

TECHNICAL MEMORANDUM

Project: Capitol Hill Station Transit Oriented Development

Subject: Transportation Analysis

Date: March 14, 2011

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1. What is the purpose of this memorandum?

The purpose of this memorandum is to present the background transportation information, forecast trip generation, and transportation access and circulation assessment for the proposed Capitol Hill Station Transit Oriented Development. The Capitol Hill Station, located just south of the intersection of Broadway, E Olive Way and E John Street, is currently under construction. Once the station is complete, Sound Transit proposes to develop the sites it acquired for the station, station portals, and construction staging with a mix of residential and commercial uses. The background transportation information together with the trip generation estimates provide the basis for evaluation of site access, including potential use and configuration of E Denny Way east of Broadway, which is currently closed to traffic during construction.

2. What is transit-oriented development?

Transit-oriented development (TOD) is characterized by a mix of residential and commercial land uses, designed to maximize access to public transport, and often incorporating features to encourage transit ridership. A TOD neighborhood typically has a center with a transit station or stop, surrounded by relatively high-density development. Nationwide research indicates that TOD commuters typically use transit two to five times more than other commuters in their region; these findings are similar for non-commute trips as well.¹

3. What could be developed at the Capitol Hill Station?

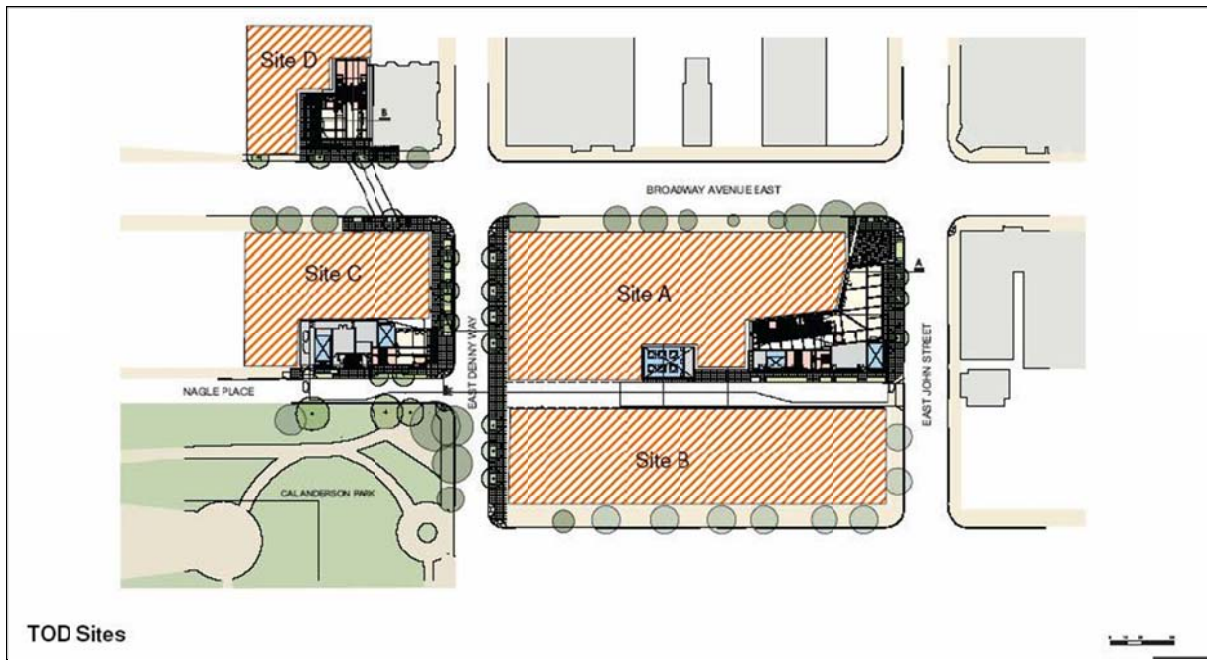
Sound Transit acquired many properties to construct the Capitol Hill Station and provide pedestrian access to the station. For planning purposes, these have been grouped into four parcels as shown on Figure 1 below:

- Parcel A – The west half of the Station block (located on the east side of Broadway between E John Street and E Denny Way).
- Parcel B – The east half of the Station block

¹ Arrington, G.B. and Robert Cevero. 2008. Effects of TOD on Housing, Parking, and Travel. Transit Cooperative Research Program (TCRP) Report 128. Transportation Research Board. Washington, DC.

- Parcel C – Site where the Station’s South Entrance would be located (east side of Broadway south of E Denny Way)
- Parcel D – Site located on the west side of Broadway north of Seattle Central Community College.

Figure 1. Capitol Hill Station Schematic Plan



Source: Capitol Hill Station TOD Sites Baseline Report, December 2008. Illustration by Hewitt Architects and Swift Design.

Table 1 summarizes the potential land uses on each parcel. The land uses shown, and subsequently analyzed, reflect the most intense of the alternatives under consideration and allowed by current zoning, and would reflect “worst case” traffic conditions. A range of parking supply is currently being considered, and will be confirmed after additional analysis has been completed.

Table 1. Preliminary Project Land Use Summary

Site	Apartments (units)	Retail (square feet)	Other (square feet)	Parking (spaces)
Parcel A – 100 Broadway E Station Block – west half	195	29,240	Service-4,500 Pavillion-3,400	105 – 202
Parcel B – 100 Broadway E Station Block – east half	137	---	Service-4,500	69 – 137
Parcel C – 1830 Broadway South entrance	115	23,040	---	63 – 121
Parcel D – 1827 Broadway Seattle Central Community College	75	15,360	---	0 – 79
Total	522	67,820	Service-9,000 Pavillion-3,400	237 – 539

Source: GVA Kidder Mathews, November 2010.

4. What are the characteristics of the existing transportation system?

The existing transportation system includes roadways, bicycle and pedestrian facilities, and transit facilities and service. Planned future projects that are not yet constructed, but have been programmed and are expected to be in place under future conditions, are also considered. The following sections described the existing and planned future transportation system elements in the study area.

4.1. Roadways, Pedestrian Facilities, and Bicycle Facilities

The Capitol Hill Station, currently under construction, is located on Broadway, just south of E John Street/E Olive Way. Roads in the station vicinity have been classified by the City of Seattle (City) and are described as follows. Bicycle and pedestrian facilities located on each of the roadways are also described.

Broadway is classified as a Minor Arterial, with one travel lane in each direction and a two-way-left-turn lane that becomes left turn pockets at signalized intersections. On-street parking is allowed on both sides of the street, with some restrictions on time and location. Sidewalks are present on both sides of the street, and sharrows are provided in both directions on the street. It has been designated by the City as a Major Transit Street. Major changes will be made along Broadway south of E John Street to accommodate the future First Hill Streetcar. These changes are described below.

E Olive Way/E John Street is classified as a Principal Arterial west of Broadway and as Minor Arterial east of Broadway. It has one travel lane in each direction during most hours of the day, but peak hour parking restrictions are in place to provide two lanes westbound during the AM peak period (7:00 to 9:00 A.M.) and two lanes eastbound during the PM peak period (4:00 to 6:00 P.M.). Currently, parking is also prohibited between Broadway and 10th Avenue E adjacent to the Capitol Hill Station site while it is under construction. With these exceptions, on-street parking is allowed on both sides of the street. Sidewalks are present on both sides of the street. It has been designated by the City as a Minor Transit Street.

10th Avenue E is classified as a local access street, and has one travel lane in each direction. It connects E John Street to E Denny Way and Cal Anderson Park, on the east side of Capitol Hill

Station. Parking was previously allowed on the west side of the street, but is currently prohibited while the station is under construction. Sidewalks are present on both sides of the street.

Nagle Place is a local access street located along the west side of Cal Anderson Park, between E Denny Way and E Pine Street. It is a narrow road (about 20-feet wide from curb to curb) but does allow one lane of travel in each direction, and parking on the west side of the street. Parking adjacent to the Capitol Hill Station site is currently prohibited while the project is under construction. A sidewalk is present on the west side of the street.

E Denny Way is classified as a Minor Arterial west of Broadway, and is a local access street east of Broadway. Currently, the section between Broadway and 10th Avenue E is closed while the station is under construction. West of Broadway, it has one through lane in each direction, sidewalks on both sides of the street, and parking allowed on the south side of the street. East of 10th Avenue E, it has one narrow through-lane in each direction, sidewalks on both sides of the street, and parking allowed on both sides of the street. It is located along the north side of Cal Anderson Park.

E Howell Street is a local access street located on the south side of the Capitol Hill Station area. It has one through lane in each direction, and sidewalks on both sides of the street. In the project area, it connects Nagle Place west to Broadway and beyond. It terminates at Nagle Place (at Cal Anderson Park) but then resumes on the east side of the park at 11th Avenue.

4.2. Transit

The following Metro bus routes run on Broadway:

- Route 9 provides weekday-only service between Capitol Hill, International District, Columbia City, and Rainier Beach.
- Route 49 provides everyday service between the University District, Capitol Hill, and Downtown.
- Route 60 provides everyday service between Capitol Hill, Beacon Hill, Georgetown, and White Center

The following Metro bus routes run on E Olive Way/E John Street:

- Route 8 provides everyday service between Seattle Center, Capitol Hill, Madison Park, and Rainier Valley
- Route 43 provides everyday service between the University District, Capitol Hill, and Downtown.

When the Capitol Hill Station is completed, it will serve as a stop in Sound Transit's North Link light rail corridor, which will extend light rail from Downtown to Capitol Hill, University District, Roosevelt, and Northgate.

4.3. Planned Future Project – First Hill Streetcar

The City, through a funding and cooperative agreement with Sound Transit, has proposed to construct the First Hill Streetcar to serve the Capitol Hill, First Hill, Central District, Chinatown/International District and Pioneer Square areas of Seattle. The system is expected to operate 20 hours per day (approximately 5:00 A.M. to 1:00 A.M.), with ten minutes between streetcar arrivals during the peak hours and 15 minutes between arrivals during off-peak hours. The planned route is approximately 2.5

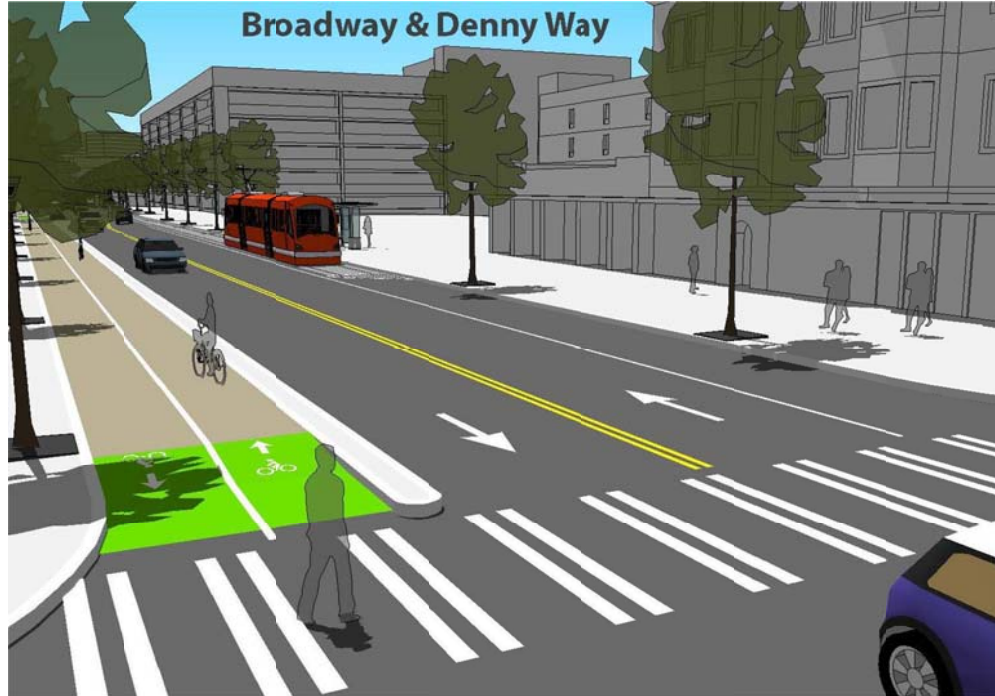
miles long, and from Yesler Way north it is planned to run on Broadway. The northern terminus will be located at the project site, just south of the intersection of Broadway and E Denny Way. Figure 2 shows an illustration of the planned configuration. In the study area, features of the streetcar include the following:²

- A two-lane roadway section with parking and passenger loading on both sides of Broadway is proposed between E Denny Way and E Pine Street. This lane configuration would eliminate the existing two-way left-turn-lane through this section.
- A streetcar stop, with side platforms, is planned in both directions on Broadway between E Howell Street and E Denny Way. Typical streetcar station platforms are expected to range from 9 to 14 feet in width. Platforms would include passenger shelters, passenger information systems, fare collection equipment, and public art. At station platform intersections, pavement material and color would be used to make crossing areas distinctive.
- A new traffic signal serving the stop location and streetcar-only movements would be installed at the intersection of Broadway and E Howell Street.
- The streetcar will be powered with a traction power system featuring traction power substations and an overhead contact system. Sound Transit has designed the Capitol Hill Station to provide space for a future streetcar traction power substation.
- On Broadway, a continuous separated bicycle facility (or “cycle track”) is proposed on the east side of the street, south of E Denny Way, to address potential effects of streetcar tracks on bicycle travel while also minimizing impacts to utilities. No left turns would be allowed from the cycle track, so bicyclists would be required to position themselves in bicycle boxes provided on the east-west running streets to head east, crossing the streetcar tracks at close to 90 degrees.

Traffic control measures are also proposed at various intersections along the length of the proposed streetcar route, but none are located in the vicinity of the Capitol Hill Station.

² City of Seattle. September 29, 2010. Environmental Checklist: First Hill Streetcar. Prepared by URS for the Seattle Department of Transportation.

Figure 2. Illustration of Broadway south of E Denny Way with the Streetcar



Source: Seattle Department of Transportation, Image on [Seattlestreetcar.com](http://seattlestreetcar.com), December 1, 2010.

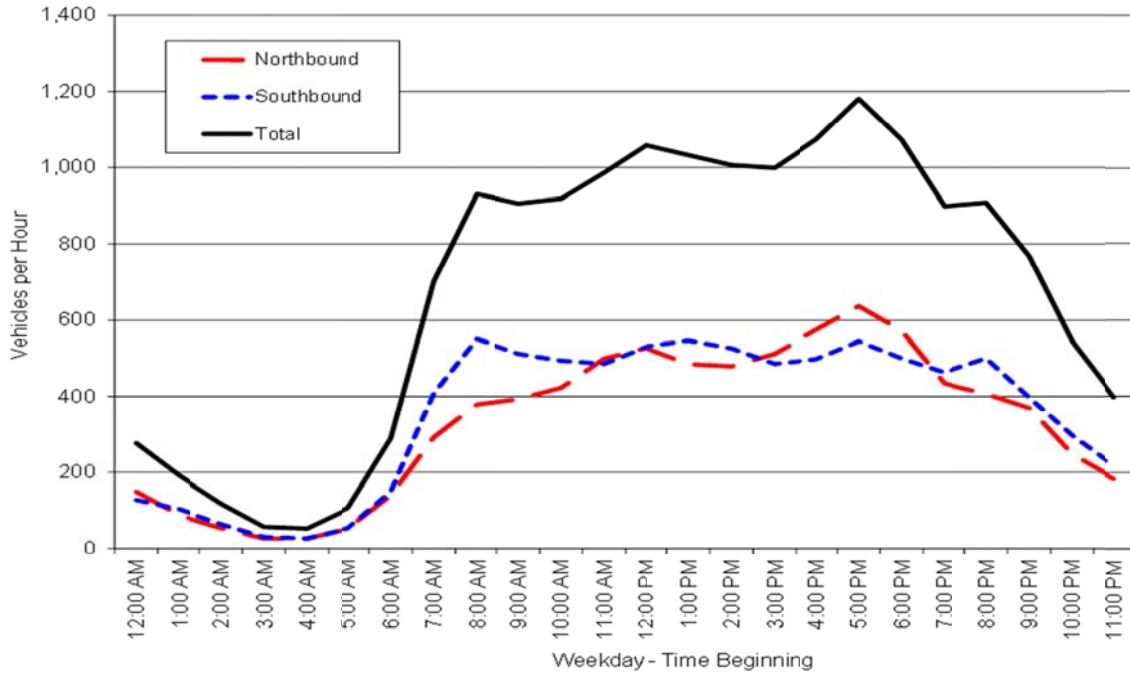
5. What are the current traffic conditions?

Evaluation of traffic conditions includes assessment of existing vehicle and pedestrian volumes during the most congested hours (peak hours) in a typical week. The following sections describe how the peak hours were determined, and then provide assessment of traffic volumes and operations. Traffic conditions both before and after the closure of E Denny Way are assessed.

5.1. Peak Hour Definitions

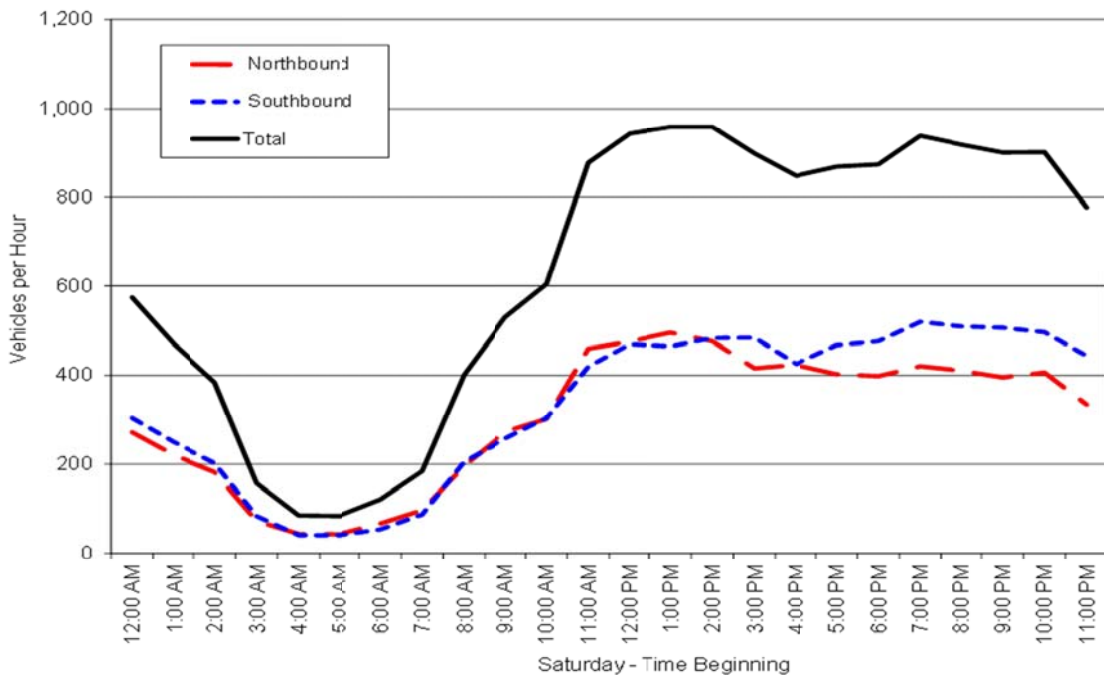
Hourly traffic data collected by the Seattle Department of Transportation (SDOT) in the project area were compiled to confirm the times in which the peak periods occur. Figure 3 and Figure 4 show the hourly volumes on Broadway south of E Denny Way, for a weekday and Saturday, respectively. The data indicate that the weekday AM peak hour occurs from approximately 8:00 to 9:00 A.M., and the weekday PM peak hour (the highest volume hour in a typical week) occurs from approximately 5:00 to 6:00 P.M. The weekend peak hour occurs on Saturday from approximately 1:00 to 2:00 P.M. The figures show that northbound and southbound traffic flows are relatively equal throughout the day; there are no sharp peaks in directional traffic as often occur on arterials in Seattle.

Figure 3. Hourly Traffic Volumes on Broadway south of E Denny Way – Weekday



Source: Seattle Department of Transportation historic count database. Average weekday conditions reflect counts performed on Tuesday, Wednesday, and Thursday during the week starting 10/01/2009.

Figure 4. Hourly Traffic Volumes on Broadway south of E Denny Way – Saturday



Source: Seattle Department of Transportation historic count database. Saturday counts were performed on 10/03/2009.

5.2. Overall Traffic Growth Trends

Historical traffic data were assessed to determine the typical level of traffic growth that has occurred in the area over the past 5 years. Table 2 summarizes SDOT counts taken in the study area between 2005 and 2008/2009. All counts reflect conditions prior to construction of the Capitol Hill Station. The table shows that traffic volumes in the area have generally declined over this period. This is consistent with trends that have been observed throughout the city over the past few years.

Table 2. Study Area Traffic Volume Trends

Location	Direction	AM Peak Hour Vehicle Trips			PM Peak Hour Vehicle Trips		
		2005	2008/09	Change	2005	2008/09	Change
Broadway, north of E John Street	Southbound ¹	536	472	-11.9%	599	565	-5.7%
Broadway, south of E John Street	Northbound ¹	462	410	-11.3%	584	507	-13.2%
	Southbound ²	490	445	-9.2%	613	570	-7.0%
E John Street, east of Broadway	Eastbound ²	447	313	-30.0%	536	406	-24.3%
	Westbound ²	525	463	-11.8%	525	508	-3.2%

1. Most recent count taken in 2008

2. Most recent count taken in 2009

Source: SDOT 2010

5.3. Traffic Effect of E Denny Way Closure

E Denny Way between Broadway and 10th Avenue E is currently closed to all traffic (vehicle and pedestrian) and is part of the construction area for the Capitol Hill Station. As part of the station project, substantial pedestrian enhancements will be made to the street, but there are many options for vehicular use of the street. These include fully or partially closing the street, or returning two-way traffic to it. There are also options for calming traffic to reduce both vehicular speed and volumes. Various options will be evaluated in later sections of this report. As background for future analyses, the effect that closing the street has had on existing traffic patterns was evaluated. This was done by comparing available traffic data collected prior to station construction to new data collected in 2010. The data comparison is presented below.

Peak hour turning movement counts were taken at the intersection of Broadway/E John Street/E Olive Way in October 2010. These volumes reflect conditions with E Denny Way closed to traffic between Broadway and 10th Avenue E. To determine how traffic patterns have changed due to the closure, these new counts were compared to SDOT counts that had been taken prior to the closure. Given the trends summarized in Table 2 that show a general decline in traffic volumes over the past few years, there is a likelihood that any increase in traffic volume that occurred after the closure are likely due to shifts in traffic patterns, rather than from regional growth.

Table 3 summarizes the comparison of the total entering traffic volume on each approach, before and after the E Denny Way closure. The table shows that in the AM peak hour, the traffic volumes on three approaches are lower than they were before the closure. On the fourth (southbound) approach, the volume is about 5% higher. Overall, the total AM peak hour traffic volume entering the intersection after the road closure is about 13% lower than the total before the closure. Thus, there is no evidence to suggest that the closure of E Denny Way has shifted additional traffic to the intersection of Broadway/E John Street/E Olive Way during the AM peak hour.

In the PM peak hour, however, the data indicate that traffic volumes in the eastbound and westbound intersection approaches are higher by 12 to 16% than they were prior to the road closure. These movements are parallel to the traffic previously accommodated on E Denny Way. In the northbound and southbound directions, volumes after the closure are similar or lower than they were before. Overall, the total PM peak hour traffic volume entering the intersection is about 5% higher than the total before the closure.

Table 3. Broadway/E John Street/E Olive Way Approach Volumes

Intersection Approach	Direction	AM Peak Hour Vehicle Trips			PM Peak Hour Vehicle Trips		
		Before Closure	After Closure	Change	Before Closure	After Closure	Change
Broadway	Northbound ¹	410	263	-35.9%	507	513	1.2%
Broadway	Southbound ¹	472	498	5.5%	565	512	-9.4%
E Olive Way	Easbound ¹	486	398	-18.1%	572	664	16.1%
E John Street	Westbound ²	463	430	-7.1%	508	572	12.6%
TOTAL		1,831	1,589	-13.2%	2,152	2,261	5.1%

1. "Before Closure" refers to closure of E Denny Way, east of Broadway – count taken in 2008

2. "Before Closure" count taken in 2009

Sources: "Before Closure" data, SDOT 2010; "After Closure" data, Heffron 2010.

As construction of the Capitol Hill Station is currently underway, it is possible that the October 2010 counts reflect some additional construction-generated traffic. The PM peak hour traffic counts indicate heavy vehicle percentages that range from 1.5% to 2.0% in each direction, which translates to a total of about 40 heavy vehicles traveling through the intersection during that period. All three haul routes to the Capitol Hill Station proposed in the Construction Traffic Engineering Report³ include the westbound movement through the intersection, and one of the three haul routes includes the eastbound movement. The report indicates that truck hauling operations "may be limited" during the commute peak periods, but there is still potential that some construction-generated traffic, unrelated to station excavation spoils removal, is occurring during those times.

5.4. Level of Service at Broadway/E Olive Way/E John Street

Level of service is a qualitative measure used to characterize traffic operating conditions. Six level of service (LOS) letter designations, "A" through "F," are used to define level of service. LOS A is the best and represents good traffic operations with little or no delay to motorists. LOS F is the worst and indicates poor traffic operations with long delays.

LOS analysis was completed for AM peak hour, PM peak hour, and Saturday peak hour 2010 "after closure" conditions at the intersection of Broadway/E Olive Way/E John Street. In addition, the percentage changes in traffic growth on each approach (shown in Table 3) were applied to the existing volumes to estimate traffic volumes and level of service prior to the E Denny Way closure.

³ Grijalva Engineering, L.L.C. December 2008. Construction Traffic Engineering Report: Capitol Hill Station and Connection to Pine Street Stub Tunnel, For U211, U230 and U240 Contracts. Prepared for Northlink Transit Partners.

Table 4 summarizes the level of service calculated for conditions before and after the closure. The table shows that during the AM peak hour, average delay at the intersection is slightly lower than it was before the street closure, but it is calculated at LOS B under both conditions. During the PM peak hour, the average delay is slightly higher than it was before the closure, but it is calculated at LOS C under both conditions. The Saturday peak hour is also calculated at LOS C under existing conditions. Overall, the analysis shows that shifts in traffic patterns have occurred since the closure of E Denny Way, and they have had some effect on average delay at the intersection of Broadway/E Olive Way/E John Street. However, they have not substantially changed overall intersection operations.

Table 4. Existing Broadway/E John Street/E Olive Way Level of Service

Time Period	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Average Delay	LOS	Average Delay	LOS	Average Delay
After Denny Way Closure	B	17.6	C	25.1	C	23.9
Before Denny Way Closure ¹	B	18.7	C	20.9	(2)	(2)

Source: Heffron Inc., October 2010.

1. The percentage change in traffic volumes by approach, summarized in Table 3, were applied to existing traffic volumes to estimate traffic volumes and level of service prior to the closure of E Denny Way.
2. No "Before Closure" Saturday volumes available, so LOS could not be estimated.

6. How many trips would the proposed TOD generate?

TOD, by design, is intended to generate fewer vehicle trips than a non-TOD project. Projects on Capitol Hill already generate a very high percentage of walking and transit trips, and the presence of light rail is expected to increase transit use and further decrease vehicle trips. In addition, the mix of uses on the sites would allow residents to obtain services on the site, generating internal trips that further reduce off-site trips. The number of trips that the proposed TOD program would generate was estimated using the following methodology:

1. The total number of "person trips" generated by the apartments and commercial space on the site was determined using trip generation rates and equations from the Institute of Transportation Engineers (ITE) *Trip Generation*⁴ plus information about the average number of persons per vehicle. These person trips reflect all trips generated by the site by all modes of travel including transit, bike, and foot. It also includes the trips made between on-site uses.
2. Internal trips between on-site uses were determined using the methodology in Chapter 7 of the *Trip Generation Handbook*.⁵ An example of an internal trip is when an apartment resident within the project shops or dines at the on-site commercial space. The percentage of internal trips depends on the balance of trips generated by the individual land uses—a development that has a balanced mix of uses (retail versus residential trips) will have a higher percentage of internal trips than a development that has one land use that dominates the sites trip generation. For the proposed TOD program, it is estimated that the percentage of internal trips in the PM peak hour would be about 9%.

⁴ Institute of Transportation Engineers. 2003. *Trip Generation*, 7th Edition. Washington, DC.

⁵ Institute of Transportation Engineers. 2004. *Trip Generation Handbook*, 2nd Edition. Washington, DC.

3. The trip generation rates applied for apartment and retail uses reflect a suburban condition with little to no transit or walking trips. This will not be the case for this urban site on Capitol Hill. Data from the *Census 2000* (the most recent Census data that are publically available) shows that 28% of the existing residential trips on Capitol Hill are made by private vehicle; about 50% are walk, bike, or other trips; and about 22% are transit trips. With the addition of light rail service, it is expected that more of the vehicle trips would switch to transit, increasing that percentage to about 30%. For the retail uses on the site, it is estimated that only 10% of the trips would be by vehicle. These modes of travel were applied to the external person trips. The person trips made by vehicle were then reduced to account for carpooling that could occur. The existing Census data determined that the average vehicle occupancy rate on Capitol Hill is 1.06 persons per vehicle.

All of the assumptions listed above were used to determine the number of vehicle trips that the site would generate. Table 5 summarizes the trip generation for the entire TOD program. As shown, the TOD is projected to generate over 4,400 walk/bike trips per day and almost 1,500 transit trips each day. The full project is estimated to generate just under 1,000 vehicle trips each day.

The vehicle trips were then divided into the individual parcels for use in future planning (e.g., access analysis). Table 6 summarizes the vehicle trip generation by parcel.

Table 5. Trip Generation Summary

Trip Type	Size / % of Trips	Daily Trips	AM Peak Hour Trips			PM Peak Hour Trips		
			In	Out	Total	In	Out	Total
PERSON TRIPS¹								
Residential Uses	522 Units							
Walk or Bicycle Trips	50%	1,910	32	124	156	117	62	179
Transit Trips ²	30%	1,150	19	75	94	70	37	107
Person Trips by Vehicle	<u>20%</u>	<u>760</u>	<u>12</u>	<u>50</u>	<u>62</u>	<u>47</u>	<u>25</u>	<u>72</u>
Total Residential Trips	100%	3,820	63	249	312	234	124	358
Retail Uses	67,820 sf							
Walk or Bicycle Trips	80%	2,510	36	22	58	104	110	214
Transit Trips ²	10%	310	5	2	7	13	14	27
Person Trips by Vehicle	<u>10%</u>	<u>320</u>	<u>4</u>	<u>3</u>	<u>7</u>	<u>13</u>	<u>14</u>	<u>27</u>
Total Residential Trips	100%	3,140	45	27	72	130	138	268
VEHICLE TRIPS²								
Residential Vehicle Trips		720	12	46	58	44	24	68
Retail Vehicle Trips		<u>270</u>	<u>3</u>	<u>3</u>	<u>6</u>	<u>10</u>	<u>13</u>	<u>23</u>
Total Vehicle Trips		990	15	49	64	54	37	91

Source: Heffron Transportation Inc., February 2011.

1. Internal trips are not included in the total. The number of internal trips was determined using capture factors in the *Trip Generation Handbook*, Institute of Transportation Engineers, June 2004. These comprise approximately 9% of the total daily trips, 4% of the AM peak hour trips, and 9% of the PM peak hour trips.
2. Person trips by vehicle were converted to vehicle trips assuming an average vehicle occupancy (AVO) rate of 1.06 for the residential uses, and 1.20 for the retail uses. The residential rate was derived from data for this area of Capitol Hill from Puget Sound Regional Council (PSRC) journey to work data.

Table 6. Vehicle Trips by Parcel - Capitol Hill TOD

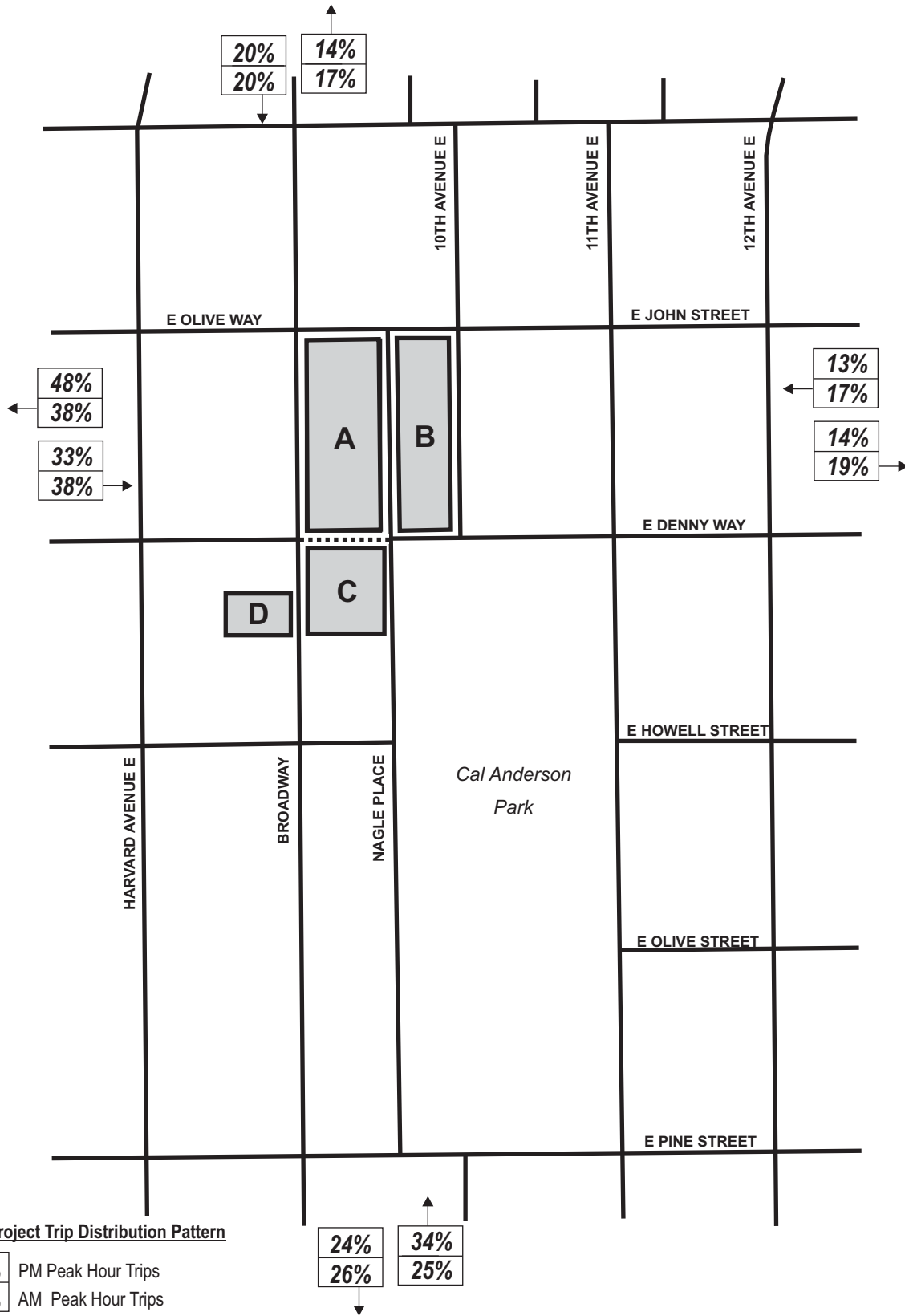
Land Use	Size	% of Space By Land Use	Daily	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Parcel A									
Retail (LU 820)	29,420 sf	43%	117	1	1	3	5	6	11
Apartment (LU 220)	195 units	37%	<u>269</u>	<u>4</u>	<u>17</u>	<u>21</u>	<u>16</u>	<u>9</u>	<u>25</u>
Total – Parcel A			386	5	18	23	21	15	36
Parcel B									
Retail (LU 820)	0 sf	0%	0	0	0	0	0	0	0
Apartment (LU 220)	137 units	26%	<u>189</u>	<u>3</u>	<u>12</u>	<u>15</u>	<u>12</u>	<u>6</u>	<u>18</u>
Total – Parcel B			189	3	12	15	12	6	18
Parcel C									
Retail (LU 820)	23,040 sf	34%	92	1	1	2	3	4	7
Apartment (LU 220)	115 units	22%	<u>159</u>	<u>3</u>	<u>10</u>	<u>13</u>	<u>10</u>	<u>6</u>	<u>16</u>
Total – Parcel C			250	4	11	15	13	10	23
Parcel D									
Retail (LU 820)	15,360 sf	23%	61	1	1	2	2	3	5
Apartment (LU 220)	75 units	14%	<u>103</u>	<u>2</u>	<u>7</u>	<u>9</u>	<u>6</u>	<u>3</u>	<u>9</u>
Total – Parcel D			165	3	8	11	8	6	14
Total All									
Retail (LU 820)	67,820 sf	100%	270	3	3	6	10	13	23
Apartment (LU 220)	522 units	100%	<u>720</u>	<u>12</u>	<u>46</u>	<u>58</u>	<u>44</u>	<u>24</u>	<u>68</u>
Total All Parcels			990	15	49	64	54	37	91

Source: Heffron Transportation Inc., February 2011. Based on allocation of space to TOD sites provided GVA Kidder Mathews.

7. Where are project-generated vehicle trips expected to go?

The projected AM peak hour and the PM peak hour distribution patterns for project generated vehicle trips are shown on Figure 5. Separate trip distribution patterns were developed for the proposed residential and retail spaces using data from the City of Seattle’s Concurrency Director’s Rule 5-2009,⁶ and compiled into the overall distribution shown on the figure. This database provides vehicle trip patterns for various types of land uses for each transportation analysis zone in the city. The data were compiled, and in conjunction with knowledge of local travel routes, were used to determine inbound and outbound patterns during the AM and PM peak hours. The assumed patterns are shown on Figure 5. The paths that motorists choose to travel to and from these general directions would depend on the access characteristics at the site, as discussed in the following section.

⁶ City of Seattle Department of Transportation, *Transportation Concurrency Project Review System, Director’s Rule 5-2009*, Effective April 13, 2009.



Capitol Hill Station
Transit Oriented Development

Figure 5
PROJECT TRIP DISTRIBUTION
AM and PM PEAK HOURS



8. How would vehicles circulate to and from the site?

Direct vehicle access to/from the site would be provided via the parking garage driveways. The driveways for Parcels A and C were assumed to be located on Nagle Place, and for Parcel B it was assumed to be located on 10th Avenue E. Since it is likely that no parking would be provided at Parcel D (which would have to take access from Broadway), the analysis presented in the memorandum assumes that vehicle trips generated by Parcel D would park on Parcel C, entering and exiting at Nagle Place. This represents a conservative ‘worst case’ assumption in which trips would be less dispersed, with a higher proportion of trips using Nagle Place. It should also be noted that analysis conservatively assumes that all vehicle trips generated by the site would park on-site; however, some trips, particularly those generated by the site’s retail, could park along area streets.

Two factors were considered in the assessment of vehicle circulation at the site: (1) the feasibility of left-turning vehicles to/from the site at E John Street, and (2) the effect of closing E Denny Way between Broadway and Nagle Place, either permanently or occasionally for festival activities. Level of service at Broadway/E Olive Way/E John Street, and overall circulation at the site, was evaluated for 2016 conditions (year of project opening) under different combinations of these conditions, with and without the project in place.

To estimate 2016 baseline (without project) volumes, an average annual growth rate of 0.5% was applied to the 2010 traffic volumes. Given the recent downward volume trends summarized in Table 2, this was considered to provide a conservative estimate of traffic that would occur as a result of regional growth. As discussed earlier, closure of Denny Way has had some effect on area traffic patterns, including turning movement volumes at Broadway/E Olive Way/E John Street. Thus, 2016 baseline volumes were projected for both the “without Denny closure” and “with Denny closure” scenarios, by applying the growth rates to their respective 2010 volumes. To estimate ‘with project’ traffic volumes at Broadway/E Olive Way/E John Street, the project-generated trips were added to the ‘without project’ volumes for each scenario.

Figure 6 shows the expected site-generated trips at Broadway/E Olive Way/E John Street under the following four scenarios:

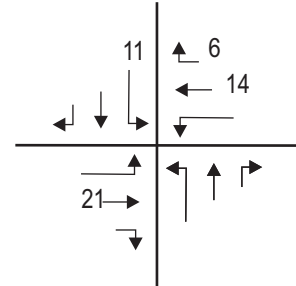
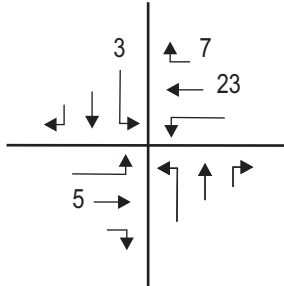
- Left turns allowed to/from the site at E John Street, E Denny Way closed
- Left turns allowed to/from the site at E John Street, E Denny Way open
- Left turns prohibited to/from the site at E John Street, E Denny Way closed
- Left turns prohibited to/from the site at E John Street, E Denny Way open



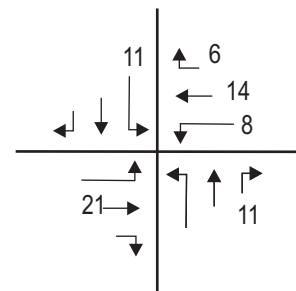
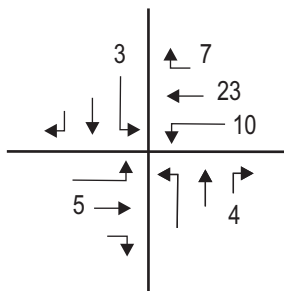
AM PEAK HOUR

PM PEAK HOUR

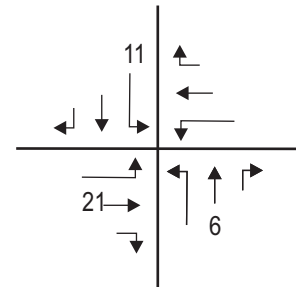
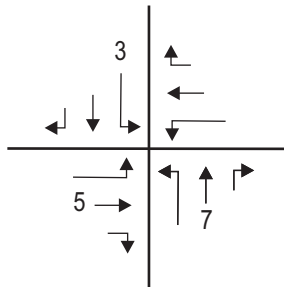
Left turns allowed on E John Street
E Denny Way open



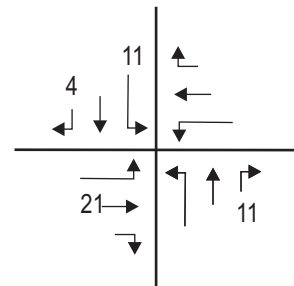
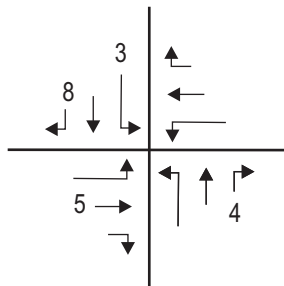
Left turns allowed on E John Street
E Denny Way closed



Left turns prohibited on E John Street
E Denny Way open



Left turns prohibited on E John Street
E Denny Way closed



Capitol Hill Station
Transit Oriented Development

Figure 6
PROJECTED TRIPS UNDER
CIRCULATION SCENARIOS
Broadway/E Olive Way/E John Street



9. How would traffic operate with the TOD project?

9.1. Operations with Left Turns Allowed at E John Street Site Access

As shown on Figure 6, the highest project-generated traffic volumes would be expected at this intersection under the scenario in which left turns to/from E John Street would be allowed and E Denny Way closed. Under this scenario, most trips with northbound, southbound and westbound origins/destinations could potentially travel through the Broadway/E Olive Way/E John Street intersection. If left turns were allowed but E Denny Way open, it is expected that most trips with southbound origins/destinations would access or egress the site via E Denny Way and Broadway.

Table 7 summarizes projected operations at Broadway/E Olive Way/E John Street under the scenarios in which left turns would occur to/from the project site at E John Street, which reflect the highest potential volume conditions. The table shows that the levels of service would be expected to remain at LOS B during the AM peak period and LOS C during the PM peak period, under these ‘worst case’ project scenarios.

Table 7. 2016 Broadway/E John Street/E Olive Way Level of Service

	AM Peak Hour				PM Peak Hour			
	LOS	Average Delay	WB Queue Length ¹		LOS	Average Delay	WB Queue Length ¹	
			50 th Percentile	95 th Percentile			50 th Percentile	95 th Percentile
Left turns allowed, ² Denny Way open	B	19.3	104	147	C	22.7	194	329
Left turns allowed, ² Denny Way closed	B	18.1	97	138	C	31.1	232	422

Source: Heffron Inc., February 2011.

1. 50th Percentile Queue means that this length of queue (in feet) or shorter is expected to occur 50% of the time. 95th Percentile Queue means that this length of queue (in feet) or shorter is expected to occur 95% of the time.

2. Indicates that left turns would be allowed to/from the site at E John Street.

However, while analysis shows that adequate levels of service would be expected for vehicles traveling through the intersection, the westbound queue at Broadway/E Olive Way/E John Street could frequently back up past the site access mid-block on E John Street during the PM peak hour and impede egress from the site at that location. That site access driveway would be located approximately 200 feet to the east of Broadway. As shown in Table 7, the length of queue is expected to exceed this length as much as half of the time during the PM peak hour. This is consistent with observations under existing conditions, in which westbound queues exceeding this length have been regularly noted during peak periods.

9.2. Effect of E Denny Way Closure

As described above, it may be difficult for motorists to enter or exit the site at E John Street during the PM peak hour because the westbound queue extending from the Broadway/E Olive Way/E John Street would often extend beyond 200 feet from the intersection, which would block the site access driveway. Under this condition, motorists may opt for an alternative route. This could have the following effects on site circulation:

- If E Denny Way were open between Broadway and Nagle Place, the majority of outbound drivers could exit the site by traveling south along the access drive between Parcels A and B to E Denny Way, and disperse in all four general directions from there. Motorists could access Broadway at E Denny Way and reach destinations north and south of the site via Broadway.
- If E Denny Way were closed between Broadway and Nagle Place, it is expected that outbound site-generated trips would travel in a more dispersed pattern to their respective destinations. Motorists headed south would most likely continue south on Nagle Place to E Pine Street and disperse from there. It is expected that without direct access to Broadway, a greater number of drivers would take E John Street or E Denny Way to 12th Avenue E, and travel on that road to destinations north and south. The destinations most restricted under this scenario would be those most easily accessed directly from E Olive Way/Denny, such as the I-5 ramps at Yale Avenue and Olive Way, South Lake Union, and Queen Anne. Without access provided via E John Street or E Denny Way, drivers would need to take a more circular path to get to this area. This could be achieved by going south to E Pine Street and then looping back north via Broadway or Boren. It is likely that many would choose a smaller 'loop', in which they would turn eastbound on E John Street, northbound on to 10th or 11th Avenues E, westbound on E Thomas Street, and then take Broadway south to E Olive Way. Thus, restriction of left turns on E John Street combined with a closure of E Denny Way does increase the potential for 'cut through' traffic in the neighborhood to the north and east of the site.
- Most inbound traffic patterns would not be affected under these scenarios. Drivers arriving from the north, south, and west could access the site via E Denny Way if it is open, or turn right to the site access driveway directly from E John Street.

10. How much parking is needed for the proposed TOD?

The proposed project would include between 237 to 529 parking spaces on-site. Parking would be used primarily by residents in the buildings. Based on the 522 residential units that are proposed, this equates to 0.45 to 1.01 parking space per unit. A review of vehicle ownership data from the Census 2000 Journey-to-Work Characteristics shows an average of 0.6 vehicles per rental unit, and 1.1 vehicles per owned unit,⁷ indicating that the optimal amount of parking provided may depend on how many of the units are expected to be owned by occupants, and how many will be rented.

Recent analysis depicted in an *ITE Journal* article, "Assessing Multifamily Residential Parking Demand and Transit Service"⁸ determined parking demand rates specific for the First Hill/Capitol Hill Urban Center. That analysis determined that the number of vehicles per dwelling unit in the neighborhood ranged from 0.33 to 0.82 with a weighted average of 0.52.

The actual parking supply for each of the parcels could vary depending on the developer selected to build each site and their intended market. However, based on available data, the proposed 0.45–1.01

⁷ Puget Sound Regional Council. September 2002. 2000 Census Journey-to-Work Characteristics. Volume 1: King County Census Tracts. The census tract used for this analysis (84.0) corresponds physically to the transportation analysis zone (TAZ) used for the trip generation analysis (TAZ 143).

⁸ Rowe, Daniel H., Bae, Dr. Chang-Hee Christine, and Shen, Qing. Institute of Transportation Engineers, December 2010.

parking spaces per unit reflect a reasonable range for the project area. In addition, since the proposed development is by definition transit-oriented and is located at the light rail station, it is expected that it will attract residents who are more inclined to travel by alternative modes. This, combined with the average vehicle ownership data for the Capitol Hill area, indicate that parking supply at the lower end of the range could be justified.

As described earlier, it is expected that the proposed retail development would primarily attract non-motorized trips by travelers who are already in the area. It is not expected to generate many new vehicle trips and by extension, would have low parking demand that should be able to be accommodated with available public parking in the area. However, if fewer spaces are needed for residents, it could be possible to reserve a few short term parking spaces to support the retail development. Short-term on-street parking could also be used for the site's retail uses.

Retail uses may also require some on-street commercial load zones to support small parcel deliveries. The future First Hill Streetcar along Broadway will remove parking along the site's Broadway frontages; therefore, any load zones would likely need to be located along side streets. The loading function would be adversely affected if E Denny Way were closed between Broadway and Nagle Place and no parking was allowed in that section.

11. What are the conclusions of this analysis?

The proposed TOD residential and retail uses at the Capitol Hill Station are expected to generate over 5,800 daily transit and non-motorized trips, and approximately daily 990 vehicle trips, with 64 expected to occur during the AM peak and 91 during the PM peak hour. Operation at the adjacent Broadway/E Olive Way/E John Street intersection is currently LOS B during the AM peak hour and LOS C during the PM peak hour. Under projected 2016 conditions with the project in place, operations are expected to remain at these levels under all access and circulation scenarios. However, both field observations and analysis indicates that westbound queues at this intersection can regularly extend beyond the proposed site mid-block access location on E John Street, particularly during the PM peak hour, which would impede left turns out of the site at this location. When this occurs, drivers would choose to avoid the delay associated with left turns and take an alternate path.

E Denny Way is currently closed between Broadway and Nagle Place while the Capitol Hill Station is under construction. Comparison of traffic counts conducted at Broadway/E Olive Way/E John Street, before and after the roadway was closed, indicate that the closure has resulted in some shift in traffic patterns but not to an extent that overall operation at the intersection has changed. The City and area neighborhoods have discussed the potential to permanently close E Denny Way between Broadway and Nagle Place or temporarily close it during events such as the farmers' market. If it is closed, it would put additional pressure on the site access at E John Street and/or push more site trips onto streets such as Nagle Place or other residential streets north and east of the site.

The proposed project would provide on-site parking in the range of 0.45 to 1.01 parking space per unit. The actual parking supply for each of the parcels could vary depending on the developer selected to build each site and their intended market. Based on available data this reflects a reasonable range for the project area. Since the proposed development is by definition transit-oriented and is located at the light rail station, it is expected that it will attract residents who are more inclined to travel by alternative modes. This, combined with the average vehicle ownership data for the Capitol Hill area, indicate that parking supply at the lower end of the range could be justified.

12. What is recommended for access to the Sound Transit sites?

Based on the finding of the traffic operations analysis, the following features are recommended for the Sound Transit sites:

- **Do not permanently close E Denny Way to vehicular traffic.** Allowing traffic to use E Denny Way to enter and exit the site would keep it from diverting to Nagle Place and 10th Avenue E. It would also relieve congestion at the site's driveway on E John Street where queues from the adjacent intersection would regularly block left-turns from the site. E Denny Way would provide for site egress with right turns.
- **Design site access to allow E Denny Way to be closed during events.** All garage driveways on the Sound Transit sites A, B and C should be able to be accessed without using E Denny Way. This includes making the Nagle Place Extension (a private alley) wide enough to accommodate two-way traffic, and aligning the Nagle Place Extension across E Denny Way with Nagle Place. This would allow E Denny Way to be closed between Nagle Place and Broadway during events.
- **Design site to allow the south end of the Nagle Place Extension to be closed for events.** Neighborhood events, such as the farmer's market, could require closing the south end of Nagle Place Extension. This may require that Site B (the site between the Nagle Place Extension and 10th Avenue E) be accessed from 10th Avenue E.
- **Provide up to two commercial load zone parking spaces on E Denny Way.** These spaces would serve commercial uses along the site's Broadway frontage that will have no on street loading due to the First Hill Streetcar.