DAVID EVANS
AND ASSOCIATES INC.

Technical Memorandum

The undersigned parties concur with approach, assumptions and methodologies set forth in the Technical Memorandum—Transportation Analysis Methods and Assumptions for the Point Wells Mixed-Use Development Project attached hereto.

Snohomish County PDS	Snohomish County DPW
_____	_____
Signature	Signature
_____	_____
Title	Title
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Date	Date
BSRE Point Wells, LP	David Evans and Associates, Inc.
_____	_____
Signature	Signature
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Title	Title
_____	_____
Date	Date

C-34 SUPERSEDED 1st Point Wells Transportation Analysis Methods and Assumptions April 17 2015
PFN: 11 101457 LU

DATE: April 17, 2015

TO: Ryan Countryman
Snohomish County

FROM: Min Luo, PE, PTOE and Kirk Harris, PE, PMP
David Evans and Associates, Inc.

SUBJECT: Transportation Analysis Methods and Assumptions

PROJECT: Point Wells Mixed-Use Development Project

PROJECT NO.: PARA0000-0004

Cc: Gary Huff, Karr Tuttle Campbell

The purpose of this memorandum is to summarize the methods and assumptions used for the transportation analysis for the Point Wells Mixed-Use Development Project (Project). Minor changes to the methods and assumptions may be updated, if necessary, as the analysis progresses from the existing conditions into the travel forecasting phase of the work. Upon updates, the memorandum will be re-submitted for review and concurrence by Snohomish County.

1.0 Study Area and Period

The study area/boundary, or area of influence, is the area in and around the project site for which traffic analysis is required. The practical cordon line follows physical boundaries such as freeways, roadways, and geographical features. For the Project, the study area was created by identifying the most used routes traveling to and from the project site. The study area for the Project extends north to the city of Edmonds and 228th Street SW, east to I-5, and south to N 130th Street.

The traffic analysis study area focuses on a study corridor between the project site and Aurora Avenue N (SR 99) located along Richmond Beach Dr. NW – NW 196th Street – NW 195th Street – NW Richmond Beach Road – N 185th Street as well as 63 intersections that are mostly within the jurisdictions of the cities of Shoreline, Edmonds, Woodway, and the Washington State Department of Transportation (WSDOT). The study intersections are documented in **Attachments A** and **B**.

The land use alternatives for the Project will include the No-Action Alternative, Urban Center Alternative, and Urban Village Alternative. The Urban Center Alternative and Urban Village Alternative of the Project will be analyzed as they are proposed to be constructed in four (4) phases. Phases I through IV are proposed to be completed in 2020, 2023, 2026, and 2030, respectively.

Intersection level of service (LOS) will be evaluated for 63 study intersections in the weekday AM and PM peak hours for the 2014 condition, 2030 No Action condition, 2020 Phase I Build condition, 2023 Phase II Build condition, 2026 Phase III Build condition, and 2030 Phase IV Build condition.

The annual average daily traffic (AADT) and volume-to-capacity (V/C) ratio in the AM and PM peak hours for the 2014 condition, 2030 No Action condition, 2020 Phase I Build condition, 2023 Phase II

Build condition, 2026 Phase III Build condition, and 2030 Phase IV Build condition will be documented on the study corridor roadway segment between the project site and Aurora Avenue N (SR 99) located along Richmond Beach Dr. NW – NW 196th Street – NW 195th Street – NW Richmond Beach Road – N 185th Street.

2.0 Existing Conditions

The following describes how the existing transportation conditions will be documented and evaluated in the study areas.

2.1 Street System Inventory

The study corridor roadway segments and intersections will be inventoried and summarized. The inventories will be based on the data provided by the agencies, aerials maps, and site visits. The roadway system inventories will include roadway functional classifications, number of lanes, speed limits, roadway shoulders, pedestrian/bicycle facilities, transit service and facilities, rail services, intersection geometry, traffic control types, traffic counts, signal timing and phasing.

2.2 Collision Data Evaluation

Collision evaluation will focus only on the primary access corridor, which is between the project site and Aurora Avenue N (SR 99) located along Richmond Beach Dr. NW – NW 196th Street – NW 195th Street – NW Richmond Beach Road – N 185th Street.

The historical collision data for the collision evaluation for a five-year period, from January 2009 to December 2013, was obtained from the city of Shoreline, Washington. The collision data will be used to identify potential existing transportation safety issues on the primary access corridor and at the intersections along the corridor.

The collisions data will be analyzed by years, types, and severity and the five most prevalent reasons for collisions will be identified. Intersection collision rates (collisions per million entering vehicles (MEV)) and roadway collision rates (collisions per million vehicle-miles of travel (MVM)) will be estimated.

The intersection collision rates will be compared to a typical threshold of concern (1.0 collision per million entering vehicles (MEV)). The roadway collision rates will be compared to the collision rates for urban minor arterials within the Northwest Region in the State of Washington during the analysis period. The intersections and roadway segments with collision rates greater than the threshold of concern or other similar classified arterials will be identified for further review.

2.3 Traffic Volumes

The existing traffic volumes were obtained from intersection turning movement counts collected in both the AM and PM peak hours in 2011, 2013 and 2014. The 2011 and 2013 intersection turning movement counts will be scaled up to the 2014 condition using a straight-line growth rate of 0.25 percent per year. The annual growth rate of 0.25 percent was provided by the city of Shoreline, Washington based on their recent traffic studies and was included in the ***Corridor Study General Scope and Assumptions*** as part of a Memorandum of Understanding (MOU) between Shoreline and the Project owner. The annual average daily traffic (AADT) was checked on SR 99 just north of N 170th Street and on SR 99 south of N 200th Street and zero to negative growth was found in the past four years; therefore, the annual growth rate of 0.25 percent provided by the city of Shoreline is a reasonable growth rate to be used for the fully developed area within the city of Shoreline limits, including the SR 99 corridor.

2.4 Traffic Operations

Although the SYNCHRO program (Versions 8 and 9) that applies the 2010 Highway Capacity Manual (HCM 2010) methodology is currently available, the SYNCHO program (Versions 8 and 9) has the following limitations in performing signalized intersections' LOS analysis using the HCM 2010 methodology:

- Intersections with more than four approaches cannot be evaluated.
- Non-NEMA or custom phasing is not supported.
- Clustered intersections cannot be evaluated.
- Turning movement with shared land exclusive lane group cannot be computed.
- U-turn movement cannot be analyzed.

In order to resolve the above limitations present in the SYNCHRO program (Versions 8 and 9), the SYNCHRO program (Version 7) that applies the HCM 2000 methodology will be used for intersection LOS evaluation for signalized intersections and stop-controlled intersection.

The peak hour factors and heavy vehicle percentages obtained from the intersection turning movement count data will be used for intersection LOS analysis.

For signalized intersections, existing signal timing and phasing were obtained from the SYNCHRO model and signal timings sheets provided by the city of Shoreline. LOS will be reported based on overall average control delay (in seconds) per vehicle.

For all-way stop-controlled intersections, LOS will be reported based on the weighted average control delay of all approaches. For two-way stop-controlled intersections, LOS will be reported based on the worst approach delay of the side streets.

The detailed SYNCHRO intersection LOS evaluation assumptions are shown in **Attachment C**.

Intersection LOS and V/C will be checked against each jurisdiction's minimum acceptable standards described as follows:

- **City of Shoreline**: per Shoreline Municipal Code 20.60.140:
    - LOS D for signalized intersections on arterial streets and for unsignalized intersections on arterials; the V/C ratio on one leg of an intersection may exceed 0.90 when the intersection operates at LOS D or better; or
    - A V/C ratio of 0.90 or lower for roadway segments on principal and minor arterials.
- **City of Edmonds**:
    - LOS D for intersections on arterials, LOS C for intersections on collectors, and LOS B for intersections on local streets.
- **City of Woodway**:
    - LOS A for major intersections within the city limits, which include Timber Lane and SW 238th Street, 114th Avenue W and SW 238th Street, and Woodway Park Road and Algonquin Road

- **WSDOT**:
  - LOS D for intersections on SR 104 and LOS E for intersections on SR 99 based on the guidance from the Aurora Corridor Improvement Project within Shoreline (City of Shoreline, 2009).

2.5 Pedestrian and Bicycle Facilities

Based upon available mapping, GIS data, existing plans, and field review, existing pedestrian and bicycle facilities within the vicinity of the study area will be documented. This will include existing and planned facilities within the study area.

2.6 Transit and Rail Services

Information on existing transit services and facilities in the vicinity of the study area, including bus routes (location, service frequency, and times of day) and rail service (Sounder service in Edmonds) will be summarized. Park and ride facilities will be documented in the vicinity of the site, as well as high occupancy vehicle lanes or transit signal priority. The inventory of transit services and facilities will be primarily based on information from Metro, Sound Transit, Community Transit, and other agencies, as applicable.

3.0 2030 No Action Condition

3.1 2030 No Action Street System

The street system for 2030 No Action condition will be the same as the existing condition, plus the proposed improvement projects that are fully funded and committed to be constructed by 2030.

3.2 2030 No Action Traffic Volumes

2030 No Action traffic volumes will include the background traffic that will be estimated based on the traffic counts, a straight-line annual growth rate of 0.25 percent for the intersections, and the site traffic generated from the existing industrial use.

3.3 2030 No Action Traffic Operations

Similar methods and assumptions used for LOS evaluation in the existing condition will be used for the 2030 No Action condition. Signal timings and phasing for signalized intersections will be optimized using the SYNCHRO program.

The detailed SYNCHRO intersection LOS evaluation assumptions are shown in **Attachment C**.

4.0 Build Condition for Urban Center Alternative and Urban Village Alternative

4.1 Street System with Proposed Improvement Options

The street system in the Build Condition will include the street system in the 2030 No Action condition, plus multiple mitigation strategies on the study corridor between the project site and Aurora Avenue N (SR 99) located along Richmond Beach Dr. NW – NW 196th Street – NW 195th Street – NW Richmond Beach Road – N 185th Street. The mitigation strategies may include single or a combination of improvements such as re-striping/re-channelization, intersection improvements and/or control types

changed, roadway widening, neighborhood street traffic calming, and an addition of a secondary site access.

These improvement options will be evaluated for each land use phase in 2020, 2023, 2026, and 2030 in both the AM and PM peak hours for both the Urban Center Alternative and the Urban Village Alternative.

4.2 Land Use Alternatives and Construction Phasing

4.2.1 Urban Center Alternative Land Use /Phasing

Alternative 1 – Urban Center Alternative: The site would be redeveloped as a mixed-use urban center, consistent with the Urban Center land use designation/zoning classification of the site at the time complete applications were submitted to the County in 2011. Development would include 3,081 residential units, approximately 32,262 square feet (SF) of commercial/office uses, approximately 94,300 SF of retail uses, on-site amenities, and parks and open space.

The Urban Center Alternative of the Point Wells project will be constructed in four (4) phases. Phases I through IV will be completed in 2020, 2023, 2026, and 2030, respectively. The total cumulative project land uses by the end of Phase IV for the Urban Center Alternative are:

- 3,081 residential units
  - 307 High-Rise Apartments
  - 1,560 High-Rise Condominiums
  - 114 Townhouses
  - 1,100 Senior Condominiums
- 32,262 square feet of office area
  - 24,762 square feet of General Office
  - 7,500 square feet of Medical-Dental Office
- 74,300 square feet of retail area
  - 30,000 square feet of Specialty Retail
  - 26,300 square feet of Supermarket
  - 18,000 square feet of Quality Restaurants
- 20,000 square feet of On-Site amenities
  - 20,000 square feet of Fitness Center

The land use for each phase and cumulative total by phase is shown in **Table 1**. Land use codes for residential uses within the four phases will be applied to buildings identified in the project site layout. Averaged heights of similar-sized and adjacent buildings may be used to designate a group of residential dwelling units within a High Rise category. Senior Adult Housing dwelling units may be included in high, mid, or low rise buildings as identified in the project site layout. It is anticipated that many of the residents may be 55 plus and semi-retired and could live in designated senior housing units or unrestricted market units.

Table 1: Land Use by Project Phase for Urban Center Alternative

Land Use Types	Land Use Code (LUC)	Units	Subtotal in Phase				Cumulative Total by Phase			
			I	II	III	IV	I	I-II	I-III	I-IV
Residential		**DU**	**653**	**254**	**1,271**	**903**	**653**	**907**	**2,178**	**3,081**
High-Rise Apartment	222	DU	53	254	-	-	53	307	307	307
High-Rise Residential Condominium/Townhouse	232	DU	433	-	763	364	433	433	1,196	1,560
Residential Condominium/Townhouse	230	DU	114	-	-	-	114	114	114	114
Senior Adult Housing – Attached (Condo)	252	DU	53	-	508	539	53	53	561	1,100
Commercial Office		**KSF**	**-**	**32.262**	**-**	**-**	**-**	**32.262**	**32.262**	**32.262**
General Office	710	KSF	-	24.762	-	-	-	24.762	24.762	24.762
Medical-Dental Office Building	720	KSF	-	7.5	-	-	-	7.5	7.5	7.5
Retail		**KSF**	**24.0**	**26.3**	**24.0**	**-**	**24.0**	**50.3**	**74.3**	**74.3**
Specialty Retail Center	826	KSF	16.0	-	14.0	-	16.0	16.0	30.0	30.0
Supermarket	850	KSF	-	26.3		-	-	26.3	26.3	26.3
Quality Restaurant(s)	931	KSF	8.0	-	10.0	-	8.0	8.0	18.0	18.0
On-Site Amenities		**KSF**	**-**	**20.0**	**-**	**-**	**-**	**20.0**	**20.0**	**20.0**
Health/Fitness Club*	492	KSF	-	20.0	-	-	-	20.0	20.0	20.0

*Health/Fitness Club will provide services to residents only; therefore no trip generation is expected.

4.2.2 Urban Village Alternative Land Use /Phasing

Alternative 2 – Urban Village Alternative: The site would be redeveloped as a mixed-use urban village, consistent with the current Urban Village land use designation of the site. The urban village development would include the same site plan as Urban Center Alternative. However, several buildings would shorter in height in the Urban Village Alternative than in the Urban Center Alternative. Approximately 2,600 residential units would be provided under the Urban Village Alternative. The same amounts of commercial/office uses (32,262 SF), retail uses and on-site amenities (94,300 SF), and parks and open space for the Urban Center Alternative is assumed for the Urban Village Alternative.

The development will be constructed in four phases in 2020, 2023, 2026, and 2030, respectively. The total cumulative project land uses by the end of Phase IV for the Urban Village Alternative are:

- 2,600 residential units
  - 260 High-Rise Apartments
  - 965 High-Rise Condominiums
  - 397 Townhouses
  - 978 Senior Condominiums

- 32,262 square feet of office area
  - 24,762 square feet of General Office
  - 7,500 square feet of Medical-Dental Office
- 74,300 square feet of retail area
  - 30,000 square feet of Specialty Retail
  - 26,300 square feet of Supermarket
  - 18,000 square feet of Quality Restaurants
- 20,000 square feet of On-Site amenities
  - 20,000 square feet of Fitness Center

The land use for each phase and cumulative total by phase is shown in **Table 2**. Land use codes for residential uses within the four phases will be applied to buildings identified in the project site layout. Averaged heights of similar-sized and adjacent buildings may be used to designate a group of residential dwelling units within a High Rise category. Senior Adult Housing dwelling units may be included in high, mid, or low rise buildings as identified in the project site layout. It is anticipated that many of the residents may be 55 plus and semi-retired and could live in designated senior housing units or unrestricted market units.

Table 2: Land Use by Project Phase for Urban Village Alternative

Land Use Types	Land Use Code (LUC)	Units	Subtotal in Phase				Cumulative Total by Phase			
			I	II	III	IV	I	I-II	I-III	I-IV
Residential		**DU**	**575**	**242**	**1,128**	**655**	**575**	**817**	**1,945**	**2,600**
High-Rise Apartment	222	DU	-	242	18	-	-	242	260	260
High-Rise Residential Condominium/Townhouse	232	DU	253	-	566	146	253	253	819	965
Residential Condominium/Townhouse	230	DU	322	-	75	-	322	322	397	397
Senior Adult Housing – Attached (Condo)	252	DU	-	-	469	509	-	-	469	978
Commercial Office		**KSF**	**-**	**32.262**	**-**	**-**	**-**	**32.262**	**32.262**	**32.262**
General Office	710	KSF	-	24.762	-	-	-	24.762	24.762	24.762
Medical-Dental Office Building	720	KSF	-	7.5	-	-	-	7.5	7.5	7.5
Retail		**KSF**	**24.0**	**26.3**	**24.0**	**-**	**24.0**	**50.3**	**74.3**	**74.3**
Specialty Retail Center	826	KSF	16.0	-	14.0	-	16.0	16.0	30.0	30.0
Supermarket	850	KSF	-	26.3	-	-	-	26.3	26.3	26.3
Quality Restaurant(s)	931	KSF	8.0	-	10.0	-	8.0	8.0	18.0	18.0
On-Site Amenities		**KSF**	**-**	**20.0**	**-**	**-**	**-**	**20.0**	**20.0**	**20.0**
Health/Fitness Club*	492	KSF	-	20.0	-	-	-	20.0	20.0	20.0

*Health/Fitness Club will provide services to residents only; therefore no trip generation is expected.

4.3 Trip Generation/Internal Capture for Urban Center and Urban Village Alternatives

Gross trip generation will be estimated for each phase for both the Urban Center and Urban Village Alternatives of the Project for the AM and PM peak hours and on a daily basis using the applicable trip rates or regression equations presented in the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (9th edition, 2012) based on the ITE recommended guidelines and procedures.

Gross trip generation will be adjusted to account for internalization for each land use alternative in each construction phase for the AM and PM peak hours. Pass-by trip and diverted-linked trip adjustments will not be calculated for off-site roadways because the project site is at the end of the study corridor and bordered to the west by the Puget Sound.

The internalization adjustments for the AM and PM peak hours will be calculated following the National Cooperative Highway Research Program Report 684 (NCHRP 684) *Trip Capture Estimation Tool* and ITE recommended procedures described in the latest *ITE Trip Generation Handbook –An ITE Proposed Recommended Practice* (3rd Edition, August 2014). The *NCHRP 684 Trip Capture Estimation Tool* estimates AM and PM peak-periods trips to and from six specific land use categories, including office, retail, restaurant, residential, cinema/entertainment, and hotel.

Mode split adjustments are included in the *NCHRP 684 Trip Capture Estimation Tool* for internalized trip capture. The mode split percentage for most land uses will refer to *Appendix C. Person Trip Data for Baseline Sites* in the latest *ITE Trip Generation Handbook –An ITE Proposed Recommended Practice* (3rd Edition, August 2014). The mode split and vehicle occupancy estimates for applicable land uses used in NCHRP 684 Internal Trip Capture Estimation Tool for the AM and PM peak hours for both Urban Center Alternative and Urban Village Alternative in each construction phase are shown in **Tables 3** and **4**, respectively.

Table 3: Mode Split and Vehicle Occupancy Estimates in AM Peak Hour

Land Use	Entering Trips				Exiting Trips		
	Vehicle Occupancy	% Transit	% Non-Motorized		Vehicle Occupancy	% Transit	% Non-Motorized
Office	1.06	1%	0%		1.06	0%	0%
Retail	1.17	0%	0%		1.16	0%	0%
Restaurant	1.62	0%	0%		1.52	0%	0%
Cinema/Entertainment	-	-	-		-	-	-
Residential	1.13	0%	4%		1.09	Refer to Table 5	2%
Hotel	-	-	-		-	-	-
All Other Land Uses	-	-	-		-	-	-

Table 4: Mode Split and Vehicle Occupancy Estimates in PM Peak Hour

Land Use	Entering Trips				Exiting Trips		
	Vehicle Occupancy	% Transit	% Non-Motorized		Vehicle Occupancy	% Transit	% Non-Motorized
Office	1.11	0%	0%		1.07	0%	1%
Retail	1.21	0%	0%		1.18	0%	0%
Restaurant	1.62	0%	1%		1.52	0%	1%
Cinema/Entertainment	-	-	-		-	-	-
Residential	1.15	Refer to Table 5	3%		1.21	0%	4%
Hotel	-	-	-		-	-	-
All Other Land Uses	-	-	-		-	-	-

For the residential land use, the transit mode share in the AM outbound direction and PM inbound direction will be adjusted based on the Puget Sound Regional Council (PSRC) *Growth Targets and Mode Split Goals for Regional Centers* (A PSRC Guidance Paper, July 2014), because a transit hub will be provided onsite at the Point Wells Project and the Point Wells Project qualifies as a Regional Growth Center (RGC) based upon the criteria defined in the PSRC Guidance Paper.

While the Point Wells Project is not currently included in the list of RGC's in the PSRC Guidance Paper, it meets the criteria for a new RGC designation. A principal measure for designation of a new RGC is to have a target activity level of 45 activity units (AU) per gross acre. Activity units are a combination of population and employment. The Urban Center alternative is estimated to have a population of 6,200 and provide 500 jobs. The Urban Village alternative is estimated to have a population of 5,232 and provide 500 jobs. The Project site has 61 gross acres which includes 45 acres of upland area and 16 acres of tideland. Therefore, the Point Wells development will yield 110 AU ((6200 + 500)/61) for the Urban Center alternative and 94 AU ((5232 + 500)/61) for Urban Village alternative and allow both alternatives to be designated a RGC.

The transit mode split in 2010 for the average RGC was 21.5 percent and the transit mode split in 2040 is forecasted to be 39 percent based on Figure 10 in the PSRC Guidance Paper. As shown in Figure 8 of the PSRC Guidance Paper, the transit mode share for Lynnwood, an RGC close to the Project, was 7 percent in 2010.

It is reasonable to assume that the Point Wells Project with residential land use as its primary land use will have similar transit mode share at approximately 7 percent, same as the Lynnwood RGC, after completion of Phase I development in the AM outbound direction and in the PM inbound direction. As construction of the subsequent phases progresses, as residential density at the Project site is increased, and as transit services are enhanced, transit mode share is expected to increase. By completion of Phase IV in 2030, it is assumed the transit mode share for the Urban Center Alternative in the AM outbound direction and in the PM outbound direction will achieve the same level of transit mode share as the average RGC in 2010, which is 22 percent. This assumption should be considered to be conservative as it falls well below PSRC's goal of a 39 percent of transit mode share for the average of all RGC's in 2040. The transit mode share for the Urban Village Alternative in Phases II to IV is assumed to be 1 to 3 percent lower than the Urban Center Alternative as a result of overall less residential units and density.

Table 5 illustrates the transit mode share assumption for the Urban Center Alternative and Urban Village Alternative in the AM and PM peak hour for each construction phase.

Table 5: Transit Mode Share in the AM Outbound and PM Inbound Directions

Alternative	% Transit for RGC in 2010	% Transit for Residential Land Use in Point Wells Project				% Transit Goal for RGC in 2040
		Phase I in 2020	Phase II in 2023	Phase III in 2026	Phase IV in 2030	
Comparison only: PSRC Regional Growth Center(RGC)	*22% (Average of all RGC's)*	-	-	-	-	*39% (Average of all RGC's)*
Urban Center Alternative 1	-	7%	12%	17%	22%	-
Urban Village Alternative 2	-	7%	11%	15%	19%	-

The *NCHRP 684 Trip Capture Estimation Tool* for internalized trip capture also takes into considration of average land use interchange distance (working distance in feet) for the PM peak hour. The working distance between each land use pair will be measured based on the site plan, then used the weighted average distances based on the land use sizes.

The daily external vehicle-trips will instead be estimated using the PM peak hour external trips and a K-factor of 0.107, which will refer to the Highway Capacity Manual 2010 (HCM 2010) for urban arterials with similar annual average daily traffic (AADT) range between 20,000 and 50,000 as on the study corridor between the project site and Aurora Avenue N (SR 99) located along Richmond Beach Drive NW – NW 196th Street – NW 195th Street – NW Richmond Beach Road – N 185th Street.

The daily trip internalization will not be calculated using the same methods as for the AM and PM peak hours because daily internal capture rates are not available in the *NCHRP 684 Trip Capture Estimation Tool* and the latest *ITE Trip Generation Handbook –An ITE Proposed Recommended Practice* (3rd Edition, August 2014).

The AM and PM peak hour external trips will be distributed into the study area via the travel demand model developed for the Point Wells Project.

4.4 Trip Distribution and Assignment in Build Condition

A Point Wells project-specific computer-based travel demand model in the PM peak hour was originally developed in 2010 using the VISUM program (Version 11) and was updated in August 2014 using the VISUM program (Version 14). The VISUM program, a Windows-based multimodal transportation modeling program, was used to help understand the existing traffic flow patterns, distribute the Point Wells project site trips throughout the project study area, which includes areas in both Snohomish and King Counties.

The Point Wells travel demand model development process includes roadway network-building, four-step modeling procedures, base model validation, and future traffic forecasting.

The roadway network building involves the laying out of roadways, intersections, and zone structure and zone connectors. The roadway network, including city and county boundaries, was built by incorporation of NAVTEQ data, which provided all freeways, principal arterials, minor arterials, collectors, and local streets in Snohomish and King Counties. Link capacity, speed, and number of lanes are most relevant for roadway coding. Intersection control type, configuration, and capacity are most critical for intersection coding. The zone structure was based on the adopted PSRC Traffic Analysis Zones (TAZ), to cover all of Snohomish and King Counties, and the zone connectors were manually added into the Point Wells model. The Point Wells project site is represented by TAZ 1001, TAZ 1002, TAZ 1003, and TAZ 1004.

Four-step modeling typically includes trip generation, trip distribution, mode choice, and traffic assignment. The Point Wells model focuses on trip generation, trip distribution, and traffic assignment. Trip generation was only applied for the project development but was not applied for the background traffic modeling. Instead, to be consistent with the PSRC traffic growth forecasting on the roadway network, the background traffic was modeled and interpolated using the PSRC vehicle trip tables for periods between 2006 and 2040 to arrive at the existing 2010 conditions and the future Build scenarios in each development phase. The project-generated trips were consistent with the trips estimated using ITE trip generation methodology, including project trip internalization. The final trip distribution and traffic assignment procedures combine the project-generated trip table and the background growth trip table to distribute trips to each TAZ and assign trips on the roadway network for the Build scenarios. The total regional background growth trips obtained from the PSRC trip table for each development phase were held constant.

Base model validation is a process of comparing the calibrated model's raw volumes against the base-year traffic counts to show the degree of correlation and to determine an acceptable accuracy and degree of confidence to use the base model to forecast future traffic volumes. The most common statistical measure of "goodness of fit" is the R-Squared statistic. This measures how well the model's raw volumes represent the observed count data. The base model validation for the Point Wells 2010 model (the R^2 value) was 0.75, and engineering judgment has concluded that the traffic flow patterns are acceptable. The VISUM model will be used as a tool for site trip distribution and traffic assignment because the model raw volumes were not intended to be used for intersection LOS and delay analysis. Instead, the intersection analysis was specially based on the actual traffic counts plus the background traffic growth plus the project-generated trips; therefore the R^2 value is not as critical in Point Wells model as in other typical travel demand models.

The future traffic forecasting model in the AM and PM peak hours will be built upon the acceptable 2010 base model in the PM peak hour by updating the land use and future improvement projects/options, and serves exclusively for the Point Wells project trip distribution. Some link speed, capacity, and/or intersection capacity were later adjusted based upon input received from the City of Shoreline staff to achieve the City of Shoreline's assumed and desired site trip distribution flow patterns. A special matrix was added in order to capture some light-rail station traffic near the I-5 and 185th Street interchange and near the I-5 and 145th Street interchange for the Phase IV full build out scenario. The final project site trip distribution patterns for Phase IV of the Urban Center land use alternative were indicated during coordination meetings as being acceptable to the City of Shoreline.

The VISUM model's raw volumes will not be used for the intersection LOS analysis; instead, the background traffic grew from the counts using the straight-line annual growth rate of 0.25 percent plus the Point Wells project site trips (i.e. derived from the VISUM model) will be used to conduct intersection LOS analysis.

4.5 Traffic Volumes in Build Condition

Traffic volumes in the Build condition for each phase of each land use alternative will be obtained by adding the background traffic and the Point Wells project site trips. The Point Wells project site trips will be modeled using the VISUM program that is described in the preceding section.

4.6 Traffic Operations in Build Condition

Intersection LOS evaluation will be conducted using the HCM 2000 methods and SYNCHRO program (Version 7) and aaSidra program (Version 5) for both the Urban Center and Urban Village Alternatives.

The mitigation improvements will be incorporated into the SYNCHRO model and the roundabout model for LOS analysis.

Traffic Volumes will be obtained by combining the background traffic, plus the Point Wells project site trips in each phase for each improvement option under each land use Alternative.

Signal Timing and Phasing –Signal split and cycle lengths for future build condition will be optimized using the SYNCHRO program. The minimum green, yellow clearance, red clearance, recalls mode will be kept the same as the existing. Pedestrian walk time and flash don't walk time will be kept unchanged from the existing even after lane conversion on Richmond Beach Road corridor because curb to curb width was unchanged, but if the road way segment is widened, walk time will be 7 seconds, and flash don't walk will be estimated based on walking speed of 3.5 feet per second. For new signalized intersections, signal timing and phasing will be referred to similar signals and will be optimized using the SYNCHRO program.

Peak hour factor and heavy vehicle percentage will be obtained from the default values in HCM 2000. The bicycle and pedestrian counts will be used in the future condition.

The detailed SYNCHRO intersection and roundabout LOS evaluation assumptions are shown in **Attachment C** and **D**, respectively.

Intersection LOS will be calculated for all study intersections for both the Urban Center and Urban Village Alternatives. Project impacts will be identified by comparing intersection delay between the No Action Alternative and Build Condition scenarios.

Roadway segment V/C ratio will be examined and checked against the city of Shoreline roadway segment V/C standard.

4.7 Traffic Safety in Build Condition

High collision locations identified from the historical collision data will be reviewed in each of the build land use alternative and potential safety impacts will be identified due to increasing traffic, control types changed, improvements added, roadways/intersections configuration changed, and any other issues.

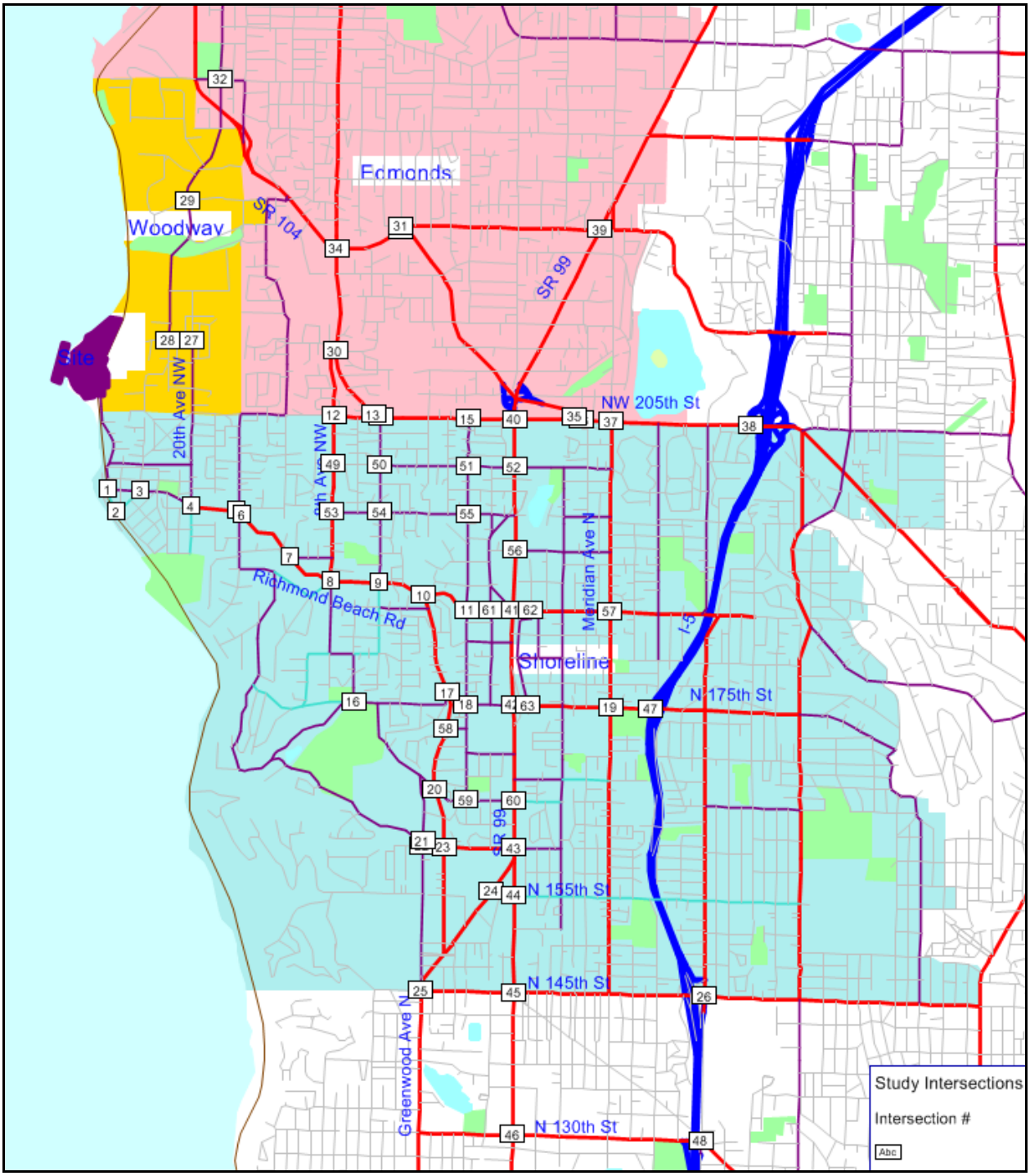
4.8 Pedestrian and Bicycle Facilities in Build Condition

Potential project impacts on pedestrian and bicycle facilities will be summarized. The efforts will be focused on the study corridor.

4.9 Transit and Rail Services in Build Condition

Potential project impacts on transit and rail services will be summarized. Consideration will be given on the ability of adding more transit services/rail services to the project study area.

Attachment A – Study Intersections in Vicinity



Attachment B – Study Intersections and Control Types

No.	Intersection	Control Type	Jurisdiction
1	Richmond Beach Drive NW & NE 196th Street	Two-way stop	Shoreline
2	Richmond Beach Drive NW & NW 195th Place	Two-way stop	Shoreline
3	24th Avenue NW & NW 196th Street	Two-way stop	Shoreline
4	20th Avenue NW & NW 195th Street	All-way stop	Shoreline
5	NW 195th Street & 15th Avenue NW	Two-way stop	Shoreline
6	15th Avenue NW & NW Richmond Beach Road	All-way stop	Shoreline
7	NW Richmond Beach Road & NW 190th Street	Two-way stop	Shoreline
8	8th Avenue NW & NW Richmond Beach Road	Signalized	Shoreline
9	3rd Avenue NW & NW Richmond Beach Road	Signalized	Shoreline
10	Dayton Avenue N & NW Richmond Beach Road	Signalized	Shoreline
11	Fremont Avenue N & N 185th Street	Signalized	Shoreline
12	100th Avenue W & 244th Street SW	Two-way stop	Shoreline
13	Firdale Avenue & 244th Street SW	Two-way stop	Shoreline
14	3rd Avenue NW & 244th Street SW	Two-way stop	Shoreline
15	Fremont Avenue N & 244th Street SW	Two-way stop	Shoreline
16	6th Avenue NW & NW 175th Street	Two-way stop	Shoreline
17	Dayton Avenue N & St Luke Place N	Two-way stop	Shoreline
18	Fremont Avenue N & N 175th Street	Signalized	Shoreline
19	Meridian Avenue N & N 175th Street	Signalized	Shoreline
20	Dayton Avenue N & Carlyle Hall Road N	Two-way stop	Shoreline
21	Greenwood Avenue N & N Innis Arden Way	Two-way stop	Shoreline
22	Greenwood Avenue N & N 160th Street	All-way stop	Shoreline
23	Dayton Avenue N & N 160th Street	Signalized	Shoreline
24	Westminster Way N & N 155th Street	Signalized	Shoreline
25	Greenwood Avenue N & SR 523 (N 145th Street)	Signalized	Shoreline
26	5th Avenue NE & SR 523 (N 145th Street)	Signalized	Shoreline
27	Timber Lane & 238th Street SW	All-way stop	Woodway
28	114th Avenue W & 238th Street SW	All-way stop	Woodway
29	Woodway Park Road & Algonquin Road	Two-way stop	Woodway
30	Firdale Avenue & 238th Street SW	Signalized	Edmonds
31	95th Place W & 228th Street SW	Two-way stop	Edmonds
32	3rd Avenue S & Pine Street	Two-way stop	Edmonds
33	95th Place W & SR 104 (Edmonds Way)	Signalized	WSDOT
34	100th Avenue W & SR 104 (Edmonds Way)	Signalized	WSDOT
35	SB SR 104 (Edmonds Way) & WB 244th Street SW	Signalized	WSDOT
36	SB SR 104 (Edmonds Way) & EB 244th Street SW	Signalized	WSDOT
37	76th Avenue W & SR 104 (Lake Ballinger Way)	Signalized	WSDOT
38	SB I-5 Ramps & SR 104 (Lake Ballinger Way)	Signalized	WSDOT
39	SR 99 & 228th Street SW	Two-way stop	WSDOT
40	SR 99 & 244th Street SW	Signalized	WSDOT
41	SR 99 & N 185th Street	Signalized	WSDOT
42	SR 99 & N 175th Street	Signalized	WSDOT
43	SR 99 & N 160th Street	Signalized	WSDOT
44	SR 99 & N 155th Street	Signalized	WSDOT
45	SR 99 & SR 523 (N 145th Street)	Signalized	WSDOT
46	SR 99 & N 130th Street	Signalized	WSDOT
47	SB I-5 Ramps & N 175th Street	Signalized	WSDOT

No.	Intersection	Control Type	Jurisdiction
48	5th Avenue NE & NE 130th Street	Signalized	Others
49	8th Ave NW & NW 200th Street	Two-way stop	Shoreline
50	3rd Ave NW & NW 200th Street	Two-way stop	Shoreline
51	Fremont Ave N & N 200th Street	All-way stop	Shoreline
52	SR 99 & N 200th Street	Signalized	Shoreline
53	8th Ave NW & NW 195th Street	Two-way stop	Shoreline
54	3rd Ave NW & NW 195th Street	All-way stop	Shoreline
55	Fremont Ave N & N 195th Street	All-way stop	Shoreline
56	SR 99 & N 192nd Street	Signalized	Shoreline
57	Meridian Ave N & N 185th Street	Signalized	Shoreline
58	Dayton Ave N & N 172nd Street	Two-way stop	Shoreline
59	Fremont Ave N & N 165th Street	Two-way stop	Shoreline
60	SR 99 & N 165th Street	Signalized	Shoreline
61	Linden Ave N & N 185th Street	Signalized	Shoreline
62	Midvale Ave N & N 185th Street	Signalized	Shoreline
63	Midvale Ave N & N 175th Street	Signalized	Shoreline

Attachment C – SYNCHRO LOS Evaluation Assumptions for Signalized and Unsignalized Intersections

Check Items	Condition			Updates	
	2014	2030 No Action	Future Build Condition by Phase	Date	Change
Roadway Network	1. Network drawn to scale. 2. Link speed verified to speed limits.	The same as existing plus funded projects	The same as 2030 No Action plus mitigation improvements.		
Channelization	1. Lane configuration checked against aerial map and field visit notes. 2. Right-turn/left-turn pocket length entered. 3. Right-turn channelization coded. 4. Right-turn on red verified. 5. Two-way left-turn lane verified.	The same as existing plus funded projects	The same as 2030 No Action plus mitigation improvements.		
Control Types	Signal or stop control verified.	The same as existing plus funded projects	The same as 2030 No Action plus intersection improvements.		
Traffic Volumes	Balance volumes between closely spaced intersections with no accesses in between.	Grew from existing based on 0.25%/year	Background traffic (grew counts using 0.25% per year) + Project site trips by phase		
Factors	Heavy vehicle (HV) percentage and peak hour factors (PHF) entered by approach based on counts or if not available, based on SYNCHRO default values.	HCM default values: PHF=0.92 HV=2%	HCM default values: PHF=0.92 HV=2%		
Signal Timing/Phasing	Signal timing and phasing based on timing sheets from agencies. If not available, use field observation. Parameter entered include: 1. Controller types 2. Cycle length 3. Phasing 4. Minimum green, splits, yellow, and red time 5. Vehicle passage time/gaps 6. Lead/lag phasing, 7. Recall mode, 8. Ped phasing and walk and flash don't walk time 9. Reference phasing	Optimized by the SYNCHRO program.	If timing is not available, use agency standards. If there are no standards, assume: 1. Minimum green = 4 sec for side streets and 8 sec for main streets. 2. Yellow =4 sec; Red = 1 sec 3. Vehicle passage time/gaps = 3 sec 3. Optimize lead/lag phasing 4. Set Min recall mode for main streets, none for minor streets 5. Set walk = 7 sec and flash don't walk = 3.5 feet/ sec 6. "Reference to" beginning of green 7. Optimize Cycle length For existing and future signals: 1.Maintain coordination on corridors 2. Optimize splits or change cycle length if LOS is poor		
Ped./Bicycle Volumes	Pedestrian Bicycle Volumes coded based on counts	The same as existing	The same as existing		

Attachment D – aaSidra LOS Evaluation Assumptions for Roundabouts

The aaSidra program (version 5) will be used for roundabout LOS analysis. The following default values that are consistent with WSDOT procedures will be used when roundabout information is not available.

1. **Environment Factor (EF)**: Varied based on analysis period
   - 1.1 for existing condition
   - 1.0 for future years (10 to 20 year out)

2. **Roundabout Capacity Model**: SIDRA Standard.

3. **Delay Model**: SIDRA Standard Delay Model is used. Control delay includes geometric delay.

4. **Gap-Acceptance Capacity**: SIDRA Standard (Akçelik M3D).

5. **LOS method:** Delay using HCM 2000.

6. **Roundabout LOS Method**: Same as Signalized Intersections. Vehicle movement LOS values are based on average delay per movement; Intersection and Approach LOS values are based on average delay for all vehicle movements.

7. **Measure of Effectiveness (MOE)**: Degree of Saturation (V/C) and LOS

8. **Lane Widths**: 13-feet entry or exit lane widths

9. **Roundabout Design Elements**: Refer to WSDOT *Design Manual* Exhibit 1320-1 as shown below

Exhibit 1320-1: Suggested Initial Design Ranges

Design Element	Mini [1]	Single-Lane	Multilane
Number of Lanes	1	1	2+
Inscribed Circle Diameter [2]	45'–80'	80'–150' [3]	135'
Circulating Roadway Width	N/A	14'–19'	29'
Entry Widths	N/A	16'–18'	25'

Notes:
[1] Reserved for urban/suburban intersections with a 25 mph or less posted speed.
[2] The given diameters assume a circular roundabout; adjust accordingly for other shapes.
[3] Inscribed circle diameters of less than 100 feet may not be appropriate on a state route.

10. Speeds: Recommended Maximum entry design speeds based on Roundabout: *An Informational Guide*, FHWA Exhibit 6-4 shown below.

Exhibit 6-4: Recommended Maximum Entry Design Speeds

Site Category	Recommended Maximum Entry Design Speed
Mini-Roundabout	25 km/h (15 mph)
Urban Compact	25 km/h (15 mph)
Urban Single Lane	35 km/h (20 mph)
Urban Double Lane	40 km/h (25 mph)
Rural Single Lane	40 km/h (25 mph)
Rural Double Lane	50 km/h (30 mph)

11. **Other Items**: Assumption related channelization, traffic volumes, heavy vehicle percentages, and peak hour factors will be consistent with Attachment C for the SYNCHRO LOS evaluation assumptions.

MXLU:

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