce Transit Main Base Expansion

## Traffic Analysis Summary

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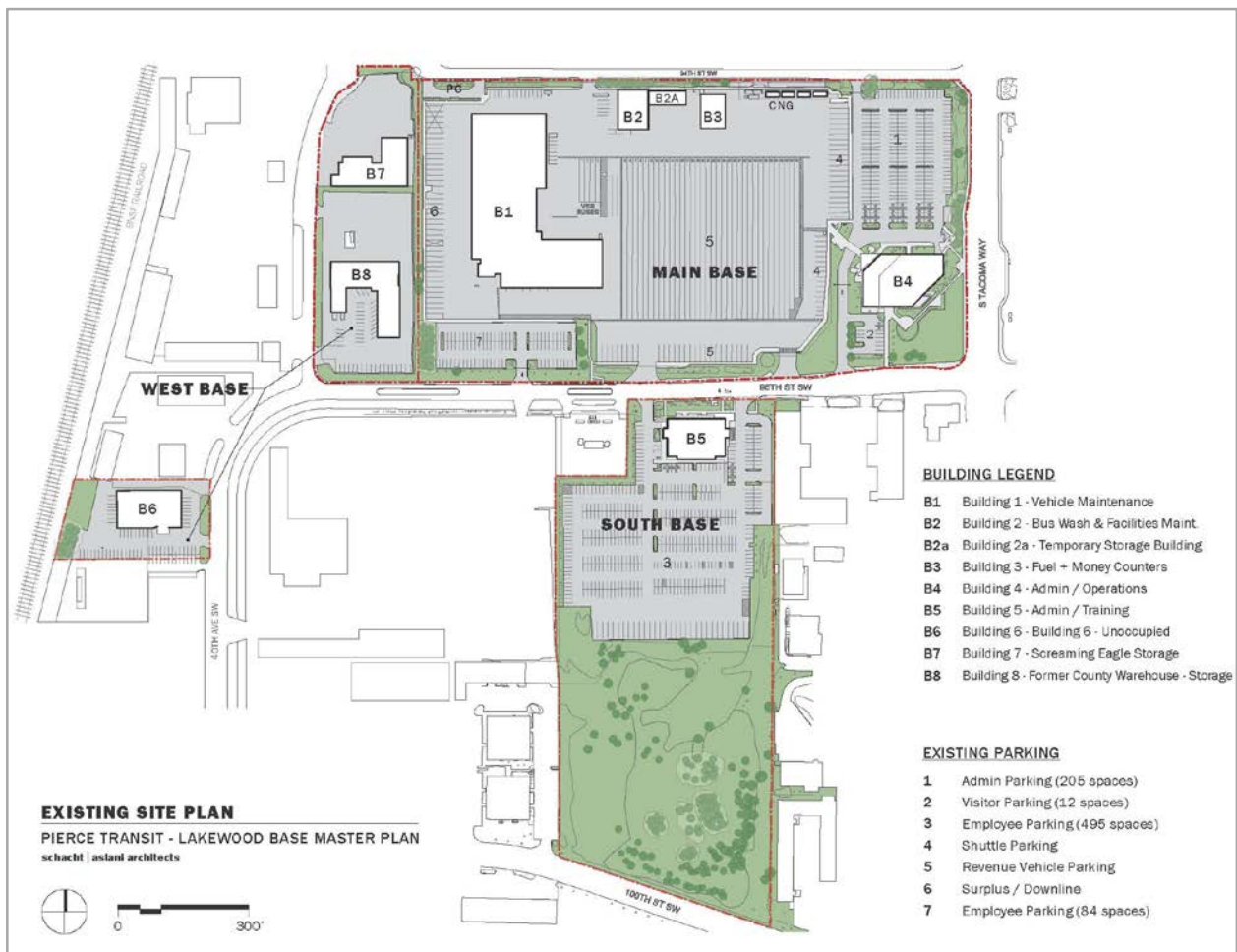
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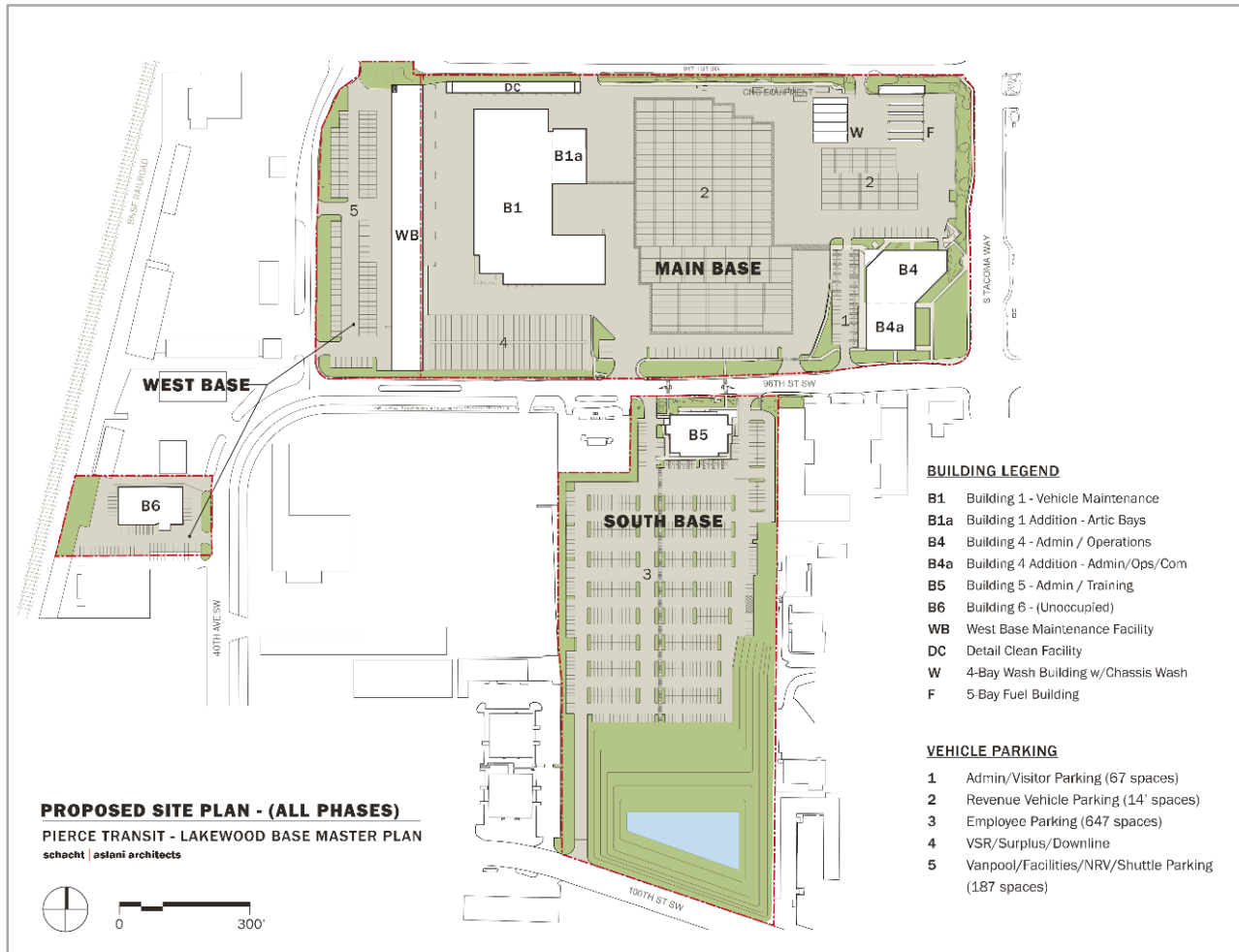
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## Project Description and Purpose

This memorandum summarizes the traffic analysis performed for the expansion of Pierce Transit's main base facility located at 3701 96th St. SW in Lakewood, Washington. The configuration of the existing main base campus is shown below.



Pierce Transit proposes to expand the main base facility to accommodate Pierce Transit's needs into the future. The proposed facility will improve Pierce Transit's capabilities to service and maintain existing and future fleet vehicles and to meet the agency's growing needs for additional employees and transit services. Pierce Transit's proposed future site plan is shown below.



The Traffic Analysis Memorandum summarizes existing traffic conditions adjacent to the site including traffic volumes entering and leaving the main campus, intersection volumes and levels-of-service, and existing pedestrian usage of the crosswalk that connects the Main Base to the South Base. The future conditions include the forecasted increase in fleet vehicles and employees. The future conditions with the proposed base expansion are compared to the conditions that would exist without the proposed expansion.

## Trip Generation

### Methods and Assumptions

Pierce Transit's future trip generation with the proposed base expansion is based upon the following assumptions and data:

- Full build out of Pierce Transit's main base facility as shown in the master plan site plan
- Pierce Transit's fleet projections (shown below)
- Existing AM and PM peak driveway counts at existing Pierce Transit facility driveways

	2017	2022	2027	2032	2037	2040
	5 years		10 years	15 years	20 years	
<b>Pierce Transit</b>						
Standard Buses (30' and 40')	154	148	178	209	245	269
Electric Buses (35')	6	12	12	12	12	12
Articulated (or Double Decker)	0	27	27	27	27	27
Shuttle	33	33	33	33	33	33
<b>Total (Pierce Transit)</b>	<b>193</b>	<b>220</b>	<b>250</b>	<b>281</b>	<b>317</b>	<b>341</b>
<b>Vehicle Equivalents</b>	<b>181</b>	<b>222</b>	<b>252</b>	<b>283</b>	<b>319</b>	<b>343</b>
<b>Sound Transit</b>						
Standard Buses (40' and 45')	120	77	42	14	0	0
Articulated (60')	10	10	10	10	0	0
<b>Total (Sound Transit)</b>	<b>130</b>	<b>87</b>	<b>52</b>	<b>24</b>	<b>0</b>	<b>0</b>
<b>Vehicle Equivalents</b>	<b>135</b>	<b>92</b>	<b>57</b>	<b>29</b>	<b>0</b>	<b>0</b>
<b>TOTAL (PT + ST)</b>	<b>323</b>	<b>307</b>	<b>302</b>	<b>305</b>	<b>317</b>	<b>341</b>
<b>Total Vehicle Equivalents</b>	<b>316</b>	<b>314</b>	<b>309</b>	<b>312</b>	<b>319</b>	<b>343</b>

FIGURE 3-6 REVISED FLEET PROJECTIONS THAT CAN BE ACCOMMODATED ON-SITE

## Pierce Transit Fleet Projections

### General Purpose and Bus Trip Generation

Two components to vehicle trip generation at the Pierce Transit site were evaluated:

1. Bus Trips
2. Employee/Visitor Auto Trips

The following table shows current trip generation, including the trip generation rates based on the bus fleet size and number of employees.

		2017 AM Peak Hour		2017 PM Peak Hour	
		# trips	Trip gen rate	# trips	Trip gen rate
<b>Bus Fleet (323)</b>	<b>Bus Trips</b>	29	0.09 trips per bus	22	0.07 trips per bus
<b># Employees (612)</b>	<b>Employee/Visitor Trips</b>	144	0.24 trips per employee	124	0.20 trips per employee
<b>Total Trips</b>		173		146	

**Existing (2017) Trip Generation Rates**

Future trip generation is estimated by applying the existing trip generation rates to the anticipated future bus fleet size and the number of employees. Pierce Transit estimates that in the future year 2037 there will be 317 buses in their fleet (a decrease of 6 buses) and 672 employees (an increase of 60 employees). The decrease in the total bus fleet is due to the decrease in the number of Sound Transit that will be operated by Pierce Transit in the future. For the purposes of this study, it is assumed that there will be no increase in buses operating out of the Pierce Transit main base in 2037.

The following table estimates the number of new trips generated by the site based on the number of buses and employees. As shown below, Pierce Transit's site will generate an additional 14 auto trips during the AM peak hour and 12 auto trips during the PM peak hour in 2037.

		2037 AM Peak Hour		2037 PM Peak Hour	
		# new trips	Trip gen rate	# new trips	Trip gen rate
<b>2037 Increase</b>	<b>Bus Trips</b>	0	0.09 trips per bus	0	0.07 trips per bus
<b>2037 Increase (60 new employees)</b>	<b>Employee/Visitor Auto Trips</b>	14	0.24 trips per employee	12	0.20 trips per employee
<b>Total Trips</b>		14		12	

**Net New (2037) Vehicle Trips with Base Expansion**

## Intersection LOS

The existing and future levels of service at the main base driveways and at the 96<sup>th</sup> Street SW/S. Tacoma Way intersection was calculated based upon the 2010 Highway Capacity Manual. Existing traffic volumes were based on the following sources:

- Existing (2017) AM and PM peak traffic counts taken at the 96<sup>th</sup> Street SW/S. Tacoma Way intersection
- Existing (2017) AM and PM peak driveway counts taken at existing Pierce Transit facility driveways

Future AM and PM peak traffic volumes were estimated based upon Pierce Transit's Main Campus trip generation rates and on the future volumes reported in the *Pierce Transit Base Expansion Transportation Impact Analysis* (DKS Associates, 2006) reported for the proposed 100<sup>th</sup> Street SW driveway. This new driveway would connect the South Base facility to 100<sup>th</sup> Street SW.

The net increase in trips with the base expansion is less than 20 trips during the peak hours in the year 2037. This small increase in peak hour trips will not impact or degrade the intersection levels-of-service on the adjacent street system. The distribution of new trips to the street network was done using the existing trip distribution at Pierce Transit driveways as shown below:

	To/From the East	To/From the West
<b>AM Peak</b>		
<b>Cars</b>	19%	81%
<b>Buses</b>	42%	58%
<b>PM Peak</b>		
<b>Cars</b>	17%	83%
<b>Buses</b>	0%	100%

#### Existing (2017) Trip Distribution at Pierce Transit Driveways

The Highway Capacity Manual (HCM) 2010 definitions for Level of Service and Delay were used to calculate driveway and intersection levels-of-service using the traffic analysis software Synchro (version 9.1). The results of this analysis is shown in the table below. The analysis evaluates existing (2017) and year 2037 traffic volumes with and without the proposed base expansion, which includes the reconfigured bus lot driveway and expanded south parking lot. The future 2037 analysis assumed a growth rate of 1% per year for background vehicular traffic. The future 2037 LOS at intersections is not impacted with the expansion of the main base facilities.

Intersection	Existing 2017	AM Peak Hour		Existing 2017	PM Peak Hour	
		Future 2037 No Build	Future 2037 Build		Future 2037 No Build	Future 2037 Build
<b>Maintenance Lot Driveway</b>	B / 12	B / 13	B / 13	B / 13	B / 15	B / 15
<b>Building 5 &amp; Bus Lot – West Driveway</b>	B / 12	C / 16	C / 17	B / 11	C / 16	C / 17
<b>Building 5 – East Driveway</b>	B / 10	B / 10	B / 12	B / 11	B / 12	B / 13
<b>Building 4 Driveway</b>	B / 12	B / 13	B / 13	B / 14	C / 17	C / 16
<b>South Tacoma Way @ 96<sup>th</sup> Street SW</b>	D / 38	E / 68	E / 68	D / 37	E / 67	E / 67
<b>100<sup>th</sup> Street SW Driveway</b>	-	-	C / 21	-	-	C / 21

#### Existing (2017) and Future (2037) Intersection LOS with Base Expansion

### 100<sup>th</sup> Street SW Driveway Sight Distance

The *Pierce Transit Base Expansion Transportation Impact Analysis* (DKS Associates, 2006) evaluated the stopping sight distance, and intersection sight distance at the proposed driveway on 100<sup>th</sup> Street SW. Stopping sight distance provides sufficient time for a motorist to recognize a hazard and stop before a

collision occurs. Intersection sight distance allows a driver stopped on a minor intersection (or driveway) to have sufficient view of the intersection to determine when to enter the major street.

The DKS study documented that the sight distance to the east is limited to 475 feet, which sufficiently satisfies the required stopping sight distance of 275 feet and the intersection entering sight distance of 440 feet. The driveway also satisfies the minimum entering sight distance for a 35 mph roadway per City of Lakewood Standard Plan RW-9 (400 feet required).

The driveway on 100<sup>th</sup> Street was approved in the previous Pierce Transit Master Plan CUP by the City of Lakewood Hearing Examiner with the following restrictions:

- Buses exiting the South Base shall be restricted from making a southbound left turn onto 100<sup>th</sup> Street SW. Staff will require a sign at the exit of the facility indicating left turns for buses are prohibited.

Source: City of Lakewood Hearing Examiner Decision, December 2006, Application #LU060198

## Pedestrian Crosswalk Evaluation

The existing 96<sup>th</sup> Street SW mid-block pedestrian crosswalk connecting the South Base to the Main Base is shown below.



**Crosswalk on 96<sup>th</sup> Street SW connection South Base to Main Base Campus**

The crosswalk is used by approximately 450 pedestrians between the hours of 7:30 AM and 5:30 PM on an average weekday. Existing counts indicate that there are approximately 45 and 25 pedestrians that use the crosswalk during the AM and PM peak hours that coincide with the street peak. The highest crosswalk usage actually occurs during the late morning from 10:30 – 11:30 AM, when approximately 70

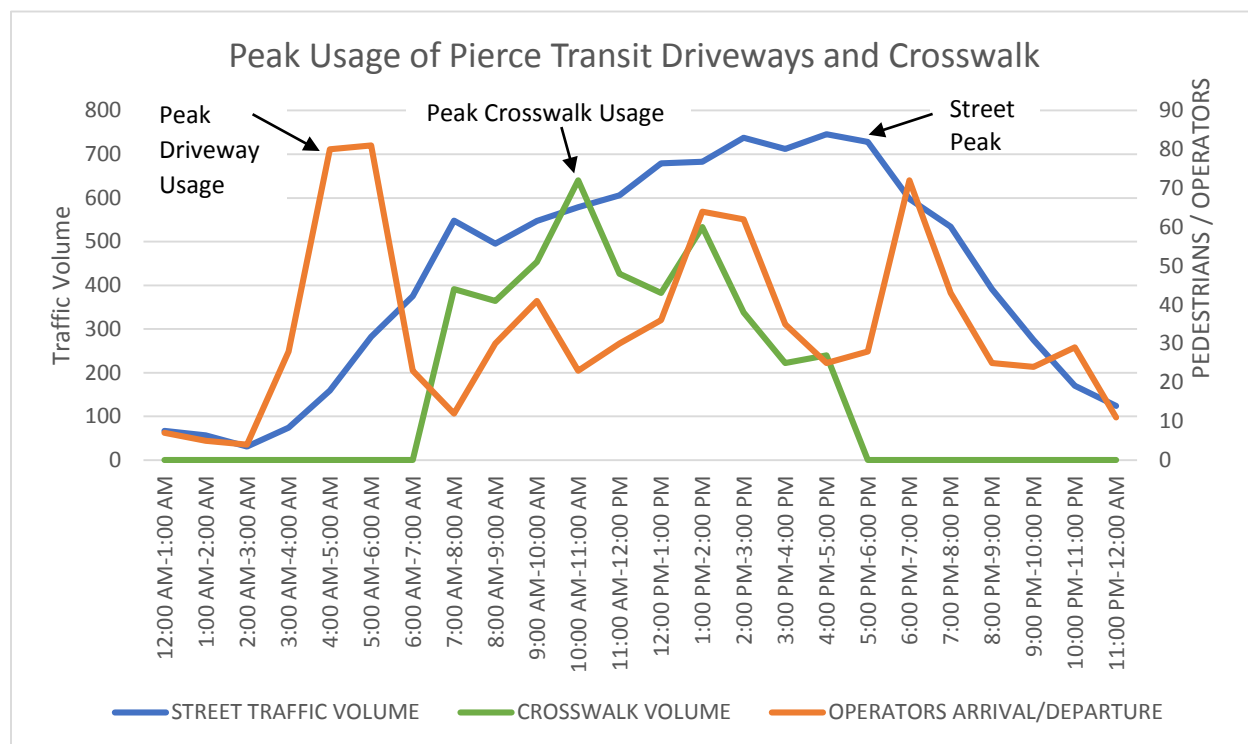


pedestrians use the crosswalk. Pedestrian counts collected on October 6, 2017 are shown in the table below.

Time	Northbound	Southbound	Total
7:30 - 8:30 AM	41	3	44
8:30 - 9:30 AM	31	10	41
9:30 - 10:30 AM	19	32	51
10:30 - 11:30 AM	21	51	72
11:30 AM - 12:30 PM	15	33	48
12:30 - 1:30 PM	34	9	43
1:30 - 2:30 PM	25	35	60
2:30 - 3:30 PM	12	26	38
3:30 - 4:30 PM	5	20	25
4:30 - 5:30 PM	1	26	27
<b>Total</b>	<b>204</b>	<b>245</b>	<b>449</b>

**2017 Pedestrian Volumes crossing 96<sup>th</sup> Street SW**

The graphic below overlays the crosswalk volumes by time of day with the traffic volume on 96<sup>th</sup> Street and the bus operator arrival/departure times from data collected by Pierce Transit. The graphic shows that the peak usage of the pedestrian crosswalk does not coincide with the peak usage of the Pierce Transit main base driveways and/or the peak volume of traffic on 96<sup>th</sup> Ave SW.





The existing pedestrian crosswalk has the following elements and features:

- Painted crosswalk markings
- Center median pedestrian refuge
- Yellow crosswalk warning signs
- Pedestrian pushbutton activated flashing yellow beacons

The 96<sup>th</sup> Street crosswalk was analyzed to determine if the existing crosswalk design meets available standards with the proposed increase in usage with the expansion of the south parking lot. The analysis evaluated pedestrian and vehicle volumes during the AM and PM peak hours as shown in the table below. The analysis also considered a “worst case” analysis assuming the highest crosswalk usage coincided with the highest on-street traffic volumes that occur during the PM peak hour. The pedestrian volumes and site-related traffic volumes are shown in the table below:

	Existing Driveway Volume	Existing 96 <sup>th</sup> Street Volume	Increase from Site Expansion	Increase from Combined Bus Driveways	Increase from Additional Parking in South Lot	Total Volume
<b>AM Peak Hour</b>						
<b>Pedestrians</b>	44	-	3	-	16	<b>63</b>
<b>Vehicles</b>	109	436	13	4	29	<b>591</b>
<b>PM Peak Hour</b>						
<b>Pedestrians</b>	27	-	2	-	11	<b>40</b>
<b>Vehicles</b>	43	600	6	8	26	<b>683</b>
<b>Worst Case Analysis</b>						
<b>Pedestrians</b>	72	-	2	-	11	<b>85</b>
<b>Vehicles</b>	43	600	6	8	26	<b>683</b>

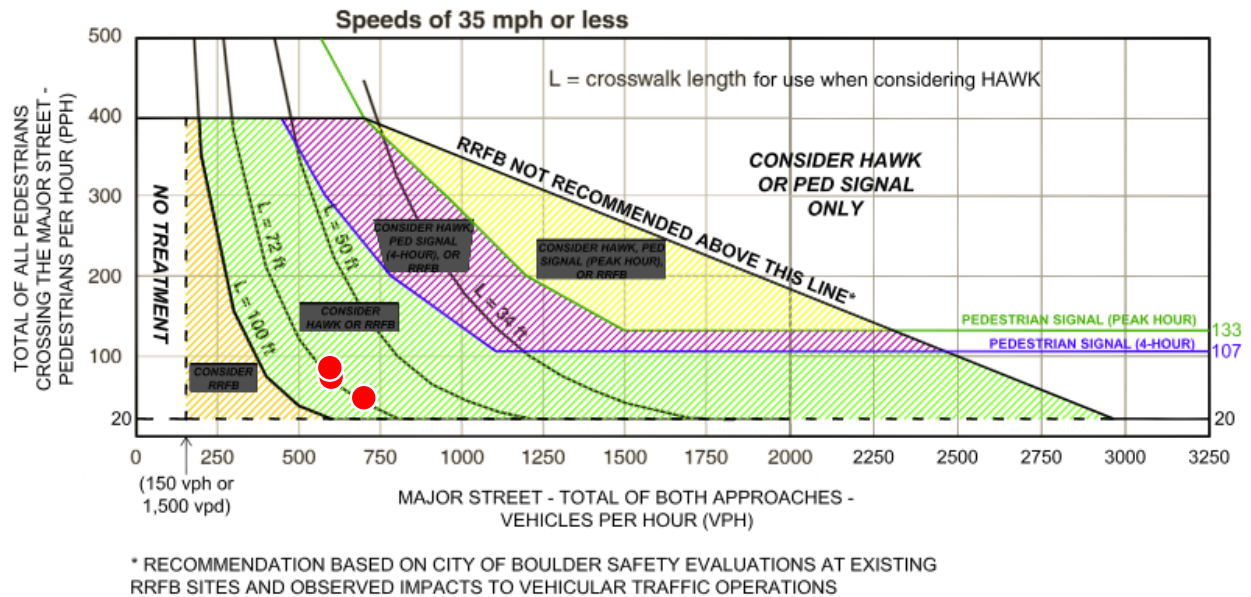
The crosswalk was evaluated using two different standards that evaluate the crossing treatments needed based upon the level of pedestrian usage and vehicular volume. The two standards evaluated include:

- WSDOT’s guidance for the Supplemental Treatments for Pedestrian Crossings
- City of Boulder, Colorado Guidelines for Crosswalk Markings and Enhancements.

WSDOT’s guidance for crosswalk treatments indicates that for a two-way, two-lane crossing with a posted speed of 35 mph, installation of flashing beacons at the crossing and advance circular beacons are optional but not required.

The City of Boulder Colorado developed guidelines for flashing beacons based on pedestrian and vehicle volumes, as indicated in the chart below. The red dots show the pedestrian and vehicle volumes for the AM and PM peak hour and “worst case” analysis. Under the City of Boulder standard, flashing beacons could be considered, but are not required.

**Figure 2a. City of Boulder Guidelines for the Installation of Pedestrian Hybrid (HAWK) Beacons, Pedestrian Signals, or Rectangular Rapid Flash Beacon (RRFB) Signs on Low-Speed Roadways**



Based upon these standards, additional crossing treatments for the 96<sup>th</sup> Street crosswalk are optional but not required.

## Collision Analysis

Collision records for 96<sup>th</sup> Street between S. Tacoma Way and 40<sup>th</sup> Avenue SW for the period December 2014 – November 2017 were provided by the City of Lakewood. A summary of analysis of the collision records is provided below:

- A total of 29 collisions were recorded during this 3-year period
- 59% of all collisions occurred at the 96<sup>th</sup> Street/S. Tacoma Way intersection
- 69% of the collisions occurred without injuries
- None of the collisions included pedestrians or occurred at the pedestrian crosswalk
- 1 collision involved a bicyclist
- 34% of collisions were rear end collisions
- 14% of collisions were entering at an angle from an adjacent street or driveway

The proposed expansion of the Pierce Transit main base is not expected to increase the collision rate on 96<sup>th</sup> street. The proposed reduction in the number of total driveways connecting the main base to 96<sup>th</sup> street is expected to have a positive impact on the collision rate.